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NATURAL SCIENCES

Abdikadirov S.M. Analogue of lelong's theorem for α -separately harmonic functions.....	7
Mukhiyatdinova A.M. On a non-local for a boussinesq type differential equation.....	11
Aitbayeva K.K., Kaypov K.P. Through indicator-saprobic species in the algoflora assessment of the ecological and sanitary condition of fish ponds.....	17
Begimkulova Ch.K., Shakarova D.Sh. Obtaining microspherical nanohybrid biopolymer/silica adsorbent for chromatography…….....	20
Kurbanbaeva G.S. Analysis of photosynthetic pigments in millet leaves: Chlorophyll and carotenoids…….....	25
Abdikadirov S.M. Analogue of lelong's theorem for α -separately subharmonic functions...	31
Aitbayeva K.K., Kaypov K.P. Ecological analysis of the algoflora of the reservoirs of Nukus agrofish fish farms…….....	36
Tanirbergenova Z.B., Madenov B.D., Reymov A.M. Nitrophosphorus fertilizers obtained based on ammonyum seliter and ammophos…….....	39
Abdiniyazova G.J., Toreniyazova S.E. Bioecological properties and agrotechnology of the medicinal plant *Cichorium intybus* l.-in the territory of Karakalpakstan.....	43
Yarlashov R.Sh. On convergence of difference schemes for a nonlinear problem.....	46
Oteniyazov R.B. Diversity and distribution of curculionidae (Coleoptera) in Karakalpakstan..	53
Abdiniyazova G.J., Baxieva L.A. Agricultural technology for cultivation of the plant *Plantago Major* L…….....	57
Abdurakhmonov E.B., Djumanova Z.K. Thermochemical activation and sorption properties of sorghum stalk.....	61
Kazakhbaev S.A. Study of the minerological composition of a complex fertilizer prepared from low-grade central Kyzylkum phosphorites…….....	67
Yuldashev X.E., Jamalova D.N., Kurbaniyazova G.T., Ro'zmatov E.Yu., Mingboev F.N., Jumabayeva K.M. Molecular phylogeny of *Ferula* (Apiaceae) in Uzbekistan inferred from its sequences…….....	71
Safarova Sh., Karimov B., Yusupov Z. Conservation status and ecological analysis of the endangered medicinal plant *Lagochilus Inebrians* (Bozulbang) in Uzbekistan.....	76
Nuriyeva M., Allaniyazova M., Berdimbetova G. Experimental evaluation of the acute toxicity of triterpenoid supramolecular complexes based on succinic acid and lupinine ester.....	80
Adilova O.A. Concept of desertification and definitions provided for it….....	84
Erkinova N.O'., Shaymatov S. Agrotechnology of thymus vulgaris and ways to improve its bioecological characteristics…….....	87
Mirametova E.K. Assessment of the impact of natural and anthropogenic factors on ecosystem indicators: Rodents of the southern Aral region…….....	91
Turdoliyev M.N. Impact of atmospheric air pollution on medical and environmental conditions in the industrial areas of the Samarkand region.....	94
Qarshiboyeva N.H. Study of the (*Caryophyllaceae)* family included in the red book of the Republic of Uzbekistan.....	106
Shamsiev D.N. On the solution of some nonlinear equations of mathematical physics by the method of variable separation…….....	109
Mirzayev A.U., Yusupov H.R., Toshtemirov Sh.A. Geological structure of the Altyntau kaolin deposit in Central Kyzylkum…….....	112
Jovliev B.E., Namazov Sh.S., Seytnazarov A.R. Mechanochemical activation of central Kyzylkum phosphate flour…….....	116
Kalimbetova R.N. Beetles (Insecta: Coleoptera) of the northwestern Kyzylkum desert: Taxonomic composition, ecological features, and pest status on dominant desert plants……	122
Orazbaeva A.I., Medetov M.J., Khudiyarova J.M. Bioecological properties and practical significance of the species Musca domestica linnaeus, 1758, of the southern Aral sea true flies (Diptera, Muscidae) family…….....	126
Baymatov P.J., Abdulazizov B.T., Yunusov O.M., Tohirjonov M.S. Numerical modeling of the density of states of a two-dimensional electron gas in a quantizing magnetic field……	129
Minajatdinova Z.N., Jumanov M.A., Begjanov M.K., Sabirova Z.J., Erjanova D.M. Fauna of vespid wasps (Hymenoptera: Vespidae) of the Uzbekistan part of the Kyzylkum desert…….....	136
Berdimuratov M.K. Mathematical foundations of cryptography…….....	145
Xojamuratova R.T, Kalenderova K.T. "The other side" of irrigation: The bioaccumulation of pollutions in the Sudochye and Julturbas lakes as a risk factor for the ecosystem…….....	151
Begjanov M.K. Morphobiology and ecology of the species *Xya Variegata* (Latreille 1809), distributed in the humid sands of the black river in eastern Uzbekistan…….....	156
Sultonov S., Yusupov F., Temirov G., Talipova Kh. Investigation of the physicochemical properties and mineral composition of Koson bentonite…….....	159
Tursunova Sh.A. Analysis of research on soil algal flora…….....	166
Orazbaeva A.A. The effect of components on the physical, chemical and biological properties of mordant solutions…….....	170
Orakbayev A.A., Usanbayev N.Kh., Namazov Sh.S., Alimov U.K., Badalova O.A., Atayev Kh., Rejepova M., Dzhumaeva O. Processing phosphate raw materials using sulfuric acid and oxidized meal.....	173
Kalenderova K.T., Xojamuratov R.T. "Aral sea fragments" hydroecological significance and protection of the lakes Sudochye and Julturbas in the conditions of the southern Aral sea region.....	182
Tursunova Sh.A. Wonders of the green planet…….....	187
Khozhamuratova R.T., Zhumaeva T.A. Assessment of hydrological indicators of Amu-Bukhara canal in Bukhara oasis…….....	190
Mirzayev A.U., Yusupov H.R., Toshtemirov Sh.A. Geological structure of the Altyntau kaolin deposit in Central Kyzylkum.....	193

O'zbekiston Respublikasi Vazirlar Mahkamasi huzuridagi OAK Tartib-qoida komissiyasi qarori 24.05.2017 y., №5/2.
Постановление комиссия по регулированию ВАК Республики Узбекистан при Кабинете Министров от 24.05.2017 г. №5/2.
Resolution of the Regulation Commission of the Supreme Attestation Commission of the Republic of Uzbekistan from 24.05.2017 y. №5/2.

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Tadjieva Sh., Maksumova A., Tadjieva G. Synthesis of nitrogen-containing acrylic monomers	198
Matkarimova N., Maksumova O. Synthesis and properties of complex esters based on biologically decomposed dicarbonic acids	205
Ismailov B.M. Effectiveness of bentonite-polymer compositions for fixing mobile sands of the Muynak deposit	211
Shamuratova G.M. Effect of the use of bio- and nanopreparations on rice plants in saline soils	216
Mamutov I.U. Technique for increasing the endurance of young volleyball players in competitive conditions	219
Abdullaev R. A Criterion for the isometricity of *Log*-algebras of type I_n	223
Khalmuratov P., Alieva P. Biological and ecological characteristics of introduced rose hip species	226
Jiemuratov R.E. The space of order-preserving functionals and perfect comfactification	229
Rakhimova M.A. *HIBISCUS HYBRID* .L. From the seed Reproduction features	236
Merganov A.T., Xamrayeva N.T. Optimizing rna-based gene activity in creating cold stress-tolerant potato varieties	240
Alimkulov N.R., Kholmurzayev J.E. Assessment of Landscape modification trends based on Key climate change indicators (a case study of Jizzakh region)	243
Qarshiboyeva N.H. Study of the (*CARYOPHYLLACEAE)* family included in the red book of the Republic of Uzbekistan	249
Kubayev J.E., Irnasova M.A., Erkinova N.F., Eshmamatova Sh.J. Structure of cestodes	252
Pirniyazov S.K. Problems of the Aral sea and its surrounding region	254
Shoymurotov T.X., Togayev I.S., Rashidova R.K., Toshtemirov Sh.A., Alimov M.M. Mesozoic deposits conditions for oil and gas presence (Western Uzbekistan)	258
Pirnazarov B.U., Madenov B.D., Reymov A.M., Kurbaniyazov R.K., Urazmatova D.Sh. Chemical activation of Jelvak phosphorites of Karakalpakstan	272
Pirniyazov S.K. Solutions for providing high-quality drinking water to the population in remote settlements of Karakalpakstan	278
Rustamov K.Zh. Studying the effectiveness of the Hektaş Fibon, K.Sus. Preparation in combating spider mites in cotton	280
Pirniyazov S.K. Selection principles for plants in unfavorable climatic zones	284
Tajetdinov M.M. Juginisov T.I. Bioecological characteristics of dominant coleoptera species in the Ustyurt plateau (Karakalpakstan section) and integrated control measures against them	288
Turdimambetov I.R., Utarbaeva K.A. The incidence of gallstones and biliary tract diseases among the population of the Republic of Karakalpakstan and its correlation with environmental factors	295
Tajetdinov M.M. Juginisov T.I. Fauna, distribution monitoring, and morphobiological characteristics of coleoptera (Beetles) of the Ustyurt plateau, Karakalpakstan region	301
TECHNICAL SCIENCES	
Tursunova S.T., Kudyarova K.K., Adinayev X.A. Technology for obtaining lead-containing low-temperature fired transparent glasses	310
Uteuliev N., Abdalieva G., Djaykov G., Kalmuratov B., Rzambetova S. Application of machine learning algorithms for automatic analysis of the Karakalpak language	316
Jurayev S.R. Integration of solar energy and hydraulic storage in irrigation systems for sustainable agriculture	319
Aymuratova T.T., Kudyarova K.K. Development of a local feldspar processing technology in Karakalpakstan, Uzbekistan	326
Uteuliev N.U., Arzimbetov T.Z., Jarilkanov B.P. Qualitative analysis methods for deterministic farm models with limited use of water resources	329
Jurayev S.R., Uzaqbaev Q.A. Application of solar power plants to reduce energy costs in pumping stations	334
Abduganiev Y.A. Technology of diffusion of europium entry atom into monocrystalline silicon in the gas phase	339
Bazarova S.J., Kudyarova K.K. Technology for determining salts on the surface of products made from ceramic materials	344
Tleubayeva G. The development and application of artificial intelligence in education	347
Djaykov G.M., Baymuratova G.T. Sustainable optimization of energy balance in solar photovoltaic systems using pso, jaya and socp algorithms	351
Jangabayev D.M., Khojamuratova R.T. Methods of purification of collector drainage waters and the possibilities of their repeated use	358
Kaipbergenova G.R. Effective composition of a mineral salt deposition inhibitor for use in oil refineries	362
Sabirov H., AlikulovR.B. Investigation of the thermophysical parameters of the cooling system for a new-type photoelectric-thermal device	366
Kutlumuratov Zh.Dj., Dawletnazarova B. State of the transport services market of the Republic of Karakalpakstan	373
Utamuradova Sh.B., Ataboev O.K., Muratov A.S. *S*-shaped current-voltage characteristics in *n*-type silicon heterojunction solar cells	381
Adilbaev I.B., Bekbauliev R.I., Abdireymova A.G. Features of the construction of wind generator stations	391
Eshonkulov T. Machine learning – the scientific basis of artificial intelligence	396
Berdimuratov M.K. Mathematical foundations of cryptography	399
Utegenova G.A. The role of education in the socio-economic development of society	405
Nurimov P.B. Experimental evaluation of speaker diarization	407
Rakhmanov J.M. Bionics as a scientific and design paradigm in the evolution of furniture design	413
Ibadullaev M., Esenbekov A.J. On the classification of electromechanical systems	417
Fazilov A.A., Nurkhanov A.A., Adizov B.Z., Nurullayeva Z.V. Improving the quality of high-octane automotive gasoline through optimized blending strategies and the use of functional additive packages	420
Kosnazarov K.K. Synthesis and characteristics of surfactants used as emulsifier in drilling solutions	426
Uteuliyev N., Kudaybergenov J., Kudaybergenov T., Shixiyev R. Problems of segmentation in the tasks of recognizing Karakalpak text	430
Eshmuratov M.S., Bektursinova Q.Q., Amatov A. Fundamental reforms in the building materials industry	436
Ibadullaev M., Esenbekov A.J. Mathematical modeling of ferroresonant oscillations	438
Kosnazarov K.K. Studying the stability and reological properties of invert emulsions of various surface-active substances	442
Seytnazarova N.A., Saydiganiyev S.S., Reymov A.M. Multi-modal assessment of workflow engagement in the service industry	452
Ismailov A., Saparova U., Djumabekova A. Research of inductive neutral growth processes in 6-35 kv electric networks	458
Saparov A.B. Evaluation of enhancing operational reliability of the main canal through the installation of a settling basin with hydraulic flushing	465
Usmanov E.G., Karchin V.V., Karimov R.Ch., Yesenbekov A.J., Xushvaktov D.Sh. Improving the quality of electrical energy by reducing voltage losses in 0.4 kv networks	469
Najimov I.P. Improving the mission formation of the regional building materials industry	477
Soy V., Nuriddinova G., Takhirjanov N. Effect of microcalcite fineness on the physico-mechanical properties of cementitious compositions for non-autoclaved foam concrete in the conditions of the Republic of Uzbekistan	482
Gafforova Sh.V., Turaev Kh.Kh., Sottikulov E.S. Obtain and application of organohybrid sorbents containing nitrogen, sulfur, and silicon	487
Abdukadirov F.B., Kamalov DJ.K. Study physic-chemical characteristic polymer applicable in bore solution	495
Ravshanova M.X. Development of a static method for crushing various rocks	499
Nazarov Z.S., Buriyev Sh.U., Avazov A.N. Scientific basis for the application of various support methods in capital and preparatory mine workings at great depths	504
Rashidova R.K. Comparative analysis of Aidarkul basalts with basalts from other regions to identify regional geochemical characteristics	510
Bakhtiyarov D.D., Dmitrieva I.V. The influence of polygonality of 3D models on the perception of video games: From stylistics to gameplay	516
Abdireimova A.G., Asamatdinov I.J. Optimal design of the composition of a composite binding agent of a dry construction mixture and a mortar based on it by the method of mathematical planning of experiments	520
SOCIAL SCIENCES	
Allaniyazov P.A. The impact of innovation and technology in the digital economy	526
Akimov N.T., Musaeva B.S. Improving the methodology for developing the speed strength qualities of gymnastics in the conditions of gymnastics of the Republic of Karakalpakstan	530

O'zbekiston Respublikasi Vazirlar Mahkamasi huzuridagi OAK Tartib-qoida komissiyasi qarori 24.05.2017 y., №5/2.
Постановление комиссия по регулированию ВАК Республики Узбекистан при Кабинете Министров от 24.05.2017 г. №5/2.
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Abdimuratov M.U. Optimization of the training of football players based on the comprehensive use of intermediate and game exercises	534
Abdaliev S.P. Movement games in volleyball as a means of developing athletes' motor and coordinational qualities	537
Kazakbaev A.M. Adaptive gymnastics as a means of physical rehabilitation and social integration of people with disabilities	541
Utepov M.D. Modern methods of training athletes in medium-distance running: theoretical foundations and experimental evaluation of training process effectiveness	544
Akimov N.T., Adilbekov U.A. The use of children's gymnastics tools ensures the targeted development of physical qualities and improves the motor activity of children	547
Tleuov N.R., Saburov U.B. The role of innovations in the development of the green economy in the Republic of Karakalpakstan	553
Atazhanova M.B. Personal data as an object of civil law protection	556
Yakubov A. Legal aspects of protecting the population and entrepreneurs during the transitional period of accession to the world trade organization	560
Khalekov R.M. Developing the physical qualities of young wrestlers through active games	566
Naurizbaev A.R. Improving the management of tourism development in the context of cross-border territories (Using the example of the Republic of Karakalpakstan)	570
Sitmuratov Sh.T. Influence of exogenic factors on economic growth (On the example of the Republic of Karakalpakstan)	575
Ibraymov I.E., Redjepova S.J., Narbayeva N.J. Competential approach to the development of students' creative activity	579
Eshniyazov R. Cognitive basics of project education in the training of civil engineers	583
Naurizbaev A.R., Kaipbergenov K.A. Experience of developed countries in assessing the diversity of bank loans	587
Sitmuratov Sh.T. Formation of the economy - the basis of sustainable development	592
Ismaylov O.K. Theoretical and legal basis of deposit operations	596
Tleumuratova A.J. Formation of national opera and ballet scenography in Karakalpakstan	599
Ismaylov O.K. Concept and features of the activities of microcredit organizations	602
Turdimambetov I.R., Urazimbetova Yu.Kh. Regional criminal security level of the Republic of Karakalpakstan	606
Isabayeva M.M., Jabborov T.M. Types of independent creative work of students in the subject of "Pedagogical technology"	612
Fayzullayev E.M. The role of national music art in shaping the spiritual and cultural development of youth	616
Ahmedova M.M. Comparative analysis of levels of forming students' problem-solving and exercise-solving skills in biology teaching	622
Utaev A.Kh. Formation of students' creative style based on the analysis of national kolorit and color harmony in the works of artists from the Uzbekistan school of painting	626
To'rayev E.I. Advancing fine arts teacher education through master classes	630
Turdimambetov I.R., Embergenov N.J., Urazbayeva S.A. Population growth of the Republic of Uzbekistan	633
Utaev A.Kh. Portrait and figurative painting: Technical and aesthetic issues of expressing psychological state through color	637
Ashirova A.I. A Method of effective organization of independent learning of theaching theory using digital educational technologies	640
Imamov N.P. Comparative analysis of temporal adverbs in expressing aspectual semantics of the predicate in English and Uzbek languages	645
Bekmanova Zh.A. Cultural development of children and youth with special needs through creative activities	649
Esnazarova Z. Gadget technologies and their impact on the development of children's speech	652
Shakirova S. Causes of speech disorders	655
Baynazarova G. The content and significance of newly adopted laws (On the example of tax legislation)	657
Akhmadjanov A.K. Improvement of accounting policy based on ifrs in joint-stock companies in the energy sector	659
Isakov J.Ya. Ways to improve the production strategy of enterprises in our country	666
Daniyarov K.D. Ways to enhance the innovative activity of business entities through financial support	671
Nazhenov D., Khozhekeeva G., Maksadboeva G., Zhangabayev A., Allanazarova Z. The importance of logistics in the formation and improvement of international cargo transportation in Karakalpakstan	678
Abdurakhimov N. Preventing damage (Delict) caused to business entities by tax authorities: A civil law analysis	682
Ilyasov B.X. The significance of somatotype indicators in increasing sports results of swimmers at the age of 14-15 years	686
Ermekbaeva I.P. Corporate governance and sustainable tourism in central Asian countries	690
Gabbarov S.N. Assessing of the influence of pastures and hay lands on livestock production (On the example of Kongrad district of the Republic of Karakalpakstan)	695
Aldjanova G.A. Analysis of a study on adolescents' experience of an age-related crisis	699
Ilyasov B.X. The role of olympic education in gender equality and inclusiveness	702
Tilewov E.M. Types of non-custodial criminal penalties for minors in foreign countries	705
Edenbaev E.I. Economic advantages of efficient resource utilization in sunflower cultivation	709
Ibadullaev R.K. Innovative development of agriculture and enhancement of economic efficiency through irrigated lands in Karakalpakstan	715
Ilyasov B.X. The method of forming a sustainable swimming skill based on the use of aquatic species	721
Nazarbayev N.O. Mechanisms for strengthening competitiveness in the fruit export sector	724
Nurmanbetov A.K. Mechanisms for enhancing consulting services to support entrepreneurship and improve their efficiency	732
Najimov I.P., Saparova G.B., Edenbaev E.I. Ways to enhance the economic potential of agricultural enterprises in the conditions of Karakalpakstan and their development prospects	739
Ilyasov B.X. Developing the strength abilities of swimmers through special exercises	744
Saparova G.B. Mechanisms for optimizing the performance of agricultural enterprises in the conditions of Karakalpakstan and their development opportunities	748
Ubaydullaev K., Ibadullaev R.K., Nazarbayev N.O. Applying modern models and approaches to promote innovative agricultural development and enhance economic efficiency through irrigated lands in the Republic of Karakalpakstan	753
Toreniyazov J.E., Dushiyev I.M. Historiography of the cities of the southern Aral sea region (Historiography of the soviet and independence period)	758
Sauxanov J.K., Edenbaev E.I., Nurmanbetov A.K. Economic efficiency of technological models for resource-efficient management in sunflower cultivation	764
Urazbaeva L.M. Livestock feeding based on the regulation of external factors in meat production	770
Alkhamov A.R. Analysis of a survey on the development of coordination abilities and technical-tactical preparation of judo athletes	777
Gubenova G.T., Salamat J.A. Toward an inclusive society: Experiences of socializing children with disabilities through the art of pottery	781
Sakhanova L.J. Improving the effectiveness of teaching electronic spreadsheets and presentations through steam approach and flipped classroom methods: Experimental results	785
Sauxanov J.K., Nazarbayev N.O., Saparova G.B. Modeling economic mechanisms aimed at strengthening competitiveness in the fruit export sector	789
Raximov G. Physiological and physical determinants of flatwater kayaking	795
Nazhenov D., Allanazarov Sh., Xojekeeva G. Major directions in transport and logistics infrastructure modernization	798
Tursinbekova K.J. Concept and structure of training future bachelors in environmental education	804
Jumanova V.A. Economic-quality model of choosing an outsourcer based on outsourcing services in quality assurance of public procurement	807
Utepbergenov A.K. Models and mechanisms: Improving the pedagogical training of a future physical education teacher based on an acmeological approach	816
Sultansuynov A.S. The role of gymnastics and dance elements in the formation of aesthetic interest in students	820
Sauxanov J.K., Nurmanbetov A.K., Ibadullaev R.K. Conceptual modeling of economic and managerial mechanisms to enhance the effectiveness of consulting services in entrepreneurship development	824
Raximov G.Y., Bobonazarova G. Physiological physical indicators of young rowing athletes in the annual training cycle	830

O'zbekiston Respublikasi Vazirlar Mahkamasi huzuridagi OAK Tartib-qoida komissiyasi qarori 24.05.2017 y., №5/2.
Постановление комиссия по регулированию ВАК Республики Узбекистан при Кабинете Министров от 24.05.2017 г. №5/2.
Resolution of the Regulation Commission of the Supreme Attestation Commission of the Republic of Uzbekistan from 24.05.2017 y. №5/2.

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Bekmuratova N.A. Approaches to enhancing English reading skills through the use of authentic texts	833
Doshmuratova G.S., Nagashbaev N.B. The world of youth under the influence of globalization: Opportunities and threats	836
Sulaymanov T.A. Digital development trends in modern art education	839
Amaniyazova S.B. Practical and legal aspects of the consumer's legal status	843
Ismailov A.M. Academik drawing technique and technology	849
Azimova N.R. Organoleptic analysis and the Importance of Using this analysis in the Educational process	853
Boltayeva R.A. Interactive methods for forming students' scientific awareness competence and orienting them toward research Activities	857
Mamatkulova U.E. Formation of Students' communicative competence through digital Technologies	862
Isabaeva M.M., Tashmatova E.Kh. Analysis of Experiences in Developing ecological competence in students of General secondary schools	866
Jumanov A.M. Scientific and theoretical foundations of Integrative teaching of Chemistry in the biology education program	869
Jumanov A.M., Xudaberdiev J.X. Interdisciplinary connections in Teaching chemistry in the Training of future biology Teachers	873
Nematov A. Principles of organizing independent study in Biology: Teaching methodology	877
Qodirova M.A. Effective use of the Principles of Determinism in Teaching chemistry	881
Yusupova N.V. Pedagogical conditions for Developing future teachers' competence in creating electronic Educational resources	884
Khaydarova S.A. Benefits of Using artificial intelligence technologies in Education	887
Mahammatova Sh.S., Abkerimov S.A. The history of the formation of advertising agencies in Uzbekistan after independence	890
Bekmuratova U.A. Organization of independent work Russian as a foreign language in the Karakalpak audience	894
Nurdinov K.P. Methodology of applying group and individual forms of work in music lessons	897
Ashurov M.A. Mechanisms of using modern it tools in developing artistic and aesthetic mastery	904
Mamadjonov T.B. Features of recognizing a citizen as missing and declaring a citizen deceased under modern conditions	910
Turayev I. The landscape genre - levitan's works and their significance in the development of aesthetic taste	914
Reymova Z.A., Kurbanbaeva A.U. Prospects for the development of the constitutional control system in the Republic of Karakalpakstan	916
Shnekeeva G.J., Aytimuratov A.M., Amatov A.M. City transport infrastructure and environmental, sanitary and hygienic problems in cities	921
HUMANITIES SCIENCES	
Usenov S.Kh. The fate of an unclaimed public figure (The fate of the Karakalpak public figure and commander Ubaydulla Bahauddinov)	925
Jangabaeva A.R., Kurbanbaeva K.J. The role of information technologies in modern philological education	928
Kaniyazova J.O. Nicknames and their function in literary works	932
Dosimbetova A., Mambetov I. Ecopoetic phenomena in modern Karakalpak lyrics (On the example of the works of K.Karimov and J.Izbaskanov)	937
Bayriyeva M.J. Reflection of emotional units in syntactic and pragmatic structures of English and Karakalpak languages	945
Djangabaeva G.K. The main theoretical principles of linguoculturology	950
Shamshetova Yu.M. Morphological structure of English borrowings in the Russian and Karakalpak languages	955
Kamalova N.B. Comparative study of stylistic and pragmatic features of fairy tales in English and Karakalpak languages	959
Ashirov O.M. The interrelationship of the Oghuz and Qipchak dialects in Muqaddimat Ul-Adab	963
Seytniyazova G.M. Gamification in EFL classrooms: motivating learners through digital tools	966
Seytjanov J.E. Pragmatic analysis of vocatives in English and Uzbek literary texts	971
Tajenova G.T. The role of game technologies in developing students' idiomatic competence	974
Abatov J.O. Methods of mastering painting techniques and technologies as an effective means of developing the quality of students' professional artistic training	978
Seytniyazova G.M. Effective ten techniques for successful presentation	983
Alishova B.B. National cultural characteristics: Ethical concepts of "Jaqsílíq" (Good) and "Jamanlíq" (Bad)	988
Doshanova G.I. The artistic expression of folk oral creativity in Sirojiddin Sayyid's works	991
Tajibayeva L. The concept of historicism in the poetry of Halima Khudoyberdiyeva	994
Kabulova Z. Ecological culture in Erkin Vohidov's poetry	997
Madaminova R. The dialectal lexicon of the Uzbek dialectal area in Karakalpakstan	1000
Allambergenova G.A., Qosnazarova U.Q. Studying the gender issue in Karakalpak linguistics	1003
Kaypnazarova G.Kh. Improvement of the use of electronic commerce tools in the context of the digital economy	1007
Dospanov O.T. Historical, ethnographic, and cultural analysis of traditi`onal fishing among the peoples of the southern Aral sea region	1012
Seytniyazova G.M. The role of inductive and deductive grammar teaching in language acquisition	1019
Khudaybergenova Z.O. Theoretical approaches to the study of color in linguistics	1023
Kaliknazarova Z.M. Effectiveness of the discourse approach in the formation of communication-oriented speech and writing skills in students	1027
Mambetkarimov R.R. Spiritual conditions for the formation of worldview in the work of the Karakalpak thinker and poet Ajiniyaz	1031
Reymov R.M. Morality is a moral principle that defines the dignity of society and the individual	1037
Bawetdinov M. Reflection of the creator's phenomenon in style	1040
Begniyazova G.A. Phraseologisms with a black component in the Karakalpak languge	1046
Ayapov S., Bayniyazov J. Traditions of teaching young people the origin and history of folk words	1056
Reymov R.M. The harmony of national identity, humanism, and universal values in the work of Ajiniyaz	1061
Allambergenova M.R. The study of Turkish written monuments by Turkish scientists	1066
Begniyazova Q.A. Traditional hypertext in journalism	1071
Kurbanbayev I.A. Contrasting in the poetry of Behzod Fazliddin	1077
Atashova F.D. Challenges in translating English proverbs into other languages	1081
Abkerimov S.A. Bionic patterns in jewelry design	1084
Utepbergenov M.S. Causes, conditions, and prevention of hooliganism	1094
Khabipova R., Sailaubaeva G.A. Development of gender linguistics in Turkic languages	1100
Abdullaev D.A. The role of phraseological units in distinguishing grammatical descriptions	1105
Saymanova Sh.S. Lexico-grammatical description of adjective metaphors in proverbs and sayings	1108
Allanazarova A.B. The role of pedagogical competencies in training future coaches and specialists in freestyle wrestling	1110
Jumamuratov D.J. Pragmatic and derivational characteristics of political speeches	1113
Djumabaeva G. Isues of civil law regulation of the conclusion of a sales contract	1116
Tojiboyev S.Z. Analysis of methods for civil law protection of big data	1120
Saparniyazova Z.M. Methods of implementing the integration of physics and technical sciences	1129
Smamutova Sh.A. Poetry of Turkic women poets: Tradition, themes, and artistic continuity (On the example of Kazakh and Uzbek poetry)	1133
Kabulov S.T. Methodology of using case technologies in non-native Russian language lessons in Karakalpakstan schools	1138
Abishova G.M. Comparative typology ofthe cases of genitive and iyelik (Possesive)	1143
Adilova G.A. Ethnodialectisms related to material culture in the language of Kazakhs of Karakalpakstan	1149
Yusupov K.A. Methods of analyzing novels	1154
Khodjayev Kh.A. Technology for developing students' singing skills through metacognitive strategies and modern technical tools	1160
Utebaeva A.D. Effective ways of developing ecological culture in pedagogical education through eco-pedagogical approach	1164
Kubeysinova D.T. Speech as an educational instrument: Strategies for effective English language learning	1169

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Ruzimbayeva D. The aesthetic interpretation of the modern character	1172
Razzakova M. Principles of poetic image transformation in cholpon's works	1175
Raximova B.B. Philosophical aphoristic meaning coherence in the poetry of Matnazar Abdulhakim	1178
Ramatullaev M.A. The activities of religious institutions in Karakalpakstan in the mid-20th century	1182
Rahimov S.Sh. Methodical improvement of error analysis skills in dutor performance based on metacognitive strategies	1186
Rahimova M.N. Improving dutor performance skills through metacognitive strategies	1189
Toleubaeva A.O. Pragmalinguistics as an object of linguistics	1193
Jumamuratov D.J. Political propaganda as a means of political manipulation	1197
Pirniyazova N.V. Ways to improve the professional competence of primary school teachers	1200
Usenov S.Kh. Written and oral sources about the historical figure of Tulga Khanmakhsim	1203
Urazaboev O.R. Lexical-grammatical features of somatic phraseologisms in the Uzbekistan and Karakalpak languages	1208
Ashurov M.A. Technology for developing students' singing skills through modern it tools based on metacognitive strategies	1211
Matekeev S. The work of Ajiniyaz and Uzbek literature	1216
Orazboyev O.R. The semantic nature of somatic phraseologisms in the Uzbek and Karakalpak languages	1219
Tanimov Sh. Socio-political foundations of religious tolerance in Uzbekistan	1222
Palimbetova M. Character system in D.Aitmuratov's comedy "in the world of foolishness	1226
Xodjanazarov A.P. The importance of historical documents in teaching history	1230
Mamirova O. Methodical improvement of performing skills based on metacognitive strategies	1232
Otamuradova M. Nurboy Jabborov's scientific and theoretical views	1235
Tajibayeva L. The image of nature in the poetry of Halima Khudayberdiyeva	1238
Kabulova Z. Ecological culture in Uzbek poetry	1241
Eshchanova G. The importance of learning English with texts	1244
Ashurov M.A. Technology for developing instrumental performance skills through modern it tools based on metacognitive strategies	1248
Karimova D. The artistic and aesthetic features of Sirojiddin Sayyid's literary work	1252
Pirniyazov I.K. Current changes and reforms in school education in Uzbekistan	1255
Toreniyazov J.Y. Central city along the southern Aral- Khojeli	1258
Avezova G.S. Artistic interpretation of the harmony of nature and man in the works of Ulugbek Hamdam	1264
Ametov D.D. Independent educational assignments development and assessment criteria for history students	1268
Avezova G.S. Some considerations on the system of polyphonic thinking	1272
Abdurakhmonov J.Sh. Improving the methodology for the development of technology safety knowledge of students of the technological educational direction	1275
Qodirov B.E. Improving technologies for developing future teachers' specific competencies in the digital learning environment	1279
Badirova D. Comparative study of adjective–noun conversion in English and Karakalpak languages	1282
Jumambetov R. Procedure for the legal protection of geographical indications	1285
Muhammadiyev A. Scientific and practical aspects of the principle of inviolability of property	1290
Bosimbekov U. The concept of a trademark and its distinctive features	1296
Imomov N.F. The concept of a consignment agreement and its specific characteristics	1301
Tojiboyev S.Z. Analysis of methods for civil law protection of big data	1307
Kamalova N.B. Pragmatic intention of "attracting the reader's attention" in the titles of English and Karakalpak fairy tales	1316
Badirova D. A Comparative analysis of the phenomenon of conversion in English and Karakalpak languages	1320
Ruzimbayeva D. The evolution of poetic form in Uzbek literature	1323
Eleusinov S.A. Theoretical foundations and practical approaches to the psychological training of volleyball players	1326
Kurbanbayev I.A. The phenomenon of inversion in Alisher Nazar's poetry	1331
Atadjanova D.A. Speech verbs in English and Karakalpak languages: a pragmatic study	1335
Badirova D. Word-class flexibility: Conversion patterns in English and Karakalpak languages	1338
Kalabaeva M. Innovative educational technologies in teaching English idiomatic expressions to second-year philology students	1341
Abdullaev Sh.D. Formation system of adjectives in Uzbek and Turkish languages	1344
Allamuratov G.A. Somatic portrait in modern Karakalpak novels...	1346
Nurjonov O. The linguistic analysis of ethno-cultural features in euphemisms	1352
Sagatova Z. A Comparative study of riddles in English and Karakalpak: Linguistic and cultural perspectives	1357
Jarekeev M.B. Issue of development of Nukus city microtoponyms	1361
Akmuratova B. Folk melodies in the poetry of Guljamol Askarova	1365
Botabaev K. The impact of student-centered learning on academic motivation in higher education	1367
Qosbergenov B. N.Tawmuratov is a scholar and social activist	1370
Maksetova M.K. Epic "Edige" as a historical source on the history of the Turkic peoples	1372
Madiyarov B.A. Linguostylistic features of expressiveness in informative genre texts abstract	1377
Abdullayev D.I. Ways of preparing students for organizing spiritual and educational activities	1380
Amaniyazova R.B. Directions for improving the efficiency of the use of labor resources in rural areas (On the example of the Republic of Karakalpakstan)	1384
Khojaniyazova S.P. Using digital learning environments in the educational process	1387
Karimova R.M. Analysis of orthodox relations towards women in islamic philosophy	1390
Nurullayeva N.R., Minnikulov I.U. Semantic features of the English aspect system: A comparative analysis	1393
Khojaniyazova S.P. Levels of cloud technologies in virtualization of the educational process	1400
Kipchakova S., Ibodullayeva R., Latipova Sh., Turamurodov U. The role of equivalence in modern translation studies	1403
Raximova Y. Human moral qualities and their social significance in Islam	1406
Normatov X.I. Improving the professional culture of future physical education teachers based on action games	1410
Pirniyazov S.K. Worthy examples of our material culture	1414
Saparniyazova Z.M. Manifestation of integration in modern technologies	1417
Abduraxmonov J.Sh. Methodology of teaching students on labor protection and technical safety	1421
Pirniyazov S.K. Information about Karakalpak housing	1425
Berdiyeva L.N. Development of visual-motor thinking in primary school pupils	1428
Pirniyazov S.K. Traditional architectural methods in eastern building design	1433
Sultanov A.S. The scientific and practical importance of modern methodology in developing students' thinking	1436
Sultanov A.S. Priority areas for the development of the education system in the Republic of Uzbekistan	1440

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NATURAL SCIENCES

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ANALOGUE OF LELONG'S THEOREM FOR $\boldsymbol{\alpha}$-SEPARATELY HARMONIC FUNCTIONS

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Summary. *This paper investigates α-separately harmonic functions and establishes an analogue of Lelong's theorem for these functions, where* $\boldsymbol{\alpha}$ *is a differential biform.*

Key words: *separately harmonic function,* $\boldsymbol{\alpha}$*-separately harmonic function, closed and strictly positive differential form.*

INTRODUCTION

As is well known, the class of separately harmonic functions, i.e., functions that are harmonic with respect to each variable when the others are fixed, plays a significant role in various problems of complex analysis, particularly in potential theory. The study of separately harmonic functions originates from the work of P. Lelong (see [1]). Subsequently, in the general setting, separately harmonic functions were investigated by many authors, including A. Zeriahi (see [2]) and J. Hecart (see [3]). In addition, A. Sadullaev and S. Imomkulov (see [4]) obtained results concerning the problem of analytic continuation of separately harmonic functions. The study of such functions is also closely related to the theory of separately analytic functions (see [5], [6]).

The well-known Hartogs theorem (see [7]) asserts *that a function* $f(z,w)$ *defined on a domain* $D\times G\subset\mathbb{C}^n(z)\times\mathbb{C}^m(w)$ *and holomorphic in each variable separately is holomorphic with respect to all variables in the domain.* In 1961, P. Lelong established the following analogue of this theorem for separately harmonic functions.

Theorem 1. (see [1]). *Let* $u(x,y)$ *be a separately harmonic function in a domain* $D\times G\subset\mathbb{R}^n(x)\times\mathbb{R}^m(y)$*; that is,* $u(x,y)$ *is harmonic in each variable when the others are fixed. Then* u *is harmonic with respect to all variables in* $D\times G$.

In this article, we introduce and study the concepts of $\boldsymbol{\alpha}$-separately harmonic functions. Under certain additional assumptions, we establish analogue of Lelong's theorem for these functions, where $\boldsymbol{\alpha}=(\alpha',\alpha'')$ denotes a differential biform.

PRELIMINARIES

We begin by recalling several fundamental notions required for the proof of the main results.

Let α be an arbitrary closed, strictly positive differential form of bidegree $(n-1,n-1)$ in a domain $D\subset\mathbb{C}^n$, given by

$$\alpha=\left(\frac{i}{2}\right)^{n-1}\sum_{j,k=1}^{n}\alpha_{jk}(z)dz[j]\wedge d\overline{z}[k],$$

where $\alpha_{jk}(z)\in Lip_\lambda(D)$ for all $j,\ k=\overline{1,n}$ and $0<\lambda<1$. The forms

$$dz\big[j\big]=dz_1\wedge\ldots\wedge dz_{j-1}\wedge dz_{j+1}\wedge\ldots\wedge dz_n,$$

$$d\overline{z}\big[k\big]=d\overline{z}_1\wedge\ldots\wedge d\overline{z}_{k-1}\wedge d\overline{z}_{k+1}\wedge\ldots\wedge d\overline{z}_n$$

are defined in the standard way. Moreover, the form α is closed, i.e. $d\alpha=0$.

Strict positivity of α means that for every compact set $G \Subset D$ there exists a constant $\varepsilon > 0$ such that the differential form $\alpha - \varepsilon\beta^{n-1}$ is positive on G, where $\beta = dd^c(|z|^2)$ denotes is the standard volume form in $\mathbb{C}^n$.

For any twice continuously differentiable function $u(z) \in C^2(D)$, $D \subset \mathbb{C}^n$, the operator $dd^c u \wedge \alpha$ can be represented as

$$dd^c u(z) \wedge \alpha(z) = \Delta_\alpha u(z) \cdot dV,$$

where

$$\Delta_\alpha u(z) = \sum_{j,k=1}^{n} \alpha_{j,k}(z) \frac{\partial^2 u}{\partial z_j \partial \overline{z}_k} = \sum_{j,k=1}^{n} \alpha_{j,k}(z)(\mathfrak{D}_j - i\mathfrak{D}_{n+j})(\mathfrak{D}_k + i\mathfrak{D}_{n+k})u(z),$$

$$dV = dx_1 \wedge dx_2 \wedge \ldots \wedge dx_{2n},\ \mathfrak{D}_j = \frac{\partial}{\partial x_j},\ j = \overline{1,2n}.$$

Definition 1 (see [8]). *A function $u(z) \in C^2(D)$ is called α-harmonic in $D \subset \mathbb{C}^n$ if $dd^c u \wedge \alpha = 0$ in D.*

Definition 2 (see [9]). *A function $u(z) \in L^1_{loc}(D)$ is called α-harmonic in $D \subset \mathbb{C}^n$ if the operator $dd^c u \wedge \alpha$ equals zero in the generalized sense:*

$$dd^c u(z) \wedge \alpha(z)(\omega) := \int u(z)\alpha(z) \wedge dd^c \omega(z) = 0,\ \forall \omega \in F(D).$$

Let α' be an arbitrary closed, strictly positive differential form of bidegree $(n-1, n-1)$ in a domain $D \subset \mathbb{C}^n(z)$, given by

$$\alpha' = \left(\frac{i}{2}\right)^{n-1} \sum_{j,k=1}^{n} \alpha'_{jk}(z) dz[j] \wedge d\overline{z}[k],$$

where $\alpha'_{jk}(z) \in Lip_\lambda(D)$, $0 < \lambda < 1$, and $d\alpha' = 0$.

Similarly, let α'' denote an arbitrary closed, strictly positive differential form of bidegree $(m-1, m-1)$ in a domain $G \subset \mathbb{C}^m(w)$, given by

$$\alpha'' = \left(\frac{i}{2}\right)^{m-1} \sum_{j,k=1}^{m} \alpha''_{jk}(w) dw[j] \wedge d\overline{w}[k],$$

where $\alpha''_{jk}(w) \in Lip_\lambda(G)$, $0 < \lambda < 1$, and $d\alpha'' = 0$.

Consider the operators acting in the class C^2:

$$d_z d^c_{\overline{z}} u(z,w) \wedge \alpha'(z) = \left(\frac{i}{2}\right)^{n} \sum_{j,k=1}^{n} (-1)^{k+j+1} \alpha'_{jk}(z) \frac{\partial^2 u(z,w)}{\partial z_j \partial \overline{z}_k} dz \wedge d\overline{z},\ \forall w \in G,$$

$$d_w d^c_{\overline{w}} u(z,w) \wedge \alpha''(w) = \left(\frac{i}{2}\right)^{m} \sum_{j,k=1}^{m} (-1)^{j+k+1} \alpha''_{jk}(w) \frac{\partial^2 u(z,w)}{\partial w_j \partial \overline{w}_k} dw \wedge d\overline{w},\ \forall z \in D.$$

Definition 3. *A function $u(z,w)$ is called $\boldsymbol{\alpha}$-separately harmonic in a domain $D \times G \subset \mathbb{C}^n(z) \times \mathbb{C}^m(w)$, where $\boldsymbol{\alpha} = (\alpha', \alpha'')$ is a biform, if it is locally integrable with respect to each variable and*

(i) $d_z d^c_{\bar{z}} u \wedge \alpha' = 0$ *in the generalized sense:*

$$\int u(z)\alpha'(z) \wedge d_z d^c_{\bar{z}} \omega(z) = 0\,,\ \forall \omega \in F(D)\,,$$

(ii) $d_w d^c_{\bar{w}} u \wedge \alpha'' = 0$ *in the generalized sense:*

$$\int u(w)\alpha''(w) \wedge d_w d^c_{\bar{w}} \omega(w) = 0\,,\ \forall \omega \in F(G)\,.$$

For an $\boldsymbol{\alpha}$-separately harmonic function w belonging to the class C^2, the following theorem holds.

Theorem 2. *If a function* $u(z,w) \in C^2(D \times G)$ *is* $\boldsymbol{\alpha}$*-separately harmonic, then with respect to the all variables*

$$dd^c u(z,w) \wedge \alpha(z,w) = 0\,,$$

i.e. $u(z,w)$ *is* α*-harmonic with respect to the total set of variables, where* $\alpha(z,w) = \alpha'(z) \wedge \alpha''(w) \wedge \beta$*, and* $\beta = dd^c\left(|z|^2 + |w|^2\right)$.

It should be noted that if the differential form α is real-analytic, then an α-harmonic function is also real-analytic.

MAIN RESULTS

As in the case of harmonic functions, to study the continuation of α-harmonic functions, we first reduce the problem to holomorphic functions and then apply the principles of holomorphic continuation. The following lemma will be useful for this purpose.

Lemma 1. *Let the differential form* α *be real-analytic in a domain* $D \subset \mathbb{C}^n \cong \mathbb{R}^{2n}$ *. Then there exists a domain* $\tilde{D} \subset \mathbb{C}^{2n}$ $\left(\mathbb{C}^n \cong \mathbb{R}^{2n} \subset \mathbb{C}^{2n}\right)$ *such that every* α*-harmonic function in* D *can be analytically (holomorphically) continued to* $\tilde{D}$.

Proof. Every α-harmonic function admits an integral representation. Indeed, if $B = B(x^0, R) \Subset D$ is an arbitrary ball and $u(x)$ is α-harmonic in D, then

$$u(z) = \int_{\partial B} P_\alpha(z,\xi) u(\xi) d\sigma(\xi)\,,$$

where $P_\alpha(z,\xi)$ denotes the Poisson kernel. Clearly, for each fixed $\xi \in \partial B$, the function $P_\alpha(z,\xi)$ is α-harmonic with on D. Since the differential form α is real-analytic in the domain $D \subset \mathbb{C}^n \cong \mathbb{R}^{2n}$, the kernel $P_\alpha(z,\xi)$ is also real-analytic in B, and hence it admits a a holomorphic continuation into some domain $\tilde{B} \subset \mathbb{C}^{2n}$ wiht $\tilde{B} \supset B$ .Thus, by the Poisson representation, any α-harmonic function in B can be holomorphically extended into $\tilde{B}$. Consequently, there exists a domain $\tilde{D}$ such that $D \subset \tilde{D} \subset \mathbb{C}^{2n}$. *The lemma is proved.*

Using this lemma together with the Siciak-Zakharyuta theorem (see [10], [11]) and Theorem 3, we can now establish the following analogue of Lelong's theorem for $\boldsymbol{\alpha}$-separately harmonic functions.

Theorem 3. *Let* α' *and* α'' *be real-analytic differential forms in the domains* $D \subset \mathbb{C}^n(z)$ *and* $G \subset \mathbb{C}^m(w)$*, respectively. Then every* $\boldsymbol{\alpha}$*-separately harmonic function* $u(z,w)$ *in* $D \times G$ *(where* $\boldsymbol{\alpha} = (\alpha', \alpha'')$*) is real-analytic and* α*-harmonic with respect to all variables:*

$$dd^c u(z,w) \wedge \alpha = 0\,,\ \forall (z,w) \in D \times G\,,$$

where $\alpha = \alpha'(z) \wedge \alpha''(w) \wedge \beta$, *and* $\beta = dd^c\left(|z|^2 + |w|^2\right)$.

Proof. Without loss of generality, assume that the domain $D \times G$ is bounded and that $u(z,w)$ satisfies the hypotheses of the theorem in a neighborhood of the closure $\overline{D} \times \overline{G}$. By Lemma 1, there exist domains $\tilde{D} \subset \mathbb{C}^{2n}$ and $\tilde{G} \subset \mathbb{C}^{2m}$ such that $u(z,w)$ can be separately analytically continued to the set

$$X = \left(D \times \tilde{G}\right) \bigcup \left(\tilde{D} \times G\right),$$

i.e., there exists a separately analytic function $\tilde{u}(z,w)$ defined on X with $\tilde{u}(z,w)\big|_{D\times G} = u(z,w)$. By the Siciak–Zakharyuta theorem (see [10], [11]), $\tilde{u}(z,w)$ admits a holomorphic extension to the domain

$$\tilde{X} = \left\{(\zeta,\eta) \in \tilde{D} \times \tilde{G} : \omega^*(\xi, D, \tilde{D}) + \omega^*(\eta, G, \tilde{G}) < 1\right\}.$$

Clearly, $D \times G \subset \tilde{X}$, hence $u(z,w)$ is real-analytic in all variables on $D \times G$. Finally, by Theorem 2, $u(z,w)$ is α-harmonic with respect to all variables, where $\alpha = \alpha'(z) \wedge \alpha''(w) \wedge \beta$ *. The theorem is proved.*

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Rezyume: *Ushbu maqolada* α*-separat garmonik funksiyalar qaraladi va ushbu funksiyalar uchun Lelon teoremasining analogi isbotlanadi, bunda* $\alpha-$*differensial biforma.*

Резюме: *В данной статье рассматриваются* α*-сепаратно гармонические функции, и для этих функций доказываются аналог теоремы Лелона, где* $\alpha-$*дифференциальная биформа.*

Kalit so‘zlar: *separat garmonik funksiya,* α*-separat garmonik funksiya, yopiq va qat’iy musbat differensial forma.*

Ключевые слова: *сепаратно гармоническая функция,* α*-сепаратно гармоническая функция, замкнутая и строго положительная дифференциальная форма.*

ON A NON-LOCAL FOR A BOUSSINESQ TYPE DIFFERENTIAL EQUATION

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Summary: *The article examines a nonlocal problem for a Bussinesk-type differential equation in multidimensional domains. Existence and uniqueness were also proven, and spectral decomposition for solution was obtained.*

Key words: *Non-local problem, Boussinesq type equation, multidimensional do-main, spectral decomposition, solvability*

1. INTRODUCTION. PROBLEM STATEMENT

Let $\Omega \subset \mathbb{R}^n$ be an arbitrary bounded domain with piecewise smooth boundary $\partial\Omega$ and T>0 Consider in the cylinder $\Omega x(0,\mathrm{T})$ the following equation

$$u_{tt} - \Delta u_{tt} + \nu^2 \Delta u = f(x), \quad x \in \Omega, \ 0 < t < T, \tag{1}$$

where parameter ν is a positive number, $f(x) \in \mathrm{L}_2(\Omega)$

Let A be a positive self - adjoint extension of the Laplace operator

$$-\Delta : \mathrm{A}u = -\Delta u, \quad u \in C_0^{\infty}(\Omega),$$
$$(\mathrm{A}u, u) \geq \mu(u, u), \qquad \mu > 0, \quad u \in D(A).$$

We assume that A has a compact inverse operator A^{-1}. In particular, this self - adjoint extension may be produced by the boundary conditions like

$$\alpha(x)\frac{\partial u}{\partial n} + \beta(x)u = 0, \quad x \in \partial\Omega, \tag{2}$$

with some appropriate $\alpha(x)$ and $\beta(x)$. We consider non-local conditions

$$u(x,0) = u(x,T), \tag{3}$$

$$\int_0^T u(x,t)dt = \phi(x). \tag{4}$$

Equations of the form (1) are known as linearized Boussinesq-type equations (see [2, eq. 26], and it becomes necessary to study the solvability of such equations. For a review of results on boundary value problems for Boussinesq-type equations, including non-linear equations, see [3].

In [4] T.K.Yuldashev considered the problem of solvability and construction of a solution of a boundary value problem for equation of the from (1) where parameter ν^2 is standed by the sign - , with nonlocal conditions similar to (3)-(4) in the case $\Omega = \{x \in R \,|\, 0 < x < 1|\}$ (see [4, condition 6]). These results were developed in [1] for arbitrary domains $\Omega \subset R^N, N > 1.$

The purpose of this paper is to study the solvability and construction of a solution for equation (1) with initial conditions (3) and (4).

We define the solution of the problem (1), (3) and (4) as the function $u(x,t)$ which:

1) belongs to the domain $D(A)$ for every t from interval $0 \leq t \leq T$ and is continuous with respect to t in the norm of $\mathrm{L}_2(\Omega)$ on this interval;

2) together with the function $Au(x,t)$ is two times continuously differentiable on the open interval $(0,T)$ in the norm of $\mathrm{L}_2(\Omega)$;

3) satisfies the equation (1) and conditions (3), (4).

In order to formulate the results on existence and uniqueness we introduce some important parameters. Let λ_k and $\upsilon_k(x)$ be the eigenvalues and corresponding eigenfunctions of the self - adjoint operator A:

$$A\upsilon_k(x) = \lambda_k \upsilon_k(x), \qquad x \in \Omega. \tag{5}$$

The spectral decomposition of any function $\phi(x) \in \mathrm{L}_2(\Omega)$ has the form

$$\phi(x) = \sum_{k=1}^{\infty} \phi_k \upsilon_k(x), \quad \phi_k = (\phi, \upsilon_k).$$

According to our assumptions,

$\mu \le \lambda_1 \le \lambda_2 ... \le \lambda_k \to \infty$.

Set

$$\nu_k = \nu \sqrt{\frac{\lambda_k}{1+\lambda_k}}. \tag{6}$$

In this paper, the validity of the following statements is proved.

Theorem. *Let* $\phi \in D(A)$, $\tilde{f} \in D(\mathrm{A})$ *and* $\tilde{f} = (f(x), \upsilon_k)$. *Then the solution of the problem (1), (3) and (4) exists and is unique.*

Remark. If the self-adjoint extension of Laplace operator is generated by Dirichlet boundary value problem (i.e. when $\alpha = 0$ and $\beta = 1$ in condition (2)), then $D(A) = W_2^2(\Omega) \cap \overset{0}{W}{}_2^1$ (see [6], chapter 3, sec. 2).

The paper is organized as follows. In the next Section 2, we find the spectral expansion of the solution associated with eigenfunctions of self - adjoint operator A.

In the final Section 3, we prove Theorem 3.

2. SPECTRAL EXPANSION OF THE SOLUTION

We can rewrite (1) as

$(I + A)u_{tt} - \nu^2 Au = f(x)$

or

$$u_{tt} - \nu^2 A(I + A)^{-1} u = (I + A)^{-1} f(x), \qquad x \in \Omega, \quad 0 < \mathrm{t} < \mathrm{T}. \tag{7}$$

Assume that $u(x,t)$ is solution of the problem (7), (3) and (4). Then, the spectral decomposition of the solution has the form

$$u(x,t) = \sum_{k=1}^{\infty} C_k(t) \upsilon_k(x), \tag{8}$$

where

$C_k(t) = (u, \upsilon_k) = \int u(x,t) \upsilon_k(x,t) dx$

Multiplying equation (7) by $\upsilon_k(x)$, k =1,2,.. we obtain

$$(u_{tt}, \upsilon_k) - \nu^2 (A(I + A)^{-1} u, \upsilon_k) = ((I + A)^{-1} f(x), \upsilon_k) \tag{9}$$

According to definition of the solution, we have

$$(u_{tt}, \upsilon_k) = \frac{d^2}{dt^2}(u, \upsilon_k) = C_k''(t).$$

Recall that operator A is self - adjoint. Taking into account the equation (5), we can write

$$(A(I + A)^{-1} u, \upsilon_k) = (u, A(I + A)^{-1} \upsilon_k) = \frac{\lambda_k}{1+\lambda_k}(u, \upsilon_k) = \frac{\lambda_k}{1+\lambda_k} C_k(t)$$

$$((I + A)^{-1} f(x), \upsilon_k) = (f(x), (I + A)^{-1} \upsilon_k) = \frac{1}{1+\lambda_k}(f(x), \upsilon_k) = \tilde{f}$$

Using the notation (6), we can write

$$v^2(A(I+A)^{-1}u,\upsilon_k)=\nu_k^2C_k(t). \qquad (10)$$

Therefore it follows from (9) and (10) that the equation

$C_k''(t)-\nu_k^2C_k(t)=\tilde{f}$

is valid. Hence,

$$C_k(t)=a_k\operatorname{ch}\nu_kt+b_k\operatorname{sh}\nu_kt+\tilde{C}(t)$$

where $\tilde{C}(t)=-\dfrac{\tilde{f}}{\nu_k^2}$

then we have $C_k(t)=a_k\operatorname{ch}\nu_kt+b_k\operatorname{sh}\nu_kt-\dfrac{\tilde{f}}{\nu_k^2}$. (11)

We add to this equation two conditions that follow from (3) and (4):

$$C_k(0)=C_k(T) \qquad (12)$$

$$\int_0^T C_k(t)dt=\phi_k \qquad (13)$$

Using (12), we obtain $a_k-\dfrac{\tilde{f}}{\nu_k^2}=a_k\operatorname{ch}\nu_kT+b_k\operatorname{sh}\nu_kT-\dfrac{\tilde{f}}{\nu_k^2}$.

Then we have $a_k(1-\operatorname{ch}\nu_kT)=b_k\operatorname{sh}\nu_kT$ or

$$-a_k\operatorname{sh}^2\frac{\nu_kT}{2}=b_k\operatorname{sh}\frac{\nu_kT}{2}\operatorname{ch}\frac{\nu_kT}{2}. \qquad (14)$$

As, all ν_k are different from zero, then we have $\operatorname{sh}\dfrac{\nu_kT}{2}\neq 0$. Then derive from (14) that

$$-a_k\operatorname{sh}\frac{\nu_kT}{2}=b_k\operatorname{ch}\frac{\nu_kT}{2}. \qquad (15)$$

Let $\operatorname{ch}\dfrac{\nu_kT}{2}\neq 0$. Set $d_k=\dfrac{a_k}{\operatorname{ch}\dfrac{\nu_kT}{2}}=-\dfrac{b_k}{\operatorname{sh}\dfrac{\nu_kT}{2}}$. Then, according to (11), we have

$$C_k(t)=d_k(\operatorname{ch}\frac{\nu_kT}{2}\operatorname{ch}\nu_kt-\operatorname{sh}\frac{\nu_kT}{2}\operatorname{sh}\nu_kt)-\frac{\tilde{f}}{\nu_k^2}.$$

Hence,

$$C_k(t)=d_k\operatorname{ch}\left[\nu_k(t-\frac{T}{2})\right]-\frac{\tilde{f}}{\nu_k^2}. \qquad (16)$$

Therefore, for the coefficients of the expansion (8) we get the equation (16). Further, according to (13), we have

$$\phi_k=\int_0^T C_k(t)dt=\int_0^T\left[d_k\operatorname{ch}\left[\nu_k(t-\frac{T}{2})\right]-\frac{\tilde{f}}{\nu_k^2}\right]dt=\frac{2d_k\operatorname{sh}\dfrac{\nu_kT}{2}}{\nu_k}-\frac{\tilde{f}T}{\nu_k^2}.$$

Therefore, it is true that

$$d_k=\frac{\phi_k\nu_k^2+\tilde{f}T}{2\nu_k\operatorname{sh}\dfrac{\nu_kT}{2}} \qquad (17)$$

Therefore, if the solution of the problem (1), (3) and (4) exists, then it has the following form

$$u(x,t)=\sum_{k=1}^{\infty}\left[\frac{\phi_k\nu_k^2+\tilde{f}T}{2\nu_k\,\mathrm{sh}\,\frac{\nu_k T}{2}}\mathrm{ch}\left[\nu_k(t-\frac{T}{2})\right]-\frac{\tilde{f}}{\nu_k^2}\right]\upsilon_k(x)\,. \tag{18}$$

Hence, we proved the validity of the following statement.

Proposition 2.1. *Let the function* $u(x,t)$ *be the solution of the problem (7), (3) and (4) for* $\phi\in L_2(\Omega)$ *. Then its spectral expansion has the form (18).*

Recall that the function $u(x,t)$ to be a solution of the considered problem, it is necessary that it and its second derivatives in t belong to the domain of the definition of the operator A. So, the following two statements relate to these conditions.

Proposition 2.2. *The function* $u(x,t)$ *defined by expansion (18) belongs to* $D(A)$ *uniformly with respect to* $t>0$ *if and only if*

$$\sum_{k=1}^{\infty}\frac{\left[|\phi_k|\lambda_k^2+\tilde{f}T\right]^2}{\nu_k{}^2\,\mathrm{sh}^2\,\frac{\nu_k T}{2}}<+\infty\ . \tag{19}$$

Proof. Applying operator *A* to equation (18), we obtain the following equation

$$Au(x,t)=\sum_{k=1}^{\infty}\lambda_k\left[\frac{[\phi_k\nu_k^2+\tilde{f}T]}{2\nu_k\,\mathrm{sh}\,\frac{\nu_k T}{2}}\mathrm{ch}\left[\nu_k(t-\frac{T}{2})\right]-\frac{\tilde{f}}{\nu_k^2}\right]\upsilon_k(x) \tag{20}$$

Hence, from (20) we have

$$\|Au(\cdot,t)\|^2=\sum_{k=1}^{\infty}\lambda_k{}^2\left[\frac{[\phi_k\nu_k^2+\tilde{f}T]}{2\nu_k\,\mathrm{sh}\,\frac{\nu_k T}{2}}\mathrm{ch}\left[\nu_k(t-\frac{T}{2})\right]-\frac{\tilde{f}}{\nu_k^2}\right]^2.$$

It follows that the inequality $\|Au(\cdot,t)\|^2\le\mathrm{const}$, $0\le t\le T$, holds when the following condition

$$\sum_{k=1}^{\infty}\lambda_k{}^2\left[\frac{[\phi_k\nu_k^2+\tilde{f}T]}{2\nu_k\,\mathrm{sh}\,\frac{\nu_k T}{2}}\mathrm{ch}\left[\nu_k(t-\frac{T}{2})\right]-\frac{\tilde{f}}{\nu_k^2}\right]^2\le\mathrm{const},\quad 0\le t\le T \tag{21}$$

is met.

Note that the definition (6) implies the inequality

$$\frac{\mu}{\mu+1}\nu^2\le\nu_k{}^2<\nu^2\,. \tag{22}$$

Hence, estimate (21) is valid if and only if the condition (19) is satisfied.

Proposition 2.3. *Let the condition (19) be fulfilled. Then the functions* $u(x,t)$ *and* $Au(x,t)$ *are two times continuously differentiable with respect to* $t>0$.

Proof. Differentiating equation (20), we obtain the following equation

$$\frac{\partial^2}{\partial t^2}Au(x,t)=\sum_{k=1}^{\infty}\frac{\lambda_k\nu_k[\phi_k\nu_k^2+\tilde{f}T]}{2\,\mathrm{sh}\,\frac{\nu_k T}{2}}\mathrm{ch}\left[\nu_k(t-\frac{T}{2})\right]\upsilon_k(x)\,.$$

Applying Parseval's equality, we get

$$\| \frac{\partial^2}{\partial t^2} Au(\cdot,t) \|^2 = \sum_{k=1}^{\infty} \frac{\lambda_k{}^2 \nu_k{}^2 [\phi_k \nu_k^2 + \tilde{f}T]^2}{4 \operatorname{sh}^2 \frac{\nu_k T}{2}} \operatorname{ch}^2 \left[\nu_k (t - \frac{T}{2}) \right].$$

Taking into account (22), we may state that the estimate

$$\| \frac{\partial^2}{\partial t^2} Au(x,t) \| \leq \text{const}$$

is valid if and only if the condition (19) is satisfied.

3. PROOF OF THEOREM

In this case the uniqueness of the solution follows immediately from Proposition 2.1.

According to Propositions 2.2 and 2.3, to prove the Theorem , it is enough to check that the series (19) converges.

Using the inequalities (22), we obtain

$$\frac{\operatorname{sh}(\nu_k T / 2)}{\nu_k T / 2} > \frac{\operatorname{sh}(\sqrt{\frac{\mu}{\mu+1}} \nu T / 2)}{\nu T / 2}$$

Then we have that

$$\operatorname{sh}(\nu_k T / 2) > \frac{\nu_k}{\nu} \operatorname{sh}(\sqrt{\frac{\mu}{\mu+1}} \nu T / 2) = \sqrt{\frac{\lambda_k}{1+\lambda_k}} \operatorname{sh}(\sqrt{\frac{\mu}{\mu+1}} \nu T / 2)$$

Therefore, the following estimate is true

$$\operatorname{sh}(\nu_k T / 2) > C_\nu(T) > 0, \tag{23}$$

$$C_\nu(T) = \sqrt{\frac{\lambda_1}{1+\lambda_1}} \operatorname{sh}(\sqrt{\frac{\mu}{\mu+1}} \nu T / 2)$$

According to assumption, $\phi \in D(A)$. Since $A\phi(x) = \sum_{k=1}^{\infty} \lambda_k \phi_k \upsilon_k(x),$ we have

$$\| A\phi \|^2 = \sum_{k=1}^{\infty} \lambda_k{}^2 \left| \phi_k \right|^2 < +\infty . \tag{24}$$

It follows from (23) and (24) that the series (17) converges.

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Rezyume: *Maqolada ko‘p o‘lchovli sohalarda Bussinesk tipidagi differensial tenglama uchun nolokal masala ko‘rib chiqiladi. Shuningdek, mavjudlik va yagonalik isbotlangan hamda yechish uchun spektral yoyilma olingan.*

Резюме: *В статье рассматриваются нелокальная задача для дифференциального уравнения типа Буссинеска в многомерных областях. Также доказано существование и единственность, а также получена спектральное разложение для решения.*

Kalit so‘zlar: *Lokal bo‘lmagan masala, Bussinesk tipidagi tenglama, ko‘p o‘lchovli do-main, spektral dekompozitsiya, yechilishi*

Ключевые слова: *Нелокальная задача, уравнение типа Буссинеска, многомерный до-мейн, спектральная декомпозиция, решение*

THROUGH INDICATOR-SAPROBIC SPECIES IN THE ALGOFLORA ASSESSMENT OF THE ECOLOGICAL AND SANITARY CONDITION OF FISH PONDS

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Summary: *Although the saprobity levels in the studied fish farms of the territorial region were not analyzed, the ecological and sanitary condition of each pond was explained based on the quantitative indicators of indicator-saprobic species. In addition, the influence of polluting sources is also noted.*

Keywords: *Fish ponds' algoflora, indicator-saprobes, ecology-sanitation.*

Analysis of sources on the topic. Significantly fewer studies have been conducted on the analysis of indicator-saprobic species in the algoflora of fishery ponds and the assessment of the ecological and sanitary state of water through them. The algoflora of fishery ponds from existing water bodies in the territory of Southern Tajikistan was studied. M.T. Boboev (2018), 245 species. The role of a number of ecological factors in the formation of the algoflora of fish ponds in this area is explained. At the same time, it provides an analysis of indicator-saprobic species in these fishery ponds.

Sh.Sh. Shernazarov (2021), who separately analyzed the indicator-saprobic species in the algoflora of a number of fish ponds in the Samarkand region, noted that the algoflora of the studied ponds contains 144 indicator-saprobic species, which constitutes 55.81% of the total number of species. Of these, 66 species are oligosaprobes, 42 species are beta-mesosaprobes, 22 species are xenosaprobes, and 14 species are alpha-mesosaprobes. Although the saprobity levels in the studied fish farms of the region were not analyzed, the ecological and sanitary condition of each pond was explained depending on the quantitative indicators of indicator-saprobic species. In addition, the influence of polluting sources is also noted.

However, in the above-mentioned sources, the degree of occurrence of indicator-saprobic species in the algoflora of the ponds of fish farms studied in both sources, saprobity indices, and the degree of water pollution, as well as pollution classes, were not analyzed.

Y.Sh. Tashpulatov (2016, 2018), who studied the algoflora of the middle reaches of the Zarafshan River, separately analyzed the indicator-saprobic species in the composition of the river's algoflora and noted that the ecological and sanitary state of the river changes seasonally and along the flow.

Similar studies revealed the ecological situation in artificial and natural water bodies as a result of analyzing the quantitative and qualitative indicators of indicator-saprobic species in the algoflora of various basins of the Western Zarafshan Range (B.Dustov, 2024).

B.Kabulova (2025), who studied indicator-saprobic species in the algoflora of Lake Khadicha, located in the territory of Bukhara region, as a separate group, studied the ecological and sanitary state of the lake by seasons and the years of research. In addition, a cadastre of indicator-saprobic species was developed (Kabulova, 2023).

In the course of our research, a separate analysis of the studied indicator-saprobic species was carried out in the section of ponds of fish farms and in the section of seasons. These studies are significant not only for the first time in this region, but also on a republican scale.

Object and methods of the study. According to the analysis of the research results, the average saprobity index of water in the reservoirs of the Khojeyli fish farm in spring was 1.60, in summer it increased to 1.78, and by autumn it slightly decreased to 1.76. The water class (3), discharge (3a - sufficiently clean) and indicators of the saprobic zone (β1-mesosaprobe) did not

change in all seasons. These results show that the deterioration of the ecological and sanitary condition of the Khojeyli fishery ponds increases significantly from spring to summer, and although this decreased somewhat by autumn, according to the general indicators, it remained moderate throughout the year (Table 1).

Table 1

Ecological and sanitary condition of the ponds of the Khodzheyli fish farm

Division		**Spring**	**Summer**	**Autumn**
Cyanoprocaryota		1,79	1,79	1,79
Dinophyta		1,6	1,6	1,6
Chrysophyta		1	2	2
Bacillariophyta		1,52	1,46	1,60
Euglenophyta		2,4	2,4	2,4
Cholorophyta		1,5	1,43	1,21
Average saprobity index		1,60	1,78	1,76
Water quality	class	3	3	3
	discharge	3a (sufficiently clean)	3a (sufficiently clean)	3a (sufficiently clean)
Saprobic zone		β^1-mezosaprobic	β^1-mezosaprobic	β^1-mezosaprobic

According to the analysis of the research results, the average saprobity index of water in the ponds of the Khojeyli fish industry fish farm in spring was 1.70, in summer it increased to 1.98, and by autumn it slightly decreased to 1.65. The water class (3), discharge (3a - sufficiently clean) and indicators of the saprobic zone (β1-mesosaprobe) did not change in all seasons. These results show that the deterioration of the ecological and sanitary condition of the fishery ponds of the Khojeyli fish industry increases significantly from spring to summer, and although this decreased somewhat by autumn, according to general indicators, it remained moderate throughout the year (Table 2).

Table 2

Ecological and sanitary condition of fishery ponds of the Khojeyli fish industry

Division		Spring	Summer	Autumn
Cyanoprocaryota		1,78	1,78	1,74
Dinophyta		1,6	1,5	1,66
Chrysophyta		1	3	1
Bacillariophyta		1,24	1,27	1,17
Euglenophyta		3	3	3
Cholorophyta		1,6	1,35	1,35
Average saprobity index		1,70	1,98	1,65
Water quality	class	3	3	3
	discharge	3a (sufficiently clean)	3a (sufficiently clean)	3a (sufficiently clean)
Saprobic zone		β^1-mezosaprobic	β^1-mezosaprobic	β^1-mezosaprobic

Conclusion. According to the results of the analysis of quantitative and qualitative indicators of indicator-saprobic species in the algoflora of the studied ponds of fish farms, the ponds of the Khojaly fish industry fish farm are more polluted with organic substances compared to other ponds. These farm pools have been operating for several years. The sources of water supply are the Old Canal from the Amu Darya, wastewater from agricultural crops, and wastewater from residential areas. The ponds are equipped with special devices for feeding fish, the bottom of which is made of clay and gravel. The number of fish raised is significantly higher than in other fishery ponds. This, in turn, requires more feed. All these factors led to an increase in the amount of organic matter in the water. Therefore, this led to an increase in the quantity and quality of indicator-saprobic species compared to the ponds of other fish farms.

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Резюме: *Хотя уровни сапробности в исследованных рыбоводческих хозяйствах региона не были проанализированы, эколого-санитарное состояние каждого пруда объяснялось количественными показателями индикаторно-сапробных видов. Кроме того, отмечается влияние источников загрязнения*

Ключевые слова: *Альгофлора рыбоводных прудов, индикатор-сапроб, экология-санитария.*

OBTAINING MICROSPHERICAL NANOHYBRID BIOPOLYMER/SILICA ADSORBENT FOR CHROMATOGRAPHY

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Summary: *Microspherical nanohybrid fibroin/silica adsorbent was synthesized in situ by sol-gel process based on silk fibroin and silica by introducing silk fibroin into hydrolytic polycondensation of tetraethoxysilane (TEOS). Synthesis was performed in 4% formic acid solution by adding NH_4OH as a catalyst, at different fibroin:TEOS ratios, at temperature from 50 ^oC to 80 ^oC and high stirring rate. It can be seen that the synthesis process takes several minutes. Obtained samples were characterized by nitrogen porosimetry and scanning electron microscopy with EDS. Results of elemental analysis indicate the presence of both fibroin (by C, O, N) and silicon dioxide (by Si) in the composition of the obtained adsorbent. The obtained adsorbent consists of microspherical particles with dimensions of 10-30 μm, with a pore size of 23 nm and a surface area of 318 m^2/g. The possibility of studying the obtained adsorbent in thin-layer chromatography is demonstrated by the effective separation of a test mixture of nitroaniline isomers.*

Key words: *biopolymer, tetraethoxysilane, fibroin, sol-gel process, nanohybrid, fibroin/silica adsorbent, hybrid material, o-, m-, p-, nitroanilines, thin-layer chromatography.*

Introduction: In recent years, significant progress has been made in the obtaning of stable hybrid materials using the sol-gel process based on natural biopolymers and inorganic materials [1]. Research into the production of hybrid materials based on multicomponent materials, proteins belonging to the class of biopolymers, and inorganic substances opens up new opportunities for the creation of innovative solutions in various fields, such as sorption technologies, biomedicine, electronics and ecology [2].

Currently, known options for synthesizing nanomaterials, such as polymer-inorganic and hybrid materials, make it possible to obtain a new generation of nanohybrid adsorbents with unique properties. Of particular interest are hybrid materials based on biopolymers and silica, which have attracted the attention of scientists due to their unique combination of mechanical properties, biocompatibility and functional potential [3].

The choice of biopolymers for the synthesis of nanohybrid adsorbents plays a key role in ensuring their properties and functionality. Biopolymers such as chitosan [4], alginates [5], and fibrillar protein [6] have unique characteristics that can significantly affect the results of the sol-gel process. These polymers not only provide the necessary mechanical strength and stability, but also contribute to the creation of a microstructure with specific adsorption properties, which is of paramount importance for chromatography. Hybridization with silica-containing components can increase the surface area and reactivity, which improves the interaction with target molecules. However, the choice of a specific biopolymer should take into account both its chemical compatibility with silica matrices and the influence of the sol-gel process conditions on its behavior. Among the biopolymers, silk fibroin, obtained from silkworm cocoons (Bombyx mori), has attracted the attention of researchers due to its mechanical and biochemical properties, namely biocompatibility and biodegradability. The use of biopolymer/silica adsorbents synthesized by the sol-gel technology opens new horizons in the development of effective materials for chromatographic separation.

The aim of this work is to obtain biopolymer/silica microspherical nanohybrid adsorbent based on fibroin and tetraethoxysilane by the sol-gel process in situ and their application for planar (thin layer) chromatography.

Object and methods of research: Formic acid, tetraethoxysilane, lithium bromide, 25% ammonium hydroxide solution, isopropyl alcohol, n-hexane, o-, m- and p- nitroaniline, ethyl acetate, hydrochloric acid, sodium carbonate, sodium hydroxide, benzene, crystalline iodine, deionized water. All reagents were obtained from Sigma- Aldrich and were used without further purification. Microspherical silica gel (MS) was obtained using the method described in [7]. Regenerated silk

fibroin was obtained from the cocoons of the silkworm Bombyx mori, cultivated by farmers in our Republic, using the processes of degumming, dialysis of fibroin solution in an aqueous solution of lithium bromide and lyophilization of the resulting fibroin solution.

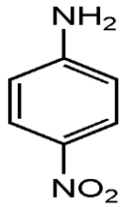
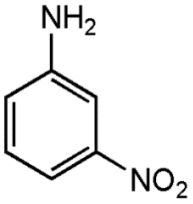
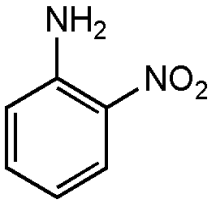
Nanohybrid microspherical fibroin/silica adsorbent was obtained according to the method of our previous work [8]. Samples obtained at ratios of 0.02:1, 0.03:1 (fibroin: TEOS) were named AFS2, AFS3, respectively.

The synthesized biopolymer/silica adsorbent was characterized by scanning electron microscope SEM-EDS Jeol JSM-IT200LA (Japan) using energy dispersive analyzer application.

The structural characteristics of fibroin/silica nanohybrid samples were determined by low-temperature nitrogen adsorption at 77 K using a Quantachrome Nova 1000e static adsorption system.

Chromatography in a thin layer of fibroin/silica adsorbent was performed on the glass plate with dimensions of 10x10 cm. For the study, 1% benzene solutions of o-, m and p- nitroaniline and structural the formulas of which are presented in Table 1.

Table 1. Structural formula of the investigated nitroaniline isomers.

Substance number		
1	2	3
 4-nitroaniline	 3-nitroaniline	 2-nitroaniline

The eluent for separating isomeric nitroanilines on fibroin/silica nanohybrid adsorbents was a mixture of benzene with ethyl acetate in the ratio of 4:1. Iodine vapor is used as a developer.

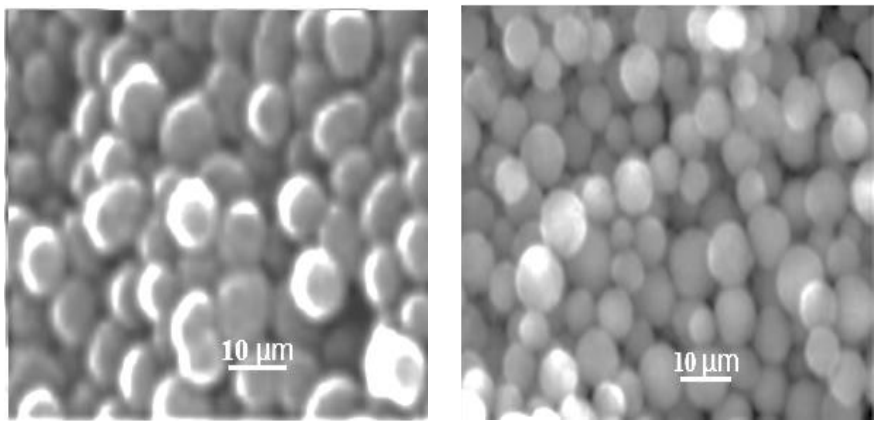
Results and discussion: The influence of temperature, pH of the system, the ratio of the initial reagents and the reaction time on the morphology and porosity of the final product was studied in our previous work [8]. From the results, it was noted that an increase in temperature promotes the complete development of the polymerization process, which in turn improves the adsorption properties of the material. In addition, variations in the pH of the medium affect the distribution of microparticles in the matrix and affects the final shape and properties of the adsorbent. As a result of careful control of the conditions for obtaining fibroin/silica adsorbents based on the sol-gel process, the optimal conditions for obtaining the target material for planar chromatography were found. We found that the optimal conditions for the synthesis of microspherical fibroin/silica adsorbent is the fibroin-TEOS ratio of 0.03:1, the amount of catalyst of 2.3 ml, the temperature of 60 ^{0} C and the stirring speed of 1800 rpm. The conditions of sol-gel synthesis of materials significantly affect their physicochemical properties. The obtained samples of microspherical nanohybrid biopolymer/silica adsorbents AFS2 and AFS3 were studied for their physicochemical properties and used as a stationary phase for the separation of nitroaniline isomers in thin-layer chromatography.

The structural characteristics of the obtained fibroin/silica adsorbents, given in Table 2, correspond to mesoporous adsorbents, which allow them to be used in chromatographic separations.

Table 2. Structural characteristics of microsphere silica gel and fibroin/silica sorbent samples

Structural characteristics	Samples		
	MS	AFS2	AFS3
Specific surface area $S_{sp,}$ m^2/g	287	297,238	318,348
Total volume $W_{0,}$ cm^3/g	0.24	1,018	1,032
Pore radius, nm	17	28.07	29.74

Fig. 1 shows the SEM results of the obtained AFS2 and AFS3 samples, and as can be seen from the images, the obtained adsorbents have the spherical shape.



(a) (b)

Fig. 1. SEM images of synthesized samples of AFS2(a) and AFS3(b)

form with a particle diameter from 5 to 30 µm. Elemental analysis of the obtained fibroin/silica sorbent samples at the ratio of the initial fibroin-TEOS reagents of 0.02:1 and 0.03:1, the results of which are given in Table 3, showed the presence of both fibroin (by the presence of C and N) and silica (by the presence of Si) in the samples.

Table 3. Elemental analysis of synthesized samples AKS2 and AKS3

Samples	Elemental analysis			
	C wt %	N wt %	O wt %	Si wt % [α]
AFS2	10.06±0.06	2.14±0.09	51.36±0.09	36.44±0.06
AFS3	26.29±0.05	3.04±0.09	48.93±0.06	24.78±0.03

[α] Calculated value

To separate nitroaniline isomers, we used nanohybrid fibroin/silica adsorbents and, microspherical silica gel for comparison. Since the particle size of these stationary phases is 10±1 µm, thin-layer chromatography using them is considered highly efficient. The results obtained are presented in Table 3 as Rf values.

From the presented data it is evident that the selectivity index of separation of nitroaniline isomers relative to each other ($\alpha_{n/n-1}$) >1 is equal to both for microspherical silica gel and for nanohybrid fibroin/silica adsorbents, which indicates complete separation of these substances.

Table 3. Results of thin layer chromatography of nitroaniline isomers

Substance number (n)	Microporous silica gel			Nanohybrid fibroin/silica adsorbent					
				AFS2			AFS3		
	R_f	$\alpha_{n/n-1}$	$\alpha_{n/1}$	R_f	$\alpha_{n/n-1}$	$\alpha_{n/1}$	R_f	$\alpha_{n/n-1}$	$\alpha_{n/1}$
1	0, 38			0.27			0.2 1		
2	0.42	1,1	1,1	0.34	1,2	1,2	0, 3 0	1.4	1.4
3	0, 51	1,2	1.3	0.49	1.4	1.8	0, 4 5	1.5	2.1

The obtained results show that the selectivity is higher on fibroin/silica adsorbents (AFS2 and AFS3) than on MS. A qualitative comparison of the obtained Rf thin layer chromatography values shows that the most effective separation of the nitroaniline isomers occurs on the nanohybrid fibroin/silica adsorbent (AFS3), since thin-layer chromatography allows for a clear identification of the nitroaniline isomers under study.

Based on the obtained results, it can be concluded that nanohybrid fibroin/silica adsorbents are a more effective mobile phase than silica gel for separating nitroaniline isomers by thin-layer chromatography, using benzene-ethyl acetate mixture in a volume ratio of 4:1 as the stationary phase.

This is due to the presence in the structure of fibroin/silica adsorbent of the combined effect on the chromatographic process of silanol groups together with NH_2 –, OH^-, and $COOH^-$ and other groups contained in the side peptide chains of the fibroin macromolecule. These groups provide the synthesized fibroin/silica adsorbents with active centers for the separation of various organic compounds.

Conclusions: Thus, mesoporous fibroin/silica adsorbent was synthesized based on silk fibroin and tetraethoxysilane by the sol-gel method and their physicochemical properties were studied. Structural analysis of the microspherical fibroin/silica adsorbent obtained under the found optimal conditions showed that the adsorbent with a pore size of 29 nm and the surface area of 318 m^2/g belongs to mesoporous structures and can be used as an adsorbent in thin-layer chromatography. SEM analysis showed that the morphology of the obtained adsorbent samples is microspheres, and the results of elemental analysis confirm the presence of fibroin and silica in the composition of the hybrid materials. It was found that the synthesized microspherical fibroin/silica adsorbent can be used as the suitable adsorbent for efficient separation of nitroaniline isomers in thin layer chromatography.

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Rezyume: *Ipak fibroinini tetraetoksisilanning (TEOS) gidrolitik polikondensatsiyasiga kiritish orqali ipak fibroin va kremnezem asosida sol-gel jarayoni in situ orqali mikrosferik nanogibrid fibroin/kremnezem adsorbenti sintez qilindi. Sintez 4% li chumoli kislota eritmasida katalizator sifatida NH_4OH ni turli fibroin:TEOS nisbatlarida, 50 ºS dan 80 ºS gacha bo'lgan haroratda va yuqori aralashtirish tezligida qo'shish orqali amalga oshirildi. Sintez jarayoni bir necha daqiqa davom etishi ko'rsatilgan. Olingan namunalar azot porozimetriyasi va skanerlash elektron mikroskopiyasi bilan EDS tavsiflangan. Elementar tahlil natijalari olingan adsorbent tarkibida ham fibroin (C, O, N bo'yicha) va kremniy dioksidi (Si bo'yicha) mavjudligini ko'rsatadi. Olingan adsorbent o'lchamlari 10-30 mkm, g'ovak o'lchami 23 nm va sirt maydoni 318 m^2/g bo'lgan mikrosferik zarralardan iboratligi aniqlandi. Olingan adsorbentni yupqa qatlamli xromatografiyada nitroanilin izomerlarining sinov aralashmasini samarali ajratish imloniyatiga ega ekanligi aniqlandi.*

Резюме: *Микросферический наногибридный фиброин/кремнеземный адсорбент был синтезирован in situ золь-гель процессом на основе фиброина шелка и кремнезема путем введения фиброина шелка в процесс гидролитической поликонденсации тетраэтоксисилана (ТЭОС). Синтез выполнен в 4% - растворе муравьиной кислоты добавлением NH_4OH в*

качестве катализатора при различных соотношениях фиброин:ТЭОС, при температуре от 50 °С до 80 °С и высокой скорости перемешивания. Показано, что процесс синтеза длится несколько минут. Полученные образцы охарактеризованы методами азотной порометрии и сканирующей электронной микроскопии с ЭДС. Результаты элементного анализа свидетельствуют о наличии в составе полученного адсорбента как фиброина (по C, O, N), так и диоксида кремний (по Si). Полученный адсорбент состоит из микросферических частиц с размерам 10-30 мкм, с размером пор 23 нм и площадью поверхности 318 м^2/г. Возможность исследования полученного адсорбента в тонкослойной хроматографии показана на эффективном разделении тестовой смеси изомеров нитроанилина.

Kalit so‘zlar: *biopolimer, tetraetoksisilan, fibroin, sol-gel jarayoni, nanogibrid, fibroin/kremnezem adsorbent, gibrid material, o-, m-, p-, nitroanilinlar, yupqa qatlamli xromatografiya.*

Ключевые слова: *биополимер, тетраэтоксисилан, фиброин, золь-гель процесс, наногибрид, фиброин/кремнеземный адсорбент, гибридный материал, о-, м-, п-, нитроанилины, тонкослойная хроматография.*

ANALYSIS OF PHOTOSYNTHETIC PIGMENTS IN MILLET LEAVES: CHLOROPHYLL AND CAROTENOIDS

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Karakalpak State University named after Berdakh

Summary: *This article covers the millet plant, its biological characteristics, cultivation technology, requirements for climatic and soil conditions, and its importance as food and feed.*

The article also analyzes the method for applying triterpenoid-nature biostimulants created on the basis of polyisoprenoids—namely Glycyrrhizic Acid (GK), Indoleacetic Acid (ISK), Indoleacetic Acid + 4-aminoantipyrine (ISK:4AA), "GLITSBUT," and "GLINBUT"—to grain crops under the conditions of the Republic of Karakalpakstan. It examines their effect on growth and development, product quality, and certain biochemical parameters within them.

Furthermore, the correlation between different SPAD 502 indicators and the content of chlorophyll and carotenoids in millet leaves was determined.

Key words: *millet plant, food, biological properties, chlorophyll "a," chlorophyll "b," carotenoids*

INTRODUCTION.

The existence of the Aral Sea problem limits the possibilities of increasing grain production in our country by expanding crop areas. Currently, the development and implementation of technologies for cultivating crops that save water and energy during yield production, increase soil fertility, and ensure high and qualitative yields from grain crops, are being carried out. At present, the use of growth stimulants is considered one of the promising and sufficiently effective directions for increasing the level of yield.

These are analogs of plant phytohormones, which can be of both natural origin and synthesized by humans.Plant growth stimulants have a complex effect on the physiological and biochemical processes that occur in plant organs.

Their application allows for accelerating the onset of phenological phases and thus contributes to the overall shortening of the growing season, which, in turn, allows for a more rational use of agricultural machinery during harvesting. Plant growth stimulants are non-toxic and are considered safe for humans and the environment due to their origin. [5.28-29]

Growth stimulants are widely used in various agricultural crops. Studies were conducted on almost all cereal crops, and their positive effect was noted. [6. 15–18].

Grain crops belong to the most important group of cultivated plants, which are characterized by an extremely high diversity. They all belong to the family Gramineae (also known as Poaceae). This family is one of the largest, including over 500 genera and more than 5000 species of annual and perennial plants widely distributed all over the world. Food products, raw materials, and concentrates are obtained from grain crops. [7.22-23]

Millet (Tariq) is one of the very common cereal crops in Uzbekistan. The groats (psheno) prepared from its grain are famous for being tasty and nutritious. Bread made from millet is small in size and quickly goes stale. Millet waste (produced during processing) is good feed for cattle. The grain, either whole or ground, is given to poultry and pigs; 1 kg of grain contains 0.97 feed units (o.b.).

Its straw contains 0.51 feed units per 1 kg, and its chaff contains 0.42 feed units. Millet straw and chaff contain, respectively, 3.9% and 7.9% protein, 38.6% and 39.5% nitrogen-free extractives (NFE), 33.9% and 32.4% fiber (cellulose), 1.8% and 2.9% fat, and 5.8% and 19.6% ash. 5.1 kg of its green mass is equal to one feed unit. The starch content in the grain reaches 57.6%, and in the groats (psheno), it reaches 71%. Millet starch turns into sugar faster than rice starch. When millet groats are cooked in milk, their nutritional and biological properties increase. [8.174-175]

Millet is cultivated in Uzbekistan as a main and repeated (second) crop. Its importance is great for harvesting two grain yields per year. Its value is further enhanced by its low seeding rate, early maturity, and being a short-day plant. It can also be used to repair sparsely grown grain fields.

One variety of millet has been registered in the State Register for planting in Uzbekistan: Saratovskaya-853, created at the former Saratov experimental station, and zoned for planting in the conditional irrigated and rain-fed lands of our republic. [8.177-178]

In the Republic of Karakalpakstan, traditional farming methods are used in millet cultivation. Farmers utilize advanced technologies and knowledge passed down through generations to ensure high yield and product quality [7].

Millet products are widely used in local cuisine and hold a special place in the traditional culture of the Karakalpaks. Furthermore, millet cultivation in the Republic of Karakalpakstan has important economic and social significance, shaping the lifestyle of local communities and contributing to the regional agricultural economy in various ways.

First, millet farming provides employment for a large part of the population in the villages of Karakalpakstan. Millet cultivation involves a series of activities that create jobs and generate income for farmers and workers, from planting and harvesting to processing and sales.

Second, for many small farmers in Karakalpakstan, millet cultivation serves as an important source of income and a means of diversifying their livelihoods. By cultivating millet alongside other crops and engaging in livestock farming, farmers can mitigate risks associated with seasonal fluctuations and market volatility, thereby increasing their resilience to economic hardship. During the research process, it was determined that the field germination of the seeds, the seedling density, and the plant survival rate varied under the influence of the year's conditions and the growth regulators.

On the field experimental plot of the Nukus District Grain and Rice Research and Production Association, millet seeds were sown in field conditions after being pre-treated for 24 hours in prepared biostimulants of triterpenoid nature: GK, ISK, glitsBUT, and ISK:4AA at concentrations of 10^{-5}, 10^{-6}, and 10^{-7}, as well as a Control (distilled water). The research was carried out at the Shortanboy field experimental plot.

30-40-day-old millet leaves were selected, and the selected samples were homogenized in a centrifuge in 50 milligrams of 5 ml of a 95% ethyl alcohol solution and allowed to settle for 15 minutes. Pigments in plant leaves are an important physiological process. The SPAD 502



Figure 1. Sowing of millet seeds at the field experimental plot of the Nukus District Scientific-Production Association of Grain and Rice

Spectrophotometer is used to detect them.

EXPERIMENTAL PART

The purpose of this study is to determine the correlation between different SPAD 502 indicators and the content of chlorophyll and carotenoids in millet leaves.

Photosynthesis is the main condition for life for plants, green algae, and some microorganisms. This complex biochemical process absorbs solar energy and synthesizes organic substances. The efficiency of the photosynthetic process is directly dependent on the amount of photosynthetic pigments in the plant leaves, such as chlorophyll 'a', chlorophyll 'b', and carotenoids. These pigments function to absorb light and convert it into chemical energy.

This article reviews the results of a scientific analysis on how the content of photosynthetic pigments changed in the leaves of the 'Saratovskoe 853' millet variety under the influence of various biostimulants. The effect of different concentrations (10^{-5}, 10^{-6}, 10^{-7}) of the biostimulants GK, ISK, GlitsBUT, and ISK:4AA on chlorophyll content and germination was investigated.

The main objective of the study is to assess the influence of 10−5, 10−6, and 10−7 concentrations of bio-growth substances, such as GK, ISK, Glycine BUT, and ISK:4AA, on the pigment composition of the millet plant. These substances are considered agents that accelerate plant growth and development and increase stress resistance. The control group (untreated plants) also participated in the experiment. The method of spectral analysis was used to determine the results of the experiment. Using this method, the indicators of light absorption (optical density) of plant leaves at a certain wavelength were measured, and based on this, the quantitative composition of pigments was calculated.



Figure 2. Determination of different SPAD 502 indicators and the content of chlorophyll and carotenoids in millet leaves.

RESULTS AND DISCUSSION

According to the analysis of the data obtained, the majority of the applied biostimulants increased the content of photosynthetic pigments in the millet leaves. This indicates that these substances significantly improve the photosynthetic activity of the plants.

For example, in millet plants treated with different concentrations of the GK biostimulant, the content of chlorophyll 'a', chlorophyll 'b', total chlorophylls, and carotenoids was higher compared to the control group. In particular, the 10^{-7} concentration of the GK substance recorded the highest results, confirming the positive effect of this substance on the photosynthetic apparatus.

SPAD 502 indicators of chlorophyll and carotenoid content in millet leaves

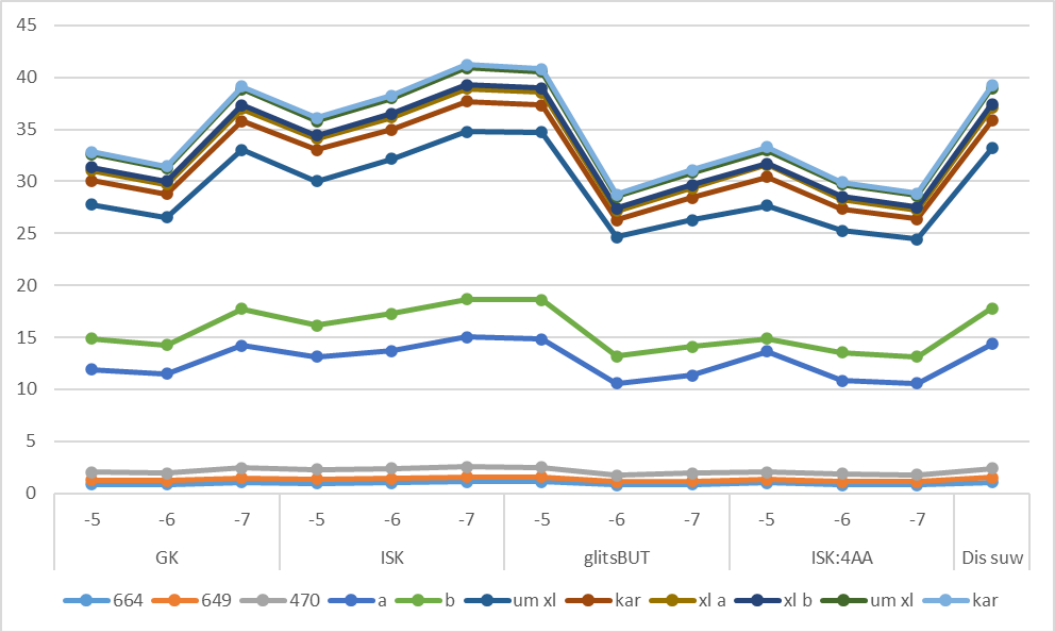
Table 1

Millet ***Saratovskaya—853***								
Biostimulator	Concentration mol/l	664	649	470	Chlorophyll *α*	Chlorophyll *β*	Total Chlorophyll	Carotenoid Content
GK	10^{-5}	0,883	0,37	0,785	0,98766	0,29791	1,2855	0,2303
	10^{-6}	0,852	0,352	0,747	0,95558	0,27371	1,2293	0,2237
	10^{-7}	1,054	0,44	0,934	1,17978	0,35107	1,5309	0,2756
ISK	10^{-5}	0,967	0,396	0,933	1,08639	0,30102	1,3874	0,2991
	10^{-6}	1,014	0,431	0,953	1,13102	0,35887	1,4898	0,2813
	10^{-7}	1,114	0,462	0,98	1,24853	0,3627	1,6112	0,2918
glitsBUT	10^{-5}	1,102	0,465	0,935	1,23094	0,38067	1,6116	0,2619
	10^{-6}	0,791	0,329	0,605	0,88603	0,26016	1,1461	0,1625
	10^{-7}	0,84	0,35	0,73	0,94059	0,27797	1,2185	0,2136
ISK:4AA	10^{-5}	1,002	0,34	0,71	1,16221	0,119	1,2812	0,2769
	10^{-6}	0,803	0,337	0,72	0,89791	0,27236	1,1702	0,2117
	10^{-7}	0,787	0,325	0,658	0,88276	0,25243	1,1351	0,1915
Control	N1	1,043	0,441	0,908	1,16457	0,36275	1,5273	0,2578

At this concentration, the content of total chlorophylls was 1.5309 mg/g, which signifies a significant increase compared to the control group. The substances ISK and glitsBUT also showed a positive effect on the pigment composition of the millet plant. Specifically, the 10^{-7}concentration of ISK increased the total chlorophyll content up to 1.6112 mg/g. This result indicates that this substance also plays an important role in enhancing the plant's photosynthetic potential.

Furthermore, the 10^{-5} concentration of the glitsBUT substance demonstrated one of the highest indicators, reaching a total chlorophyll content of 1.6116 mg/g. This suggests that the substance at this concentration is effective in increasing the green mass and enhancing the yield of the millet plant.

Analysis of the content of chlorophyll "a," chlorophyll "b," total chlorophyll, and carotenoids in millet leaves



The germination of seeds sown in the experimental field, that is, according to the initial germination indicators, in the control variant, millet was 60%.

***Growth rate of grain crops grown under the influence of biostimulants in the conditions of the Republic of Karakalpakstan (%)**

Table 2

Biostimulants	Conc. (molar)	Germination, %
		Tarı 3000079 (Saratovskoe 853)
Control (dist.water)	-	60
GK	10^{-5}	84
	10^{-6}	74
	10^{-7}	79
ISK	10^{-5}	83
	10^{-6}	89
	10^{-7}	79
ISK :4AA	10^{-5}	78
	10^{-6}	78
	10^{-7}	78
Glits BUT	10^{-5}	67
	10^{-6}	74
	10^{-7}	66

In this case, the **highest germination rate** in millet was observed with the ISK 10^{-6} M (89%) concentration, followed by ISK 10^{-5} M (83%), GK10^{-5} M (84%), ISK:4AA (78 %), and GlitsBUT 10^{-6} (74 %). Considering these concentrations, ISK 10^{-6} M showed the highest result.The results clearly indicate that higher germination rates were observed across various compositions compared to the control variant.

Diagram of the germination rate of the 'Saratovskoe 853' millet variety grown in the conditions of the Republic of Karakalpakstan under the influence of biostimulants.



Conclusion

This study presents a scientifically grounded method for applying triterpenoid-nature biostimulants, created on the basis of polyisoprenoids, to the 'Saratovskoe 853' millet variety. It is possible to increase the yield by enhancing the activity of the plant's photosynthetic apparatus.

The ISK and GK biostimulants provided a high level of germination in tests conducted at various concentrations (approximately 83-89%). The germination rate of ISK at a lower concentration (10^{-6} M) was slightly higher (89%) , indicating that this substance is effective even at

a low concentration. GK, on the other hand, showed a germination rate almost equal to ISK at 10^{-5} M (84 %).

Therefore, the germination effectiveness of the ISK and GK substances is high and at a similar level, but ISK may also work effectively at a lower concentration. These results create new opportunities for increasing efficiency in agricultural practice and seed production.

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Rezyume: *Maqolada tariq o'simligi, uning biologik xususiyatlari, yetishtirish texnologiyasi, iqlim va tuproq sharoitlariga bo'lgan talablari, hamda oziq-ovqat va yem-xashak sifatidagi ahamiyati yoritilgan. Shuningdek, maqolada* ***p****oliizoprenoidlar asosida yaratilgan triterpenoid tabiatga ega biostimulyatorlar — glitserrizin kislotasi (GK), indol sirka kislotasi (ISK), indol sirka kislotasi + 4-aminoantipirin (ISK:4AA) «GLITSBUT», «GLINBUT» biostimulyatorlarining Qaraqolpaqston Respublikasi sharoitida donli ekinlariga qo'llash usulini ishlab chiqish va o'sib rivojlanishiga, mahsulot sifatiga hamda ularning tarkibidagi ba'zi biokimyoviy ko'rsatkichlarga ta'sirini tahlil qilingan. Tariq barglarining turli SPAD 502 ko'rsatkishlari va xlorofill, karotinoidlar miqdorini o'zaro bog'likligini aniqlangan.*

Резюме: *В статье рассматривается просо, его биологические особенности, технология выращивания, требования к климатическим и почвенным условиям, а также его значение в качестве пищи и корма. Также в статье проанализировано влияние биостимуляторов тритерпеноидной природы - глицерризиновой кислоты (ГК), индолуксусной кислоты (ИСК), индолуксусной кислоты + 4-аминоантипирина (ИСК:4АА) "GLITSBUT," "GLINBUT," созданных на основе полиизопреноидов, на качество продукции и некоторые биохимические показатели зерновых культур в условиях Республики Каракалпакстан. Установлена взаимосвязь между различными показателями SPAD 502 и количеством хлорофилла, каротиноидов в листьях проса.*

Kalit so'zlar*: tariq o'simligi, oziq-ovqat, biologik xususiyatlari, xlorofill "a," xlorofill "b," karotinoidlar*

Ключевые слова*: растение просо, пища, биологические свойства, хлорофилл "а," хлорофилл "б," каротиноиды*

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ANALOGUE OF LELONG'S THEOREM FOR $\boldsymbol{\alpha}$-SEPARATELY SUBHARMONIC FUNCTIONS

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Summary. *This paper investigates* ***α-separately subharmonic functions*** *and establishes an* ***analogue of Lelong's theorem*** *for these functions. An analogue of Lelong's theorem is proved under additional assumptions, where* $\boldsymbol{\alpha}$ *is a* ***differential biform****.*

Key words: *separately subharmonic function,* $\boldsymbol{\alpha}$*-separately subharmonic function, closed and strictly positive differential form.*

INTRODUCTION

The well-known Hartogs theorem (see [1]) asserts *that a function* $f(z,w)$ *defined on a domain* $D\times G\subset\mathbb{C}^n(z)\times\mathbb{C}^m(w)$ *and holomorphic in each variable separately is holomorphic with respect to all variables in the domain.* In 1961, P. Lelong established the following analogue of this theorem for separately harmonic functions.

Theorem 1. (see [2]). *Let* $u(x,y)$ *be a separately harmonic function in a domain* $D\times G\subset\mathbb{R}^n(x)\times\mathbb{R}^m(y)$*; that is,* $u(x,y)$ *is harmonic in each variable when the others are fixed. Then* u *is harmonic with respect to all variables in* $D\times G$*.*

Since the publication of Lelong's aforementioned work, separately harmonic, separately R-analytic, and separately subharmonic functions have become the subject of study for many authors. The main focus has been directed toward the following problem: *Is a separately subharmonic function subharmonic with respect to the totality of variables?* The answer to this question is negative. More precisely, in 1988, Jan Wiegerinck (see [3]) constructed an example of a separately subharmonic function that is not subharmonic with respect to all variables taken together.

Under additional assumptions, this question has been studied in the works of various authors, including V. Avanissian [4], M. G. Arsove [5], J. Riihentaus [6], as well as D. H. Armitage and S. J. Gardiner [7], where important results were obtained.

Further advances in the study of separately subharmonic functions are associated with additional conditions, such as harmonicity or real analyticity with respect to one group of variables.

In this article, we introduce and study the concepts of **α**-separately subharmonic functions. Under certain additional assumptions, we establish analogue of Lelong's theorem for these functions, where $\boldsymbol{\alpha}=(\alpha',\alpha'')$ denotes a differential biform.

PRELIMINARIES

We begin by recalling several fundamental notions required for the proof of the main results.

Let α be an arbitrary closed, strictly positive differential form of bidegree $(n-1,n-1)$ in a domain $D\subset\mathbb{C}^n$, given by

$$\alpha=\left(\frac{i}{2}\right)^{n-1}\sum_{j,k=1}^{n}\alpha_{jk}(z)dz[j]\wedge d\bar{z}[k],$$

where $\alpha_{jk}(z) \in Lip_{\lambda}(D)$ for all $j, k = \overline{1, n}$ and $0 < \lambda < 1$. The forms

$$dz[j] = dz_1 \wedge ... \wedge dz_{j-1} \wedge dz_{j+1} \wedge ... \wedge dz_n,$$

$$d\overline{z}[k] = d\overline{z}_1 \wedge ... \wedge d\overline{z}_{k-1} \wedge d\overline{z}_{k+1} \wedge ... \wedge d\overline{z}_n$$

are defined in the standard way. Moreover, the form α is closed, i.e. $d\alpha = 0$.

Strict positivity of α means that for every compact set $G \Subset D$ there exists a constant $\varepsilon > 0$ such that the differential form $\alpha - \varepsilon\beta^{n-1}$ is positive on G, where $\beta = dd^c(|z|^2)$ denotes is the standard volume form in $\mathbb{C}^n$.

For any twice continuously differentiable function $u(z) \in C^2(D)$, $D \subset \mathbb{C}^n$, the operator $dd^c u \wedge \alpha$ can be represented as

$$dd^c u(z) \wedge \alpha(z) = \Delta_{\alpha} u(z) \cdot dV,$$

where

$$\Delta_{\alpha} u(z) = \sum_{j,k=1}^{n} \alpha_{j,k}(z) \frac{\partial^2 u}{\partial z_j \partial \overline{z}_k} = \sum_{j,k=1}^{n} \alpha_{j,k}(z)(\mathfrak{D}_j - i\mathfrak{D}_{n+j})(\mathfrak{D}_k + i\mathfrak{D}_{n+k})u(z),$$

$$dV = dx_1 \wedge dx_2 \wedge ... \wedge dx_{2n}, \ \mathfrak{D}_j = \frac{\partial}{\partial x_j}, \ j = \overline{1, 2n}.$$

Definition 1 (see [8]). *A function $u(z) \in C^2(D)$ is called α-subharmonic in $D \subset \mathbb{C}^n$ if $dd^c u \wedge \alpha \geq 0$ in D.*

Definition 2 (see [9]). *A function $u(z) \in L^1_{loc}(D)$ is called α-subharmonic in $D \subset \mathbb{C}^n$ if*

(i) it is upper semicontinuous in D, i.e.

$$\overline{\lim_{z \to z^0}} u(z) \leq u(z^0), \ \forall z^0 \in D$$

(ii) the operator $dd^c u \wedge \alpha$ is positive in the generalized sense, that is,

$$dd^c u(z) \wedge \alpha(z)(\omega) := \int u(z)\alpha(z) \wedge dd^c \omega(z) \geq 0, \ \forall \omega \in F(D), \ \omega \geq 0.$$

Let α' be an arbitrary closed, strictly positive differential form of bidegree $(n-1, n-1)$ in a domain $D \subset \mathbb{C}^n(z)$, given by

$$\alpha' = \left(\frac{i}{2}\right)^{n-1} \sum_{j,k=1}^{n} \alpha'_{jk}(z) dz[j] \wedge d\overline{z}[k],$$

where $\alpha'_{jk}(z) \in Lip_{\lambda}(D)$, $0 < \lambda < 1$, and $d\alpha' = 0$.

Similarly, let α'' denote an arbitrary closed, strictly positive differential form of bidegree $(m-1, m-1)$ in a domain $G \subset \mathbb{C}^m(w)$, given by

$$\alpha'' = \left(\frac{i}{2}\right)^{m-1} \sum_{j,k=1}^{m} \alpha''_{jk}(w) dw[j] \wedge d\overline{w}[k],$$

where $\alpha''_{jk}(w) \in Lip_{\lambda}(G)$, $0 < \lambda < 1$, and $d\alpha'' = 0$.

Consider the operators acting in the class C^2:

$$d_z d_{\bar{z}}^c u(z,w) \wedge \alpha'(z) = \left(\frac{i}{2}\right)^n \sum_{j,k=1}^{n} (-1)^{k+j+1} \alpha'_{jk}(z) \frac{\partial^2 u(z,w)}{\partial z_j \partial \bar{z}_k} dz \wedge d\bar{z}\,,\ \forall w \in G\,,$$

$$d_w d_{\bar{w}}^c u(z,w) \wedge \alpha''(w) = \left(\frac{i}{2}\right)^m \sum_{j,k=1}^{m} (-1)^{j+k+1} \alpha''_{jk}(w) \frac{\partial^2 u(z,w)}{\partial w_j \partial \bar{w}_k} dw \wedge d\bar{w}\,,\ \forall z \in D\,.$$

Definition 3. *A function* $u(z,w)$ *is called* $\boldsymbol{\alpha}$*-separately subharmonic in a domain* $D \times G \subset \mathbb{C}^n(z) \times \mathbb{C}^m(w)$*, where* $\boldsymbol{\alpha} = (\alpha', \alpha'')$ *is a biform, if it is locally integrable and upper semicontinuous with respect to each variable, and the following conditions are satisfied:*

(i) The operator $d_z d_{\bar{z}}^c u \wedge \alpha'$ *is positive in the generalized sense:*

$$\int u(z)\alpha'(z) \wedge d_z d_{\bar{z}}^c \omega(z) \geq 0\,,\ \forall \omega \in F(D)\,,\ \omega \geq 0\,.$$

(ii) The operator $d_w d_{\bar{w}}^c u \wedge \alpha''$ *is positive in the generalized sense:*

$$\int u(w)\alpha''(w) \wedge d_w d_{\bar{w}}^c \omega(w) \geq 0\,,\ \forall \omega \in F(G)\,,\ \omega \geq 0\,.$$

For an $\boldsymbol{\alpha}$-separately subharmonic function w belonging to the class C^2, the following theorem holds.

Theorem 2. *If a function* $u(z,w) \in C^2(D \times G)$ *is* $\boldsymbol{\alpha}$*-separately subharmonic, then with respect to all variables*

$$dd^c u(z,w) \wedge \alpha(z,w) \geq 0\,,$$

i.e. $u(z,w)$ *is* $\boldsymbol{\alpha}$*-subharmonic with respect to the total set of variables, where* $\alpha(z,w) = \alpha'(z) \wedge \alpha''(w) \wedge \beta$*, and* $\beta = dd^c\left(|z|^2 + |w|^2\right)$.

It should be noted that if the differential form α is real-analytic, then an α-harmonic function is also real-analytic.

MAIN RESULTS

As in the case of harmonic functions, to study the continuation of α-harmonic functions, we first reduce the problem to holomorphic functions and then apply the principles of holomorphic continuation. The following lemma will be useful for this purpose.

Lemma 1. *Let the differential form* α *be real-analytic in a domain* $D \subset \mathbb{C}^n \cong \mathbb{R}^{2n}$*. Then there exists a domain* $\tilde{D} \subset \mathbb{C}^{2n}$ $\left(\mathbb{C}^n \cong \mathbb{R}^{2n} \subset \mathbb{C}^{2n}\right)$ *such that every* α*-harmonic function in* D *can be analytically (holomorphically) continued to* $\tilde{D}$*.*

Under additional assumptions on an $\boldsymbol{\alpha}$-separately subharmonic function $u(z,w)$, the following theorem holds, which is an analogue of Lelong's theorem for $\boldsymbol{\alpha}$-separately subharmonic functions.

Theorem 3. *Let a real-analytic differential biform* $\boldsymbol{\alpha} = (\alpha', \alpha'')$ *be given in a domain* $D \times G \subset \mathbb{C}^n(z) \times \mathbb{C}^m(w)$*, and let* $u(z,w)$ *be a* $\boldsymbol{\alpha}$*-separately subharmonic function in* $D \times G$ *satisfying the following conditions:*

(i) For each fixed $w^0 \in G$*, the function* $u(z,w^0)$ *is real-analytic with respect to the variable* z*;*

(ii) For any fixed $z^0 \in D$ *, the function* $u(z^0, w)$ *is* α''*-harmonic with respect to the variable* w.

Then $u(z,w)$ *is a real-analytic* α*-subharmonic function in* $D \times G$ *with respect to all variables, where* $\alpha = \alpha'(z) \wedge \alpha''(w) \wedge \beta$.

Proof. Assume without loss of generality that $D \times G$ is bounded and that $u(z,w)$ satisfies the above assumptions in a neighborhood of $\bar{D} \times \bar{G}$.

By Lemma 1, for each fixed $w \in G$, the function $u(z,w)$ with respect to the variable z can be holomorphically extended from $\bar{D}$ to a certain domain $\tilde{D}_w \subset \mathbb{C}^{2n}$. Let $d(\bar{D}, \tilde{D}_w)$ denote the distance from $\bar{D}$ to $\partial \tilde{D}_w$. Denote by $\tilde{u}(\zeta, w)$ the holomorphic extension of the function $u(z,w)$ with respect to the first group of variables.

By the α''-harmonicity of the function $u(z,w)$, for every $z \in \bar{D}$ there exists a domain $\tilde{G} \subset \mathbb{C}^{2m}(\eta)$, with $\bar{G} \subset \tilde{G}$, such that $u(z,w)$ can be holomorphically extended from $\bar{G}$ to $\tilde{G}$; denote this function by $\hat{u}(z,\eta)$.

Define the following sequence of sets

$$E_k = \left\{ w \in \bar{G} : d(\bar{D}, \tilde{D}_w) \geq \frac{1}{k} \right\},\ k = 1, 2, \ldots .$$

Clearly, $\bigcup_{k=1}^{\infty} E_k = \bar{G}$. Since $\bar{G} \subset \mathbb{C}^m \cong \mathbb{R}^{2m} \subset \mathbb{C}^{2m}$ is non-pluripolar in $\tilde{G} \subset \mathbb{C}^{2m}(\eta)$, there exists an index l such that E_l is non-pluripolar in $\tilde{G}$. Fix a domain $\tilde{D} \subset \mathbb{C}^{2n}(\zeta)$ with $\bar{D} \subset \tilde{D} \subset \tilde{D}_w$ for all $w \in E_l$, and denote

$$E_l^M = \left\{ w \in E_l : \left|\tilde{u}(\zeta, w)\right| \leq M, \forall\, \zeta \in \tilde{D} \right\}.$$

Since $\bigcup_{N=1}^{\infty} E_l^M = E_l$, there exists M such that $E = E_l^M$ is non-pluripolar in $\tilde{G}$.

We now show that for each $w \in \bar{E}$, the function $u(\cdot, w)$ can be holomorphically extended from $\bar{D}$ to $\tilde{D}$. For $w \in E$, this is immediate. If w^0 is a limit point of E, take a sequence $\{w_l\} \subset E$ with $w_l \to w^0$. Since $\left|\tilde{u}(\zeta, w_l)\right| \leq M$ for all $\zeta \in \tilde{D}$, by Montel's theorem there exists a subsequence $\left\{\tilde{u}(\zeta, w_{l_k})\right\}_{k=1}^{\infty}$ converging uniformly on $\tilde{D}$. Let us note that the limiting function on $\bar{D}$ coincides with $\tilde{u}(z, w^0) = u(z, w^0)$; hence, it also coincides with $\tilde{u}(\zeta, w^0)$ in $\tilde{D} \cap \tilde{D}_{w^0}$. It then follows that $\tilde{D} \subset \tilde{D}_{y^0}$.

Thus, we have defined a separately analytic function $u(z,w)$ on

$$X = \left(\tilde{D} \times \bar{E}\right) \bigcup \left(\bar{D} \times \tilde{G}\right).$$

By the Siciak–Zakharyuta theorem (see [10], [11]), $u(z,w)$ can be holomorphically extended to the open set

$$\hat{X} = \left\{(z,w) \in \tilde{D} \times \tilde{G} : \omega^*(z,\overline{D},\tilde{D}) + \omega^*(w,\overline{E},\tilde{G}) < 1\right\}.$$

Since $D \times G \subset \hat{X}$, the function $u(x,y)$ is real-analytic and, by Theorem 2, α-subharmonic $D \times G$. *The theorem is proved.*

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Rezyume: *Ushbu maqolada* $\boldsymbol{\alpha}$*-separat garmonik va* $\boldsymbol{\alpha}$*-separat subgarmonik funksiyalar qaraladi va ushbu funksiyalar uchun Lelon teoremasining analoglari isbotlanadi, bunda* $\boldsymbol{\alpha} = (\alpha', \alpha'')$ *– differensial biforma.*

Резюме: *В данной статье рассматриваются* $\boldsymbol{\alpha}$*-сепаратно гармонические и* $\boldsymbol{\alpha}$*-сепаратно субгармонические функции, и для этих функций доказываются аналоги теоремы Лелона, где* $\boldsymbol{\alpha} = (\alpha', \alpha'')$ *– дифференциальная биформа.*

Kalit so‘zlar: $\boldsymbol{\alpha}$*-separat garmonik funksiya,* $\boldsymbol{\alpha}$*-separat subgarmonik funksiya, yopiq va qat’iy musbat differensial forma,* Δ_α *operatori,* $dd^c \wedge \alpha$ *operatori.*

Ключевые слова: $\boldsymbol{\alpha}$*-сепаратно гармоническая функция,* $\boldsymbol{\alpha}$*-сепаратно субгармоническая функция, замкнутая и строго положительная дифференциальная форма, оператор* Δ_α*, оператор* $dd^c \wedge \alpha$.

ECOLOGICAL ANALYSIS OF THE ALGOFLORA OF THE RESERVOIRS OF NUKUS AGROFISH FISH FARMS

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Summary:. *In this article, scientific research is being conducted to observe the ecological changes observed in the water bodies of fish farms of the Republic of Karakalpakstan, to assess the pollution of water bodies under the influence of organic substances depending on the level of biodiversity, data are presented on the specific features of fish ponds in the regions, and the results of the analysis of the life forms of the algoflora of the studied territory showed that phytoplankton clearly leads in the studied water bodies, which were studied by dividing them into groups according to the number of species.*

Key words: *Algoflora fish ponds, leadership, phytobenthos, periphyton, littoral, epiplanton*

Analysis of sources on the topic. A number of studies have been conducted on the algoflora of artificial reservoirs, their ecological features, and the regularities of the formation of algoflora in reservoirs in Central Asia and other regions (Nomokonova V.I., Pautova V.N. Pervichnaya 2013. , Alimjanova Kh.A., Tashpulatov Y.Sh., 2014, M.T. Boboev, 2018. Shernazarov Sh.Sh., 2021; Tashpulatov I.Sh., Kobulova B.B., 2015)

Object and methods of the study. The study of the algoflora of fish ponds in Karakalpakstan, through the analysis of the ecological characteristics of the species in it, plays an important role in thinking about the algoflora as a whole and in understanding the features of its formation.

The obtained results and their analysis. The results of the analysis of the life forms of the algoflora showed that in the studied water bodies, phytoplankton clearly dominated, constituting 114 species, which accounted for 48.10% of the total algoflora. The following places are occupied by phytobenthoses, containing 55 species - 23.21%, periphyton - 23 species - 9.70%, littoral - 41 species - 17.30%, epiplanton - 4 species - 16.88%. Typical phytoplants include *Merismopedia elegans, Gomposphaeria lacustris* (blue-green), *Lindavia bodanica, Cyclotella meneghiniana, Diatoma tenuis* (diatom), *Peridiniopsis quadridens, Peridinium bipes, Parvodinium pusillum* (dinophyte), *Euglena deses, E. gracilis, E. salina* (evglena*), Chlamydomonas atactoga*ma, *Ch. Incerta, Chlorogonium elongatum* (green) can be cited as examples.

Phytobenthos include *Fragilaria construens* Ehr, *Navicula bacillum* Ehr (diatom), *Ulothrix tenuissima* Kutz *Oedogonium oblongum* Wittr. (green) is an example.

The following table shows the distribution of life forms of algae by sections (Table 1).

Table 1.

Distribution of life forms of algae by sections

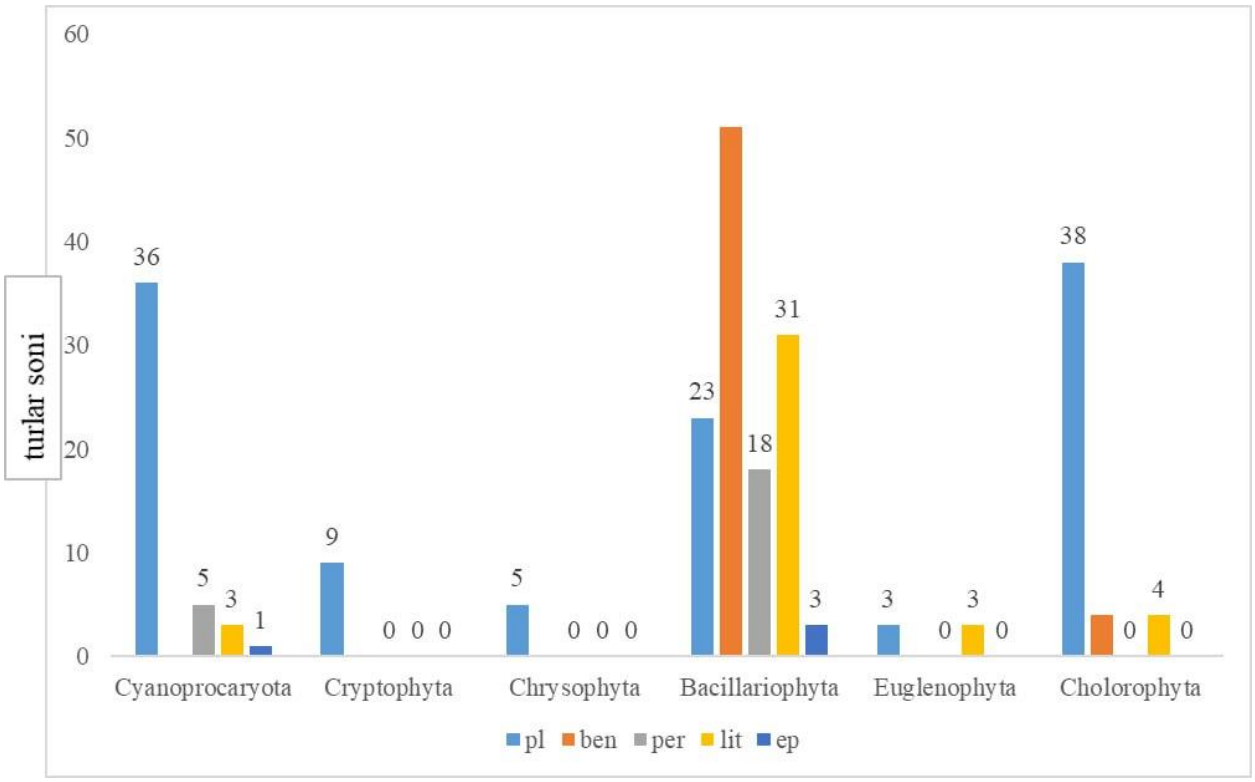
Division	p	%	b	%	per	%	L	%	ep	%
Cyanoprocaryota	36	31,58	0	0	5	21,74	3	7,32	1	25
Dinophyta	9	7.89	0	0	0	0	0	0	0	0
Chrysophyta	5	4,38	0	0	0	0	0	0	0	0
Bacillariophyta	23	20.17	51	92,73	18	78,26	31	75,61	3	75
Euglenophyta	3	2,63	0	0	0	0	3	7,32	0	0
Cholorophyta	38	33,33	4	7,27	0	0	4	9,75	0	0
	114	**100**	**55**	**100**	**23**	**100**	**41**	**100**	**40**	**100**

Note: p - plankton, b - benthos, L - littoral; per - periphyton, earth-epiplactone

Bentos *was found in the Department of Green Algae: Ulothrix tenuissima* Kutz *, U. zonata (L.)* Ehr. *Morch.* Kutz., *Oedogonium oblongum* Wittr, *Cladophora glomerata* Kutz. (1.69%) species.

Identified in the Department of Litoral Green Algae *Zygnema. pectinalis (*Vauch.*) Ag. emend. Czurda, Spirogyra varians (*Hass.) Kutz *, Euastrum . Dentikulatum (*Kirchn *.) Gay , Micrasterias (1.69%) of species.*

As can be seen from the analysis, planktonic algae occupy a leading place in the algoflora of the studied water bodies. This is a characteristic feature of all non-flowing water bodies. From this, it can be concluded that phytoplankton has a significant share in these water bodies, which indicates the presence of favorable conditions for the initial feeding stages of herbivorous fish and all fish fry that feed on phytoplankton.



Note: p - plankton, b - benthos, L - littoral; per - periphyton, earth-epiplactone

Conclusion. From this, it can be concluded that phytoplankton has a significant share in these water bodies, which indicates the presence of favorable conditions for the initial feeding stages of herbivorous fish and all fish fry that feed on phytoplankton.

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Резюме: *В статье представлены научные исследования по мониторингу экологических изменений, наблюдаемых в водоемах рыбного хозяйства Республики Каракалпакстан, оценке загрязнения водоемов под влиянием органических веществ во взаимосвязи с уровнем биологического разнообразия, а также приведены данные об особенностях рыбоводных прудов регионов результаты анализа по жизненным формам альгофлоры региона показали, что в исследованных водоемах явным лидером является фитопланктон, который по числу видов разделился на группы.*

Ключевые слова*: Альгофлора рыбоводных прудов, лидерство, фитобентос, перифитон, литораль, эпиплантон*

NITROPHOSPHORUS FERTILIZERS OBTAINED BASED ON AMMONYUM SELITER AND AMMOPHOS

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Karakalpak State University named after Berdakh

***Summary**: The article states that granulated ammonium nitrate containing from 2.33 to 12.08% P2O5 is obtained by adding powdered ammophos to the ammonium nitrate melt. It has been shown that the strength of saltpeter granules increases from 1.60 MPa to 6.94 MPa with the addition of ammophos in the amount of 12.08% P2O5, and the porosity decreases from 8.64 to 7.66%.*

The article describes the production of granulated ammonium nitrate with a P2O5 content of 2.33 to 12.08% by introducing powdered ammophos into its melt. It was shown that the strength of nitrate granules increases from 1.60 MPa without the addition of ammophos to 6.94 MPa with the addition of ammophos in the amount of 12.08% P2O5, and the porosity of granules decreases from 8.64 to 7.66%.

This article described the production of ammonium nitrate with a P2O5 content of 2.33 to 12.08% by injecting powdered ammophos into its melt. It was shown that the strength of saltpeter grains increases from 1.6 MPa without additional ammophos to 6.94 MPa with the addition of ammophos in the amount of 12.08% P2O5, but the porosity of the grains under it decreases from 8.64 to 7.66%.

***Key words:** ammonium nitrate, nitrate fertilizer, Makham-Chirchik, ammophos (Ammophos-Maxam), P2O5 (phosphorus pentoxide), N (nitrogen), granulation, granule strength, porosity, crystallization temperature, melt, oxidizing property, storage and transportation rules, agrochemical efficiency*

Ammonium nitrate is one of the most effective and widely used nitrogen fertilizers in the world. In Uzbekistan, three large industrial enterprises - OAO "Maxam-Chirchik," OAO "Navoiazot," and OAO "Ferganaazot" - produce it for agriculture. The combined capacity of these three plants is over one million tons of saltpeter per year. However, this fertilizer has two very serious drawbacks - its caking tendency during storage and increased explosion hazard [1, 2]. If they have learned to combat caking by introducing various additives (calcium and magnesium salts, sulfate, sulfate-phosphate, sulfate-phosphate borate additives) into the saltpeter [3], then the problem of explosion safety has not been fully resolved.

It is known that pure ammonium nitrate is an oxidizer capable of maintaining combustion [4]. Under normal environmental conditions, ammonium nitrate is a stable substance. When heated in a closed space, when the thermal decomposition products cannot be freely removed, saltpeter can explode under certain conditions. It is also capable of detonating when exposed to a strong impact load or initiated by explosives.

1921 г1947 г2001 г2004 гIt is known to the human community that explosions occurred during the violation of the rules for handling ammonium nitrate and fertilizers based on it during their storage and transportation (September 21 at the plant's warehouse in the city of Oppau, Germany; April 16 on a ship in the Bay of Texas City, USA; September 21 at the plant's warehouse in Toulouse, France; April 22. at the Ryonqchon railway station, North Korea, etc.) [5].

We also know that many accidents and terrorist acts using ammonium nitrate have occurred over the past century [6]. The Irish Republican Army (IRA) began using ammonium nitrate in terrorist acts for the first time. During the IRA's activities (1969-1994), 14,000 explosions were carried out. At the height of the explosions in the early 70s, the British government banned the sale of ammonium nitrate to Northern Ireland. Similar restrictions were also introduced in Ireland. But, despite this, two major explosions were carried out in London.

A series of ammonium nitrate terrorist acts in Southeast Asia, Russia, the USA, and Uzbekistan, carried out at the beginning of the 21st century, put ammonium nitrate consumers and producers in a

difficult situation. A number of countries - China, the Philippines, Colombia, Ireland - have banned the use of ammonium nitrate in agriculture.

In this regard, worldwide, the search is underway for fertilizers based on ammonium nitrate that retain agrochemical effectiveness, have significantly greater resistance to external influences, and, consequently, a lower explosion hazard.

0,1 ммWe decided to obtain stabilized ammonium nitrate by introducing finely ground powder - ammophos, produced at "Ammofos-Maxam" OJSC, into its melt. Granulated ammophos was ground in a porcelain mortar to particle size. Amofos composition: P_2O_5 - 46.5%, N - 10.1%.

The ammonium nitrate produced by OJSC "Maxam-Chirchik" was melted in a metal bowl on an electric stove. Powdered ammophos was introduced into the melt in such a quantity that the final product contained from 2.0 to 12.0% P_2O_5.

1 ммAs the preliminary results showed, adding ammophos to the ammonium nitrate melt significantly reduces the melt's crystallization temperature (Table. Therefore, the resulting mixture was cooled to 155^0C with constant stirring. Then the melt was poured into a granulator, which is a metal beaker with a perforated bottom, the diameter of the holes in which is equal to. A pump created pressure in the upper part of the glass and sprayed the melt from the ninth floor of the building onto the polyethylene film lying on the ground. After this, the strength of the granules was measured, and the granules were then ground and analyzed according to known methods [7].

No.	1.	2.	3.	4.	5.	6.	7.
Amount of additive, g	5.	10.	15.	20.	25.	30.	35.
Crystallization temperature, °C	154.	150.	147.	146.	145.	143.	141.

Tab. 1. Influence of the amount of ammophos additive on the crystallization temperature of the ammonium nitrate mel

The assimilated form P_2O_5 was determined by solubility in both citric acid and Trilon B solution. 2.

Table 2.

Chemical composition of nitrogen-phosphorus fertilizers obtained by introducing finely ground ammophos into the melt of ammonium nitrate

Number of floats, g.	Amount of ammophos, g	N, %	R_2O_{5total} %	P_2O_{5usv} by 0.2M tr.B, %	R_2O_{5usv} 2% each. k-te, %	R_2O_{5water}, %	$\frac{R_2O_{5total}}{R_2O_{5total}}$ for 0.2M trB %	$\frac{R_2O_{5usv}}{P_2O_{5total}}$ for 2%-lim. acid %	$\frac{R_2O_{5water}}{R_2O_{5total}}$ %
100.	-	34.6	Ammonium nitrate without additives						
95.	5.0	33.31	2.33	2.21	2.27	2.00	94.84	97.42	85.83
100.	10.0	32.31	4.24.	4.01	4.14.	3.64	94.57	97.64	85.85
100.	12.0	31.92	5.01	4.73	4.89	4.30.	94.41	97.60	85.83
100.	15.0	31.35	6.07	5.74	5.88	5.22	94.56	96.87	85.99
100.	18.0	30.81	7.10	6.68	6.88	6.08	94.08	96.90	85.63
100.	21,0	30,28	8,09	7,65	7,90	6,94	94,56	97,65	85,78
100.	24.0	29.80	9.01	8.52	8.74	7.72	94.56	97.00	85.68
100.	27,5	29,24	10,06	9,51	9,82	8,63	94,53	97,61	85,78
100.	35,0	28,01	12,08	11,42	11,78	10,37	94,53	97,51	85,84

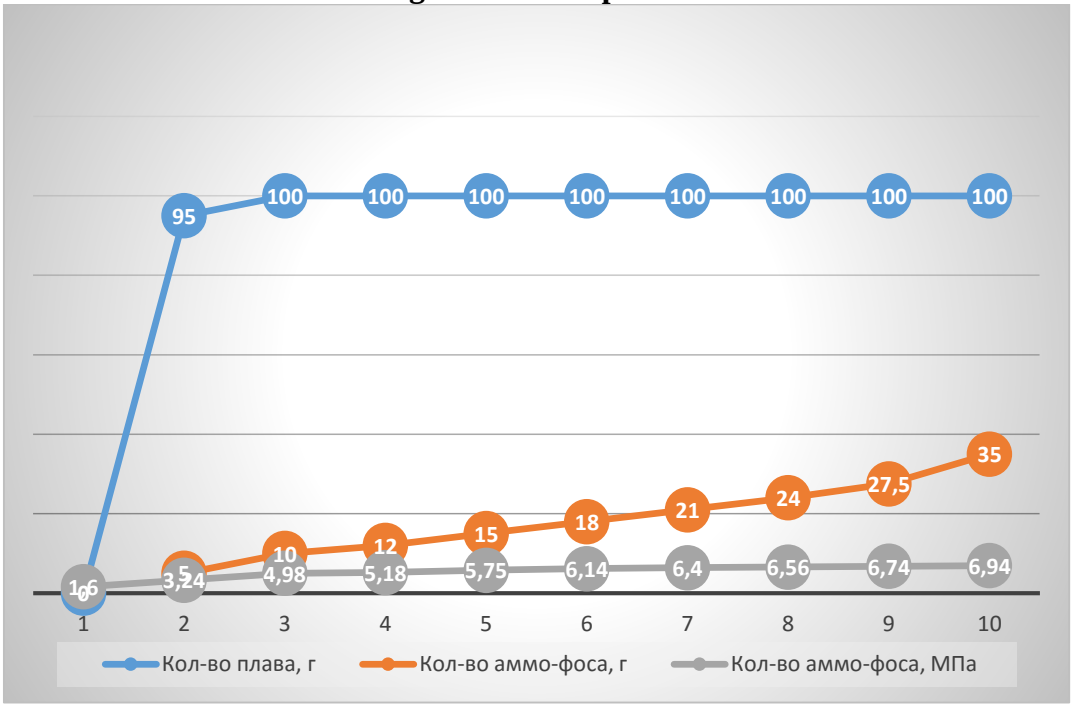
The table shows that at all ratios of ammonium nitrate: ammophos, high-concentrated nitrogen-phosphorus fertilizers with a nitrogen content of 28.01-33.31% and a phosphorus content of 2.33-12.08% are obtained. The amount of phosphate additive practically does not affect the relative content of assimilable and water forms P2O5 in the finished product.

The strength of granules is one of the most important indicators characterizing stabilized ammonium nitrate. We determined this indicator using the method [8]. The test results are presented in the table. 2. Ammonium nitrate with a 12-% additive P_2O_5 has the highest granule strength of 6.94 MPa. Such granule strength indicates a decrease in porosity and the internal specific surface area of

the nitrate, which means a decrease in the penetration of diesel fuel into the granule, leading to a decrease in the detonation capacity of the nitrate.

Figure 1

Strength of granules of fertilizers obtained by introducing ammonium nitrate into the melt of ground ammophos



10 гThe porosity of the granules is also one of the quality indicators of ammonium nitrate. The porosity value of the granules was determined by the volumetric method [3]. The essence of determining the porosity of granules using this method was as follows. A certain amount of cryoscopic benzene (V_1) was poured into a 25 ml burette equipped with a tap. Then, ammonium nitrate or nitrogen-phosphorus fertilizer, obtained by introducing ammophos into its melt, was added to it, and after 1-2 minutes, the changed volume in the burette was recorded (V_2). Then the tap was opened and the benzene between the fertilizer granules was discharged into the second burette (also 25 ml) and its volume was measured (V_3). The porosity (in percent) was calculated using the formula:

$$П = \frac{V_1 - V_3}{V_2 - V_3} \times 100$$

For porous ammonium nitrate used as a component of explosive mixtures, this indicator is 20% or more. For ordinary ammonium nitrate - 9.15%.

The results of the experimental data are presented in Figure 1. The obtained data show that the addition of ammophos to the ammonium nitrate melt in an amount of from 2.33 to 12.08% in terms of P_2O_5 contributes to a decrease in the porosity of the granules of the obtained nitrogen-phosphorus fertilizers from 8.64 to 7.66%.

Thus, by introducing ground ammophos into the melt of ammonium nitrate, it is possible to obtain concentrated nitrogen-phosphorus fertilizers with improved physicochemical properties.

No.	1.	2.	3.	4.	5.	6.	7.
Amount of additive, g	8.	10.	15.	20.	25.	30.	35.
Granule porosity, %	8.6	8.4	8.3	8.2	7.9	7.8	7.7

Tab. 3. Dependence on the influence of ammophos additives on the porosity of ammonium nitrate granules.

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GOST 21560.2

BIOECOLOGICAL PROPERTIES AND AGROTECHNOLOGY OF THE MEDICINAL PLANT *CICHORIUM INTYBUS* L.-IN THE TERRITORY OF KARAKALPAKSTAN

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Summary: *The article provides information on the agricultural technology, composition, use, distribution, and raw materials of Cichorium intybus L. in laboratory conditions, including seed germination studies in water-soaked and control variants, as well as field experiments.*

Key words: *Karakalpakstan, medicinal plants, Asteraceae family, life form, folk medicine, agricultural technology*

INTRODUCTION

The search for new species of medicinal plants to expand the range of domestic herbal remedies remains a pressing area of modern pharmacy. Studying the chemical composition of both organic and inorganic substances is a necessary step in substantiating the pharmacological action of drugs during their development. Plants of the chicory genus (*Cichorium* L.) represent promising candidates for herbal remedy development. The most common species both cultivated and wild, is common chicory. Common chicory (*Cichorium intybus* L.) belongs to the genus Chicory (*Cichorium*) of the *Asteraceae* family. The plant has sedative, choleretic, diuretic, anthelmintic, and anti-inflammatory properties. It regulates metabolism, improves digestion, lowers blood sugar levels, and somewhat improves cardiac function. Chicory also has astringent, antimicrobial, antiparasitic, and antipyretic properties. Tincture of this plant improves appetite, digestion, and has a calming effect on the nervous system.

MATERIALS AND METHODS

Cichorium intybus L.– In our country, chicory is mainly found in alfalfa among irrigated crops. Chicory begins to grow in March-May, blooms and bears fruit from July to October. It is a plant that reproduces by seeds. The roots of chicory contain up to 20% inulin. In addition, the roots and leaves of chicory contain a large amount (up to 11%) of polysaccharides, insulin, proteins (4%), glycoside intebelin, which are unique in their own way. Organic acids are vitamins - thiamine, riboflavin, ascorbic acid, carotene; seeds contain 15-28% fatty oil, young leaves contain dacarotene, ascorbic acid (up to 0.08%), inulin, potassium salts. It is used instead of starch or sugar in diabetes, helps digestion and soothes the stomach. It is also recommended to consume the plant when the spleen and spleen organs are disturbed. The plant is also useful for the heart. The inflorescences of the plant are an effective tool for the normal functioning of the heart. In addition, the plant is widely used as a fever reducer. The plant has many other medicinal properties. Namely, it is an expectorant, antimicrobial, anti-inflammatory, and is used in the treatment of liver and gastrointestinal tract diseases. In folk medicine, decoctions are prepared from its roots and used for skin diseases and to improve metabolism.

RESULTS AND DISCUSSION

The agrotechnology of cultivation of *Cichorium intybus* L. was studied in the conditions of Karakalpakstan. The seeds of the plant were sown in Petri dishes in laboratory conditions at temperatures of +10-13^{0}C, +15-18 ^{0}C, +20-23 ^{0}C, and the results obtained are presented in Table 1.

Table 1

Germination of Cichorium intybus L. seeds under laboratory conditions (2024 seeds)

Petri dishes and seed number	Temperature ranges (°C)			Germination %
	+10-13^{0}C	+15-18 ^{0}C	+20-23 ^{0}C	
I. Petri dish (100 seeds)	22	36	23	81
II. Petri dish (100 seeds)	20	26	24	70
III. Petri dish (100 seeds)	14	32	21	67
IV. Petri dish (100 seeds)	17	25	23	65
Average	18,25	29,75	22,75	70,75

After observation in laboratory conditions, the plant Cichorium intybus L. was studied in field experimental conditions by sowing seeds in March, April, and May 2024 and 2025(table 2,3,4,5). The effect of sowing dates on the growth and development of the plant was also studied (Table 2).

To study the fertility of *Cichorium intybus* L. in field conditions, the plant was planted four times and the average was taken(Table 3). The results obtained in March, April and May are presented below(Table 4).

Table 2

The effect of sowing dates on the growth and development of *Cichorium intybus* L. (2024)

Planting periods	Maturity (days)	Number of leaves	Flowering	Number of stems	Maturity period (days)
15.03.2024	15	2	55	11	190
25.03.2024	10	5	41	15	142
05.04.2024	5	7	25	21	120
15.04.2024	8	5	35	10	123
Average	10,75	5,25	39	14,25	143,75

Table 3

Field viability of *Cichorium intybus* L. March 2025

Factors		Observed in Days (March 30)						
		15	17	20	22	24	27	30
Average air temperature ^{0}C		11,5	16,2	17,7	13,0	17,4	17,6	18,8
Humidity %		50	34	46	57	44	44	32
Seed sowing date								
		March 15						
Seed sowing and maturity dates	1	+	-	1	4	7	35	47
	2	+	-	3	3	7	23	38
	3	+	-	1	3	5	30	46
	4	+	-	2	5	10	22	34
Average		+	-	1,75	3,75	7,25	27,5	41,25

Table 4

Field productivity of Cichorium intybus* L. *April 2025

Factors		Observed in Days (April 30)								
		5	9	12	16	18	20	24	27	30
Average air temperature ^{0}C		19,8	26,8	24,8	22,8	23,0	26,4	29,0	32,5	25,6
Humidity %		42	31	38	29	29	28	25	19	25
Seed sowing date										
		5-April								
Seed sowing and maturity dates	1	+	-	-	1	12	19	35	55	72
	2	+	-	-	2	11	25	40	44	63
	3	+	-	-	2	9	27	33	40	70
	4	+	-	-	3	20	27	40	53	72
Average					2,0	13,0	24,5	37,0	48,0	69,25

Table 5

Field productivity of Cichorium intybus L. April, May 2025

Factors		Observed in days April, May							
		15	17	20	25	28	1	4	7
Average air temperature 0 C		24,4	21,2	26,4	28,0	31,8	26,6	29,0	30,4
Humidity %		32	33	28	26	20	27	26	37
Seed sowing date									
		15- April							
Seed sowing and maturity dates	1	+	-	2	11	20	23	28	36
	2	+	-	2	9	17	28	34	43
	3	+	-	1	11	15	22	36	47
	4	+	-	-	15	23	39	46	51
Average		+	-	1,25	11,5	18,7	28,0	36,0	44,25

Agrotechnology of cultivation: The *Cichorium intybus* L. plant is considered a wild plant that grows naturally along the banks of ditches, among various plant crops. However, the medicinal properties of this plant and its use in other fields require its cultivation in field areas.

Tillage and seeding: Initially, the experimental area was cleared of weeds and the planting area was determined as 1 m2. There were 5 rows, with a row spacing of 15 cm. It is noted in the literature that 3-25 thousand seeds can be obtained from one sachratqi ball.

It was determined that one ball of seeds planted in the experimental area contained up to 10-20 seeds. A total of 50 seeds were sown in each row, 10 seeds, at a depth of 1 cm. The plant grows well on moderately dry and moist soils. The soil should be enriched with organic matter and have a normal pH. The plant does not grow well in saline or constantly wet soil [4.5.7]. Two seeds were sown 15-20 cm from the marked moisture line, and the seeds were covered with a thin layer of dry soil from 1-3 cm to 4-5 cm above this line. The moisture around the seeds should be maintained for 3 days (late sowing / warmer) to 5 days (early sowing / cooler).

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Rezyume: *Ushbu maqolada Cichorium intybus L. o'simligining laboratoriya sharoitlarida (urug'larni suvga ivitish va kontrol variantlari), shuningdek, dala tajribalarida yetishtirish agrotexnologiyasi, tarkibi, ishlatilishi, tarqalishi va xom ashyo tayyorlash haqida ma'lumotlar keltirilgan.*

Резюме: *В статье приведены сведения по агротехнике выращивания, составу, использованию, распространению и заготовке сырья Cichorium intybus L. в лабораторных условиях (включая варианты с замачиванием семян и контрольные), а также в полевых опытах.*

Kalit so‘zlar: *Qoraqalpog'iston, dorivor o'simliklar, Asteraceae oilasi, hayot shakli, xalq tabobati, yetishtirish agrotexnologiyasi.*

Ключевые слова: *Каракалпакстан, лекарственные растения, семейство Asteraceae, жизненная форма, народная медицина, агротехника выращивания.*

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ON CONVERGENCE OF DIFFERENCE SCHEMES FOR A NONLINEAR PROBLEM

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Summary: *In this paper, difference schemes are constructed for a nonlinear problem of quasistationary processes in semiconductors with a stationary distribution of free charge current sources. The finite difference method is used to discretize the spatial variable, and the resulting system of nonlinear ordinary differential equations is solved by the first- and second-order Euler methods. Based on the theory of difference equations, stability conditions for the difference schemes are obtained, as well as a priori estimates of convergence.*

Key words*: nonlinear pseudo-parabolic equation, difference equation, difference schemes, stability, uniform stability, convergence, accuracy.*

1. Introduction. Many applied problems require the solution of non-classical Sobolev-type equations. Numerical methods play a key role in tackling such problems arising in filtration theory, semiconductor physics, biology, ecology, and hydrology. Among these, finite difference methods are particularly important in numerical analysis, as they reduce the solution process to a finite number of arithmetic operations, making the implementation straightforward.

Typically, numerical approaches are employed to solve nonlinear, time-dependent initial–boundary value problems. The method of lines is commonly used to approximate differential equations by discretizing only the spatial variables. The resulting system of nonlinear ordinary differential equations is then solved using Runge–Kutta methods of various orders of accuracy. One of the main challenges in the analysis of difference schemes lies in proving their stability and obtaining *a priori* convergence estimates between the discrete and continuous solutions.

Recently, much attention has been given to developing and analyzing numerical methods for pseudoparabolic equations that contain a linear operator in the time derivative. Analytical treatments of such problems can be found in [1]–[4], while numerical approaches are presented in [5]–[9]. In [5], L^2-stable difference schemes, known as Complex Rosenbrock Schemes (CROS), were developed for both linear and nonlinear pseudoparabolic equations with initial–boundary conditions. Reference [6] discusses the construction of schemes on quasi-uniform grids for related problems. These works primarily focus on the formulation and implementation of the schemes but do not address their stability or convergence properties. In [7] and [8], finite difference and finite element methods were applied to construct and analyze high-order schemes for linear pseudoparabolic equations.

In this paper, we construct and analyze a difference scheme for a nonlinear problem arising in semiconductor theory. The method of lines is first employed to discretize the spatial variables. The resulting Cauchy problem for a nonlinear ordinary differential equation is then solved using Euler methods. Based on the theory of difference equations developed in [9], we derive stability conditions for the proposed scheme and obtain *a priori* convergence estimates.

2. Problem statement. In domain $\overline{Q}_T = \left\{(x,t): x \in \overline{\Omega} = [0 \le x \le l],\ t \in [0,T]\right\}$, we consider the following initial-boundary value problem for a nonlinear pseudo-parabolic equation:

$$\frac{\partial}{\partial t}(\Delta u - u) + u^3 = f(x,t),\ \ (x,t) \in Q_T, \tag{1}$$

$$u(x,0) = u_0(x),\ \ x \in \overline{\Omega}, \tag{2}$$

$$u\big|_{\partial\Omega} = 0,\ \ t \in (0,T], \tag{3}$$

where $\Delta = \dfrac{\partial^2}{\partial x^2}$ - is the one-dimensional Laplace operator, $Q_T = \Omega \times (0,T]$, $\Omega = \{0 < x < l\}$.

Equation (1) describes quasistationary processes in semiconductors in the presence of a stationary distribution of free charge current sources. The solvability and uniqueness of the solution to problem (1)–(3) are given in [1].

3. Spatial Discretization. Let us construct subspace $\overset{\circ}{H}_h$ approximating H –Hilbert space with scalar product (u,ϑ) and norm $\|\cdot\|$. Here, $\overset{\circ}{H}_h$ – is the space of discrete functions vanishing at the boundary points. We approximate equation (1) by the finite difference method with respect to the spatial variable and introduce uniform grid $\bar{\omega}_h = \{x = ih,\ i = \overline{0,N},\ h = l/N\}$ in domain $\bar{\Omega}$. Here $\bar{\omega}_h = \omega_h + \gamma_h$. Further, we define subspace $H_h = H_0^1(\omega_h)$ – the space of grid functions $\vartheta(x)$ with norm $\|\vartheta\|_1^2 = \sum_{i=0}^{N} h(\vartheta_{\bar{x}})^2 \le M$, where constant M is independent of h, where $\vartheta = \vartheta_i = \vartheta(ih)$, $\vartheta_{\bar{x}} = (\vartheta_i - \vartheta_{i-1})/h$. Then from (1)-(3), we obtain the following Cauchy problem for a system of first-order ordinary differential equations:

$$D\frac{du_h}{dt} = f(u_h),\quad u_h(0) = u_{h,0}, \tag{4}$$

where $D = \Lambda - E$ is the linear constant operator that acts from $H_h \to H_h$,

$$\Lambda = \frac{1}{h^2}\begin{pmatrix} -2 & 1 & 0 & \dots & \dots & 0 \\ 1 & -2 & 1 & 0 & \dots & 0 \\ 0 & 1 & -2 & 1 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & \dots & 1 & -2 & 1 \\ 0 & \dots & & 0 & 1 & -2 \end{pmatrix},\quad E = \begin{pmatrix} 1 & 0 & 0 & \dots & 0 \\ 0 & 1 & 0 & \dots & 0 \\ 0 & 0 & 1 & \dots & 0 \\ \dots & \dots & \dots & \dots & \dots \\ 0 & \dots & \dots & 1 & 0 \\ 0 & \dots & & 0 & 1 \end{pmatrix}.$$

Here $D^* = D > 0$, $\forall\, t \ge 0$, $f(u_h) = -u_h^3 + f_h$, $u_h = u_h(t) \in H_h$, $f(u_h),\ f_h \in H_h$, $\Lambda u_h = u_{h,\bar{x}x}$, u_h is the value of the function at a fixed node $x = (ih)$, $u_{h,\bar{x}x} = [u_h((i+1)h) - 2u_h(ih) + u_h((i-1)h)]/h^2$, f_h approximates $f(x,t)$. The difference operator (matrix) D approximates the second-order differential operator $\Delta u - u$, i.e. $O(h^2)$. Here, operator D is non-degenerate, hence, there exists the inverse operator D^{-1}.

4. Time discretization. To discretize the time variable in (4), we use the first- and second-order Euler methods.

1° *Explicit Euler scheme*. We introduce the uniform time grid $\bar{\omega}_\tau = \{t_n = n\tau,\ n = 0,1,...\}$, $\tau > 0$. Let y be the grid function that approximates semi-discrete function u_h. From (4), we obtain the following difference scheme:

$$Dy_t = f(y),\ y(0) = u_0,\ n = 0,1,..., \tag{5}$$

where $y_t = (y_{n+1} - y_n)/\tau$, $y = y_n = y(t_n) \in \overset{\circ}{H}_h$.

As is known, scheme (5) has the first-order accuracy, i.e. $\left|y-u_h\right|=O(\tau)$. Let us rewrite it as the following difference equation:

$$y_{n+1}=S_n y_n+\tau D^{-1}f(y_n),\ y_0=u_{h,0},\ n=0,1,\ldots, \tag{6}$$

where $S_n\equiv E$.

We investigate the stability of scheme (5) or (6) based on the following difference equation:

$$y_{n+1}=S_n y_n+f_n(y_n),\ y_0=u_{h,0},\ n=0,1,\ldots \tag{7}$$

To do this, we use the results of [9], where the following theorems were proven.

Theorem 1. *Suppose that the following conditions are satisfied*

a) the trivial solution to equation

$$y_{n+1}=S_n y_n,\ y_0=u_{h,0},\ n=0,1,\ldots \tag{8}$$

is uniformly stable, i.e., $\forall j>0,\ j\le n$, *estimate* $\|y_n\|\le M_1\|y_j\|$ *holds,* $j=0,1,\ldots,n_0-1,\ 0\le n\le n_0$, *where* M_1 *- is the positive constant;*

b) the nonlinear right-hand side of equation (7) satisfies the following conditions:

$$\|f(y_n)\|=K_n\|y_n\|^r,\ r>1,\ f_n(0)=0,\ \sum_{m=0}^{n-1}K_m\le M_2<\infty,$$

where M_2 *is some positive constant. In this case, the trivial sequence* $y_n=0$ *is the solution to equation (8);*

c) the initial perturbation y_0 *is sufficiently small.*

Then the trivial solution of the equation (8) is stable, i.e., the following estimate holds:

$$\|y_n\|\le M\|y_0\|,\ \forall n=0,1,\ldots,$$

where M *– is the positive constant.*

Now consider the following difference equation:

$$y_{n+1}=S_n y_n+f_n(y_n)+g_n,\quad y_0=u_{h,0},\quad g_n(0)\ne 0,\quad n=0,1,\ldots \tag{9}$$

Theorem 2. *Let the conditions of Theorem 1 be satisfied. Furthermore, the constantly acting perturbation* g *satisfies the following condition:*

$$\sum_{m=0}^{n=1}\|g_m\|\le\delta_0,\ \forall m,\ \delta_0>0,$$

where δ_0 *- is sufficiently small. Then the trivial solution to equation (9) is stable under constantly acting disturbances, and the following estimate is valid for its solution:*

$$\|y_n\|\le M\left(\|y_0\|+\sum_{m=0}^{n=1}\|g_m\|\right). \tag{10}$$

Let us define the error of scheme (5) $z=y-u$ $(y=z+u)$, which satisfies the following equation:

$$Dz_t=f(y_n)-f(u_n)+g_n,\ g_n(0)\ne 0,\ n=0,1,\ldots,\ z_0=0, \tag{11}$$

where g_n is the approximation error, i.e., $g=O(\tau)$, as a constantly acting perturbation.

Using the Fréchet derivative for functional f, we obtain:

$$f(y)-f(u)=f(u+z)-f(u)=f'(u)z+O(z^2),$$

i.e., from (11) we have

$$Dz_t = f'(u)z_n + q(z_n) + g_n,\ z_0 = 0, \tag{12}$$

where $q(z_n) = O\left(\|z_n\|^r\right),\ r > 1,\ f'(u) = \partial f(u) / \partial u$. From (12), it follows that

$$z_{n+1} = S_n z_n + \tau D^{-1} q(z_n) + \tau D^{-1} g_n,\ z_0 = 0, \tag{13}$$

where $S_n = 1 + \tau D^{-1} f'(u)$.

By Theorem 2, the scheme (12) is stable if the solution to its first approximation $z_{n+1} = S_n z_n$ is uniformly stable, i.e., the condition for the uniform stability of the solution is condition $\|S_n\| \le M$ ($M = 1 + c_0\tau$, $n = 0,1,2,...,n_0 - 1$, $c_0 \ge 0$ is the constant independent of the grid steps [10]). If this condition is satisfied, we obtain the uniform stability estimate

$$\|z_{n+1}\| \le M \|z_j\|,\quad j = 0,1,...,n_0.$$

Since $F'(u)$ is a bounded linear functional, $\|1 + \tau D^{-1} f'(u)\| \le M$ holds, and the remaining conditions of Theorem 2 are satisfied.

Now we prove the convergence of the scheme. By assumption, that solution (8) is uniformly stable (the first condition of Theorem 1), we obtain from (13):

$$\|z_{n+1}\| \le \|S_n\|\|z_n\| + \tau\left\|D^{-1} q(z_n)\right\| + \tau\left\|D^{-1} g_n\right\|.$$

Hence

$$\|z_{n+1}\| \le M\left(\|z_0\| + \tau\left\|D^{-1}\right\|\sum_{m=0}^{n-1} K_m \|z_n\| + \tau\left\|D^{-1}\right\|\sum_{m=0}^{n-1}\|g_m\|\right),$$

i.e., by Theorem 2, the following estimate holds

$$\|z_{n+1}\| \le \tilde{M}\left(\|z_0\| + \tau\sum_{m=0}^{n-1}\|g_m\|\right). \tag{14}$$

Provided that $\|S_n\| \le 1$, for $M = 1$ we get the following stability conditions

$|1 + \tau D^{-1} f'(u)| \le 1$ or $-1 \le 1 + \tau D^{-1} f'(u) \le 1$, i.e.

a) $1 + \tau D^{-1} f'(u) \le 1$ is satisfied, since $f'(u) = -3u^2 \le 0$;

b) $-1 \le 1 + \tau D^{-1} f'(u)$, $\tau\left|\bar{D}^{-1} f'(u)\right| \le 2$, $\tau \le 2 / \left[\left\|D^{-1}\right\|\left|f'(u)\right|\right]$.

Since $\left\|D^{-1}\right\| \le h^2 / 4$, we obtain the uniform stability condition for scheme (5)

$$\tau \le h^2 / [2|f'(u)|]. \tag{15}$$

Thus, the following theorem is proven.

Theorem 3. *Let the uniform stability condition (15) hold. Then the solution of the explicit difference scheme (5) is stable with respect to the initial data and the right-hand side. In particular, it satisfies the a priori estimate (14) and converges to the solution of the original problem (1)–(3) with rate* $O(\tau + |h|^2)$.

2°. Implicit Euler scheme. We approximate problem (4) with the following implicit difference scheme

$$Dy_t = f(\hat{y}),\ \ y(0) = u_0,\ \ n = 0,1,..., \tag{16}$$

where $\hat{y} = y_{n+1}$. This scheme also has first-order accuracy, i.e. $|y - u_h| = O(\tau)$.

For the error, we obtain problem $(z = y - u,\ y = z + u)$:

$$Dz_t = f(\hat{y}) - f(\hat{u}) + g_n.$$

Using the Fréchet derivative, we have

$$Dz_t = f'(u)z_{n+1} + q(z_{n+1}) + g_n. \tag{17}$$

where $\|q(z_{n+1})\| = K_{n+1}\|z_{n+1}\|^r$, $r > 1 (n = 0,1,...)$, $f'(u)$ is the bounded linear operator (functional). To study the convergence of scheme (17), we obtain the following first-approximation equation:

$$z_{n+1} = S_n z_n,\ \ S_n = \left(1 - \tau D^{-1} f'(u)\right)^{-1}.$$

Let the solution to this equation be uniformly stable, i.e., $\|S_n\| \le 1$, i.e., then we have the uniform stability condition of solution $1/\left(1 - \tau D^{-1} f'(u)\right) \le 1$. This condition is always satisfied, since $f'(u) \le 0$. Therefore, based on Theorem 2, the following theorem holds.

Theorem 4. *The solution of the implicit difference scheme (16) is absolutely stable with respect to the initial data and the right-hand side. In particular, it satisfies the a priori estimate (14), and it converges to the solution of the original problem (1)–(3) with at a rate* $O(\tau + |h|^2)$.

The schemes considered have first-order accuracy with respect to the time variable. Therefore, we consider difference schemes of a higher order of accuracy, i.e., a modified Euler scheme of second-order accuracy.

3°. We approximate problem (4) with the following difference scheme (parameter $\sigma > 0$)

$$Dy_t = (1-\sigma) f(y_n) + \sigma f(y_n + \tau f(y_n)),\ \ y(0) = u_0,\ \ n = 0,1,.... \tag{18}$$

It is known [10] that the difference scheme (18) has second-order accuracy, i.e., $|y - u_h| = O(\tau^2)$ for $\sigma = 1/2$. From (18) for $\sigma = 0$, we obtain the explicit difference scheme (5) and for $\sigma = 1$, we obtain the implicit difference scheme (16), where $y_{n+1} = y_n + \tau f(y_n)$ is the explicit Euler scheme.

Let us study the stability of scheme (18). To do this, we write it in the following form:

$$y_t = F(y_n),\ \ y(0) = u_0,\ \ n = 0,1,..., \tag{19}$$

where $F(y_n) = (1-\sigma)D^{-1} f(y_n) + \sigma D^{-1} f(y_n + \tau f(y_n))$. Next, defining the errors using expression $z = y - u$ and, substituting $y = z + u$ into the difference scheme (19), we obtain the problem for the scheme error.

$$z_t = F(y_n) - F(u_n) + g_n,\ \ n = 0,1,2,...,\ \ z_0 = 0.$$

Using the Fréchet derivative for $F(y)$, we obtain

$$z_t = F'(u_n)z_n + q(z_n) + g_n,\ \ z_0 = 0, \tag{20}$$

where

$$F'(u) = (1-\sigma)D^{-1} f'(u) + \sigma D^{-1} f'(u + \tau f(u)) \cdot (1 + \tau f'(u)).$$

From (20), we obtain the first-approximation equations

$$z_{n+1} = S_n z_n,\ \ S_n = 1 + \tau D^{-1} \tilde{f}'(u_n),$$

where

$$\tilde{f}'(u) = (1-\sigma) f'(u) + \sigma f'(u + \tau f(u)) \cdot (1 + \tau f'(u)). \tag{21}$$

Let us check under what conditions the uniform stability condition $\|S_n\| \le 1$is satisfied, i.e. $\left\|1+\tau D^{-1}\tilde{f}'(u_n)\right\| \le 1$ or $-1 \le 1+\tau D^{-1}\tilde{f}'(u_n) \le 1$. Hence,

a) $1+\tau D^{-1}\tilde{f}'(u_n) \le 1$ if $\tilde{f}'(u) \le 0$. From (21), it follows that $\tilde{f}'(u) \le 0$, if

$$\tilde{f}'(u) = (1-\sigma)D^{-1}f'(u) + \sigma D^{-1}f'(u+\tau f(u))\cdot(1+\tau f'(u)) \le 0. \qquad (22)$$

Applying the Taylor expansion formula for $f'(u+\tau f(u))$, we obtain the condition for inequality (22) to be satisfied.

$$\tilde{f}'(u) = f'(u) + \sigma\tau f(u) f''(u) + \frac{\sigma\tau^2}{2} f^2(u) f'''(u) + \sigma\tau f'^2(u) +$$

$$+\sigma\tau^2 f(u) f'(u) f''(u) + \frac{\sigma\tau^3}{2} f^2(u) f'(u) f'''(u) \le 0. \qquad (23)$$

Direct verification of condition (23) for $f(u) = -u^3$ leads to the uniform stability condition for scheme (18) $\tilde{f}'(u) = -u^2 + 5\sigma\tau u^4 - 5\sigma\tau^2 u^6 - 3\sigma\tau^3 u^8 \le 0$, which is always satisfied due to the first term and the smallness of $\tau << 1$ ($\sigma > 0$).

b) $-1 \le 1+\tau D^{-1}\tilde{f}'(u)$, $\tau\left|D^{-1}\tilde{f}'(u)\right| \le 2$, $\tau \le 2 / \left[\left\|D^{-1}\right\|\left|\tilde{f}'(u)\right|\right]$. Considering $\left\|D^{-1}\right\| \le h^2/4$, we obtain the uniform stability condition for scheme (18).

$$\tau \le h^2 / \left[2\left|\tilde{f}'(u)\right|\right]. \qquad (24)$$

This proves the following theorem.

Theorem 5. *Let condition (24) be satisfied. Then the solution of the difference scheme (18) for $\sigma > 0$ is stable with respect to the initial data and the right-hand side, and it satisfies the a priori estimate (14). Moreover, this solution converges to the solution of the original problem (1)–(3) with the rate $O(\tau^2 + |h|^2)$.*

5. Conclusions. The nonlinear problem of quasi-stationary processes in semiconductors, characterized by a stationary distribution of free charge current sources, has been addressed using Euler methods. To discretize the problem, the method of lines was first employed, leading to a Cauchy problem consisting of a system of nonlinear ordinary differential equations. This system was subsequently solved using first- and second-order Euler methods. Drawing on the theory of difference equations outlined in [9], we have derived stability conditions for the difference schemes and established a priori convergence estimates. Theorems regarding the accuracy of the scheme are presented.

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Rezyume*: Ishda erkin zaryadlar tok manbalarining statsionar taqsimoti mavjud bo‘lganda yarimo‘tkazgichlarda kvazistatsionar jarayonlarning bitta nochiziqli masalasi uchun ayirmali sxemalar qurilgan. Fazoviy o‘zgaruvchini diskretlash uchun chekli ayirmalar usuli qo‘llanilgan va bunda hosil bo‘lgan nochiziqli oddiy differensial tenglamalar sistemasi Eyler, birinchi va ikkinchi tartibli differensial tenglamalar usullari bilan yechilgan. Ayirmali tenglamalar nazariyasi natijalari asosida ayirmali sxemalarning turg‘unlik shartlari olingan, shuningdek, yaqinlashishning aprior baholari olingan.*

Резюме: *В работе построены разностные схемы для одной нелинейной задачи квазистационарных процессов в полупроводниках при наличии стационарного распределения источников тока свободных зарядов. Для дискретизации пространственной переменной применяется метод конечных разностей, и полученная при этом система нелинейных обыкновенных дифференциальных уравнений решены методами Эйлера, первого и второго порядков. На основе результатов теории разностных уравнений получены условия устойчивости разностных схем, а также получены априорные оценки сходимости.*

Kalit so‘zlar *nochiziqli psevdoparabolik tenglama, ayirmali tenglama, ayirmali sxemalar, turg‘unlik, tekis turg‘unlik, yaqinlashish, aniqlik.*

Ключевые слова: *нелинейное псевдопараболическое уравнение, разностное уравнение, разностные схемы, устойчивость, равномерная устойчивость, сходимость, точность.*

DIVERSITY AND DISTRIBUTION OF CURCULIONIDAE (COLEOPTERA) IN KARAKALPAKSTAN

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Summary: *This article provides information on the ecological factors influencing the biodiversity and activity of weevils (Curculionidae), whose distribution and life cycles depend on various abiotic and biotic conditions. These factors determine the development, reproduction, migration, and population dynamics of weevils in arid regions. The ecosystems inhabited by weevils are affected by natural processes and anthropogenic impacts, including desertification. This study analyzes key ecological factors affecting weevil life, with a focus on pest and invasive species such as Megamecus viridans (Menetries, 1849) and Lixus incanescens (Faldermann, 1837). A list of taxa collected during long-term field research in Karakalpakstan is provided, along with bioecological descriptions of some rare and endemic species from the collection. High-quality descriptions of rare species, such as Ammocleonus quadrimaculatus (Motschulsky, 1860), are presented, including their habitats and host plants.*

INTRODUCTION

The family Curculionidae (weevils) comprises over 50,000 species worldwide, making it one of the largest in the order Coleoptera. These insects play vital roles in ecosystems as phytophages, contributing to plant decomposition and serving as prey for predators. However, many species are economically significant pests, damaging crops, forests, and desert vegetation, leading to substantial losses in agriculture and forestry. The ecology and biology of weevils, particularly their adaptations to temperature, humidity, and salinity, are crucial for understanding their distribution and activity in arid zones. In the Palaearctic region, weevils are diverse, with several species exhibiting limited ranges. In Uzbekistan, numerous weevil species have been recorded, holding both ecological and economic importance. Nevertheless, data on the biodiversity and ecology of Curculionidae in Karakalpakstan remain limited. This region, characterized by extreme climatic conditions—hot summers (+40°C) and cold winters (-20°C to -30°C)—offers a unique setting for studying insect adaptations to desertification and environmental stress. The aim of this study is to address knowledge gaps regarding the weevil fauna of Karakalpakstan, investigating the biology and ecology of key species in the region. Insect activity, development, and reproduction are directly influenced by external temperatures. Sudden temperature fluctuations can impact populations significantly; for instance, cold winters induce diapause, while high summer temperatures accelerate feeding and reproduction. Humidity is another critical factor, with desert-adapted species tolerating low moisture levels, unlike those in humid tugai forests. Currently, in Karakalpakstan, anthropogenic landscape transformations and climate changes are degrading plant flora, creating favorable conditions for phytophagous weevils. Widespread desert plants like *Haloxylon* spp., *Tamarix* spp., and *Ferula* assa-foetida serve as key hosts, playing essential roles in local ecosystems.

Historical entomological research in Central Asia, including the works of Yakhontov (1950), Alimjonov (1950), Bekuzin (1962), Shamuratov (1970), Toreniyozov (1969), Avanesova (1982), Davletshina (1984), Utepbergenov (1990), Khamrayev (2000), Bekbergenova (2000), Shamuratova (2007), Qulumbetova (2008), Medetov (2010), and Qoshonova (2010), has documented the diversity of Curculionidae; however, post-desiccation updates specific to Karakalpakstan remain limited. International studies by Tauber et al. (1986), Lachininsky et al. (1992), Basset (1994), Ram and Tchernyshev (1995), Showalter (2011), Brockerhoff and Liebhold (2017), as well as by CIS researchers such as Yanshin and Goldenberg (1960), Chinayev (1964), Stolyarov (1967), Sinadsky (1972), Bey-Bienko (1980), Bogach (1982), Iskakov (1983), Kasheyev (2002), Zamotailov (2009), Zakhvatkin et al. (2009), and Childebaev (2011), have provided a broad context for understanding entomofauna in arid zones.

EXPERIMENTAL RESEARCH

The research materials were collected from the desert and tugai areas of Karakalpakstan in 2025. Standard entomological methods were employed, including visual observations, sweeping nets, pitfall traps, and soil excavations for collecting weevils (e.g., *Megamecus viridans*, *Lixus incanescens*, *Ammocleonus quadrimaculatus*).

1. In our studies, we used the Barber method of soil traps [1] to catch beetles. Glass containers with a diameter of 72–73 mm and a capacity of 0.5 liters and 0.25 liters (55 mm diameter) were used as traps, which were dug level with the soil surface. In each biotope, 10 traps were typically placed in a row, 10 meters apart. In some experiments, between 20 and 70 traps were used. Ethyl acetate solution was employed as the fixation liquid. The traps were often used for faunal collection.
2. In our research, we mainly used the light trap method described by N.L. Sakharova [2]

Specimens were photographed using a Canon PowerShot A640 camera and MicroMed MC-2-ZOOM microscope, with images edited in Adobe Photoshop 7.0. Species identification relied on international catalogs such as "Catalogue of Palaearctic Coleoptera" [6] and scientific references therein. A map of surveyed regions in Karakalpakstan was included (Figure 1), with symbols indicating collection sites, habitat types, and trap locations for visual context.

Figure 3. Map of surveyed areas in Karakalpakstan, showing trap sites, habitats, and collection points.



FIGURE 1. Territories where the scientific researches are held. A) The Lower Amudarya State Biosphere Reserve; B) The Sudochje-Akpetki State Reserve;

RESEARCH RESULTS

Weevil (Curculionidae) distribution and development are strongly influenced by environmental factors such as host plant availability, temperature, humidity, and soil salinity [1–3]. Anthropogenic impacts, including pesticide application and habitat modification, contribute to reductions in biodiversity and population abundance [4,5].

Megamecus viridans (Menetries, 1849)

Records from the Southern Aral region and Kyzylkum desert in Karakalpakstan indicate active spread of *Megamecus viridans*. Adults are typically observed on the flowers of *Glycyrrhiza glabra* and *Haloxylon* spp. during the May–June flowering period.

- Geographic distribution: Central Asia (Afghanistan, Iran, Kazakhstan, Uzbekistan)
- Host plants: *Glycyrrhiza glabra*, *Haloxylon* spp.
- Feeding habits: Larvae develop on roots and rhizomes of Apiaceae and Chenopodiaceae; adults feed on stems.
- Life cycle: 1–2 years; pupation occurs in soil cocoons.
- Adult activity: April–July; crepuscular or nocturnal, attracted to light
- Body length: 10–15 mm
- Collection records:
  - The Sudochje-Akpetki State Reserve; (2025): 5♂, 3♀ on *Glycyrrhiza*
  - Kyzylkum desert (2025): 2♂, 4♀ on *Haloxylon*

Lixus incanescens (Faldermann, 1837)

Lixus incanescens has a wide distribution from Europe to Central Asia, occurring in both tugai forests and desert ecosystems.

- Larval development: Occurs in stems and roots of dying herbaceous plants; galleries are irregular beneath bark and may penetrate wood for pupation.
- Adult activity: May–September, feeding on host plants or nearby felled vegetation.
- Records in Karakalpakstan: Taxtakopir district and Southern Aral regions (e.g., 42.5°N, 60.3°E); found alongside species such as *Ammocleonus quadrimaculatus* on *Tamarix* and *Haloxylon*.

Ammocleonus quadrimaculatus (Motschulsky, 1860)

Ammocleonus quadrimaculatus is polyphagous, feeding on at least ten plant species. Young plants with thin roots are particularly susceptible.

- Larval feeding: Larvae girdle roots, often leading to plant death [2].
- Control measures: Insecticides, e.g., imidacloprid, are applied in affected areas.
- Adult emergence: April–May at ~20°C; active in evenings, hide during daytime
- Reproduction: Females lay 200–250 eggs over ~2 months
- Larval development: 9–17 days; tunnels extend ~25 cm
- Pupation: Occurs in soil chambers
- Life cycle: Approximately 2 years

CONCLUSIONS

The study shows that populations of Megamecus viridans and Lixus incanescens in Karakalpakstan are tied to host plants like Glycyrrhiza glabra and Haloxylon spp., with peak activity during blooming in May–June. These align with prior research on weevil feeding (Zhuginisov T, 2023). Temperature and humidity influence activity, with higher temperatures boosting reproduction, but climate changes pose risks. Pesticides (e.g., imidacloprid) reduce pest numbers on trees, offering control options. However, long-term effects on biodiversity need further study.

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Rezyume: *Ushbu tadqiqot Qoraqalpoqiston Respublikasidagi filcha qo‘ng‘izlar (Curculionidae) ekologik va biologik xususiyatlarini o‘rganadi, xususan Megamecus viridans (Menetries, 1849) va Lixus incanescens (Faldermann, 1837) turlariga e’tibor qaratilgan. Tadqiqot 2025 yilda o‘tkazilgan bo‘lib, an’anaviy entomologik usullar, masalan, tuproq va yorug‘lik tuzoqlari qo‘llanilgan. Aniqlangan turlar Qoraqalpoqistonning Janubiy Orolbo‘yi va Kizilqum cho‘llarida, ayniqsa Glycyrrhiza glabra va Haloxylon spp. o‘simliklarida topilgan. Tadqiqot ekologik omillar, masalan, harorat, namlik va oziq-ovqat manbalari turlarining tarqalishi va ko‘payishiga ta’sirini ko‘rsatdi. Shuningdek, inson faoliyati, jumladan pestitsidlar ishlatilishi, hasharot populyatsiyalari va yashash joylariga ta’siri o‘rganildi. Qoraqalpoqistonda filcha qo‘ng‘izlar haqidagi ma’lumotlar yetarli emasligiga qaramay, ushbu tadqiqot turlarning tarqalishi va ekologik afzalliklarini o‘rganishda muhim ma’lumotlarni taqdim etdi. Asosiy natijalar ekologik omillarning hasharot populyatsiyalarini shakllantirishdagi ahamiyatini ko‘rsatdi va Qoraqalpoqistonda bioxilma-xillikni saqlash zarurligini ta’kidlaydi.*

Резюме*: Это исследование посвящено экологическим и биологическим особенностям жуков-долгоносиков (Curculionidae) в Каракалпакстане, с акцентом на виды Megamecus viridans (Menetries, 1849) и Lixus incanescens (Faldermann, 1837). Исследование проводилось в 2025 год с использованием традиционных энтомологических методов, таких как почвенные и световые ловушки. Выявленные виды найдены в Южно-Приаралье и пустыне Кызылкум Каракалпакстана, особенно на растениях Glycyrrhiza glabra и Haloxylon spp. Работа рассматривает роль экологических факторов, таких как температура, влажность и источники пищи, в распространении и размножении видов. Также изучено влияние человеческой деятельности, включая использование пестицидов, на популяции насекомых и их среды обитания. Несмотря на недостаток данных о жуках-долгоносиках в Каракалпакстане, это исследование предоставляет важную информацию о распространении видов и их экологических предпочтениях. Основные результаты подчеркивают важность экологических факторов для формирования популяций насекомых и необходимость их учета для сохранения биоразнообразия в Каракалпакстане.*

Kalit so‘zlar*: Qoraqalpoqiston, filcha qo‘ng‘izlar, Megamecus viridans, Lixus incanescens, Glycyrrhiza glabra, ekologik omillar, entomologik tadqiqotlar, pestitsidlar, bioxilma-xillikni saqlash.*

Ключевые слова*: Каракалпакстан, жуки-долгоносики, Megamecus viridans, Lixus incanescens, Glycyrrhiza glabra, экологические факторы, энтомологические исследования, пестициды, сохранение биоразнообразия.*

AGRICULTURAL TECHNOLOGY FOR CULTIVATION OF THE PLANT *PLANTAGO MAJOR* L

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Summary: *This article provides information on the agricultural technology, chemical composition, applications, distribution, and raw material processing of* Plantago major *L. Studies include seed germination experiments conducted under laboratory conditions (water-soaked and control variants) as well as field experiments.*

Key words: *Karakalpakstan, medicinal plants,* Plantaginaceae *Juss. family, life form, folk medicine, agricultural technology*

INTRODUCTION

Plantago major L. is a perennial herbaceous plant belonging to the *Plantaginaceae* Juss. family. It is characterized by a large, thick rhizome and is a stemless perennial herb. The above-ground portion consists of basal leaves and a flower spike 10-50 cm in height [1].

The leaves are long-petiolate, winged, broadly ovate or broadly elliptical, with 3-9 prominent parallel veins [1]. One or several flower spikes emerge from the plant. The small, inconspicuous, four-lobed flowers are arranged in a spike-like inflorescence at the apex of the flowering stem. The fruit is an ovoid, many-seeded capsule. The plant flowers and fruits mature during June-September. The stem is erect and branched, reaching 30-60 (80) cm in height [4]. The lower leaves have petiole sheaths, dry out early, and fall off. The middle and upper stem leaves are linear, entire-margined, and sessile. The flower heads are large and solitary at the ends of stems and branches. The marginal flowers of the head are light blue (rarely white or light pink), obliquely funnel-shaped, and sterile; the central flowers are tubular, blue-violet, and bisexual (Figure 1).

MATERIALS AND METHODS

The fruit is gray or yellowish gray with sparse hairs at the seed apex. Each plant produces up to 2,500 seeds. It blooms in June-July, with fruits ripening in August-September. Reproduction occurs exclusively by seed. The leaves of *P. major* are the primary medicinal raw material. Seeds are 12-15 mm long and 5-9 mm wide, slightly pubescent with a cobweb-like appearance. The lower and middle leaves are triangular, silvery-white or blackish brown in color, with short margins. The flower corolla is blue violet, with margins that are blue or purple, and in some cases light red or white. The marginal flowers are ovoid. Seeds are elliptical-oval, 3-4.5 mm long and 1.5-1.8 mm wide (Figure 2). The pappus is multi-rowed, 3-3.5 mm long, with inner hairs three times shorter than the outer ones, consisting of narrow bristles.



Figure 1. Flowers of *Plantago major* L.



Figure 2. Seeds of *Plantago major* L.

The 1000-seed weight of ***P. major*** is 1.0-1.7 g. According to State Pharmacopoeia requirements, dried ***P. major*** leaves should be ovate or elliptical with entire margins, bearing 5-9 parallel veins, up to 12 cm long and 8 cm wide, with short petioles. Moisture content should be 14%, yellowed and blackened leaves should not exceed 5%, flower stalks should not exceed 1%, organic and mineral impurities should be 1%, total ash content should not exceed 20%, and extractive substance content should be at least 30%. The moisture content of fresh plant leaves should be at least 70%.

Experimental Design

Laboratory Experiments

In our laboratory experiments, we first determined the germination rate of *P.major* seeds (Table 1). Experiments were initiated on March 27, 2024, and field experiments were conducted on April 23, 2024, at the experimental site in the Biology Faculty area (Table 2). The procedure was as follows:

- Seeds of *P. major* (collected in 2024) were counted.

- Four Petri dishes were thoroughly cleaned for the experiment, labeled, and prepared. Filter papers were placed in the Petri dishes, seeds were distributed, and 3-5 ml of water was added. Care was taken to avoid excess water. Seed germination was monitored and recorded. The dishes were kept moist throughout the experiment.

Seed germination of *P. major* was monitored at different temperatures. Forty seeds were counted in Petri dishes for each treatment, with four replicates (Table 1). Seeds were tested under two conditions: (1) untreated control and (2) water-soaked.

Table-1

Germination of Plantago major L. seeds under laboratory conditions (2024)

№	Treatment	Number of seeds	plant germination %		
			Sowing date	Germinated seeds	Germinatio%
1	Control (untreated)	40	27.03.2024	25	62,5 %
2	Water-soaked	40	27.03.2024	31	77,5 %

The experimental field was plowed on April 30, 2024, to a depth of 25-30 cm using specialized equipment. On May 6, 2024, the field was prepared for seed sowing. On May 9, 2024, seeds were sown with row spacing of 60-70 cm and plant spacing of 20-30 cm. Sowing depth was 1.0-1.5 cm.

The germination of *P.major* seeds was studied under various field conditions. Seeds sown in the experimental field at the Biology Faculty on April 23, 2024, germinated on May 16, 2024. Budding occurred on June 21, 2024, flowering on July 3, 2024, and fruiting on July 23, 2024.

A separate planting was established on May 1, 2024, to study cultivation in a front yard location, with germination occurring five days later. Budding occurred on July 18, 2024, flowering on June 26, 2024, and fruiting on July 30, 2024. The total vegetation period for *P. major* was approximately 85-90 days (Table-2).

Table-2

Germination of *Plantago major* L. seeds under different field conditions (2025)

	Sowing date	Germination date	Budding date	Flowering date	Fruiting date	Vegetation period (days)
Experimental area at Biology Faculty	23.04	15.05	21.06	3.07	23.07	85
Front yard	01.05	06.05	18.07	26.06	30.07	90

Medicinal preparations of *P.major* (infusions, preserved juice from freshly harvested leaves or aerial parts, and plantaglucid preparations) are used to treat gastrointestinal diseases including gastritis, enteritis, enterocolitis, colitis, and gastric and duodenal ulcers. Additionally, they are beneficial in cases of reduced gastric acid secretion. The juice extracted from leaves or aerial parts is used to treat colitis and wounds that are difficult to heal.

Seeds are sown using a seed drill with 60 cm row spacing. Sowing depth is 0.5-1.0 cm. Approximately 5-6 kg of seeds are required per hectare. Prior to sowing, seeds are thoroughly washed to remove the mucilaginous layer and dried.

To ensure even distribution, 1 kg of seeds is mixed with 10 kg of sand, powdered manure, or similar material. Seeds can also be sown in autumn, in which case they are first stratified to accelerate germination.

P.major requires 10-12 irrigations during the growing season, 3-4 cultivations, and fertilization with 30 kg nitrogen, 40 kg phosphorus, and 20 kg potassium per hectare during May-July.

In the second and subsequent years, in May, plants in two rows spaced 10 cm apart are thinned to maintain optimal density of 8-10 plants per linear meter. The field is irrigated 10-12 times during

the season, cultivated 3-4 times, and fertilized with 30 kg nitrogen, 40 kg phosphorus, and 20 kg potassium per hectare during May-July.

From the second year onward, 6-7 centners (600-700 kg) of dried leaves can be harvested from plantings of *P.major*. The plantation can be harvested for 3-4 years. Over the productive lifespan, 1.5-2 tons of dried leaves can be obtained per hectare.

The average 1000-seed weight of *P.major* is 1.0-1.7 g. Seeds are small and brown. In our 2024 experiments, the sowing date of March 25 showed good performance [2].

A decoction prepared from the leaves or fresh leaf juice has been used in folk medicine to treat respiratory tract diseases, eye diseases, skin conditions, malaria, colitis, and various infectious diseases, including anthrax. *P. major* leaves are also used in treating lung and stomach cancer and as an expectorant in respiratory diseases. Freshly picked leaves are crushed and applied to wounds, cuts, and abrasions. A decoction of seeds or seeds roasted with sugar is used to treat coughs, fevers, and other ailments. Freshly picked leaves crushed and mixed with equal amounts of sugar and kept in a warm place for three weeks yield a juice that is administered at 3-4 teaspoons per day to treat lung and stomach cancer [2,3].

The leaves of *P. major* contain xanthone glucoside, aucubin, alkaloids, tannins, mucilaginous substances, vitamin K, and uronic acids. Seeds contain steroid saponins, 44% mucilaginous substances, 22% fat, 0.16-0.17% pentosans, 22% protein, and 16% various amino acids. Both leaves and seeds contain vitamins C and K, carotene, and mucilage-forming substances. The roots contain up to 4% anthracene derivatives (anthraglycosides, chrysophanol, and emodin), 8-15% tannins, flavonoids, 0.19-0.95% essential oil, resins, vitamin K, mucilage, and other compounds. The fruit contains 0.73-0.83% anthracene compounds, 4.18-5.36% tannins, 123.1 mg % vitamin C, 2.86-2.91% mucilage, and resins. The leaves and stems contain 1.5-1.58% anthracene compounds, up to 98.9 mg% vitamin C, and resins [4].

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Rezyume: *Ushbu maqolada* Plantago major *L. o'simligining laboratoriya sharoitlarida (urug'larni suvga ivitish va kontrol variantlari), shuningdek, dala tajribalarida yetishtirish agrotexnologiyasi, tarkibi, ishlatilishi, tarqalishi va xom ashyo tayyorlash haqida ma'lumotlar keltirilgan.*

Резюме: *В статье приведены сведения по агротехнике выращивания, составу, использованию, распространению и заготовке сырья* Plantago major *L. в лабораторных условиях (включая варианты с замачиванием семян и контрольные), а также в полевых опытах.*

Kalit so'zlar: *Qoraqalpog'iston, dorivor o'simliklar,* Plantaginaceae *Juss. oilasi, hayot shakli, xalq tabobati, yetishtirish agrotexnologiyasi.*

Ключевые слова: *Каракалпакстан, лекарственные растения, семейство* Plantaginaceae *Juss., жизненная форма, народная медицина, агротехника выращивания.*

THERMOCHEMICAL ACTIVATION AND SORPTION PROPERTIES OF SORGHUM STALK

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Summary. *In the woodworking industry, lignin materials are disposed of into waste, a large amount of hydrolyzed lignin accumulates in landfills. Their processing by various thermal methods will allo.w, under certain conditions, to obtain high-quality adsorbents - activated carbon. The information given in this article is explained by the fact that it allows to obtain adsorbents with high structure parameters and high adsorption properties.*

Key words: *activated carbon, lignin, corn stalk, iodine, methyl blue, adsorption.*

INTRODUCTION. Currently, consumers are experiencing a shortage of high-quality activated carbons with high adsorption capacity. Review [1] examines the structure of activated carbon consumption. According to him, the main consumers of carbon adsorbents are food production (42%), technological use (38%), environmental protection (10%). It also explores the fields of using activated carbons, with particular attention to depyrogenation of solutions and water purification, chemical synthesis, gold and a number of other precious metals extraction processes, etc. [2].

Both granular and powdered activated carbon are suitable for cleaning liquids. Mostly continuous processes are carried out in granular AC and powdered AC is more suitable for working with batch processes. In order to ensure better contact of the cleaned medium with the coal, the process is often carried out with intensive mixing. The simplest method of separating the adsorbent from the liquid phase is precipitation, but it is rarely used due to the duration of the precipitation. Often, this method is used to purify wine and other alcoholic products [3]. Because of these difficulties, filtering is often used. The technologies of using powdered activated carbons are very diverse and allow to solve certain problems. For example, when cleaning wines, only powdered carbon dioxide is used, because in this case it is necessary to avoid short-term contact of the product with a large amount of coal. In many chemical industry processes, substances are recrystallized after filtration by treatment with activated carbon to obtain a pure crystalline end product.

Although the devices commonly used for solvent recovery are of standard design that provide approximately the same gas treatment efficiency, the devices used to treat air and gas without recovery of absorbed substances are quite different. Depending on the volume of air and the type of impurity, usually cylindrical filters with constant or open charge, as well as cassette filters of various shapes are used [4].

Sulfur dioxide emissions exceed all other toxic gases that pollute the atmosphere. It is formed by the combustion of sulfur, hydrogen sulfide, as well as by heating various sulfates in a stream of air or oxygen. Sulfur in fuels and ores turns into an aggressive gas when burned or oxidized. Pre-desulfurization of fuels (such as high-sulfur coal) and ores cannot completely eliminate sulfur dioxide emissions to the atmosphere. Thermal power plants are the main source of air pollution with sulfur dioxide. The concentration of SO_2 in the exhaust gases of thermal power plants mainly depends on the sulfur content of the fuel.

In the production of activated carbon, the starting material is first subjected to heat treatment in the absence of air, as a result of which volatile substances (moisture and partial resins) are removed from it. Carbonized materials are characterized by the reduction of oxygen and hydrogen [5]. The structure of the obtained raw coal is large-porous; and it cannot be used directly as an industrial adsorbent. The problem of obtaining an open work microporous structure during the activation process is solved. Activation is carried out by two main methods: oxidation with gas or steam or treatment with chemical reagents [6].

Activated carbon technologies implemented in industrial practice are mainly based on the use of steam-gas and chemical activation methods of various carbon materials [4].

It is necessary to study thermodynamic processes in microporous adsorbents at the molecular level. The authors conducted research on several types of micropores and studied their complete thermodynamic properties [7-12].

RESEARCH METHODOLOGY. Washing - the process of washing coal from soda products formed during pyrolysis. In preliminary studies, the most complete extraction of soda water was achieved by boiling the charcoal three times for half an hour (each time with a fresh portion of distilled water). The filtrates of the washings were combined and analyzed. At the end of the washings, the coal was treated with 0.5 n hydrochloric acid solution to reduce the ash content. After acid washing, the filter residue is washed with distilled water. The completion of acid washing of coal was monitored using universal indicator paper.

The existing technology for the production of carbon adsorbents using thermochemical activation methods made it possible to determine that, along with sulfate and carbonate, sodium hydroxide also has a certain effect on the formation of adsorptive properties. Its positive effect on the production of activated carbon from various carbon materials can be considered proven. Below are experimental data describing the activation properties of sodium hydroxide in connection with thermal processing of hydrolignin, as well as the possibility of using the obtained adsorbents for the production of high-power supercapacitors.

Discussion. The lignin was subjected to vibration grinding to ensure good contact of the carbon material particles with the activator. For this purpose, it was crushed in a vibrating mill and a lignin suspension was prepared in a 42% sodium hydroxide solution. The resulting mass was evaporated and dried in an oven at 103 °C, after which it was heat treated at temperatures of 500, 550 and 600 °C. Experimental data describing the productivity and adsorption properties of coal washed with hot water from sodium compounds are presented in Table 1.

From the experimental data of Table 1 follows. only at doses of 300% alkali compared to a.s. lignin forms a porous structure that allows iodine, MG, and heptane to be adsorbed in amounts that significantly exceed those of industrially produced powdered AC. The high efficiency of coal is noteworthy, it is 3 times higher for the steam-gas activation option. In the range of 500 - 600 ° C, the positive effect of temperature is weakly observed.

At the same time, for the practical implementation of such a process, the initial lignin should be dried to a moisture content of 18-20% and crushed in a vibrating mill.

Table 1 – Release and adsorption properties of activated carbon from vibration grinding lignin

№	D, r/r	Temperature TXA, ^{0}C	Coal output GL, %	Adsorption		
				Iodine, мг/г	MG, mg/g	Hepten, mg/g
1	1.8	500	55,31	320	75,4	304,7
2	1.8	600	53,37	335	74,9	327,6
3	1.8	700	53,95	305	72,6	304,2
4	2.4	500	53,14	4012	77,8	220,4
5	2.4	600	52,65	418	69,7	248,9
6	2.4	700	46,59	425	69,8	238,8
7	3.1	500	47,60	965	548,7	528,4
8	3.1	600	39,54	1074	539,7	553,9
9	3.1	700	37,32	1121	560,7	573,5

Taking into account the imperfection of the vibration grinding process and its inherent disadvantages, a comparative experiment of chemical activation of vibrating lignin with sodium hydroxide and original lignin without grinding was conducted. In the second case, lignin was divided into 5 fractions by particle size: 0-1 mm, 1-2 mm, 2-3 mm, 3-5 mm and more than 5 mm. All fractions made it possible to obtain an adsorbent with the same yield and the same properties. Table 2 therefore presents comparative data obtained with vibro-milled lignin and original unfractionated GL. The dose of alkali was 300%, and the heat treatment temperature was 600 °C.

Table 2 – Effect of sorghum extract and activated carbon on yield and properties

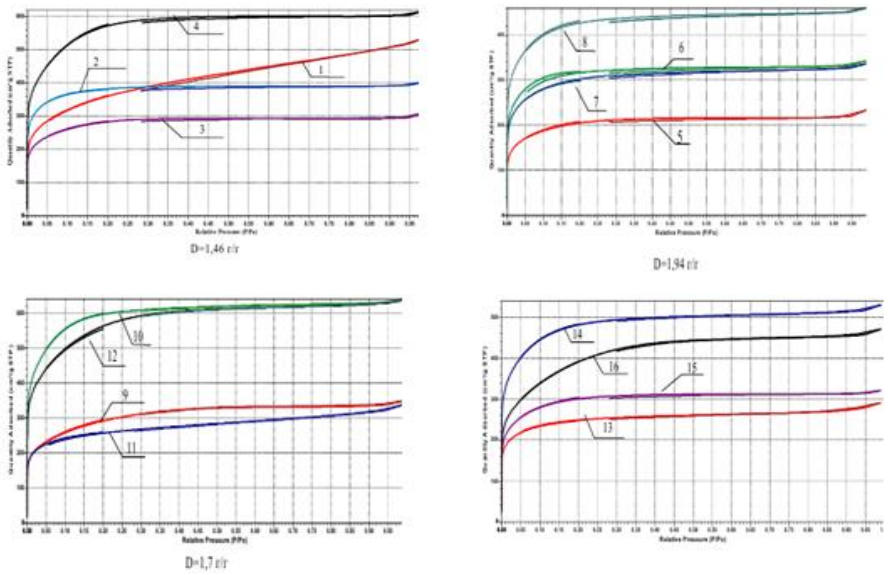
№	Lignin	Washed coal output,%	Adsorption	
			Iodine	MG
1	Extract residue	35.4	1222	581
2	Original plant	27.4	1145	588

Table 2 shows that the effect of grinding affects the yield of coal, but not the sorption properties. In addition, in the absence of grinding, the yield is significantly reduced: from 38.4 to 26.2%. At the same time, eliminating the need to use a GL vibration grinding step in practical implementation of the process makes it even more advantageous.

At the end of preliminary studies with vibratory grinding and the original unfractionated GL, four experiments were conducted that differed in the method of moisture removal from the reaction mass after the treatment of lignin with an aqueous alkali solution. In one case, both alkali-treated lignins were pre-dried in an oven, and in the second case, crude GL with NaOH was immediately placed in an oven heated to 600°C. The obtained experimental data show that the method of removing moisture from the reaction mass does not affect the yield and sorption properties of AC. In both cases, they remain at the levels presented in Table 2 for vibro-milled and original lignin.

In order to analyze the influence of the operating parameters of the AC synthesis on the formation of their porous structure, the planned experimental samples with a high dose of NaOH were used.

Nitrogen adsorption-desorption isotherms obtained for activated carbon samples under different conditions of thermochemical activation are presented in Figure 1 (the numbering of the curves corresponds to the experimental numbers in the table in Appendix B).



ТП/П=400 оС; ТТХА=675 оС

Figure 1. - Nitrogen adsorption - desorption isotherms

It can be seen from them that the porous structure is mainly represented by micropores (relative pressure up to 0.16). Mesopores are present in small amounts. In order to clarify the questions regarding the formation of the porous structure, these isotherms were processed using the BET equation, Langmuir equation, Dubinin-Radushkevich and Dubinin-Astakhov equations, as well as the t-line in the range of 0.05-0.35 relative pressure. equation (specific surface area of micropores), the size and dimensions of micropores in the studied materials were estimated by Horvat-Kawazoe, BET and Dubinin-Astakhov methods.

All adsorption isotherms obtained for the series samples are typical of type I according to the YuPAK classification, characteristic of microporous solids with predominant slotted pores, developed microporous system, and relatively small volume of pores of other sizes.

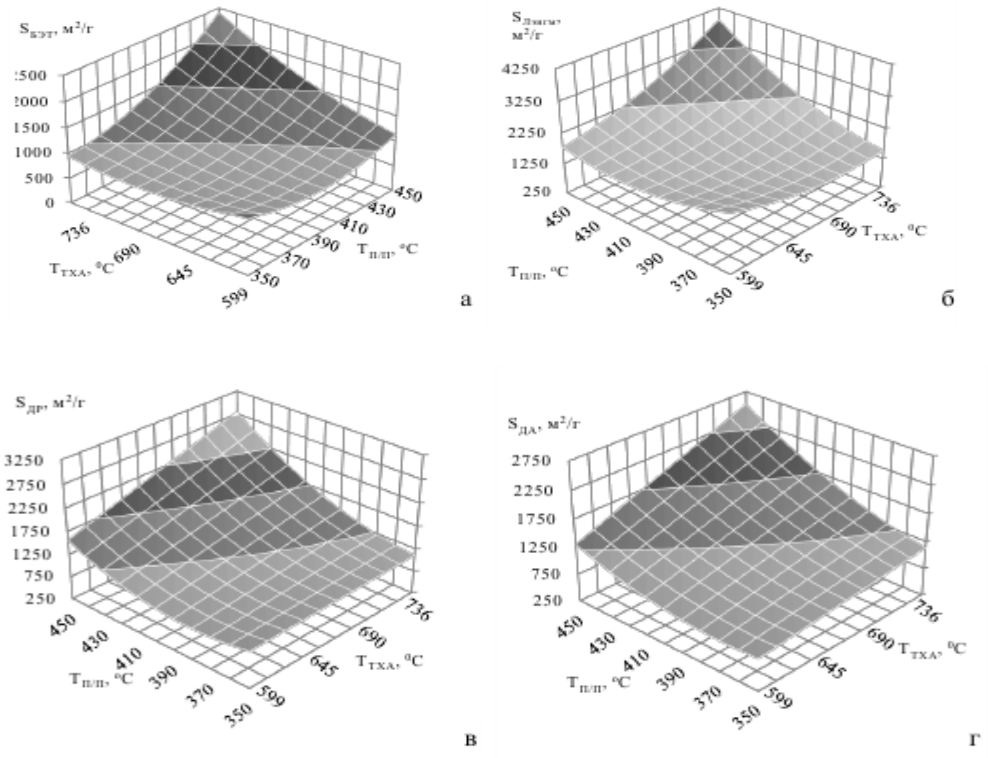
A summary table describing the values of the output parameters for these calculation methods is presented in Appendix B. They were used to calculate the coefficients of the regression equations connecting the obtained experimental data with the conditions of the experiments.

Analyzing the presented relationships, it becomes clear that their character is similar for all porosity parameters, except for the surface area using the t-plot method.

However, calculations using the Langmuir equation show clearly overestimated results, since adsorption using this method is assumed to occur via a monomolecular mechanism. This means that the adsorbed nitrogen, including the micropores, decomposes into a homogeneous surface in the form of a monolayer when it is filled in volume.

Calculation results using the Dubinin-Radushkevich and Dubinin-Astakhov equations turned out to be very close to the results obtained using the BET method. However, taking into account that in world practice, only the BET equation is used to describe the specific surface area according to the results of low-temperature nitrogen adsorption, we used this specific method in the following analysis.

To analyze the specific surface area determined by micro- and mesopores, we used the t-plot method, which, in our opinion, allows the most accurate assessment of the surface of these pores individually, if we take the total specific surface. area is determined by BET. The sum of Smi and Sme on the T-plot quantifies the specific surface area by BET. As can be seen from Figure 2, the total specific surface area of micropores is best generated under the conditions of the highest pyrolysis and thermochemical activation temperatures. In addition, the positive effect of prepyrolysis and TCA temperature mainly manifests itself at high temperatures of both factors.



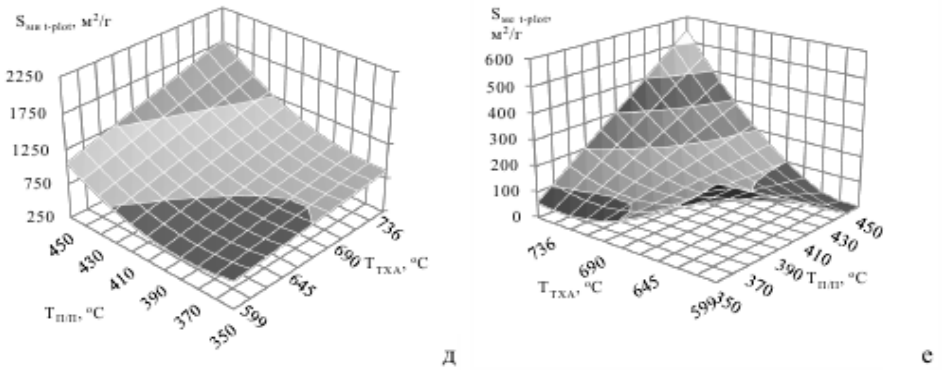


Figure 2. – **The effect of operating parameters on the formation of the specific surface of alternating current according to the indicator:**

a) specific surface according to BET, m^2/g; b) Langmuir specific surface area, m^2/g; c) specific surface according to Dubinin-Radushkevich, m^2/g; d) specific surface area according to Dubinin-Astakhov, m^2/g e) specific surface area using the t-plot method (micropores), m^2/g; e) specific surface of mesopores, m^2/g

The effect of the alkali dose on the specific surface of the samples is not visible, that is, it can be reduced without disturbing the parameters of the porous structure. As can be seen from Figure 2(e), the total specific surface area increases under the above conditions due to mesopores. As the prepyrolysis temperature increases from 350°C to 450°C at the maximum TCA temperature, the mesopore area increases from 50 to 550 m^2/g. Similarly, when the TCA temperature increases from 600 to 735°C, the surface area of mesopores increases more than 10 times. It can be seen from the regression equation, which is essentially a mathematical model of the process, that the alkali consumption under the experimental conditions has a very important effect on the formation of the specific surface of the mesopores. Analysis of coefficients for two-way interactions shows that the strongest and more positive effect of alkali on the value of the mesopore surface appears again at higher temperatures before pyrolysis and chemical activation. This is confirmed by both the sign of these coefficients and their absolute value. Naturally, the specific surface area of AC depends on the size of sorption pores, especially the size of micropores.

Summary. Using modern experimental methods, the effect of operational parameters on the value of the coefficients in the Freundlich and Langmuir equations during adsorption from methylene blue and iodine solutions was determined, which allows to predict their adsorption properties. Based on the data on low-temperature nitrogen adsorption, it was experimentally determined that the specific surface area of carbon adsorbents obtained from hydrolytic lignin under optimal synthesis conditions reaches 1600 m^2 BET and the pore structure is represented by 90% supermicropores.

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Rezyume: *Yog'ochni qayta ishlash sanoatida katta miqdordagi lignin moddalari chiqindi sifatida tashlab yubariladi. Xususan, poligonlarda o'n millionlab tonna gidrolizlangan lignin to'planadi, ularni turli xil issiqlik usullari bilan qayta ishlash oraqali ma'lum sharoitlarda yuqori sifatli adsorbentlar-faollashtirilgan uglerodlarni olish imkonini beradi. Ushbu maqolada keltirilgan ma'lumotlar g'ovakli tuzilish parametrlari va yuqori adsorbsion xususiyatlarga ega adsorbentlarni olish imkonini berishi bilan izohlanadi.*

Резюме: *В нефтеперерабатывающей промышленности лигнинсодержащие материалы утилизируются как отходы, а большие объёмы гидролизного лигнина накапливаются на свалках. Переработка его различными термическими методами позволяет при определённых условиях получать высококачественные адсорбенты – активированные угли. Представленная в статье информация объясняется тем, что она позволяет получать адсорбенты с пористой структурой и высокими адсорбционными свойствами.*

Kalit so'zlar: *faollashtirilgan uglerod, lignin, makkajo'xori qobig'i, yod, metil ko'k, adsorbsiya.*

Ключевые слова: *активированный уголь, лигнин, кукурузный стебель, йод, метиловый синий, адсорбция.*

STUDY OF THE MINEROLOGICAL COMPOSITION OF A COMPLEX FERTILIZER PREPARED FROM LOW-GRADE CENTRAL KYZYLKUM PHOSPHORITES.

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Summary: *The work studied the mineralogical composition of complex fertilizers obtained from low-grade phosphorites using modern physicochemical analysis methods. It was established that the obtained fertilizers consist of calcium nitrate, calcium dihydroorthophosphate, ammonium sulfate, and ammonium nitrate.*

Key words: *Nitrophosphate fertilizer; Low-grade phosphorite; Nitric acid decomposition; Sulfuric acid treatment; Hygroscopicity; Calcium nitrate; Calcium dihydroorthophosphate; Ammonium nitrate; Ammonium sulfate; Fluorocarbonate apatite.*

Phosphorite was decomposed with nitric acid at a stechometric norm of 45% relative to CaO, ammoniated to pH-3, and steamed to a density of 1.80 g/cm^3. The resulting melt was poured onto the horizontal surface and after hardening by crushing, irregularly shaped granules were obtained, resulting in their cross-sectional diameter being calculated approximately (1-2 мм) [1-2].

The surface of the NKFU granules was sprayed with 93% sulfuric acid in amounts of 8, 16, and 33% of the total mass. The resulting mass was neutralized with gaseous ammonia. Chemical analysis data showed that 60-80% of the total sulfuric acid content is present on the NKFU surface in the form $(NH_4)_2SO_4$ Thus, it has been established that when treated with sulfuric acid, the hygroscopicity class of NKFU transitions from very highly hygroscopic to highly hygroscopic[3-6].

Table 1

Dependence of the hygroscopic point of fertilizers on the sulfuric acid norm

Sample number	Sulfuric acid norm,%	Hygroscopic point,%
1.	NKFU+ 0	32.
2.	NKFU + 16%	35.
3.	NKFU + 33%	55.

As can be seen from the table. As the amount of sulfuric acid applied to the nitrogen-containing fertilizer increases, the hygroscopic point increases. Fertilizer without sulfuric acid treatment has a 32% hygroscopic point. Increasing the sulfuric acid content to 16 and 33% led to an increase in the hygroscopic point to 35 and 55%, respectively. Without treating the fertilizer with sulfuric acid, the hygroscopic point was too small, i.e., the resulting fertilizer can clearly be classified as very highly hygroscopic. From the data presented in Table 1, it follows that at all ratios of ammoniated nitric acid mixture: sulfuric acid, the hygroscopic point of fertilizers increases almost the same with an increase in the acid norm. This work examines the mineralogical composition of the obtained fertilizers using modern analysis methods [3-14].

The thermal analysis of the sample of the substance - 100-200 mg - was carried out on a Paulik-Paulik-Erdey derivatograph with a heating rate of 10-12 deg/min, in the temperature range of 20-10000C. The recording was carried out under atmospheric conditions with constant removal of gas using a water jet pump. A 7mm diameter platinum crucible served as the holder. Heated aluminum oxide was used as a standard [7-8].

The identification of the solid phase was carried out by methods of physicochemical analysis. The X-ray diffraction patterns of the studied compounds were taken on a Dron-2.0 diffractometer with filtered copper radiation at a voltage of 40kV, current strength of -20mA, and a speed of the counter of -2 deg/min. The values of the interplanar distances were determined from the reference book according to the reflection angle [9-10], and the intensity of the diffraction lines was determined from the stobalized scale. IR spectroscopic analysis was carried out to clarify the nature of interaction between the constituent components of the studied compounds with the registration of data on a

Specord IR-75 spectrophotometer in the 4000-400cm^{-1} frequency region. Samples were prepared by pressing with KBr, as well as by grinding in vaseline oil [12-14].

The approximate composition of the nitrogen-phosphorus fertilizer was determined by X-ray phase, thermogravimetric, and IR spectroscopic analysis methods. Nitrophosphorus fertilizers treated with sulfuric acid and without treatment differ little in the content of the main nutrient components.

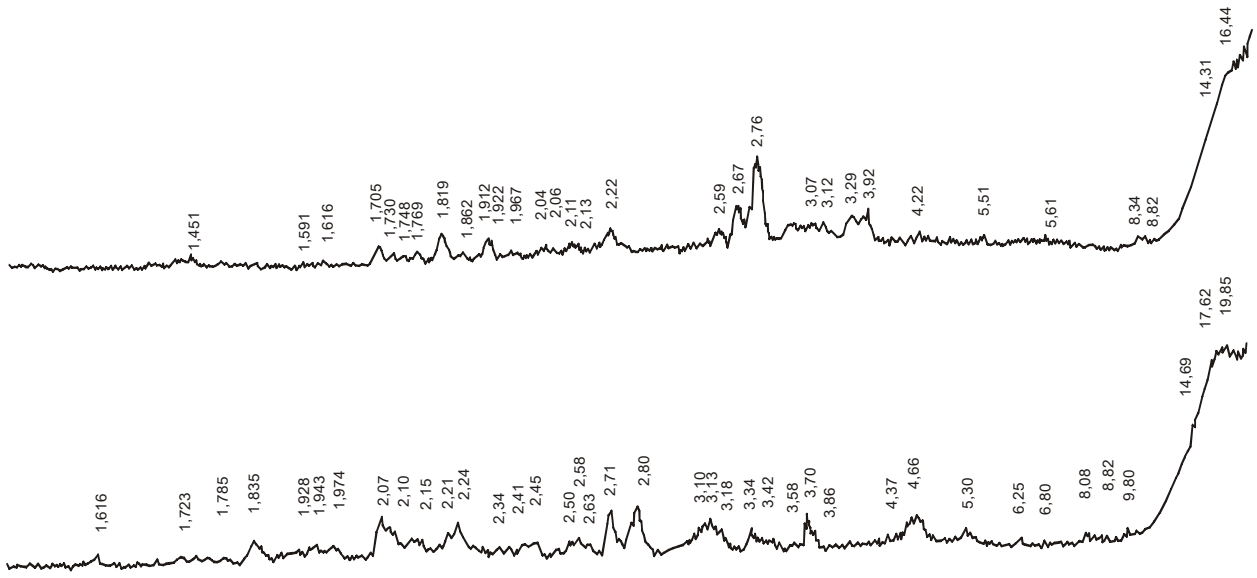


Figure 1 Radiographs of nitrogen-phosphorus fertilizers obtained:
1. By decomposition with nitric acid without treatment with sulfuric acid;
2. Decomposition by nitric acid with treatment with sulfuric acid

As can be seen from Figure 1, diffraction peaks of 2.76; 2.65, 1.83 A^{o,} which can be attributed to fluorocarbonapatite. The 2.27 A^{o} band is characteristic of calcite. This indicates that during the decomposition of Kyzylkum phosphorites with an incomplete norm of nitric acid, undecomposed phosphorites remain in the obtained fertilizers. In the diffractograms of fertilizers, in addition to fluorocarbonate apatite, diffraction bands belonging to calcium nitrate (2.05A^{o}), calcium hydroorthophosphate (3.13A^{o}), ammonium nitrate (3.92A^{o}) are recorded.

The X-ray diffraction pattern of the second fertilizer also shows peaks of 3.17 Å^{o}; 2.67A^{o}; 3.92; 2.80 and 2.23 A^{0} respectively, which can be attributed to calcium nitrate, calcium dihydroorthophosphate, ammonium sulfate, and ammonium nitrate.

The spectrograms of nitrogen-phosphorus fertilizers obtained by decomposition with nitric acid without treatment and treatment with sulfuric acid show the presence of gas absorption at 1400; 1550cm^{-1}characteristic for tetrahydrate calcium nitrate.

The IR spectra characterized by 1600 cm^{-1} bands apparently belong to the undecomposed phosphate part of the fertilizer. In the spectrograms, the brightly expressed absorption bands are 1055; 1354; 1380; 1733; c^{-1} refer to Ca $(NO_3)_2 \cdot 4H_2O$, $CaHPO_4 \cdot 2H_2O$ and $(NH_4)_2SO_4$.

The thermal behavior of fertilizers is important for determining the influence of the material composition, including impurities in the raw material, on the temperature characteristics and the nature of thermal effects accompanying the transformations of minerals during heating.

Thermal studies were conducted for two samples obtained by decomposition of phosphorites at a nitric acid norm of 50% from unenriched Kyzylkum phosphorite. The DTA curves are almost similar in terms of the nature of thermal effects, only a change in the depth of individual thermal effects was noted, caused by the influence of the quantitative ratio of phosphate, nitrate, and sulfate salts in fertilizers.

In the fertilizer obtained by decomposition with nitric acid (Figure 2), the content of Ca $(NO_3)_2$ *$4H_2O$, CaO P_2O_5, Ca $(H_2PO_4)_2$ is observed. With increasing temperature, the following changes are observed: at 75 -175

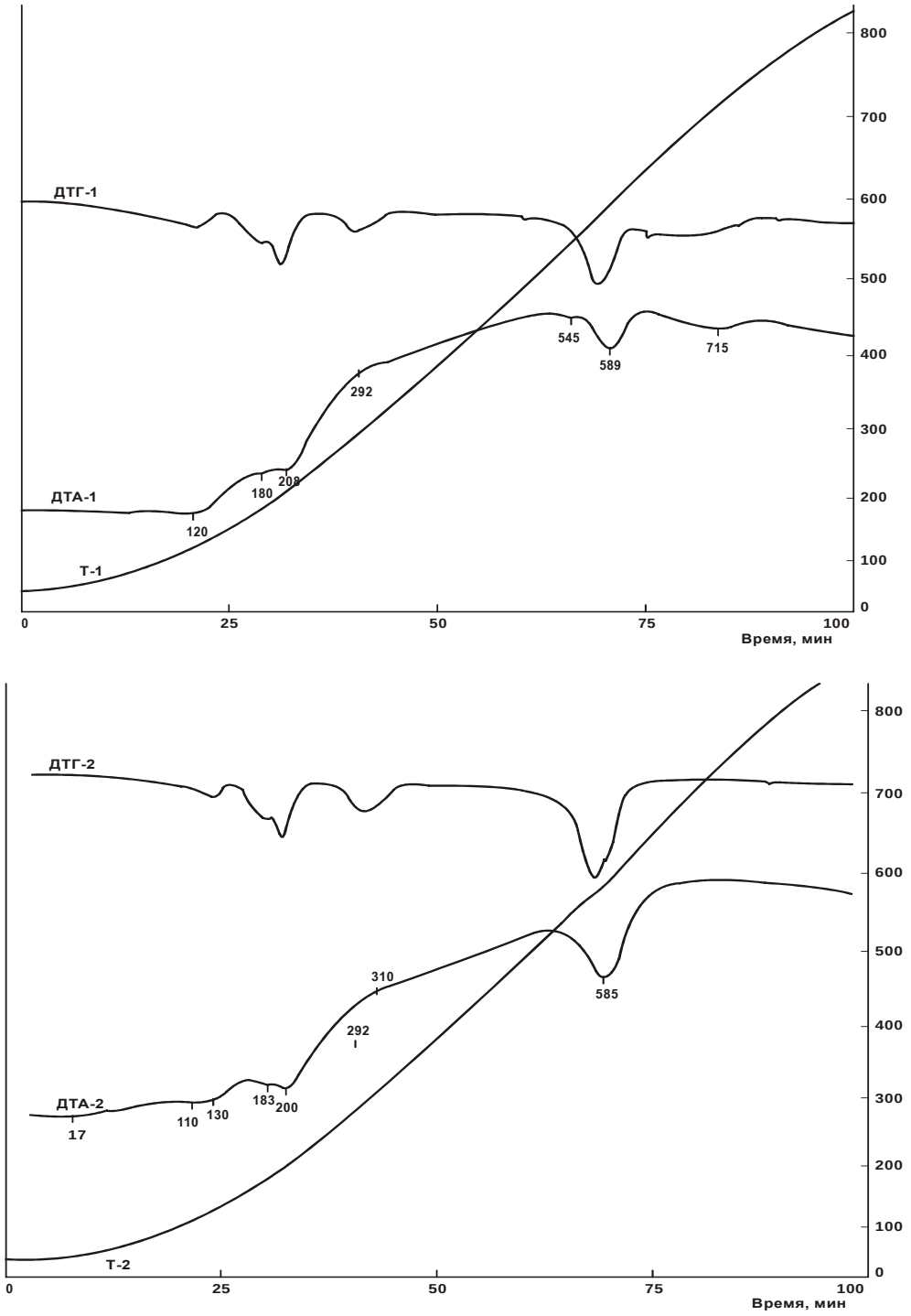


Fig. 2. Derivatograms of nitrogen-phosphorus fertilizers obtained:
1.Decomposition by nitric acid without sulfuric acid treatment.
2. Decomposition with nitric acid and treatment with sulfuric acid.

^{o}C absorption water loss occurs, which is observed on the DTA curve at a temperature of 120 ^{0}C.

At a temperature of 175-260 ºC, the loss of crystallization water Ca $(NO_3)_2 \cdot 4H_2O$ occurs. This effect is observed in DTA at temperatures of 180 ºC and 200 ºC. The process continues until 260 ºC.

Endothermic effects at 545º C and 589º C temperature indicate the decomposition of calcium nitrate, and at 715ºC - of monocalcium phosphate.

Monocalcium phosphate and dicalcium phosphate are stable at low temperatures. Their modification transformations from low-temperature to high-temperature forms begin at a temperature of 1050ºC.

In the thermogram of a nitrogen-phosphorus fertilizer stabilized with sulfuric acid, ammonium sulfate may be present in addition to known minerals. On the thermogram, in the temperature range of 75-175 ºC, the absorbed moisture begins to evaporate. An endoeffect is observed at a temperature of 130-183 ºC. In the temperature range of 175-260 ºC, a distinct endoeffect is observed at a temperature of 200ºC, indicating the evaporation of crystallization moisture from Ca $(NO_3)_2 \cdot 4H_2O$. At a temperature of 585ºC, a distinct endoeffect is observed, describing the process of melting and decomposition of Ca $(NO_3)_2$ to Ca$(NO_2)_2$. When treating nitrogen-phos Calcium phosphates and residual phosphorite acquire greater resistance to thermal decomposition, and their hygroscopic properties improve.

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Rezyume: *Ishda past navli fosforitlardan olingan murakkab o‘g‘itlarning mineralogik tarkibi zamonaviy fizik-kimyoviy tahlil usullari yordamida o‘rganildi.Olingan o‘g‘itlar kalsiy nitrat, kalsiy digidroortofosfat, ammoniy sulfat va ammoniy nitratdan iborat ekanligi aniqlandi.*

Резюме: *В работе изучена минералогичиский состав комплекисных удобрения прученний из низкосортных фосфоритов с применением современных физико-химических методов анализа.Установлено что полученных удобрений состоит из* нитрату кальция, дигидроортофосфату кальция, сульфату и нитрату аммония.

Kalit so‘zlar*: Nitrofosforli o‘g‘it; Past navli fosforit; Nitrat kislotali parchalanish; Sulfat kislotali ishlov berish; Gigroskopiklik; Kalsiy nitrat; Kalsiy digidroortofosfat; Ammoniy nitrat; Ammoniy sulfat; Ftorkarbonat apatit.*

Ключевые слова: *Нитрофосфатное удобрение; Низкосортный фосфорит; Разложение азотной кислотой; Сернокислотная обработка; Гигроскопичность; Нитрат кальция; дигидроортофосфат кальция; Нитрат аммония; сульфат аммония; Фторкарбонатный апатит.*

MOLECULAR PHYLOGENY OF *FERULA* (APIACEAE) IN UZBEKISTAN INFERRED FROM ITS SEQUENCES

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Summary: *This study is devoted to the molecular investigation of species of the genus* Ferula *(Apiaceae) occurring in the flora of Uzbekistan. Based on data retrieved from the NCBI GenBank database, 51 species of* Ferula *were analyzed. Among them, ITS (Internal Transcribed Spacer) sequence data were available for 42 species, while nine species lacked molecular information. The data were processed in the RStudio environment (v4.3.2), and an interactive sunburst diagram was generated using the* plotly *package to visualize the proportion of species with ITS, chloroplast (CP) genome, and missing data. Phylogenetic analysis was conducted with 1,000 bootstrap replicates. The resulting tree revealed several well-supported clades within* Ferula*. In particular,* F. prangifolia, F. kyzylkumica, F. lipskyi, *and* F. karatavica *formed a strongly supported clade with a 98% bootstrap value, indicating close evolutionary relationships. Similarly,* F. korshinskyi, F. sabulosa, *and* F. nuda *clustered into a distinct clade with 96% bootstrap support. The analysis confirmed the monophyly of the genus* Ferula*, indicating that all examined species originated from a common ancestor.* Diplotaenia cachrydifolia *and* Prangos ferulacea *were used as outgroup taxa to root the tree. This study provides important insights into the molecular phylogenetic structure of the genus* Ferula *and establishes a foundation for further systematic and evolutionary research.*

Keywords: Ferula*, ITS, chloroplast genome, NCBI GenBank, RStudio, phylogenetic analysis, flora of Uzbekistan*

Introduction

The genus *Ferula* L. (Apiaceae) comprises plants of significant biological and economic importance. Members of the genus are valued for their essential oils, use as fodder plants, medicinal properties, role in honey production, starch storage, aromatic compounds, nutritional value, and various industrial applications. Due to these biological and economic benefits, *Ferula* species represent a taxonomically and economically important group (Panahi et al., 2018).

At present, the genus *Ferula* includes about 228 recognized species worldwide, distributed from the Macaronesian Islands to the western Himalayas and Ethiopia, and from Eastern–Central Europe to Mongolia (POWO, 2025). In Central Asia, 105 species of *Ferula* have been recorded, of which 63 occur in the flora of Uzbekistan. More than 50 species are distributed in the western Tien Shan, approximately 60 in the Pamir–Alay system, and about 33 species in the southwestern Pamir–Alay region (Yang et al., 2022).

Recent molecular and systematic studies have demonstrated that *Ferula* is a polyphyletic genus and belongs to the tribe Scandiceae within the Apiaceae family (Kurzyna-Młynik et al., 2008). Further investigations in Central Anatolia (Turkey) revealed new endemic species—*Ferula turcica* and *Ferula latialata*—which were described as distinct taxa based on morphological, molecular, and phytochemical evidence (Tuncay et al., 2023). These findings indicate that the genus *Ferula* still harbors a high level of unexplored genetic and evolutionary diversity.

In this study, ITS (Internal Transcribed Spacer) sequence data available in the NCBI GenBank database were analyzed for *Ferula* species distributed in Uzbekistan to clarify their phylogenetic relationships. The main objective of the study was to assess the molecular diversity of *Ferula* species occurring in the flora of Uzbekistan and to determine their evolutionary affinities based on existing molecular evidence.

Materials and Methods

Data sources

In this study, 52 species of the genus *Ferula* (Apiaceae) occurring in the flora of Uzbekistan were examined. For each species, nuclear ribosomal ITS (Internal Transcribed Spacer) and chloroplast (CP) genome sequences were retrieved from the NCBI GenBank database. Specific searches were performed using scientific species names as keywords to ensure accurate data collection. The overall analysis revealed that ITS sequence data were available for 43 species, while nine species lacked molecular information in GenBank.

Data processing and visualization

The processing, classification, and visualization of molecular data availability were carried out in the RStudio environment (v4.3.2). A primary dataset was first compiled in Microsoft Excel 2021 and imported into R using the *readxl*, *dplyr*, and *plotly* packages. For each species, the presence or absence of ITS and CP marker data was encoded as "1" (present) or "0" (absent). Based on these data, an interactive sunburst diagram was generated to simultaneously display the proportion of *Ferula* species possessing ITS, CP, or no molecular data. The diagram was constructed using the *plotly* package and exported to high-quality HTML and PNG formats using the *htmlwidgets* and *webshot2* packages.

Phylogenetic analysis

ITS sequences of *Ferula* species were downloaded from the NCBI GenBank database in FASTA format and used for phylogenetic reconstruction. Phylogenetic analysis was performed using the RAxML program (v8.2.12) under the Maximum Likelihood (ML) criterion with 1,000 bootstrap replicates. The best-scoring ML tree was selected among all inferred trees, and the corresponding RAxML_bipartitions output file was generated. The tree was rooted using *Diplotaenia cachrydifolia* and *Prangos ferulacea* as outgroup taxa, as they are considered the closest relatives of *Ferula*. The final tree was visualized and edited in FigTree software (v1.4.4).

Results

A total of 51 species of the genus *Ferula* distributed in Uzbekistan were analyzed. According to the search results from the NCBI GenBank database, ITS (Internal Transcribed Spacer) sequence data were available for 42 species, while nine species lacked molecular information (Fig. 1).

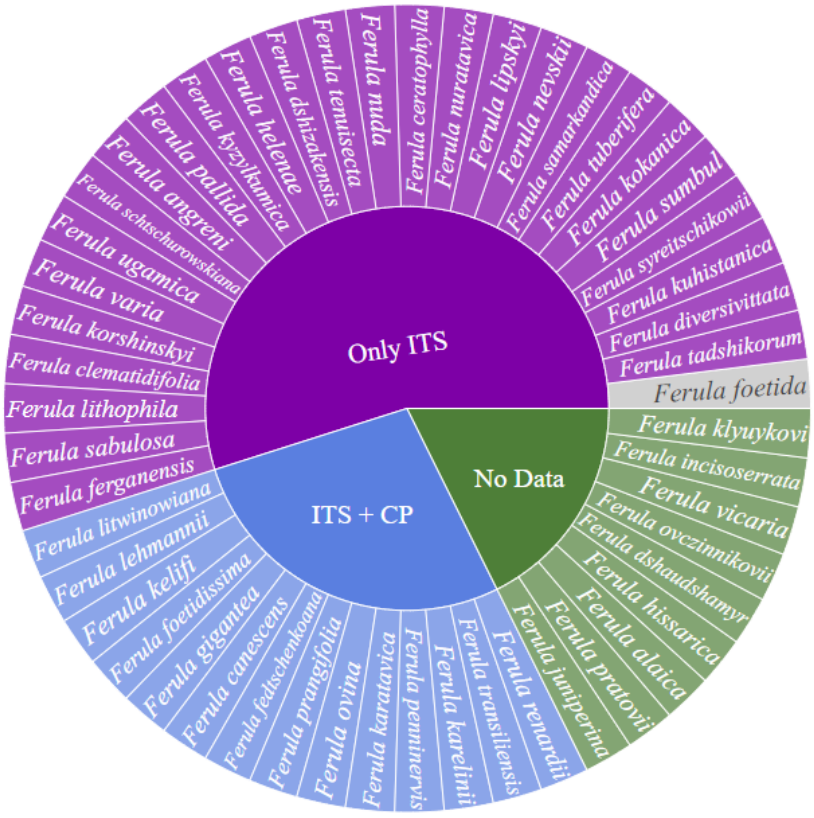


Figure 1. Analysis of the availability of molecular marker data for *Ferula* species occurring in Uzbekistan (based on NCBI GenBank information).

Phylogenetic relationships among *Ferula* species were analyzed based on ITS (Internal Transcribed Spacer) sequence data (Fig. 2). The analysis was performed using ITS sequences obtained from the NCBI GenBank database.

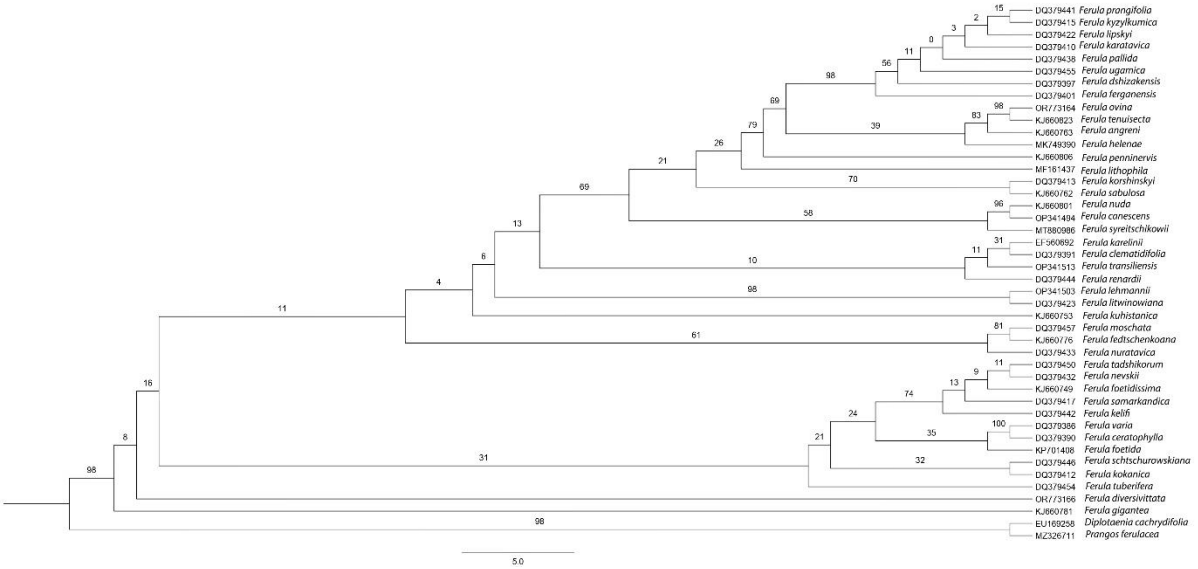


Figure 2. Phylogenetic tree of *Ferula* species based on ITS (Internal Transcribed Spacer) sequences constructed using the Maximum Likelihood (ML) method in RAxML.

Results

The Maximum Likelihood phylogenetic tree constructed in RAxML revealed the evolutionary relationships among *Ferula* species distributed in Uzbekistan. Node values represent bootstrap support percentages based on 1,000 replicates.

The results showed that *Ferula* species were divided into several well-supported major clades. In the upper part of the tree, *F. prangifolia*, *F. kyzylkumica*, *F. lipskyi*, *F. karatavica*, and *F. pallida* formed a strongly supported clade with a bootstrap value of 98%, indicating close evolutionary relationships. In the middle portion, *F. korshinskyi*, *F. sabulosa*, and *F. nuda* grouped together with 96% bootstrap support, reflecting high genetic affinity among them. Similarly, *F. moschata*, *F. tedtschenkoana*, and *F. nutans* clustered with 81% bootstrap support, suggesting moderate genetic relatedness and possible recent divergence.

In the lower part of the tree, *F. varia*, *F. ceratophylla*, *F. foetidissima*, and *F. samarkandica* formed a clade supported by a 74% bootstrap value, closely associated with *F. koksana* and *F. tuberifera*, together forming a distinct evolutionary branch.

The tree was rooted with *Diplotaenia cachrydifolia* and *Prangos ferulacea*, which were used as outgroup taxa closely related to *Ferula*. The inclusion of these outgroups allowed for correct tree orientation and reliable identification of the major *Ferula* clades.

Overall, the RAxML analysis demonstrated clear phylogenetic differentiation among *Ferula* species, with several lineages supported by high bootstrap values. The ITS-based phylogenetic tree accurately reflected the internal genetic structure of the genus, revealing evolutionary affinities and genetic divergence among taxa. These results provide a molecular framework for future comparative studies involving chloroplast genome (CP) data to better elucidate the evolutionary history of *Ferula*.

Discussion

The results of this study highlight the current state of molecular data availability and phylogenetic relationships among *Ferula* species in the flora of Uzbekistan. Analysis of the NCBI GenBank database revealed that 42 out of 51 species possessed ITS sequence data, confirming the ITS region as one of the most informative molecular markers for phylogenetic inference within *Ferula*.

The Maximum Likelihood tree generated in RAxML indicated a complex but evolutionarily coherent structure of relationships among *Ferula* species. High bootstrap support values confirmed strong genetic relatedness within certain clades, while lower values in other parts of the tree may reflect incomplete lineage sorting or unresolved genetic variation.

The clade comprising *F. prangifolia*, *F. kyzylkumica*, *F. lipskyi*, and *F. karatavica* (bootstrap = 98%) represents a well-defined evolutionary group widespread in Central Asia. Their close genetic similarity is consistent with previously reported morphological similarities (Maslova et al., 2017; Pimenov & Leonov, 2004), suggesting adaptation to similar ecological and climatic conditions.

The second major clade, including *F. korshinskyi*, *F. sabulosa*, and *F. nuda* (bootstrap = 96%), also indicates strong genetic relatedness. Morphologically, these species share similar leaf architecture and fruit characteristics (Korovin, 1940), supporting the molecular evidence of their close affinity.

Furthermore, *F. moschata*, *F. tedtschenkoana*, and *F. nutans* formed a moderately supported clade (bootstrap = 81%), implying genetic similarity despite some retained molecular differences. These taxa occur in geographically proximate areas, suggesting recent divergence from a common ancestor.

In the lower part of the phylogeny, *F. varia*, *F. ceratophylla*, *F. foetidissima*, and *F. samarkandica* formed a well-supported clade (bootstrap = 74%), sharing a common genetic background despite exhibiting distinct morphological traits.

The use of *Diplotaenia cachrydifolia* and *Prangos ferulacea* as outgroups was essential for determining the evolutionary direction of the tree, confirming the monophyly of the genus *Ferula*. Overall, the results affirm that *Ferula* is a monophyletic group, meaning that all analyzed species originated from a common ancestor. However, the presence of clades with lower bootstrap support indicates the need for further molecular and taxonomic studies to fully resolve phylogenetic relationships. Integrating molecular data with morphological evidence will provide a more comprehensive understanding of the intrageneric systematics of *Ferula*.

Conclusion

This study presents, for the first time, a systematic analysis of molecular data and phylogenetic relationships of *Ferula* species distributed in Uzbekistan using RStudio and RAxML environments. Database analysis revealed that 42 out of 51 species possess ITS sequence data, confirming the ITS region as an effective genetic marker for assessing genetic relatedness and evolutionary patterns within the genus.

The ITS-based phylogenetic tree demonstrated clear genetic differentiation among species and confirmed the polyphyletic origin of the genus *Ferula*. Several species formed highly supported clades, while others represented distinct evolutionary lineages. These results reveal the genetic diversity of *Ferula* species and their differentiation processes influenced by geographic and ecological factors. The findings provide a molecular foundation for future expanded phylogenetic research based on chloroplast DNA (CP markers) or multi-gene combinations (ITS + *rbcL* + *matK*), contributing to a deeper understanding of the evolutionary history of the genus *Ferula*.

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CONSERVATION STATUS AND ECOLOGICAL ANALYSIS OF THE ENDANGERED MEDICINAL PLANT *LAGOCHILUS INEBRIANS* (BOZULBANG) IN UZBEKISTAN

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Summary: *Lagochilus Bunge ex Benth. (Lamiaceae) includes 46 species distributed worldwide. In the flora of Uzbekistan, this genus is represented by 18 species, four of which (L. vvedenskyi, L. olgae, L. proskorjakovii, and L. inebrians) are listed in the Red Data Book of the Republic of Uzbekistan. Anthropogenic pressures such as overgrazing, collection for medicinal purposes, habitat degradation, and drought have led to a reduction in the population size and distribution area of Lagochilus species. L. inebrians exhibits sedative, hypotensive, and antiallergic effects, and contains diterpene alcohol lagokhilin, essential oils, tannins, and vitamins. The Extent of Occurrence (EOO) of L. inebrians is 88,817 km², and its Area of Occupancy (AOO) is 96 km², mainly distributed in the Western Tien Shan and Central Asian semi-desert regions. Based on IUCN Red List criteria, this species could be assessed as "Endangered." This study emphasizes the need for habitat protection, population monitoring, and restoration efforts to ensure the conservation of L. inebrians in its natural environment in Uzbekistan.*

Keywords: *Lagochilus inebrians, conservation status, ecoregion, endangered species.*

Introduction

The genus *Lagochilus* Bunge ex Benth. belongs to the family Lamiaceae and comprises 46 species distributed across arid and semi-arid regions of the world [12]. In the flora of Uzbekistan, 18 species of *Lagochilus* have been recorded [7], four of which (*L. vvedenskyi*, *L. olgae*, *L. proskorjakovii*, and *L. inebrians*) are included in the Red Data Book of the Republic of Uzbekistan [8].

Populations of *Lagochilus* species are declining under the influence of anthropogenic factors such as livestock grazing, harvesting for forage and medicinal raw materials, and trampling [2,4,13]. Insufficient water supply and prolonged droughts are additional natural factors contributing to population reduction [10].

Lagochilus inebrians Bunge (Lamiaceae) extract is used as a sedative, hypotensive, antiallergic, and hemostatic agent. The plant contains diterpene alcohol lagokhilin, mono- and diacetyl derivatives of lagokhilin, vulgarol, essential oils, tannins, resins, carotene, vitamins K and C, organic acids, calcium, magnesium, and about 20 trace elements [3,6,15]. *L. inebrians* exhibits a wide range of therapeutic effects and is used in traditional and folk medicine as an infusion or decoction for its hemostatic properties [1].

Previous studies have investigated the ethnobotany [1], phytochemistry, and pharmacological properties [3] of *L. inebrians*. Additionally, microclonal propagation techniques under in vitro conditions have been developed [14]. However, no detailed studies have been conducted on the species' conservation status or eco-regional analysis. Therefore, this study provides a comprehensive assessment of the conservation condition and ecological distribution of *L. inebrians* in Uzbekistan.

Research Methodology.

To determine the distribution range of the medicinal plant *Lagochilus inebrians*, data from the National Herbarium of Uzbekistan (TASH), the Global Biodiversity Information Facility (GBIF), iNaturalist, and the database "Plants and Lichens of Russia and Neighboring Countries" (Plantarium) were used. Herbarium records were converted into GPS coordinates. For the ecoregional analysis, the map of terrestrial ecoregions of the world [11] was clipped to the territory of Uzbekistan using ArcGIS software. The Extent of Occurrence (EOO) and Area of Occupancy (AOO) were calculated using the GeoCAT platform.

Analysis and Results.

The main part of *L. inebrians* populations was found to grow in the Alai–Western Tianshan steppe ecoregion, and partly in the Central Asian southern desert and Badkhiz–Karabil semi-desert

ecoregions (Fig. 1).
The distribution range (EOO) of *Lagochilus inebrians* is 88,817 km², while the area of occupancy (AOO) is 96 km². The reduction in population size and habitat range of this species is mainly caused by factors such as insufficient precipitation, trampling by livestock, and large-scale harvesting over many years.

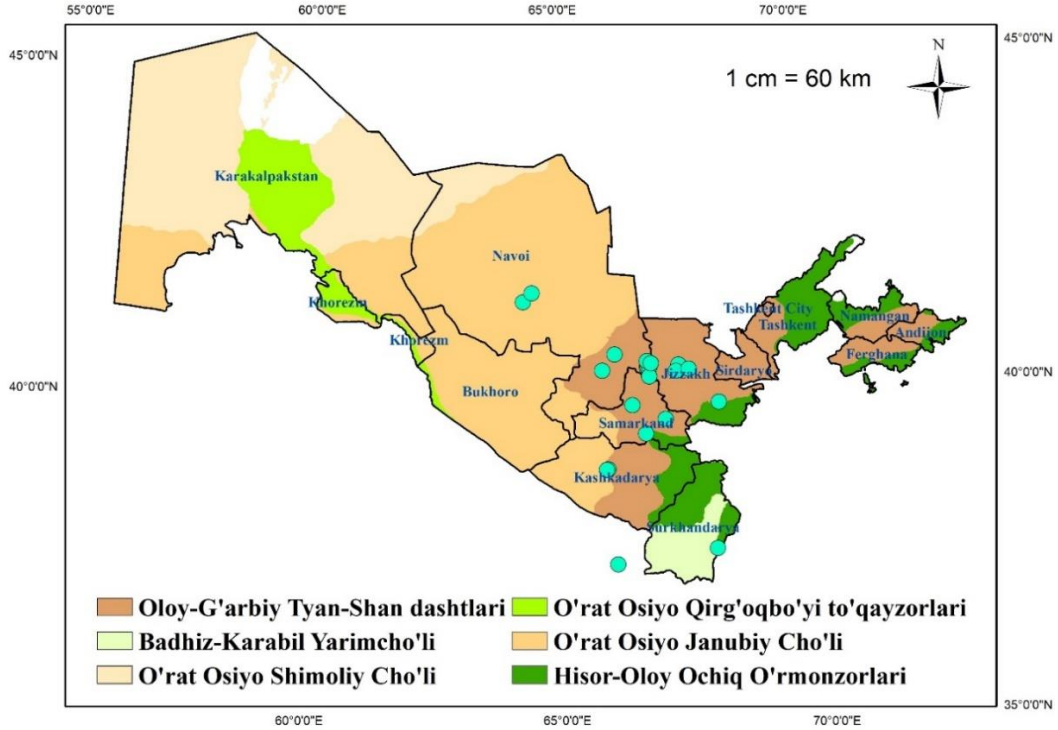


Figure 1. Distribution of *Lagochilus inebrians* across ecoregions

The species *Lagochilus inebrians* has not yet been formally assessed according to the criteria of the International Union for Conservation of Nature (IUCN) Red List. However, this species is included in the Red Data Book of the Republic of Uzbekistan, and there is evidence that its natural habitats are shrinking and being affected by anthropogenic factors. Based on these observations, *L. inebrians* may be considered as a species at high risk of extinction (Endangered).



Figure 2. Assessment of the conservation status of *Lagochilus inebrians*

The restricted distribution range, small population size, and various threats to its survival indicate the urgent need for conservation measures to prevent further reduction or possible extinction of *L. inebrians* within its natural range.

To ensure the long-term conservation and restoration of *L. inebrians* in Uzbekistan, the following actions are recommended:

Population monitoring and assessment: Regular monitoring of the status and dynamics of *L. inebrians* populations. Evaluation of population size, distribution area, and habitat characteristics. Collection and analysis of data on population conditions and threats.

Habitat protection: Preservation and protection of key habitats important for *L. inebrians*. Limitation of grazing, harvesting, and other anthropogenic impacts in the regions where the species occurs. Restoration and management of ecosystems to mitigate the effects of climate change.

Population recovery and propagation: Development of microclonal propagation technologies for *L. inebrians* to support both *ex situ* and *in situ* conservation. Implementation of programs aimed at strengthening natural populations and reintroducing the species into new suitable habitats.

Legislation and management: Inclusion of *L. inebrians* in the official IUCN Red List. Improvement of legislation regulating the protection and sustainable use of the species' habitats. Development of effective management strategies in cooperation with local communities, landowners, and other stakeholders.

Research and education: Promotion of new research on the biology, ecology, pharmacology, and ethnobotany of *L. inebrians*. Training of qualified specialists in species conservation and management. Raising public awareness about this species and its protection through mass media and the educational system.

The effective implementation of these approaches is crucial for ensuring the long-term conservation and restoration of *L. inebrians* within its natural range in Uzbekistan.

Conclusion.

The genus *Lagochilus* Bunge ex Benth. is represented by 18 species in the flora of Uzbekistan, four of which are listed in the Red Data Book. The populations of *Lagochilus inebrians* are under threat due to anthropogenic factors and natural conditions. Its extent of occurrence is 88,817 km², and its area of occupancy is 96 km². The species requires formal assessment under the IUCN evaluation system, but it is likely to be classified as Endangered. Ensuring the conservation of *L. inebrians* can be achieved through long-term protection and restoration measures, population monitoring, habitat conservation, and public awareness initiatives.

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Rezyume: *Lagochilus Bunge ex Benth., Lamiaceae oilasiga mansub bo'lib, dunyo bo'ylab 46 ta turi aniqlangan. O'zbekiston florasida ushbu turkumning 18 turi uchrab, to'rttasi (L. vvedenskyi, L. olgae, L. proskorjakovii va L. inebrians) Qizil kitobga kiritilgan. Antropogen omillar, masalan, o'tlash, dorivor yig'im-terim va tabiiy yashash joylarining buzilishi hamda qurg'oqchilik tufayli Lagochilus turlarining populyatsiyasi va yashash maydoni qisqarmoqda. L. inebrians sedativ, gipotenziv va antiallergik xususiyatlarga ega bo'lib, tarkibida diterpen spirti lagoxilin, efir moylari, taninlar va vitaminlar mavjud. L. inebrians turining tarqalish maydoni (EOO) 88,817 km2 ni, joylashuv maydoni (AOO) esa 96 km2 ni tashkil etadiva asosiy qismi G'arbiy Tyanshan va Markaziy Osiyo yarim cho'llarida joylashgan. IUCN mezonlariga ko'ra, ushbu tur "Xavf ostida" (Endangered) deb baholanishi mumkin. Tadqiqotda yashash joylarini himoya qilish, populyatsiyalarni kuzatish va qayta tiklash muhimligi ta'kidlangan. Bu chora-tadbirlar L. inebrians ning O'zbekistonda tabiiy muhitda saqlanishini ta'minlaydi.*

Резюме: *Lagochilus Bunge ex Benth., относящийся к семейству Lamiaceae, включает 46 видов, идентифицированных по всему миру. Во флоре Узбекистана этот род представлен 18 видами, четыре из которых (L. vvedenskyi, L. olgae, L. proskorjakovii и L. inebrians) включены в Красную книгу. Из-за антропогенных факторов, таких как выпас скота, сбор лекарственного сырья, разрушение естественных мест обитания и засуха, популяции и ареалы видов Lagochilus сокращаются. L. inebrians обладает седативными, гипотензивными и противоаллергическими свойствами, содержит дитерпеновый спирт лагохилин, эфирные масла, танины и витамины. Ареал распространения (EOO) L. inebrians составляет 88 817 км², а площадь обитания (AOO) – 96 км², основная часть которых находится в Западном Тянь-Шане и полупустынях Центральной Азии. По критериям МСОП данный вид может быть отнесён к категории «Находящиеся под угрозой исчезновения» (Endangered). Исследование подчёркивает важность защиты мест обитания, мониторинга популяций и мер по восстановлению для сохранения L. inebrians в природных условиях Узбекистана*

Kalit so'zlar: *Lagochilus inebrians, muhofaza holati, ekoregion, xavf ostidagi tur.*

Ключевые слова: *Lagochilus inebrians, охранный статус, экорегион, исчезающие виды.*

EXPERIMENTAL EVALUATION OF THE ACUTE TOXICITY OF TRITERPENOID SUPRAMOLECULAR COMPLEXES BASED ON SUCCINIC ACID AND LUPININE ESTER

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Summary: *The article examined the acute toxic properties of the supramolecular complexes of the monoammonium salt of glycyrrhizic acid with succinic acid (MASGA:SA) in a 2:1 molar ratio and the monoammonium salt of glycyrrhizic acid with bislupinine ether of succinic acid (MASGA:SA) in a 4:1 molar ratio on laboratory mice. LD_{50} indicators were determined based on the OECD criteria (2001). The changes in the body mass of mice were recorded and statistically analyzed. Also, these substances in high doses (5000 mg/kg) do not have toxic effects and are classified as relatively harmless compounds belonging to the VI class according to the OECD classification. These results will serve as an important theoretical basis for the development of pharmacological preparations in the future.*

Key words: *Monoammonium salt of glycyrrhizic acid, succinic acid, lupinine, supramolecule, acute toxicity, mice, LD_{50}, pharmacology, drug, MASGA:SA, MASGA:SLE, OECD classification, statistical analysis, dose, respiration, body weight, quarantine conditions, triterpenoid.*

Introduction

In recent years, interest in complex compounds derived from natural substances has been increasing in the fields of pharmaceuticals and medicine. Glycyrrhizic acid, a triterpenoid obtained from the roots of licorice, is well known for its anti-inflammatory, antioxidant, hepatoprotective, and antiviral effects. It has long been widely used in traditional medicine, particularly in Eastern countries (Ibn Sina). Numerous studies conducted by English and Russian researchers have confirmed its pharmacological properties (Haraguchi et al., 1998; Wang et al., 2013; Mironov, 2012).

Among plant growth stimulators, organic acids are considered effective agents for increasing the productivity of agricultural crops. Their application in crop science allows for accelerating flowering, reducing fruit drop, enhancing plant tolerance to drought, ensuring uniform ripening suitable for mechanized harvesting, and influencing various other developmental processes. Succinic acid, as an important metabolite of the Krebs cycle, represents a central component of cellular energy metabolism. It activates redox reactions in the organism and exhibits adaptogenic effects (Grishina, 2015).

Therefore, the search for new, highly effective, and environmentally safe plant growth stimulants based on succinic acid and its derivatives is of great significance. Consequently, studying the biological activity of supramolecular complexes formed from glycyrrhizic acid and succinic acid has become an important research direction. Without determining their toxicological safety, their application in pharmaceuticals and agriculture cannot be justified. For this reason, our study is devoted to evaluating the acute toxicity of complexes derived from glycyrrhizic acid and succinic acid in laboratory mice.

During the research, supramolecular complexes with different ratios (MASGA:SA, 2:1 and MASGA:SLE, 4:1) were synthesized using monoammonium glycyrrhizinate obtained from licorice roots growing in the Aral Sea region, based on methods described in the literature (Nuriyeva M.U. et al., 2023). Solutions of the obtained supramolecular compounds were prepared in various concentrations and ratios, and their effects on the germination and pigment accumulation processes of autumn and spring wheat grains were tested under laboratory and field conditions in the saline soils of the Republic of Karakalpakstan.

Literature Review

A considerable body of scientific literature provides information on the biological activities of glycyrrhizic acid derivatives. Haraguchi et al. (1998) demonstrated the effective antiviral activity of glycyrrhizic acid against influenza virus. Wang et al. (2013) confirmed its hepatoprotective properties, while Matsumoto et al. (2013) reported its positive effects on the immune system.

Extensive data are also available in Russian scientific sources. Mironov (2012) presented key methodological approaches in the toxicology of medicinal substances, whereas Stefanov (2002) described methods for conducting preclinical studies. Alekseeva (2010) provided insights into the role of succinic acid as a metabolic regulator, and Grishina (2015) elaborated on its significance in cellular bioenergetics. Based on these studies, complexes of glycyrrhizic and succinic acids are regarded as promising pharmacological agents.

In Uzbekistan, researchers such as S.V. Lukyanova, A.A. Toychiev, D.N. Dalimov, A.A. Akhunov, and H.H. Qoshiev have studied the effects of various physiologically active substances on the growth and development of agricultural crops. Studies by Allaniyazova M.K. (2023) and Djuraev T.A. (2019) have examined the mechanisms by which triterpenoid compounds influence wheat growth and development, highlighting the scientific and practical relevance of this research direction.

In our study, the acute toxicity of the most effective supramolecular complexes MASGA:SA (2:1) and MASGA:SLE (4:1) was evaluated using a mouse model. The experiments were conducted in collaboration with L.U. Makhmudov at the Pharmacology and Screening Laboratory of the Institute of Bioorganic Chemistry named after academician O.S. Sodiqov, Academy of Sciences of the Republic of Uzbekistan.

Materials and Methods

The experiments were conducted using the acute oral toxicity test at a fixed dose, as strictly recommended by OECD (2001).

This test allows for the assessment of acute toxicity of chemical substances through a single oral administration. Supramolecular complexes MASGA:SA (2:1) and MASGA:SLE (4:1) were administered to groups of animals of the same sex in a stepwise manner at a fixed dose of 5000 mg/kg. The experiments used male albino laboratory mice weighing 22 ± 2 g. The animals were kept under quarantine conditions for 10–14 days and selected for pharmacological testing when healthy and sexually mature.

The study was conducted in two stages. On the first day of stages I and II, the general condition of the animals was monitored hourly, including signs of tremors and possible mortality. For up to two weeks, all animals were observed daily for general condition, locomotor activity, skin and coat condition, respiration rate and depth, urine output, body weight changes, and other parameters [8]. The animals were provided with standard diet and water ad libitum.

The animals were divided into three groups (control and two experimental groups):

- **Control group** – received distilled water.
- **Experimental group 1** – received MASGA:SA (2:1) at a dose of 5000 mg/kg orally.
- **Experimental group 2** – received MASGA:SLE (4:1) at a dose of 5000 mg/kg orally.

The observation period lasted 14 days. Data were analyzed using arithmetic mean (M) and standard error of the mean (m). Statistical significance was accepted at $p<0,05$.

Results

Following oral administration of MASGA:SA at 5000 mg/kg, mice exhibited short-term accelerated respiration, temporary immobility, and slight narrowing of the eyes within 5 minutes. These effects lasted 15–20 minutes, after which normal behavior resumed.

After oral administration of MASGA:SLE at 5000 mg/kg, similar signs were observed 8 minutes post-administration and lasted 10–15 minutes, after which normal activity returned. Throughout the experiment, no mortality was recorded in mice receiving either MASGA:SA or MASGA:SLE at 5000 mg/kg (5/0).

No significant differences in body weight changes of mice in the experimental groups were observed compared to the control on days 7 and 14 ($p > 0.05$). The mean lethal dose (LD_{50}) for both complexes was determined to be $LD_{50} > 5000$ mg/kg, confirming their low acute toxicity (Table 1).

Table 1.

Evaluation of Acute Toxicity of Supramolecular Complexes GKMAT:SA (2:1) and GKMAT:YLE (4:1) in Male Mice (M ± m, n=5)

Group	Dose,mg/kg, ml	Total Animals / Deaths	Average Body Weight, g			LD_{50}, mg/kg
			Day 1	Day 7	Day 14	
Control	0,4 ml	5/0	22,0 ± 1,9	22,6 ± 2,2	23,2 ± 2,3	-
MASGA:SA (2:1)	5000 mg/kg	5/0	21,6 ± 1,8	21,9 +2,1	23,0 ± 2,2	>5000
MASGA:SLE (4:1)	5000 mg/kg	5/0	21,0 ± 2,0	21,7 ± 2,0	22,8 ± 2,1	>5000

Discussion

The results of this study confirmed that supramolecular complexes based on glycyrrhizic acid and succinic acid do not exhibit acute toxicity even at high doses. This indicates their potential as safe components for the development of pharmaceutical preparations.

Other studies have also highlighted the toxicological safety of glycyrrhizic acid derivatives (Fiore et al., 2008; Chen et al., 2019). However, the effects of long-term administration, including chronic toxicity, reproductive toxicity, and mutagenicity, have not yet been sufficiently investigated.

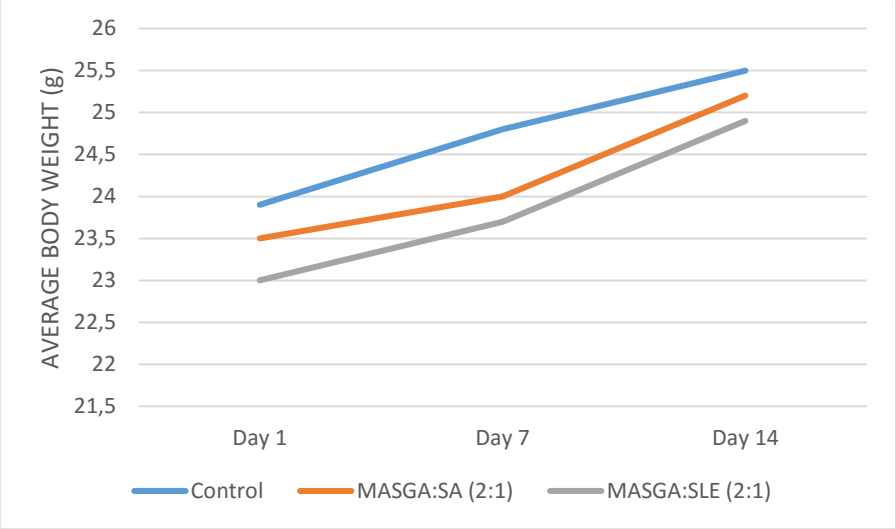


Figure 1. Body weight changes in mice during the experiment

Conclusion

1. Administration of the MASGA:SA (2:1) complex to mice at a dose of 5000 mg/kg resulted in no mortality, with an $LD_{50} > 5000$ mg/kg.
2. The MASGA:SLE (4:1) complex was also found to be safe at the same high dose. According to OECD classification, both complexes belong to Class VI, indicating relatively harmless substances.

These findings provide a significant scientific basis for the future development of glycyrrhizic acid and succinic acid complexes as pharmaceutical agents and as environmentally safe, effective biostimulators for enhancing plant growth in agriculture.

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Rezyume: *Maqolada glitsirrizin kislotasining monoammoniyli tuzi bilan yantar kislotasining (GKMAT:YK) 2:1 va glitsirrizin kislotasining monoammoniyli tuzi bilan yantar kislotasi bislupininli efirining (GKMAT:YLE) 4:1 molyar nisbatdagi supramolekulyar komplekslarining laboratoriya sichqonlarida o'tkir zaharlilik xususiyatlari o‘rganilgan. OECD (2001) mezonlariga asoslanib LD_{50} ko‘rsatkichlari aniqlangan. Sichqonlarning tana vaznining o‘zgarishi qayd etilib, statistik tahlil qilingan. Shuningdek, bu moddalar yuqori dozada (5000 mg/kg) toksik ta’sir ko‘rsatmasligi va OECD tasnifiga ko‘ra VI-sinfga kiruvchi, nisbatan zararsiz birikmalar sifatida qayd etilgan. Ushbu natijalar kelgusida farmakologik preparatlar ishlab chiqishda muhim nazariy asos bo‘lishi keltirilgan.*

Резюме: *В статье изучены острые токсические свойства супрамолекулярных комплексов моноаммонийной соли глицирризиновой кислоты с янтарной кислотой (МАСГК:ЯК) в молярном соотношении 2:1 и моноаммонийной соли глицирризиновой кислоты с бислупиниловым эфиром янтарной кислоты (МАСГК:ЯК) в молярном соотношении 4:1 на лабораторных мышах. Показатели LD_{50} были определены на основе критериев ОЭСР (2001). Зафиксированы и статистически проанализированы изменения массы тела мышей. Также эти вещества в высоких дозах (5000 мг/кг) не оказывают токсического действия и классифицируются как относительно безвредные соединения, относящиеся к VI классу по классификации ОЭСР. Эти результаты послужат важной теоретической основой для разработки фармакологических препаратов в будущем.*

Kalit so‘zlar: *Glitsirrizin kislotasining monoammoniyli tuzi, yantar kislotasi, lupinin, supramolekula, o'tkir zaharlilik, sichqonlar, LD_{50}, farmakologiya, preparat, GKMAT:YK, GKMAT:YLE, OECD tasnifi, statistik tahlil, doza, nafas olish, tana vazni, karantin sharoiti, triterpenoid.*

Ключевые слова: *Моноаммониевая соль глицирризиновой кислоты, янтарная кислота, лупинин, супрамолекула, острая токсичность, мыши, LD_{50}, фармакология, препарат, МАСГК:ЯК, МАСГК:ЯЛЭ, классификация ОЭСР, статистический анализ, доза, дыхание, масса тела, карантинные условия, тритерпеноид.*

CONCEPT OF DESERTIFICATION AND DEFINITIONS PROVIDED FOR IT

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Summary: *The article examines the process of desertification, its causes and consequences, as well as various definitions of desertification given by scientists. In addition, the study explores issues such as the broad promotion of innovative projects aimed at combating desertification and drought, increasing the awareness of the local population regarding measures to fight desertification and drought, and the development and practical implementation of programs ensuring sustainable land use.*

Key words: *arid, desertification, degradation, scale, pasture, ecosystem, geosystem, erosion, ecological migration, ecosystem, intensive, humus.*

Introduction. Desertification is a geographical and ecological process in which soil degradation and loss of fertility occur in arid and semi-arid regions, leading to the deterioration of all forms of organic life and a decline in the natural and economic potential of these territories. This process develops under the influence of human activity and climate change, resulting in the expansion of desert areas.

Desertification arises due to natural and anthropogenic (human-induced) factors. The main factors include deforestation, climate change, improper irrigation, overgrazing, and others. As a result, agricultural lands and pastures deteriorate, negatively affecting agriculture and ecosystems.

Today, desertification is one of the major environmental, social, and economic challenges facing humanity. Among the primary drivers of this process are the continuous growth of the population and technological development, which increase the scale and intensity of desertification.

Desertification occurs on almost all continents, particularly in the arid regions of Africa, Asia, Australia, and South America.

Main Part. This process manifests differently in plains compared to mountain and foothill areas due to variations in precipitation, resource usage, and climatic elements. In plains, land is mainly used for irrigated agriculture, whereas in mountain and foothill regions it is used for rain-fed agriculture, pasture farming, mining, and other purposes. Therefore, today the greatest anthropogenic pressure falls on mountain and foothill areas.

Although the mountainous and foothill regions occupy only a small southeastern part of our country, they rank high in terms of intensity of land use. As a result, years of unplanned exploitation have led to negative consequences.

The desertification process occurring in our country and the development of preventive measures is not only a matter of scientific research but also a state-level priority. The *Action Strategy for Further Development of the Republic of Uzbekistan* identifies tasks such as ensuring an ecologically safe environment, preventing environmental problems harmful to public health, and preserving the gene pool.

Additionally, Presidential Decree No. PK-4204 (February 22, 2019) “On measures to improve the efficiency of activities to combat desertification and drought,” the Law “On Pastures” (May 20, 2019), and other legal documents emphasize the need to conduct natural-geographical research and apply its findings in practice.

Despite many scientific articles, projects, and studies being carried out on the causes, consequences, and prevention of desertification, much of the research remains in theoretical form. Desertification is not a process that occurs within a few months or even a few years; it requires long periods of time and continuous monitoring to properly observe its dynamics.

According to researchers, both natural and anthropogenic factors contribute to modern desertification. Depending on the region, these factors and their indicators vary. Natural factors mainly include wind and precipitation levels, while anthropogenic factors include population growth, increased livestock numbers in mountain areas, agriculture, and other human activities.

Desertification not only affects the areas where it occurs but also reduces water resources, biodiversity, and alters climate conditions in other regions. This leads to rising food prices, disruption of market mechanisms, and increases in social and political tensions worldwide.

Scientific Definitions of Desertification

Desertification refers to the cumulative effect of natural and anthropogenic factors that cause degradation of landscapes and ecosystems in arid regions, leading to a decline in biological productivity and natural-economic potential. It affects the living standards and health of the population, resulting in forced migration.

Many scientists, both domestic and foreign, have proposed various definitions of desertification based on their research regions.

• S. B. Abbasov defines desertification as the reduction of productive land, degradation of ecosystems, aridification of climate, and expansion of desert territories — essentially a disturbance of ecosystem balance.

• L. A. Alibekov describes it as a complex process of environmental degradation in arid zones, including loss of vegetation, water and wind erosion, soil salinization, reduction of humus, and a decline in biological productivity.

• U. Q. Nazarov views desertification as the impoverishment of landscape ecosystems, leading to reduced biological productivity, increased salinization, and intensified erosion.

The UN Convention to Combat Desertification defines desertification as "land degradation in arid, semi-arid, and dry sub-humid areas resulting from various factors, including climate change and human activities."

• Dregne (1976) states that desertification is a process caused by the combined effects of human activities and drought, resulting in decreased vegetation productivity, changes in fauna and flora, intensified soil erosion, and threats to employment.

• Le Houerou H.N (1972) argues that desertification is primarily linked to human activity rather than climate change, emphasizing demographic pressure and overgrazing, agricultural overuse, deforestation, and mechanized farming.

• Rozanov and Zonn (1980) define desertification as irreversible degradation of vegetation and soil cover in arid regions, leading to reduced biological productivity and transforming territories into deserts.

Worldwide, continuous population growth and increased anthropogenic pressure on landscapes contribute significantly to desertification. According to UNEP, deserts formed by human influence already exceed 9 million sq. km, and 7 million hectares of agricultural land are affected by desertification each year.

Arid regions cover 30% of the world's land surface, containing 145 million hectares of irrigated land, 170 million hectares of rain-fed land, and 3.6 billion hectares of pastures. Over 860 million people live in these areas. Central Asia is one of the major regions where desertification is rapidly intensifying, with a population of over 70 million. The increasing population and intensive use of natural resources are driving desertification in both plains and mountain regions.

The worsening ecological situation in arid regions worldwide requires ecological load regulation, continuous monitoring, use of advanced desertification-control technologies, creation of pasture cadasters, and development of predictive thematic maps.

Conclusion. In our country as well, desertification is progressively advancing from plains to higher elevations. The scale and intensity of desertification in mountain and foothill regions indicate that if preventive measures are not taken, vast mountain landscapes may turn into barren rocky deserts within several decades, causing severe ecological consequences.

Addressing this urgent environmental problem requires conducting field experiments to quantitatively evaluate desertification dynamics and applying modern methods such as aerospace monitoring, geoinformation systems, cartography, and other technologies to implement a comprehensive and systematic approach to combating desertificat

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Rezyume: *Maqolada cho'llanish jarayoni, uning keltirib chiqaruvchi sabablar va oqibatlari, olimlar tomonidan cho'llanishga berilgan turli tariflar o'rganilgan. Budan tashqari, tadqiqot ishida cho'llanish va qurg'oqchilikka qarshi kurashish bo'yicha innovatsion loyihalarni ishlab chiqarishni keng targ'ib qilish, mahalliy aholining cho'llanish va qurg'oqchilikka qarshi kurashish bo'yicha xabardorligini oshirish, hamda yerlardan barqaror foydalanishni amalga oshirish dasturlarini ishlab chiqib va amaliyotda qo'llashni kabi muammolar tadqiq qilingan.*

Резюме: *В статье исследуется процесс опустынивания, его причины и последствия, а также различные тарифы, взимаемые учеными за опустынивание. Кроме того, в исследовательской работе были исследованы такие проблемы, как широкое продвижение инновационных проектов по борьбе с опустыниванием и засухой, повышение осведомленности местного населения о борьбе с опустыниванием и засухой, а также разработка и практическое применение программ по внедрению устойчивого землепользования.*

Kalit so'zlar: *arid, cho'llashish, degradatsiya, ko'lam, yaylov, ekosistema, geosistema, eroziya, ekologik qochoq, ekotizim, intensiv, gumus.*

Ключевые слова: *засуха, опустынивание, деградация, масштаб, пастбища, экосистема, Геосистема, эрозия, экологическая дезертирство, экосистема, интенсивный, гумус*

AGROTECHNOLOGY OF THYMUS VULGARIS AND WAYS TO IMPROVE ITS BIOECOLOGICAL CHARACTERISTICS

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Summary: *The article discusses the agrotechnological aspects of Thymus vulgaris cultivation and the improvement of its bioecological characteristics under various environmental conditions. The study focuses on optimizing soil preparation, planting density, irrigation regimes, and nutrient management to achieve higher yield and better essential oil quality. Particular attention is paid to the influence of ecological factors such as temperature, humidity, and light on the growth and development of Thymus vulgaris. The research also highlights the plant's adaptability to arid climates and its potential for sustainable cultivation in ecologically sensitive regions. The results contribute to the development of advanced cultivation technologies and demonstrate the importance of integrating agroecological principles in medicinal and aromatic plant production systems.*

Key words: *Thymus vulgaris, agrotechnology, bioecological characteristics, plant cultivation, propagation methods, ecosystem adaptation, root system, photosynthetic efficiency, winter hardiness, pest resistance.*

Thymus vulgaris L., commonly known as thyme, is a medicinal and aromatic plant belonging to the Lamiaceae family, widely used in pharmaceuticals, cosmetics, and the food industry [1;2]. Studying the agro-technological and bioecological characteristics of this plant is crucial for improving its yield, enhancing essential oil content, and ensuring ecosystem adaptability [3;4]. Research indicates that photosynthetic efficiency, root system development, and winter hardiness are key factors determining the economic and ecological significance of Thymus vulgaris [5]. Therefore, scientific studies focused on improving the agro-technological methods, propagation, and bioecological traits of Thymus vulgaris are highly relevant.

Furthermore, studying the bioecological characteristics of Thymus vulgaris is also ecologically significant. Root system development, photosynthetic efficiency, leaf morphology, and winter hardiness determine the plant's adaptability to environmental conditions [3;4]. Various studies have shown that plant chemotypes and agro-technological conditions significantly affect essential oil yield and composition [1;2]. Therefore, modern agro-technological research focuses not only on increasing plant yield but also on ensuring its bioecological stability [5].

Experimental trials measuring essential oil content, root system development, and photosynthetic efficiency under different varieties and cultivation conditions provide a scientific basis for developing optimized agro-technological recommendations for Thymus vulgaris [3;4;5].

Site Selection and Climatic Conditions. The optimal site for Thymus vulgaris is sunny, protected from strong winds, and well-drained. The plant thrives in subtropical and temperate climates [1;2]. The ideal temperature range is 15–25°C, and plants should be partially protected from frost and harsh winds [3]. Site selection should also consider ecosystem conditions and soil potential, as the yield and essential oil composition are influenced by climate and location [2;4].

Additionally, microclimate conditions of the area should be considered. Lower, moist slopes reduce yield as excessive soil moisture increases the risk of root rot [3]. Plants flower better in open, wind-protected areas, which improves both the quantity and quality of essential oils [2;4].

Climatic conditions also affect the plant's bioecological characteristics. Dry and warm climates increase growth rates, but excessively high temperatures may lead to leaf desiccation and reduced essential oil content [4;5]. With optimal irrigation, sunny and warm conditions promote rapid development and extended flowering periods, enhancing essential oil yield [3;5].

Soil Requirements and Preparation. Thymus vulgaris grows best in light sandy-loam or medium-loam soils with a pH of 6.0–7.5. Acidic or highly saline soils reduce plant growth [4;5]. Soil preparation involves the following agrotechnical practices:

1. Deep tillage and harrowing: Fields are tilled to a depth of 25–30 cm to improve root development and facilitate water and nutrient penetration [4].

2. Organic fertilizers: Adding compost or manure enhances soil biological activity and supports root growth [5].

3. Mineral fertilizers: Phosphorus and potassium are essential; nitrogen is applied in moderation, as excessive nitrogen promotes vegetative growth and reduces essential oil content [3;5].

4. Drainage and moisture control: Soil preparation must prevent waterlogging, as excess moisture leads to root rot and disease development [4].

Additionally, soil structure and sand content must be considered – overly sandy soils dry out quickly, while heavy loam retains moisture for a long time, potentially slowing plant growth [5].

Propagation and Planting Technology. Thymus vulgaris can be propagated using three main methods: seed propagation, vegetative propagation, and in vitro micropropagation.

I. Seed propagation:

1. Seeds are sown in spring and germinate within 7–10 days [2;3].

2. Seeds should be sown 1–2 cm deep, with row spacing of 30–45 cm, providing optimal growth and air circulation [2].

3. The soil is pre-moistened, and a covering material is applied to enhance germination speed [3].

4. Seed propagation preserves genetic diversity and allows rapid sowing over large areas.

II. Vegetative propagation:

1. Cutting and layering methods are most effective [3;5].

2. Cuttings of 8–12 cm are planted in moist soil and allowed to root for 3–4 weeks.

3. This method accelerates yield and maintains plant quality.

4. Vegetative propagation ensures consistency in essential oil content and quality.

III. In vitro micropropagation:

1. Conducted under laboratory conditions to produce genetically uniform, high-quality plants [1;3].

2. This method is critical for research and industrial purposes, allowing rapid multiplication of high-yielding varieties.

Planting technology:

- Sowing is done in spring or early summer. The soil must be previously tilled and fertilized [4;5].
- Variety selection and planting density directly influence yield and essential oil composition. For example, 30–45 cm row spacing and 20–25 cm plant spacing optimize leaf area development and reduce disease incidence [4].



Figure.1 Thymus Vulgaris cultivated under the climatic conditions of Jizzakh

After planting, mulch is applied to conserve soil moisture and reduce weed growth [5].

Irrigation and Maintenance. Although Thymus vulgaris is drought-tolerant, moderate irrigation during the growing season is crucial for improving yield and essential oil content [4;5]. The optimal irrigation regime depends on plant age and climatic conditions:

Seedling stage: During the first month after sowing, irrigation is applied 2–3 times per week, keeping the soil consistently moist to stimulate root development [3;4].

Growth and flowering stage: Irrigation is reduced to 1–2 times per week, maintaining soil moisture at 60–70 % [4].

Excessive irrigation causes root rot and disease, while insufficient water reduces growth rate and essential oil yield [4;5].

Maintenance practices include:

1. Weeding: Weeds compete for nutrients and moisture, negatively affecting growth and yield [5].

2. Soil loosening and aeration: Loosening the soil improves air penetration, promotes root system development, and reduces disease risk [4].

3. Use of biological pest control agents: Biological agents (ladybugs, Trichoderma sp., Bacillus sp.) are preferred over chemical pesticides to avoid negative effects on essential oil quality [5].

4. Mulching: Covering the soil with organic mulch helps retain moisture and suppress weed growth [4;5].

Regular maintenance also enhances plant stress tolerance, improves winter hardiness, and ensures stable yield [3;5].

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Rezyume: *Ushbu maqolada Thymus vulgaris L. (oddiy timyan) o‘simligining agrotexnologiyasi va uning bioekologik xususiyatlarini takomillashtirish yo‘llari ilmiy asosda yoritilgan. Tadqiqotlar natijasida Jizzax viloyati iqlim sharoitida timyan o‘simligini yetishtirish uchun qulay joy tanlash, tuproq tahlili, urug‘ va vegetativ ko‘paytirish texnologiyalari, sug‘orish va parvarish tizimlari aniqlab berildi. O‘simlikning fotosintez faoliyati, ildiz tizimi rivojlanishi va efir moyi hosildorligini oshirishda agrotexnik tadbirlarning roli o‘rganildi.*

Резюме: *В статье представлены результаты научных исследований, посвящённых агротехнологии выращивания растения Thymus vulgaris L. (обыкновенный тимьян) и совершенствованию его биоэкологических свойств. Проведённые опыты в климатических условиях Джизакской области позволили определить оптимальные участки для выращивания, провести анализ почвы, разработать технологии семенного и вегетативного размножения, а также установить эффективные режимы орошения и ухода. Изучено влияние агротехнических приёмов на фотосинтетическую активность, развитие корневой системы и повышение содержания эфирного масла в растении.*

Kalit so‘zlar: *Thymus vulgaris, agrotexnologiya, bioekologiya, efir moyi, ko‘paytirish, iqlim, tuproq, moslashuvchanlik.*

Ключевые слова: *Thymus vulgaris, агротехнология, биоэкология, эфирное масло, размножение, климат, почва, адаптация.*

ASSESSMENT OF THE IMPACT OF NATURAL AND ANTHROPOGENIC FACTORS ON ECOSYSTEM INDICATORS: RODENTS OF THE SOUTHERN ARAL REGION

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Summary: *The Southern Aral region has experienced substantial ecological changes in recent decades due to reduced inflows from the Amu Darya and Syr Darya rivers. The shrinking of the Aral Sea has accelerated desertification, ecosystem degradation, and biodiversity loss [1, 2].*

This study, conducted from 2019 to 2023 on the Ustyurt Plateau and the lower Amu Darya area, assessed the effects of climate change and anthropogenic activities on rodent populations, which serve as key bioindicators of ecosystem health. Methods included stationary observations, live trapping, diet analysis, and regression modeling [5, 6].

The results revealed cyclic fluctuations in ***Rhombomys opimus*** *populations and consistently low densities of* ***Microtus ilaeus****, primarily due to habitat degradation, food scarcity, and climatic stress [7, 12]. These findings underscore the necessity of continuous ecosystem monitoring and biodiversity conservation measures in the region [8, 9].*

Keywords: *Southern Aral region, rodents, population density, ecosystem degradation, climatic factors, anthropogenic impact.*

Introduction

The Southern Aral region is a unique natural complex that has undergone significant ecological transformations over recent decades due to both natural and anthropogenic factors [1, 2]. Reduced inflows from the Amu Darya and Syr Darya rivers have caused a dramatic decline in the Aral Sea level, resulting in ecosystem degradation, desertification, and biodiversity loss [1, 3]. Historically, the Aral Sea regulated the local climate by moderating air temperature and humidity [2].

Studying the influence of climatic conditions and anthropogenic pressures on mammalian populations, particularly rodents, is a key objective of modern ecology. Rodents serve as bioindicators for the state of desert and semi-desert ecosystems [5, 7].

Materials and Methods

The research was conducted from 2019 to 2023 on the Ustyurt Plateau and in the lower Amu Darya region. Control points representing typical biotopes—sandy and gypsum deserts, tugai forests, and agricultural lands—were selected for stationary observations [2, 4].

Rodent populations were estimated using night-time visual counts, complete trapping on fixed plots, trapping-plot methods, and route surveys along colonies [5]. Diet analysis included stomach content studies, sampling of vegetation at feeding sites, and feeding experiments [6]. Reproductive activity was assessed through direct observations and literature data [5].

Quantitative analysis of factors affecting population density was performed using multifactor screening and multiple regression models [3, 10, 11]. Population density, as the dependent variable, was expressed as a linear combination of ecological factors: climatic parameters, food availability, and intrinsic population characteristics. Statistical significance was evaluated using Student's t-test and Fisher's F-test, with the coefficient of determination (R^2) indicating the proportion of variance explained [3].

The study focused on **Rhombomys opimus**, dominant in desert ecosystems, and **Microtus ilaeus**, inhabiting wet habitats [7, 12].

Results

Meteorological analysis showed that the climate of the Southern Aral region has become more continental, with summer temperatures reaching 43–48 °C and a 1.5–2.5 °C increase in seasonal temperature variation [1, 2]. Average annual precipitation declined to 130–150 mm, and spring and autumn frost periods lengthened.

Regional ecosystems underwent major transformations: the area of tugai forests decreased by almost 90%, productive hayfields reduced sixfold, and low-productivity grass communities emerged

[2, 3]. Pasture potential declined, resulting in an estimated loss of approximately 5.5 million tons of forage [3].

Rodent populations demonstrated seasonal and multi-year dynamics. **Rhombomys opimus** exhibited cyclic fluctuations influenced by aridification and food availability, while **Microtus ilaeus** remained at consistently low densities due to degradation of wet habitats [7, 12]. Regression analysis confirmed the significant influence of climatic factors, anthropogenic landscape changes, and food availability on population density [6, 8].

Discussion

These results confirm that ecosystem degradation in the Southern Aral region and changes in the hydrological regime of the Aral Sea have a long-term impact on rodent population density and structure. The reduction of tugai forests, desertification, and salinization decrease biological productivity and food resources for rodents [3, 8].

Climatic factors manifest as increased thermal stress and reduced humidity, enhancing soil water evaporation and reducing habitats suitable for moisture-dependent species. Multifactor analysis indicated that adaptive mechanisms in rodents partially compensate for adverse conditions; however, population resilience is limited under intensive anthropogenic pressure [7, 12].

Conclusions

1. Ecosystem degradation in the Southern Aral region and changes in the Aral Sea hydrological regime directly affect rodent population density.
2. Comprehensive ecosystem monitoring and biodiversity conservation measures, including restoration of tugai forests and water resource management, are essential.
3. Rodent adaptive mechanisms partially offset adverse conditions, but populations remain vulnerable without reduced anthropogenic pressures.

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Rezyume: *Janubiy Orolbo‘yi Amudaryo va Sirdaryo oqimining kamayishi natijasida ekologik o‘zgarishlar yuz berdi. Orolning qurishi cho‘llashish, ekotizimlarning yemirilishi va biologik xilma-xillikning kamayishiga olib keldi [1, 2].*

2019–2023 yillarda Ustyurt va Amudaryoning quyi oqimida tadqiqotlar iqlim o‘zgarishi va antropogen ta’sirning kemiruvchilar populyatsiyasiga ta’sirini baholadi. Kuzatuvlar, tuzoqlar, oziqlanish tahlili va regressiya usullari qo‘llanildi [5, 6].

Natijalar ***Rhombomys opimus*** *populyatsiyasida siklik tebranishlar va* ***Microtus ilaeus****da doimiy past zichlikni ko‘rsatdi. Bunga yashash joylarining yomonlashuvi, ozuqa tanqisligi va iqlim stressi sabab bo‘ldi [7, 12]. Tadqiqot ekotizimlarni muntazam kuzatish va tabiiy muhofaza choralarini kuchaytirish zarurligini ta’kidlaydi [8, 9].*

Резюме: *Южное Приаралье претерпело значительные экологические изменения из-за сокращения стока Амударьи и Сырдарьи. Понижение уровня Аральского моря ускорило деградацию экосистем, опустынивание и снижение биоразнообразия [1, 2].*

Исследование (2019–2023 гг.) на Устюрте и в нижнем течении Амударьи оценивало влияние климатических изменений и антропогенной деятельности на грызунов, которые являются биоиндикаторами экосистем. Использовались стационарные наблюдения, ловушки, анализ рациона и регрессионный анализ [5, 6].

Результаты показали циклические колебания численности ***Rhombomys opimus*** *и постоянную низкую плотность* ***Microtus ilaeus****, что связано с деградацией местообитаний, снижением кормовой базы и климатическим стрессом [7, 12]. Подчёркивается необходимость регулярного мониторинга экосистем и природоохранных мер [8, 9].*

Kalit so‘zlar: *Janubiy Orol mintaqasi, kemiruvchilar, populyatsiya zichligi, ekotizim degradatsiyasi, iqlim omillari, antropogen ta’sir.*

Ключевые слова: *Южное Приаралье, грызуны, численность, деградация экосистем, климатические факторы, антропогенное воздействие.*

IMPACT OF ATMOSPHERIC AIR POLLUTION ON MEDICAL AND ENVIRONMENTAL CONDITIONS IN THE INDUSTRIAL AREAS OF THE SAMARKAND REGION

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Summary: *This study examines atmospheric pollution in the industrial zones of the Samarkand region, its impact on public health, and the environmental issues that arise from it. As the region's industrial sectors continue to grow, the release of harmful substances into the air has intensified, leading to a deterioration in air quality and a negative effect on the well-being of local residents. Industrial plants, motor vehicles, and various other human activities represent the primary pollution sources. These contributors reduce air quality and are linked to increasing cases of respiratory illnesses, allergies, asthma, and other health disorders within the population. Promoting environmentally sustainable industrial practices in the Samarkand region is essential, and the paper offers key recommendations aimed at protecting and enhancing environmental and public health in the area.*

Key words: *Samarkand region, industrialized areas, atmospheric air, pollution, environmental problems, medical problems, health, industrial enterprises, transport pollution, air purification.*

Introduction: The problems of air pollution require constant attention, and the economic development of the country will undoubtedly cause an increase in pollution. The increase in the number of vehicles in cities and densely populated areas requires increased control of industrial enterprises over sources of emissions into the atmosphere.

In recent years, as a result of increased human exposure, changes in the gas balance have been observed. It has been established that changing the constant amount of gases in the atmosphere has negative consequences for the planet. Today, independent Uzbekistan is a large industrial and agricultural region, and further development of the global complex of mechanical engineering, energy, chemistry, food industry, and transport is planned in the future. The development of such productive forces has a certain negative impact on the state of socio–ecosystems in the republic. [1]

Under the influence of various environmental and unfavorable anthropogenic factors, serious environmental factors are increasing in our republic, affecting the medical environment, the environment, and human health. It plays an important role in ensuring sustainable development, that is, the health of future generations. [2].

Air pollution has a negative impact on people and the environment. Carbon monoxide, sulfur compounds, nitrogen oxides, inorganic dust, soot, hydrocarbons and other harmful substances are released from industrial enterprises into the atmospheric air. Dust from industrial plants is released into the atmosphere from almost all sources. SO_2, CO, NO_x, heavy metals negatively affect the human body. They affect the central nervous system. [3].

Gases and toxic compounds released by industrial enterprises cause air and water pollution. It causes respiratory diseases, allergies, and cancers. Scientists have conducted a number of cancer studies. In the urban environment, it causes diseases not caused by exposure to previously unknown human environmental pollutants. [4].

According to experts from the World Health Organization [5], 23% of all diseases and 25% of all cancers are associated with environmental factors.

The negative impact of industrial production activities occurs mainly in two directions:

1) in the process of developing natural resources (such as minerals, land, forest, ocean resources);

2) During the production process. The mining industry is the main industry developing mineral natural resources. It causes the greatest damage to the environment during the extraction of various subsurface resources and their primary processing [6]

Environmental pollution is particularly severe during the operation of industrial enterprises. The thermal and electric power grid, which is the main energy system in the world, tends to pollute the Earth's groundwater, atmospheric and water shells with sulfur dioxide ($S0_2$), nitrous oxide (NO), carbon monoxide (CO), benzopyrene, and millions of tons of solids. The “merit" of coal-fired thermal power plants in this regard is especially great. For example, according to the data, such thermal power plants pollute the environment by 2 times with sulfate gas compared to stations running on petroleum products, and 100 times more compared to stations running on natural gas.

Today, the Samarkand region is one of the fastest growing regions of our republic, along with the development of industry, the amount of toxic gases released by industrial enterprises and transport is increasing. In particular, in the industrialized areas of the province, this creates various problems. Substances such as dust, sulfur dioxide, carbon dioxide, nitrous oxide, and phenols emitted by industrial enterprises and transport are considered harmful to the human body.[6]

The main part (89%) of pollutants released into the atmosphere without purification are gaseous: sulfur oxide, carbon monoxide, nitrous oxide, hydrocarbons and volatile organic compounds. The rest (11%) - solid particles (dust, soot, etc.) are formed during the production process.

The level of atmospheric air pollution depends on the number of vehicles, their normal operation, aeration of city streets, large and small number of plantings, climatic conditions of the air and other factors. Today, the number of cars in the Samarkand region is 387 thousand. Metabolic processes in the body are closely related to oxygen in the air. Along with this air, harmful dusts and gases polluting it enter the human body. How many harmful factors can enter the human body if, on average, a person breathes 16-18 times per minute? What diseases can be caused if they exceed the hygienic norm?

That is why in cities with high air pollution there is an increase in the incidence of various diseases of the respiratory tract, the human body as a whole: anemia, bronchitis, pneumonia, rhinitis and others. Nitrogen oxides in the air cause diseases of the respiratory tract, eyes, and throat in children, and sulfur gas exacerbates diseases of the organs of vision, respiration, and hearing. [7,8]

MATERIAL AND METHODS.

Study area.

The research was conducted in industrialized areas of the Samarkand region. The construction, transport, light, textile, and metallurgical industries are widely developed in the region. Today, Kattakurgan, Djomboy, and Urgut districts of the Samarkand region are among the most notable areas in terms of active production and processing. Along with the development of industry, the impact on the environment is also growing.

Enterprises selected for research and comparison based on the production potential of enterprises:

Following the example of the cement company “Hengguan Cement” LLC, located in Kattakurgan district, the cement company “Jambai Green Lanterns” LLC, located in Jambai district, and the “Urgut Textile Slate” enterprises, a study was conducted.

Methods. The theoretical basis of this study includes data from scientific works on the impact of industry on urban air pollution and human health. To achieve the goal of this study, empirical research methods were used, namely, empirical description (when recording data on urban air pollution and human health), as well as comparison (when comparing the impact of air pollution in industrial areas on human health). This study analyzes the indicators of pollutant emissions into the atmosphere by the Republic of Uzbekistan and regions. World Health Organization data [9] were used in writing the article. In addition, the study used official data from the State Statistics Committee of the Republic of Uzbekistan [10] for recording and analyzing data on air pollution and human health. Also, atmospheric air pollution was calculated using sanitary and epidemiological standards [11]. At a separate stage of the study, based on statistical data, the level of general morbidity observed

with cardiovascular diseases and respiratory diseases in 2021-2024 was studied using the example of the Samarkand region. This information is based on data from regional health departments and Centers for Sanitary and Epidemiological Surveillance.

Methods of statistical analysis, including time series analysis, were used to determine the state of atmospheric air. With the help of these methods, it was established that the level of pollution varies over the years and corresponds to health problems.

RESULTS. The Samarkand region differs from other regions in its more developed industry. According to the statistics agency, as of February 2024, 68,691 industrial enterprises are operating in Uzbekistan. Most of them are concentrated in Tashkent -11,930. Ferghana region is in second place with 7,635. Tashkent region rounded out the top three with 7,273, and Samarkand region took the fourth place with 5,416 industrial enterprises [10]. Of these, 61 are accounted for by large enterprises. [11].

Environmental hazard of objects the degree of danger is divided into types depending on the degree of environmental impact of objects, that is, the amount of pollutants released into the atmosphere, the formation of wastewater, and industrial waste. In particular, Cabinet of Ministers Resolution No. 949 dated November 22, 2018 “On Approval of the Regulation on State Environmental Assessment” provides a list of objects subject to state environmental assessment according to the degree of danger, divided into 4 categories depending on the danger of their impact on the environment. [4]. The collected data show that there are only 5,416 environmental impact sites in the Samarkand region.(diagram 1).

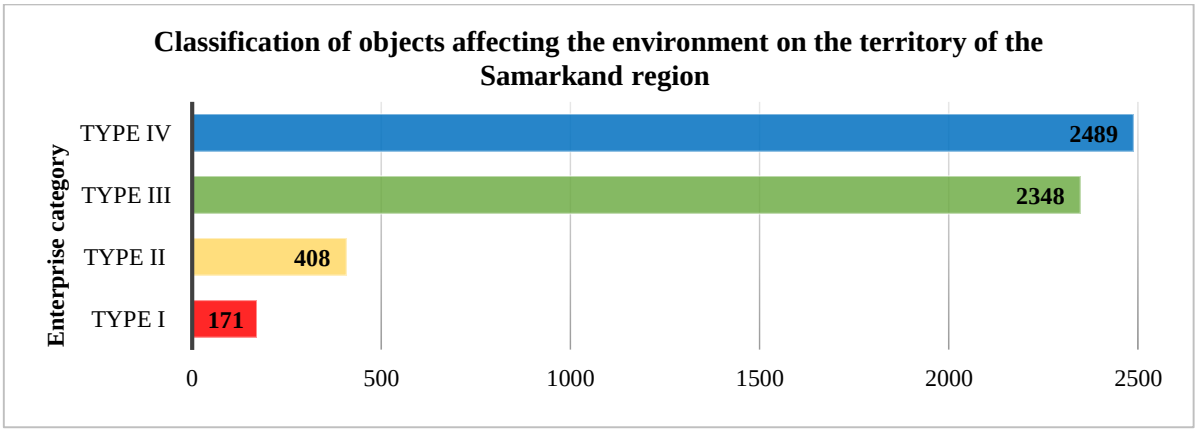


Diagram 1. The diagram was compiled by the author based on data from the Samarkand Regional Statistics Department.

In recent years, the economic development of Uzbekistan, the expansion of industry and the increase in car transport have exacerbated environmental problems, in particular, pollution of atmospheric air. In the Samarkand region, industrial zones are densely populated, this situation directly affects the health of the population. The results show that air pollution in the industrialized zones of the Samarkand region is inextricably linked with health problems. Especially cases of respiratory and heart disease are increasing sharply in areas with a high pollution index. There are 1.5–2 times more pollutants than the norms recommended by the WTO. In particular, today the Samarkand region has a population of about 4.3 million, making it the most populous province in the Republic. The Samarkand region is distinguished from other regions by the fact that industry is much more developed. According to the statistics agency, the Samarkand region, on the other hand, has 5,416 industrial enterprises, of which 61 are accounted for by large enterprises. [10], [11]. The Samarkand region is distinguished from other regions by the fact that industry is much more developed. According to the statistics agency, the Samarkand region, on the other hand, has 5,416 industrial enterprises, of which 61 are accounted for by large enterprises. [10], [11]. Today, the Samarkand region has more than 380,000 vehicles, of which more than 354,758 or 93.4% belong to the private sector, and more than 24,951 or 6.6% to public sector vehicles. As a result of the movement

of these vehicles, 103,526 tons of pollutants are released into the atmosphere annually. The total amount of pollutants released into the atmosphere in the Samarkand region in 2024 amounted to 52.3 thousand tons. It was found that this amount is 34% more than in 2023. (diagram 2).

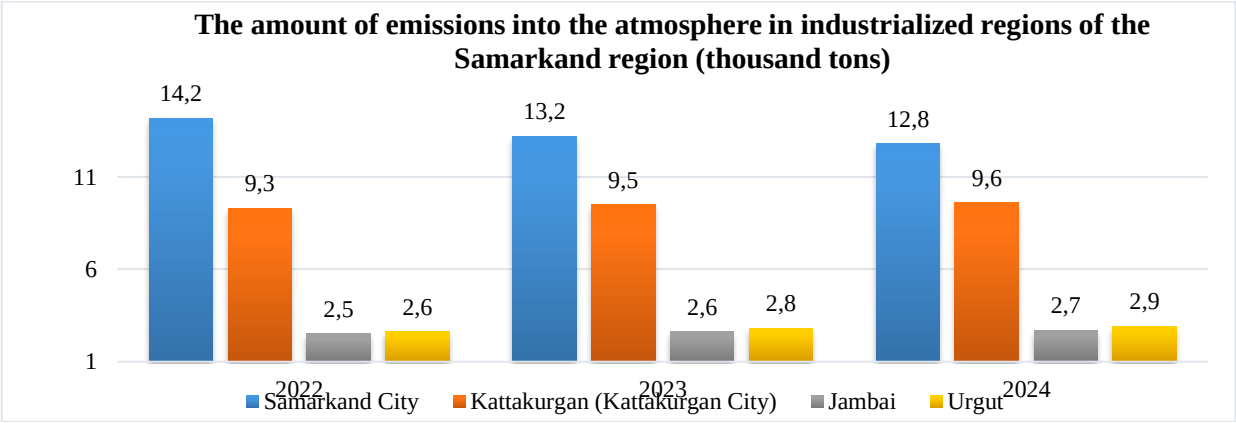


Diagram 2. The diagram was compiled by the author based on data from the Samarkand Regional Statistics Department.

According to the observations, the annual capacity of "Hengguan Cement" LLC cement plant, located in Kattakurgan district, is 2.7 million tons. The main fuels for production are natural gas and coal. The use of coal alone is 472 thousand tons per year.

For reference: when burning 10 tons of coal, 220 kg of soot, 360 kg of sulfur II oxide, 64 kg of carbon monoxide, 16 kg of nitrogen II oxide and 2 tons of ash are released into the atmosphere.

The main components of the pollution of the territory's atmosphere are released from the cement production plant: cement dust, inorganic dust, carbon monoxide, nitrous oxide, hydrocarbon, benz(a)pyrene.

The main components of pollution of the territory where the enterprise is located are: cotton dust, carbon monoxide, nitrogen oxide, inorganic dust, gypsum dust, hydrocarbons, welding dust (iron oxide), manganese oxide and benzapyrene, cement dust, inorganic dust, welding dust, manganese oxide released into the atmospheric air during concrete production, inorganic dust, welding dust, manganese oxide, in the asphalt production workshop, asphalt production releases inorganic dust, carbon monoxide, nitrous oxide, benz(a)pyrene, and hydrocarbon released into the atmospheric air.

Data and empirical analysis show that 6893.24 tons of 17 types of pollutants are released from the enterprise into the atmospheric air per year. The main part of them are carbon monoxide, sulfur oxide, nitrogen dioxide, nitrit oxide, inorganic dust, silicon oxide and iron oxides. In addition, about 93,000 tons of the substance per year are captured through dust collection devices. (diagram 3)

The supply of inorganic dust, on the other hand, includes both mineral and metallic dust. Metal dust is formed, for example, by an electric gas flame, which during the welding process joins the smoke in the air to form aerosols. In the air of industrial premises of construction enterprises, 70-80% are dust particles up to 5 microns in size. The design sanitary standards of industrial enterprises establish the maximum permissible dust content in the air of industrial enterprises. For example, the amount of dust in a room should be 1 mg/m^3 when the free silica content in the air exceeds 70%, and 2 mg/m^3 when the silica content is 10-70%, and 3-4 mg/m^3 when the dust content is less than 10%. [1,15]

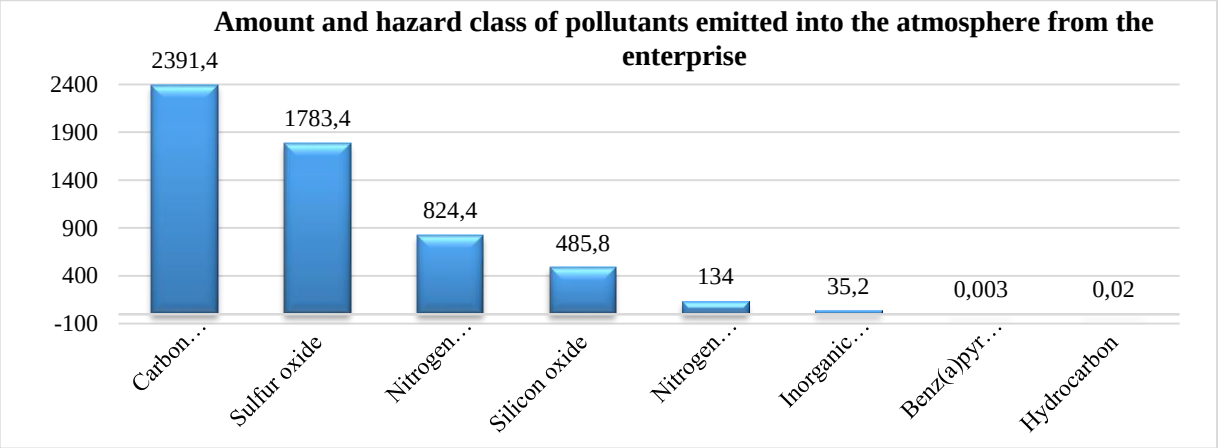


Diagram 3 The diagram was compiled by the author based on data from the Samarkand Regional Statistics Department.

Our other research work was carried out at the cement production plant of LLC “Jambai Green Lanterns”, located in the Jambai district.

The cement production company ”Jambai Green Lanterns" LLC is located in the village of Farhad, Jambai district. The main activity of the enterprise is the production of cement with an annual capacity of 180 thousand tons. The total area of the enterprise is 7.36 hectares. There are agricultural lands in the north, “Construction of Zarafshan Water SOGDA” LLC in the east, a highway in the south, and the territory of “RISO Production Business” LLC in the West. The nearest settlement is located at a distance of about 300 m in a northeasterly direction. This does not comply with sanitary standards and rules for the protection of atmospheric air in populated areas of the Republic of Uzbekistan.

Coal and natural gas are mainly used as fuel in cement production. It is worth mentioning here that the use of coal fuel significantly changes the emissions of carbon monoxide, sulfur oxide, and nitrogen dioxide.

46 types of pollutants are released into the atmospheric air from the enterprise, and 18 from stationary sources. The total amount of pollutants released into the atmosphere is 319.08 tons per year [diagram 4.]

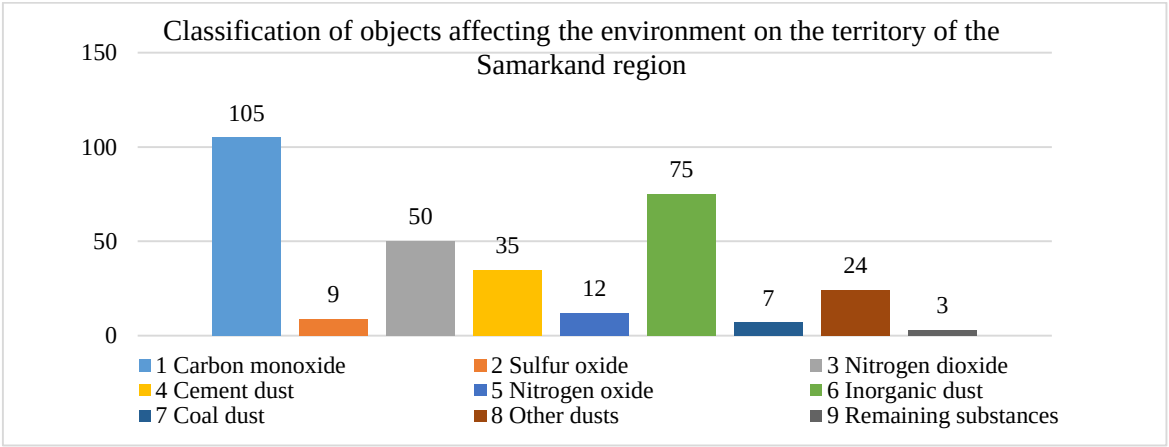


Diagram 4 The diagram was compiled by the author based on data from the Samarkand Regional Statistics Department.

The limited Liability Company ”URGUT TEXTILE SLATE" is located on the territory of the makhalla of soils of the Urgut district of the Samarkand region. The total land area of the enterprise is 4.72 hectares.

The village of Kayrakly is located 350 meters to the northwest, the village of Sanchikul is 900 meters to the northeast, and the village of Khojak is 500 meters to the south. The annual capacity of the enterprise is designed to produce 696.7 thousand pieces of slate.

The limited liability Company ” URGUT TEXTILE SLATE” is included in the list of Category 1 facilities in accordance with paragraph 26 of Appendix 2 to Resolution No. 949 of the Cabinet of Ministers of the Republic of Uzbekistan dated November 22, 2018. "On approval of the Regulations on the State Environmental Expertise". In the production technological process of the enterprise, the volumes of pollutants for each source of pollutants into the atmosphere are determined separately and in full for the enterprise.

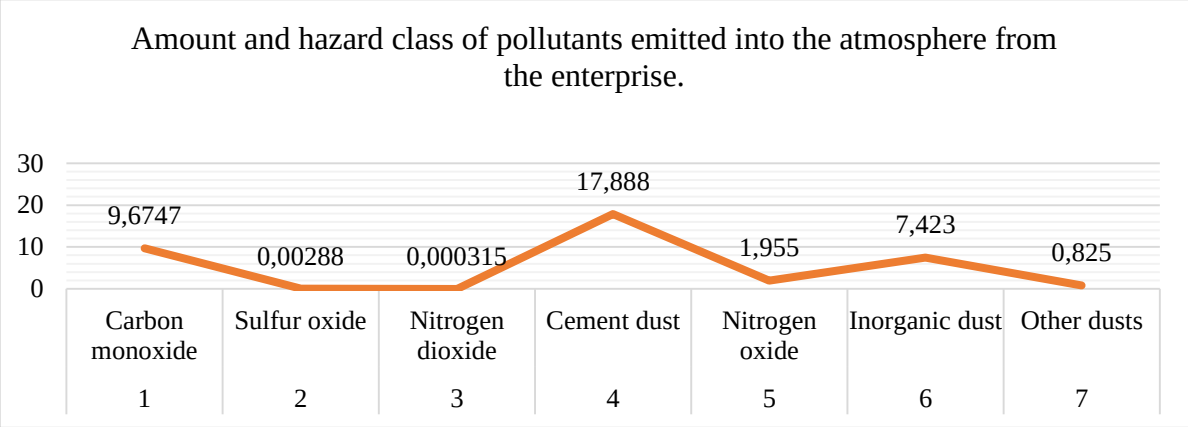


Diagram 5. The diagram was compiled by the author based on data from the Samarkand Regional Statistics Department.

Limited Liability Company ”URGUT TEXTILE SLATE". Devices and equipment for the separation of pollutants–23 pcs. Sources of pollutant emissions -21 of them: organized sources - 10, unorganized sources-11. Pollutants released into the atmospheric air at an enterprise from sources of pollutant emissions are of 11 types, with a gross volume of 37.768277 tons/year. (diagram 5)

It is worth mentioning here that atmospheric air pollution directly affects human health. Many studies show that carbon monoxide, nitrogen oxides, sulfur oxide and other toxic compounds cause respiratory and cardiovascular diseases. According to the WHO (World Health Organization), 7 million people a year die prematurely as a result of diseases associated with atmospheric pollution [11].

In the industrially developed (Samarkand, Kattakurgan, Urgut, Jambai) districts of the Samarkand region, atmospheric air pollution does not remain without consequences for human health. In particular, the statistics on the incidence of respiratory diseases and cardiovascular diseases in these areas are presented. Statistical data show that Kattakurgan district has a higher incidence of respiratory diseases. This is due to the geographical location of the area, the direction of the wind, and other abiotic factors that cause a higher incidence of these diseases in the area.

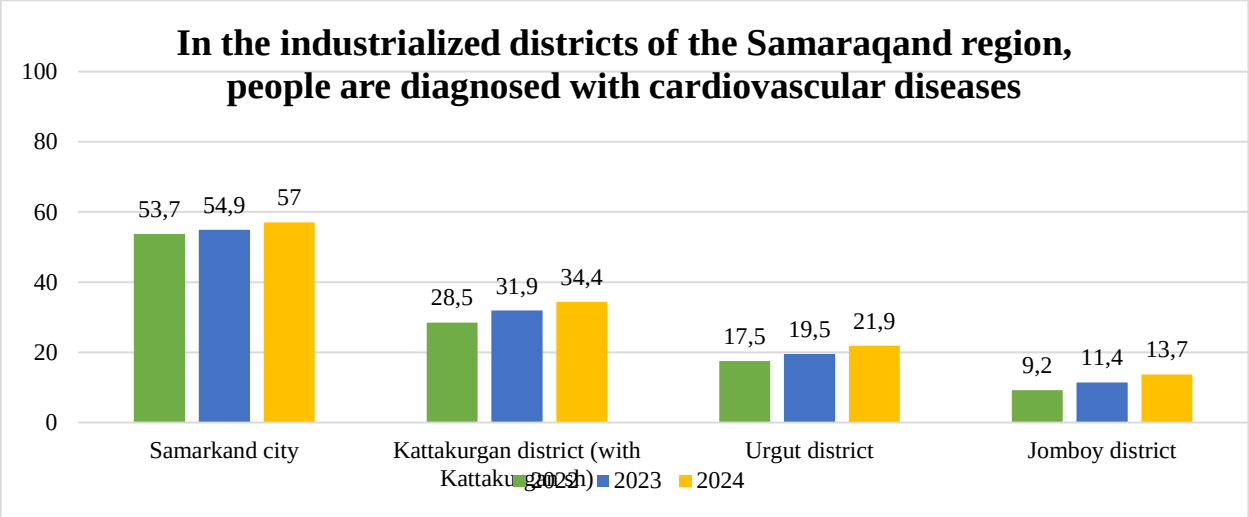


Diagram 7. The diagram was compiled by the author on the basis of the statics of the Health Department of the Samarkand region

The city of Samarkand is the regional center and the most industrially developed region in the area. The population of the city of Samarkand is growing year by year. According to the Samarkand Statistics Department, today the city's population is 595.8 thousand people. The growth rate of the population is about 2%. The main sources of air pollution in Samarkand are transport and large industrial enterprises. The population density of Samarkand is 4,945 people per 1 km2. In total, there are about 370 thousand cars in the Samarkand region, most of which are in the city of Samarkand. Notably, in the city of Samarkand, the pollution of motor vehicles is more than 70 percent, and if cars switch to gas operation in order to reduce harmful gases released into the atmosphere, the pollution will be relatively reduced.

According to the Regional Committee on Climate Change and Environmental Protection, the air in Samarkand is being polluted with dust, nitrogen, chlorine, carbon monoxide, hydrogen fluoride, phenol, and other harmful wastes. Therefore, in cities with extremely polluted air, there is an increase in various diseases of the respiratory tract and the human body as a whole: anemia, bronchitis, pneumonia, rhinitis, etc. Along with pollution and population growth, there is also an increase in respiratory diseases and cardiovascular diseases in Samarkand.

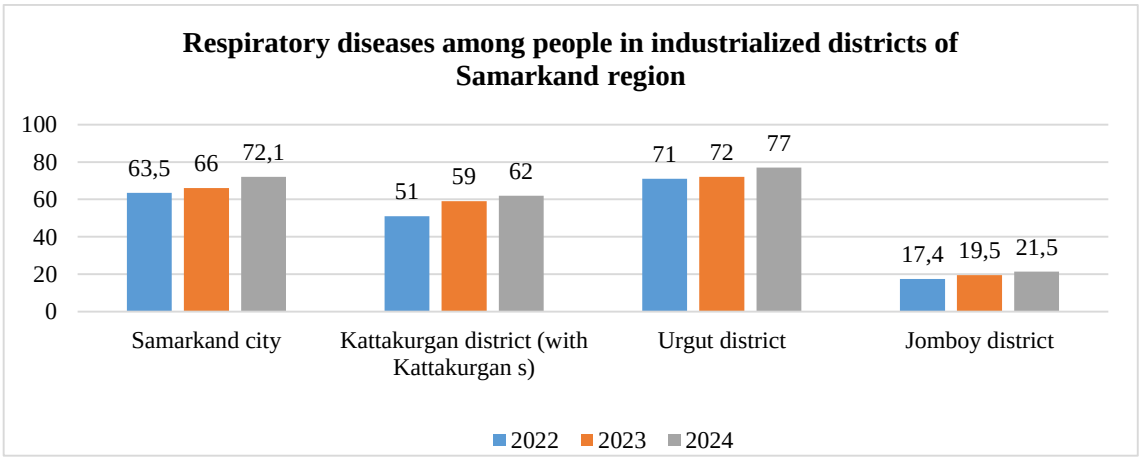


Diagram 6. The diagram was compiled by the author on the basis of the statics of the Health Department of the Samarkand region

According to statistics, in 2022, the number of people with respiratory diseases of varying degrees in the city of Samarkand was 63.5 thousand people per 100,000 people, while the number of people with cardiovascular diseases was 53.7 thousand per 100,000 people. This was 63.5% and

53.7% of the total population, respectively. In 2023, the number of people with respiratory diseases was 66.2 thousand per 100 thousand people and constituted 66.2% of the total population. Cardiovascular diseases amounted to 54.9 thousand people, and 54.9% of the total population suffered from a certain type of this disease. It should be noted that in 2024, the number of people with respiratory diseases was 72.1 thousand people per 100 thousand people, which is 72.4% of the total population, and cardiovascular diseases were 57.0 thousand people, which is 57% of the total population. The year-on-year increase in morbidity can be explained by the increasing number of cars in the city, the construction of many new industrial enterprises, and the noise level of the urban ecosystem.

Kattakurgan district is one of the largest productive industrial regions of the area. At the same time, the amount of harmful substances emitted into the atmosphere from industrial enterprises in the district is also high. As a result of toxic gases emitted by industrial enterprises and vehicles, respiratory diseases of varying degrees are encountered among the population.

The population of the district in 2024 will be 390.1 thousand people. Harmful compounds from industrial enterprises cause various respiratory and cardiovascular diseases in humans. The studied materials show that respiratory diseases of the population in the district in 2022 amounted to 54.1 thousand people per 100 thousand people and constituted 54.1% of the total population of the district. Cardiovascular diseases amounted to 28.5 thousand people per 100 thousand people, which is 28.5% of the district's population. In 2023, this figure was 56.8 thousand people per 100,000 people. This represented 56.8% of the total population of the district. Cardiovascular diseases accounted for 31.9 thousand people, which is 31.9% of the district's population. In 2024, 61.8 thousand people per 100,000 people suffered from various respiratory diseases, which amounted to 61.8% of the total population. Cardiovascular diseases amounted to 34.4 thousand people per 100 thousand people, which is 34.4% of the district's population. The main reason for this can be explained by the increase in the number of industrial enterprises. As a result of toxic gases emitted by industrial enterprises and vehicles, various respiratory diseases are encountered among the population.

Urgut district is one of the largest manufacturing and industrial places of the region. There is also an economic zone in this area. At the same time, the amount of harmful substances emitted into the atmosphere from industrial enterprises in the district is also high. As a result of toxic gases emitted by industrial enterprises and vehicles, various respiratory diseases and cardiovascular diseases are also encountered among the population.

The district's population reached 595.8 thousand people in 2024. Statistical analysis of materials shows that respiratory diseases of the population in the district in 2022 amounted to 50.6 thousand people per 100 thousand people. This was 50.6% of the district's population. The number of people with cardiovascular diseases was 17.5 thousand people per 100 thousand people, which is 17.5% of the total population of the district. In 2023, this figure was 51.8 thousand and 19.5 thousand people per 100,000 people, respectively, and the share of infected was 51.8% and 19.5%. In 2024, 57.8 thousand people per 100,000 people suffered from various respiratory diseases, which constituted 57.8% of the total population. The number of people with cardiovascular diseases was 21.9 thousand per 100 thousand people, and the share of those infected was 21.9%. The main reason for this is the establishment of a free economic zone in the region, which can be explained by the large number of light and construction industry enterprises and various toxic gases emitted from them.

Jomboy district is one of the largest manufacturing and industrial areas of the region. At the same time, the amount of harmful substances emitted into the atmosphere from industrial enterprises in the district is also high. As a result of toxic gases emitted by industrial enterprises and vehicles, various respiratory diseases and cardiovascular diseases are also encountered among the population. The population of the district in 2024 will be 190.6 thousand people. Due to population density, harmful compounds emitted by industrial enterprises cause various respiratory diseases in humans. Statistical analysis shows that the respiratory diseases of the population in the district in 2022 amounted to 17.4 thousand people per 100,000 people. This was 17.4% of the district's population. The number of people with cardiovascular diseases was 9.2 thousand people per 100 thousand people, and the share of those infected was 9.2%. In 2023, this figure was 19.5 and 11.4 thousand people per

100,000 people. This is 19.5% and 11.4% of the total population of the district. In 2024, 21.5 thousand people per 100,000 people suffered from various respiratory diseases, which constituted 21.5% of the total population. The number of people with cardiovascular diseases was 13.7 thousand people per 100 thousand people, and the share of those infected was 13.7%. The main reason for this can be explained by the growth of industrial enterprises. As a result of toxic gases emitted by industrial enterprises and vehicles, various respiratory and cardiovascular diseases are encountered among the population (diagram 6-7).

DISCUSSION. In order to reduce emissions into the atmosphere, it is necessary to centralize aeration systems with the construction of highly effective means of purifying exhaust gases, including the modernization and replacement of outdated purification equipment with new ones, the introduction of new technological schemes, the introduction of methods for reducing the formation of harmful substances, the liquidation of small boiler houses, the development and implementation of automated systems for managing and controlling emissions of pollutants into the atmosphere, the use of new foreign technologies for measuring pollutants in the atmosphere, as well as a reduction in emissions by 60-65% by 2025. It is necessary to increase the number of tree plantations and green avenues in cities and industrial centers. Our scientists recommend planting green trees in two sides of the main streets and residential buildings. Considering that the largest amount of atmospheric air pollution is attributed to motor vehicles, in order to reduce the emission of toxic gases from them, it is necessary to stop the production of gasoline-powered vehicles in our republic and establish the production of electric vehicles, develop public transport, increase the efficiency of dust and gas cleaning equipment at industrial enterprises, replace the old one with a new one, and expand green areas.

Ways to improve the ecological situation in the country and the main strategic goals of the Republic of Uzbekistan in the field of environmental protection and rational use are:

creation of favorable conditions for the health of the population, maintaining the balance of the biosphere;

The main direction of atmospheric air protection is improving the quality of atmospheric air in cities and settlements with subsequent observance of sanitary and hygienic rules, for which it is necessary to reduce emissions in all regions of the republic, create low-waste technologies, create new dust collection and cleaning equipment and increase the efficiency of their production, and replace obsolete equipment with new ones. [15.]

Currently, the number of factories and plants, road transport, and the population are growing year by year. The area of forests and green meadows is decreasing. This, in turn, leads to the accumulation of "greenhouse gases" in the atmospheric air, which should be absorbed by plant leaves. This can cause an increase in temperature on the ground [7].

Systemic measures are also being taken for landscaping, protecting trees and shrubs, expanding and preserving green spaces.

The "Uzbekistan 2030" Strategy, aimed at sustainable development, also pays special attention to environmental protection, including atmospheric air, and greening of territories [17].

Recommendations: to improve the quality of atmospheric air in cities, it is necessary to implement systematic and scientifically based measures aimed at reducing emissions of pollutants. Modern ecological research confirms that these anthropogenic sources - industrial enterprises, vehicles, and energy facilities - are the main factors of air pollution in urbanized areas. In this regard, the following priority measures are necessary:

- Optimization of transport infrastructure: transition to environmentally friendly transport (electric vehicles, hybrid and hydrogen systems), strengthening toxic emission standards, introducing smart transport systems to reduce traffic congestion and pollution levels.
- The development of an environmental monitoring system, including automatic air quality monitoring stations, taking into account meteorological conditions, will ensure adequate assessment and forecasting of the risk of exceeding MPCs (permissible maximum concentrations).

- Control of the effectiveness of treatment facilities and compliance with technological regulations for the capture and neutralization of harmful impurities, implementation of modern filtration systems with the participation of regulatory bodies.
- Limiting waste in adverse weather conditions, controlling the forced cessation or decrease in production intensity during periods when the spread of pollutants is difficult (settling, temperature inversion, etc.).

CONCLUSIONS

Observations show that especially in highly urbanized districts (Samarkand City, Kattakurgan, Urgut, Jambay), the concentrations of particles such as SO_2, NO_x, and CO exceed the current hygienic standards. Atmospheric pollution is causing not only environmental, but also serious medical problems. During the research, a statistical correlation was identified between air pollution and respiratory diseases, cardiovascular disorders, and allergic reactions. Such diseases are particularly common among children and the elderly, and living in densely industrialized areas is the main risk factor for them.

Studies indicate that the population living in the industrialized areas of the Samarkand region is exposed to a high level of environmental risk. The degree of atmospheric air pollution poses a serious threat to public health. To address this issue, a comprehensive approach is required, including strengthening the analysis and monitoring system and enhancing cooperation between the government and the public.

According to the research results, it is necessary to strengthen environmental monitoring, introduce technological modernization aimed at reducing industrial emissions, and develop regional environmental safety programs that operate in continuous collaboration with the healthcare system. Complex measures in this direction play an important role not only in protecting the environment, but also in safeguarding public health.

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Rezyume: *Ushbu tadqiqot Samarqand viloyatining sanoatlashgan hududlarida atmosfera ifloslanishi, uning aholi salomatligiga ta’siri va natijada yuzaga kelayotgan ekologik muammolarni o‘rganishga qaratilgan. Hududlardda sanoat tarmoqlarining rivojlanishi bilan havoga zararli moddalarning chiqarilishi ortib bormoqda, bu esa havo sifatining yomonlashuviga va mahalliy aholining salomatligiga salbiy ta’sir ko‘rsatmoqda. Sanoat korxonalari, transport vositalari hamda boshqa antropogen faoliyatlar ifloslanishning asosiy manbalaridir. Ushbu omillar havo sifatining pasayishiga sabab bo‘lib, aholida nafas olish tizimi kasalliklari, allergiya, astma va boshqa salomatlik bilan bog‘liq muammolarning ko‘payishiga olib kelmoqda. Ushbu maqolada Samarqand viloyatida ekologik jihatdan barqaror sanoat amaliyotlarini rivojlantirish muhim bo‘lib, ushbu maqolada hududning ekologik va sanitariya holatini yaxshilashga qaratilgan asosiy tavsiyalar berilgan.*

Резюме: *Данное исследование направлено на изучение загрязнения атмосферного воздуха в индустриализированных районах Самаркандской области, его воздействия на здоровье населения и возникающих в результате экологических проблем. С развитием промышленных отраслей в регионе выбросы вредных веществ в атмосферу увеличиваются, что приводит к ухудшению качества воздуха и негативно сказывается на здоровье местных жителей. Основными источниками загрязнения являются промышленные предприятия, транспортные средства и другие антропогенные виды деятельности. Эти факторы приводят к снижению качества воздуха и росту заболеваний дыхательной системы, аллергии, астмы и других проблем, связанных со здоровьем. В статье подчеркивается важность развития экологически устойчивых промышленных практик в Самаркандской*

области и представлены основные рекомендации, направленные на улучшение экологической и санитарной обстановки региона.

Kalit so‘zlar: *Samarqand viloyati, sanoatlashgan hududlar, atmosfera havosi, ifloslanish, ekologik muammolar, tibbiy muammolar, salomatlik, sanoat korxonalari, transport ifloslanishi, havo tozalash.*

Ключевые слова: *Самаркандская область, индустриализированные районы, атмосферный воздух, загрязнение, экологические проблемы, медицинские проблемы, здоровье, промышленные предприятия, транспортное загрязнение, очистка воздуха.*

UDC 502.172:582(575.1) U 32

STUDY OF THE (*CARYOPHYLLACEAE)* FAMILY INCLUDED IN THE RED BOOK OF THE REPUBLIC OF UZBEKISTAN

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Summary: *The new edition of the Red Book of the Republic of Uzbekistan includes 329 plant species belonging to 48 families. Ten species belonging to the family Caryophyllaceae are included in the Red Book. The species found in the Molguzar, Turkestan and Nurota mountain ranges of the Jizzakh region were analyzed according to literature sources. These include species such as Kachimsimon yetmak (bex) – Allochrusa gypsophiloides, mountain silena – Silene oreina, and glandless silena – Silene paranadena. A table was compiled for species belonging to the Caryophyllaceae family.*

Key words: *Red Book, Caryophyllaceae family, protection, endemic, life forms.*

The conservation of plant diversity has great vital importance for humanity. On December 3, 2004, the laws “On Protected Natural Areas,” on September 21, 2016, the law “On the Protection and Use of Plant Resources,” and on April 16, 2018, the law “On Forests” were adopted in a new edition. These laws are important documents for preserving all plant species, protecting them, and ensuring their conservation. [3] According to the 2019 edition of the Red Book, 329 plant species of Uzbekistan’s flora are considered at risk of extinction. Specialists and scientists of the Republic continuously study their current status. Their observations show that the number and distribution of some species have significantly increased. [5] According to data from 2009, 321 plant species were included in the Red Book [1], while the 2019 edition contains 329 species belonging to 48 families. [3] Among these, ten species belong to the Caryophyllaceae family. A table was compiled for species of the Caryophyllaceae family included in the Red Book. The table provides extensive information such as local and scientific names, rarity status, distribution area, life form, and conservation measures. A description of the family was given. Based on literature, descriptions of some species were provided, and their conservation measures were studied. Caryophyllaceae — a family belonging to the order Caryophyllales. It includes subshrubs, as well as annual, biennial, and perennial herbs. The family comprises about 2000 species belonging to 80 genera. In Uzbekistan, 122 species belonging to 24 genera grow. The leaves are simple, opposite, sessile, with entire margins. The flowers are regular, 4–5-lobed. The calyx may be free or fused. Stamens number 4–10, carpels 1–5, the ovary is superior, and the fruit is a capsule. The family is widespread mainly in the temperate regions of the Northern hemisphere. Species such as Dianthus, Silene, Lychnis, Saponaria and others are ornamental. The roots of species like Gypsophila, Acanthophyllum, Onosma and others are used in the preparation of halva and various beverages. Some species of the Caryophyllaceae family are used in the perfumery industry and medicine. Ten species of Caryophyllaceae are included in the Red Book of the Republic of Uzbekistan. [4]

Table 1. Species of the Caryophyllaceae Family Included in the Red Book of the Republic of Uzbekistan

Uzbek name	Scientific name	Rarity status	Height	Distribution	Life form	Conservation measures
1. Kachimsimon yetmak (bex)	Allochrusa gypsophiloides (Regel) Schischk.	3 – endemic	30–60 cm	Tashkent, Samarkand, Namangan, Jizzakh	Perennial herb	Protected in Surkhan, Kitab, and Chatkal reserves

2.Michelson's silene	Silene michelsonii Preobr.	1 endemic	25–30 cm	Surkhandarya	Perennial herb	Conservation measures not developed
3.Woolly silene	S. tomentella Schischk.	2 – endemic	30–40 cm	Bukhara, Navoi	Perennial herb	Not specially protected
4.Popov's silene	S. popovii Schischk.	2 – endemic	20–25 cm	Samarkand, Kashkadarya, Zarafshan	Perennial herb	Not under special protection
5.Mountain silene	S. oreina Schischk.	1 – endemic	10–15 cm	Samarkand, Kashkadarya, Zarafshan Range	Perennial herb	No special conservation measures
6.Natalia's silene	S. nataliae F.O.Khass.	1 – endemic	3–5 cm	Surkhandarya	Subshrub	Protected in Surkhan Reserve
7.Glandless silene	S. paranadena Bondarenko et Vved.	2 – endemic	30–50 cm	Nurota–Molguzar Ranges (Samarkand, Navoi, Jizzakh)	Perennial herb	Protected in Nurota State Reserve
8.Needle-like white-thorn	Acanthophyllum albidum Schischk.	3 – endemic	30 cm	Fergana, Namangan	Subshrub	Strict protection recommended
9.Awl-leaf white-thorn	A. cyrtostegium Vved.	3 – endemic	20–30 cm	Bukhara, Navoi	Subshrub	Monitoring of populations necessary
10.Uzbekis-tan carnation	Dianthus uzbekistanicus Lincz.	3 – endemic	40 cm	Samarkand, Kashkadarya	Perennial herb	Some populations protected in Kitab State Reserve

Descriptions of Selected Species

1. Kachimsimon yetmak — *Allochrusa gypsophiloides* (Regel) Schischk. A perennial herb, 30–60 cm tall. Stems thin and numerous. Leaves 10–25 mm long, flat, glabrous, and spineless. Flowers pink, arranged in spreading paniculate inflorescences at the top of the stem. Fruit a capsule. Flowering occurs from May to August; fruits ripen in August–September.

2. Mountain silene — *Silene oreina* Schischk. A perennial, many-headed (caudex-forming), densely tufted herb, 10–15 cm tall. Leaf tips elongated and very sharp, covered with dense glandular hairs. Basal leaves are oblanceolate, narrowing toward the base; stem leaves are broader. Flowers white, 1–3 per stem tip. Calyx 2–3 times longer than the corolla, initially cylindrical, later campanulate. Carpophore glabrous. Capsule ovoid. Flowers in May; fruits ripen in May–June.

3. Glandless silene — *Silene paranadena* Bondarenko et Vved. Perennial herb, 30–50 cm tall; stems numerous, woody at the base. Leaves lanceolate, 3–6 cm long, 10–12 mm wide. Flowers solitary at branch tips, large, 30–32 mm long. Petals white to pale pink, deeply bifid. Calyx cylindrical, non-inflated, 22–25 mm long; tube glabrous; teeth with white hairs. Fruit a capsule 10–12 mm long. Flowers April–June; fruits ripen in June. Distribution Notes According to literature sources, the species Allochrusa gypsophiloides, Silene oreina, and Silene paranadena occur in the Molguzar, Nurota, and Turkestan ranges of Jizzakh region. [5, 6]. In the 2009 edition, Allochrusa tadschikistanica Schischk. (Tajik yetmak) was included; however, it is absent from the 2016 and 2019 editions, indicating that the species has likely increased in number or been restored. Dianthus uzbekistanicus Lincz. (Uzbekistan carnation) was not included in the 2009 edition but is present in the 2019 edition, indicating that its population has declined in recent years.

Conclusions 1. In the 2019 edition of the Red Book of the Republic of Uzbekistan, 329 plant species were included. Among them, 10 species belong to the family *(Caryophyllaceae*).

2.The species *Dianthus uzbekistanicus* (3 – endemic) was included in the 2019 edition. This indicates that the species is currently decreasing in number 3. The species *Allochrusa tadschikistanica*

(3 – endemic) was included in the 2009 edition but omitted from the 2019 edition. This suggests that the species has increased in number or has been successfully propagated. 4.Protecting the species included in the Red Book of the Republic of Uzbekistan, including those belonging to the Caryophyllaceae family, is of great importance for humanity.

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Rezyume: Ushbu maqolada O‘zbekiston Respublikasi Qizil kitobining yangi nashriga kiritilgan Chinniguldoshlar (*Caryophyllaceae)* oilasiga mansub turlar tahlili haqida ma’lumotlar berilgan.

Резюме: В статье приведены данные по анализу видов семейства Гвоздичные (Caryophyllaceae), включенных в новую редакцию Красной книги Республики Узбекистан.

Kalit so‘zlar: Qizil kitob, chinniguldoshlar oilasi, muhofaza qilish, endemik, hayotiy shakllari

Ключевые слова: Красная книга, семейство гвоздичных, охрана, эндемик, жизненные формы

UDC 517.9

ON THE SOLUTION OF SOME NONLINEAR EQUATIONS OF MATHEMATICAL PHYSICS BY THE METHOD OF VARIABLE SEPARATION

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Summary: *The article deals with a two-dimensional equation that includes nonlinearity by first derivatives. Using the method of variable separation, solutions of nonlinear equations of mathematical physics containing homogeneous functions of the first order from derivatives are obtained. Analysis of solutions for some special cases is carried out.*

Keywords: *differential equation, mathematical physics, homogeneous function, variable separation method, partial derivative.*

In modern mathematical physics and its applications, one of the most important methods is the method of variable separation (VS), which is successfully used to solve partial differential equations [1]. In this work, this method is applied to the solution of equations containing homogeneous functions of the first order from derivatives.

Consider an equation relative to an unknown function of three unknowns $u(t,x,y)$

$$Lu = F\left(\frac{\partial u}{\partial x}, \frac{\partial u}{\partial y}\right) \tag{1}$$

$L \equiv \sum_{k=1}^{M} \varphi_m(t) \frac{\partial^m}{\partial t^m}$ - linear differential operator by variable t; F a known homogeneous function with respect to its arguments [2].

According to the method of dividing variables [1], we will look for the solution of equation (1) in the form

$$u(t,x,y) = \varphi(t) + \psi(t)g(x,y). \tag{2}$$

where $\varphi(t), \psi(t), g(x,y)$ unknown functions to find.

Substitute function (2) in (1), then

$$L\varphi(t) + g(x,y)L\psi(t) = \psi(t)F\left(\frac{\partial g}{\partial x}, \frac{\partial g}{\partial y}\right)$$

or

$$\frac{L\varphi(t)}{\psi(t)} + \frac{L\psi(t)}{\psi(t)} g(x,y) = F\left(\frac{\partial g}{\partial x}, \frac{\partial g}{\partial y}\right) \tag{3}$$

Next, let's consider the following special cases:

$$1) \quad \frac{L\psi(t)}{\psi(t)} = \lambda \neq 0\,. \tag{5}$$

Then out of (3) we have

$$\frac{L\varphi(t)}{\psi(t)} = F\left(\frac{\partial g}{\partial x}, \frac{\partial g}{\partial y}\right) - \lambda g(x,y) \tag{6}$$

The left and right sides of this equation are functions of different variables, so they are equal to a certain constant μ. Accordingly, we get the equations

$$L\varphi(t) = \mu\psi(t)\,, \tag{7}$$

$$F\left(\frac{\partial g}{\partial x},\frac{\partial g}{\partial y}\right)=\lambda g(x,y)+\mu\,. \tag{8}$$

After replacement $q(x,y)=g(x,y)+\frac{\mu}{\lambda}$, equation (8) is converted to the form

$$F\left(\frac{\partial q}{\partial x},\frac{\partial q}{\partial y}\right)=\lambda q(x,y)$$

Further, due to the homogeneity of the function F we have

$$F\left(\frac{1}{q(x,y)}\frac{\partial q}{\partial x},\frac{1}{q(x,y)}\frac{\partial q}{\partial y}\right)=\lambda$$

or

$$F\left(\frac{\partial \ln q}{\partial x},\frac{\partial \ln q}{\partial y}\right)=\lambda \tag{9}$$

We will look for the solution of this equation in the form of an exponential function

$$q(x,y)=e^{k(c_1x+c_2y)}. \tag{10}$$

A simple substitution can make sure that $k=\frac{\lambda}{F(c_1,c_2)}$. Thus

$$q(x,y)=e^{\frac{\lambda}{F(c_1,c_2)}(c_1x+c_2y)},$$

or

$$g(x,y)=e^{\frac{\lambda}{F(c_1,c_2)}(c_1x+c_2y)}-\frac{\mu}{\lambda},$$

2) $L\psi(t)=0.$ (11)

Then

$$\frac{L\varphi(t)}{\psi(t)}=F\left(\frac{\partial g}{\partial x},\frac{\partial g}{\partial y}\right) \tag{12}$$

or

$$\frac{L\varphi(t)}{\psi(t)}=\lambda \tag{13}$$

$$F\left(\frac{\partial g}{\partial x},\frac{\partial g}{\partial y}\right)=\lambda \tag{14}$$

Here, equation (14) is similar to equation (9) and its solution would be the function

$$g(x,y)=\frac{\lambda}{F(c_1,c_2)}\left(c_1x+c_2y\right).$$

At $\lambda=0$ in the first and second cases, by solving the equation

$$F\left(\frac{\partial g}{\partial x},\frac{\partial g}{\partial y}\right)=0$$

due to the homogeneity of the function F, there will be an arbitrary differentiable function $f\left(c_1x+c_2y\right)$ for the coefficients of which the condition must be met $F(c_1,c_2)=0.$

Functions $\varphi(t)$ and $\psi(t)$ in the first case, we find from equations (5) and (7), in the second case, from equations (11) and (13). And the general solution in each case is found by formula (2).

Example. Consider the equation

$$\frac{\partial u}{\partial t} = \sqrt{a\left(\frac{\partial u}{\partial x}\right)^2 + b\left(\frac{\partial u}{\partial y}\right)^2}.$$

According to the above method, in the first case

$$u(t,x,y) = r_0 c_0 e^{\lambda t} + c_0 e^{\lambda t}\left(e^{\frac{\lambda}{\sqrt{ac_1^2+bc_2^2}}(c_1x+c_2y)} - r_0\right),$$

in the second case

$$u(t,x,y) = \lambda t + c_0 + \frac{\lambda}{\sqrt{ac_1^2+bc_2^2}}\left(c_1x + c_2y\right),$$

at $\lambda = 0$ we get

$$u(t,x,y) = f\left(c_1x + c_2y\right).$$

In here $r_0, c_0, c_1, c_2, \lambda -$ arbitrary constants, f voluntary differentiable function.

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Rezyume: *Maqolada tarkibida birinchi tartibli hosilalar boyicha nochiziqliligi bo‘lgan ikki o‘zgaruvchili tenglama qaralgan. O‘zgaruvchilarni ajratish usuli yordamida matematik fizikaning hosilalarga nisbatan birinchi tartibli bir jinsli funksiyalarni o‘z ichiga olgan nochiziqli temglamalarining yechimlari olingan. Ba’zi xususiy hollar uchun yechimlar tahlil qilingan.*

Резюме: *В статье рассматривается двумерное уравнение, включающее нелинейность по первым производным. С помощью метода разделения переменных получены решения нелинейных уравнений математической физики, содержащих однородные функции первого порядка от производных. Выполнен анализ решений для некоторых частных случаев.*

Kalit so‘zlar: *differensial tenglama, matematik fizika, bir jinsli funksiya, o‘zgaruvchilarni ajratish usuli, xususiy hosila.*

Ключевые слова: *дифференциальное уравнение, математическая физика, однородная функция, метод разделения переменных, частная производная.*

GEOLOGICAL STRUCTURE OF THE ALTYNTAU KAOLIN DEPOSIT IN CENTRAL KYZYLKUM

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[2]National University of Uzbekistan named after Mirzo Ulugbek

Summary: *The Altyntau kaolin deposit in the Central Kyzylkum region represents a unique geological and industrial site, the study of which is important for both fundamental and applied geology. The article highlights the deposit's geological structure, lithology, tectonics, mineralogy, geochemistry, and industrial evaluation. It emphasizes the genetic features of kaolin formation, their distribution within the weathering crust, and industrial applicability, as well as provides recommendations for further research, including associated minerals and rare-earth elements.*

Key words: *Kaolin, weathering crust, granitoids, mineralogy, geochemistry, prospective resources, rare earth elements, Altyntau, Uzbekistan.*

INTRODUCTION.

The "Altyntau" kaolin clays deposit, located in the western part of Uzbekistan, is a unique geological object with high industrial potential. Kaolin is used in the ceramic, refractory, paper, and rubber industry. Studying the geological structure, mineralogical composition, and predicted resources is crucial for the rational development of the deposit. The kaolinization of rocks is due to the interaction of geochemical processes, hydrothermal fluids, and tectonic activity. The work examines the features of the formation of primary and secondary kaolins, their placement in various morphological and stratigraphic complexes, and provides a predictive assessment of their reserves and industrial significance [1].

Degree of study of the problem and research methods. Geological study of the area began in the 1930 s. In 1953, a 1:100000 scale state survey was conducted, and in 1961, a geological map was published. In 1970-1974, a 1:50000 scale survey was carried out, which allowed for detailed dissection of sedimentary-metamorphic rocks and igneous complexes.

The first information about ancient weathering crusts dates back to the 1940s, and their systematic study began in the 1960s. It was shown that thick kaolin crusts formed during the pre-glacial period. In 1970-1977, Uzbekistan's territory was regionalized for the preservation of weathering crusts, and a map of their distribution was compiled, where linear and area types were identified, and a mineralogical-chemical characterization was provided.

In 1994, the "Химгеолнеруд" expedition prepared a report on the study of kaolin clays and the assessment of refractory and ceramic raw materials of the Altyntau massif [2-3].

Geological structure of the deposit. The "Altyntau" deposit is located on the southern slope of the Zirabulak gorst-anticlinorium within the Zeravshan-Turkestan zone. It is confined to granites of the Late Paleozoic complex, which have undergone deep kaolinization. The geological structure is complicated by a system of submeridional and sublatitudinal faults that control the depth of kaolinization and fragment the usable layer into individual blocks.

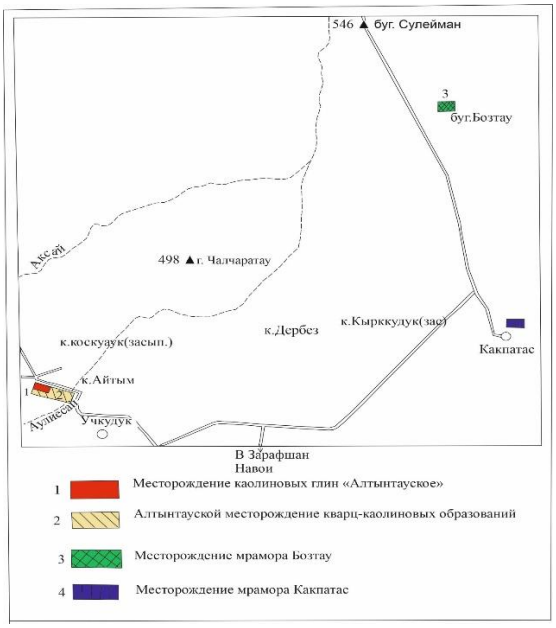


Fig. 1. Overview map of the work area, scale 1:2000000

The foundation of the deposit is represented by metamorphosed Proterozoic strata: siliceous shales, quartzites, and phyllites. These are exposed by drilling at depths of 5-10 m and are overlain by Cenomanian and kaolinite deposits. Mineralogically, these rocks are enriched with quartz and hydromicas, indicating a high degree of metasomatic alteration.

The main industrial object is the pre-bull weathering crust, formed on granites under long-term subtropical climate conditions. It is characterized by a distinct zonality: above it, a completely clay zone with a kaolinite content of over 60% is distinguished, white in color, and soft in structure. Below, the texture of the parent rock is preserved, but the degree of kaolinization differs; quartz, feldspar, and biotite are present.

The thickness of the kaolinized layers reaches 12-15 m, especially in the central and southern parts of the deposit. In the northwest, the crust is partially eroded, where granites and Proterozoic rocks emerge to the surface. The southern and eastern sections are complicated by re-deposited Cenomanian sandy-clayey rocks and conglomerates.

Geomorphologically, the territory is a slightly hilly plain with a south-eastern slope. Erosion forms have developed here - ancient channels and furrows that erode the kaolin thickness and form zones of secondary accumulation. Faults with an amplitude of up to 40 m play a dual role: they simultaneously contribute to the development of kaolinization and complicate the geological structure.

Thus, the geological structure of the "Altyntau" deposit is mosaic in nature, reflecting the interaction of the ancient foundation, granitoid magmatism, weathering crust, and covering sediments. This necessitates the heterogeneity of kaolin mineralization placement, variation in raw material quality, and the need for detailed geological-structural studies when assessing reserves [4-5].

Litological characteristic

Within the deposit, several lithological complexes are distinguished:

Metamorphic rocks of the Proterozoic – quartzites, siliceous schists, fillite-like argillites; they form tectonic contacts with granites and are characterized by high density, the presence of iron veins and sulfides (pyrite, marcasite).

Paleozoic granitoids – biotite-muscovite granites of light pink and grey-greenish color, products of the third phase of granitoid magmatism of late carbon - early perm; it is on them that the main zone of kaolinization is developed.

Prehistoric age of weathering crust – the main industrial facility with vertical zonality.

Cenomanian sandy-clayey deposits – erosion furrows are made, the kaolin thickness is covered.

Quaternary covers – are represented by modern deposits that partially remove and redistribute kaolin material.

Thus, the geological structure of the "Altyntau" deposit is mosaic in nature, reflecting the interaction of the ancient foundation, granitoid magmatism, weathering crust, and covering sediments. Such a complex structure has led to the formation of heterogeneous in composition and thickness kaolinized layers, which directly affects the quality and industrial value of raw materials. The presence of tectonic faults and erosional forms further complicates the deposit's morphology, creating both favorable kaolin accumulation zones and areas with their destruction. All this determines the need for detailed geological-structural, mineralogical, and geochemical studies to obtain a reliable assessment of reserves and their rational development [6-7-8-9].

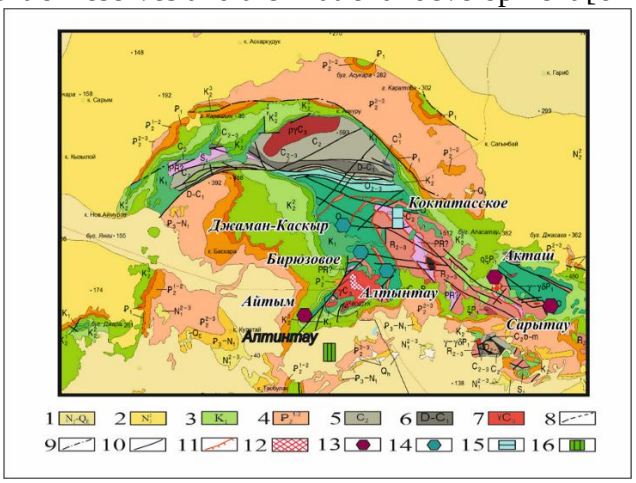


Fig. 2. Overview geological map of the Altyntau deposit

1-Neogene-Quaternary systems. Polyocene-eopleistocene (N2-QE); 2- Upper Pliocene (N22); 3-Unsegmented Cretaceous deposits (K1); 4- Lower-Middle Eocene (β21-2); 5- Carboniferous system. Middle section (C2); 6- Devonian system - Carboniferous system, lower section; 7- Granites, alyascites (γS3); 8- Identified and proposed based on geophysical data; 9-Precipitates under the sedimentary cover; 10- Fractures of undefined morphology; 11-Adviges; 12- Acidic compound. Rioliths, trachyroliths, granite-porphyries;13- Kacholong; 14 - Turquoise; 15-Marble; 16-kaolin;

Analysis and results. As a result of the analyses, the following content of components was obtained (1-table).

Chemical composition of kaolins of the Altyntau deposit

Table-1

	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	K_2O	Na_2O	SO_3	CaO	MgO	P_2O_5	p.p.
Clay of brick-red color, aleuritic	77,72	12,3	0,96	1,42	0,24	0,16	0,58	0,81	0,72	0,07	0,9
St. gray kaolin clay	81,72	11,22	0,46	0,95	0,11	0,08	0,2	0,19	0,58	0,05	0,06
St. gray kaolin clay	73,45	16,85	1,09	1,19	0,18	0,12	0,22	0,29	0,8	0,06	0,22
In thoracic kaolin clays	63,04	24,2	1,39	0,79	0,17	0,22	0,16	0,25	0,71	0,14	0,25
In thoracic kaolin clays. Purple	61,2	22,1	1,14	3,12	0,3	0,17	0,94	0,74	0,85	0,87	1,17
Violet-colored kaolin granite	23,72	8,24	0,46	2,16	0,26	0,14	0,68	0,2	0,61	0,03	0,52
Kaolin clays of gray color with a violet tinge	69,52	19,23	1,08	0,98	0,32	0,12	0,4	0,38	0,59	0,06	0,31
Kaolin clays of gray color with a violet tinge	74,35	16,73	0,97	0,55	0,31	0,08	0,19	0,19	0,73	0,03	0,11
White-colored caolin granite	85,37	8,81	0,54	0,66	0,22	0,11	0,19	0,16	0,45	0,03	0,19
Caolinized gray granite with a violet tinge	62,84	21,74	0,81	2,04	3,42	0,11	0,39	0,24	0,81	0,09	0
Aleurolite clays	65,36	23,08	0,72	0,76	0,06	0,09	0,13	0,22	0,56	0,04	0,52
In thoracic kaolin clays	65,45	23,31	0,72	0,48	0,09	0,16	0,14	0,13	0,66	0,03	0,5
In thoracic kaolin clays	64,79	21,35	0,62	3,33	0,14	0,1	0,3	0,29	0,75	0,07	0

CONCLUSION

The "Altyntau" kaolin clays deposit is an important geological and industrial object, characterized by its complex structure, diverse lithological complexes, and high industrial potential. Conducted research shows:

Kaolinization is developed mainly on Late Paleozoic granites and is distinguished by a pronounced zonality;

The thickness of the useful layer reaches 12-15 m, the quality and composition of the raw material vary depending on the degree of preservation of the weathering crust and geological conditions;

chemical analysis confirms the industrial value of kaolins, which have a high content of SiO_2 and Al_2O_3 making them suitable for use in ceramic, refractory, and other industries;

the presence of erosion processes, tectonic disruptions, and re-deposited layers requires a comprehensive approach to further study and development.

Thus, the "Altyntau" deposit can become a promising raw material base for various industries of Uzbekistan, provided that it is rationally developed and detailed structural-geological studies are carried out.

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Rezyume: *Markaziy Qizilqum hududidagi Oltyntau kaolin koni noyob geologo-sanoat obyekti bo‘lib, uni o‘rganish fundamental va amaliy geologiya uchun muhimdir. Maqolada konning geologik tuzilishi, litologiyasi, tektonikasi, mineralogiyasi, geokimyosi va sanoat bahosi yoritilgan. Kaolinlarning shakllanish xususiyatlari, tarqalishi va sanoatga yaroqliligi ko‘rsatilib, hamroh foydali qazilmalar va nodir elementlarni o‘rganish bo‘yicha tavsiyalar berilgan.*

Резюме: *Олтынтауское месторождение каолинов в районе Центральных Кызылкумов представляет собой уникальный геолого-промышленный объект, изучение которого важно как для фундаментальной, так и для прикладной геологии. В статье освещены геологическое строение, литология, тектоника, минералогия, геохимия и промышленная оценка месторождения. Подчёркнуты генетические особенности формирования каолинов, их распространение в коре выветривания и промышленная пригодность, а также даны рекомендации по дальнейшему изучению, включая сопутствующие полезные ископаемые и редкоземельные элементы.*

Kalit so`zlar: *kaolin, nurash qobig‘i, granitlar, mineralogiya, geokimyo, prognoz resurslar, nodir yer elementlari, Oltintau, Markaziy Qizilqum.*

Ключевые слова: *каолин, кора выветривания, гранитоиды, минералогия, геохимия, прогнозные ресурсы, редкоземельные элементы, Алтынтау, Узбекистан.*

MECHANOCHEMICAL ACTIVATION OF CENTRAL KYZYLKUM PHOSPHATE FLOUR

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Summary: *Mechanical activation of phosphorites is considered an effective and environmentally friendly method of processing low-grade phosphorites. The effect of mechanical activation of phosphorite at a speed of 200 rpm and 30 minutes (20:1, 15:1, 10:1, 5:1 mass ratio) was studied using a Rigaku MiniFlex (Rigaku Corporation, Japan) X-ray diffractometer. The structural properties of the absorbable phosphorus and mechanically activated phosphorite flour were determined in Trilon B solution. The absorbable form of phosphorus in Trilon B solution after mechanical action in a mass ratio of 20:1 is 30.61%, and after a mass ratio of 5:1 is 33.66%. The increase in solubility is primarily due to a sharp decrease in the size of phosphorite particles, a decrease in the degree of crystallization of minerals and an increase in crystal lattice distortions through the $PO_4^{3-} \leftrightarrow CO_3^{2-}$ exchange, as well as the addition of OH^- groups to the structural lattice. The results of X-ray diffractometry show that the structural and phase changes caused by mechanical activation significantly increase the solubility of phosphorus in Trilon B solution. This indicates the economical and promising nature of this method for processing low-grade Central Kyzylkum phosphorites as fertilizers.*

Key words: *Central Kyzylkum phosphate, X - ray diffraction analysis, planetary ball mill, Trilon B solution, mechanochemical activation*

Introduction: Currently, the development of highly efficient and technologically advanced methods for the comprehensive processing of Central Kyzylkum phosphates, which are considered a primary raw material resource for the mineral fertilizer industry, is regarded as one of the strategically important directions in the advancement of the chemical industry. The government of our country is paying serious attention to ensuring the industrial sector with phosphate raw materials. According to the "Uzkhimyasanoat" Joint-Stock Company program for the deep processing of mineral resources for 2016-2030, developed under the directive of the President of the Republic of Uzbekistan, the production of phosphate rocks is planned to increase by 157% by 2020 and by 264% by 2030. At the same time, the annual volumes of off-balance ore and slag phosphate rock are expected to increase to 0.6-0.92 million tons and 1.1–1.8 million tons, respectively. The content of P_2O_5 in phosphate raw materials varies significantly between countries, ranging from 21% in Uzbekistan to 38.2% in Nauru. Globally, more than 85% of mined phosphate raw materials are used in the production of phosphate fertilizers, while the remaining 15% are utilized for the production of elemental phosphorus and feed additives for animals [1].

The use of activation methods in phosphate processing allows for a reduction in reagent consumption and an improvement in the quality of the final product. Activation methods include mechanical, chemical, thermal, and their combined forms, such as mechanochemical and thermochemical techniques. Worldwide, 70–80% of high-quality phosphate (P_2O_5 > 30%) is used for the production of phosphate fertilizers to adequately supply nutrients to agricultural crops. The decreasing availability of high quality phosphate, along with environmental problems arising from insufficient acid treatment, has intensified the need to search for more efficient methods of phosphate fertilizer production [2]. Nitrogen fertilizers should not be applied during autumn fertilization, as they are leached from the soil by water before sowing. In contrast, phosphate fertilizers are most effective when applied in autumn. Agricultural requirements dictate that 60-70% of the annual phosphate fertilizer for cotton and 100% for cereal crops should be applied during autumn fertilization. For these two crops alone, 272–292 thousand tons of P_2O_5 are required annually in the form of phosphate fertilizers. However, in 2019, our factories produced only 118.9 thousand tons of ordinary ammonium superphosphate. One of the main challenges at the Kyzylkum Phosphate Plant is the utilization of

enrichment residues classified as “off-balance ores.” Currently, more than 13 million tons of these residues have been accumulated. With the construction of the 2nd and 3rd Kyzylkum phosphate complexes, similar to the 1st complex, their volume is expected to increase significantly. A promising method for converting these residues into mineral and organomineral fertilizers is their chemical activation [3]. Phosphorus is one of the most important macronutrients involved in plant energy metabolism, photosynthesis, cell division, root system development, and yield formation. According to global scientific literature, phosphorus deficiency can reduce crop yields by 25–40% in cereals, legumes, and industrial crops. In the conditions of Uzbekistan, where a large part of soils is calcareous, phosphorus immobilization is intensified, which decreases its efficiency even when fertilizers are applied. The Central Kyzylkum phosphate represents the largest phosphate resource in the country and serves as an inexpensive raw material for industry. However, its main drawback is the very low solubility of apatite minerals in water and citrate. Therefore, the direct use of Central Kyzylkum phosphate as a fertilizer does not provide agronomic efficiency. Traditional activation methods, such as treatment with acids, thermal decomposition, and sulfation, are economically expensive, energy-intensive, or have limitations in terms of environmental safety [4].

In recent years, the field of mechanochemistry has proposed new approaches for phosphate processing. Fundamental studies conducted by Ivanov (2018) and Smith (2017) have scientifically demonstrated that during mechanochemical treatment, the crystal lattice of minerals undergoes deformation, microcracks appear on particle surfaces, and chemical reaction rates are accelerated. It has been shown that during co-grinding with sulfate reagents, the conversion of calcium phosphate to ammonium–phosphate complexes is highly probable. Uzbek researchers—Rasulov (2020) and Bekchanov (2019)—have studied the mineral composition, physicochemical properties of Central Kyzylkum phosphate, and technologies for its activation adapted to local conditions. Their studies indicate that the granulometric composition of the phosphate, the high content of carbonates, and the crystal structure of apatite are the main factors limiting phosphorus bioavailability. The advantages of the Central Kyzylkum phosphate (CKP) technology can be explained as follows: a) low-cost reagents (ammonium sulfate is inexpensive and widely available); b) energy-efficient process (no acid consumption during mechanochemical activation); c) environmentally friendly (no waste gypsum is formed); d) the resulting product has high agronomic value. Although sufficient studies have been conducted on the mechanochemical activation of CKP, the acceleration process with ammonium sulfate and its impact on plant phosphorus uptake have not been fully explored [5].

Results and Discussion

The chemical composition of the phosphate used in this study is presented in Table 1. The effectiveness of phosphate fertilizers is determined by the content of P_2O_5 in forms that are insoluble in water but soluble in soil solutions and available for plant uptake.

Table 1

Raw material	P_2O_{5total}	CaO_{total}	CO_2	MgO	SO_3	Fe_2O_3	Al_2O_3	F^-	P_2O_5 0.2 M Trilon B	P_2O_5 2% citric acid	CaO 2% citric acid	CaO 2% citric acid	P2O5 2% citric acid (ass)	CaO 2% citric acid (ass)
Phosphoplast 2	19,26	49,19	13,49	1,27	1,96	1,52	2,54	3,99	3,75	2,52	34,34	31,44	13,08	69,81

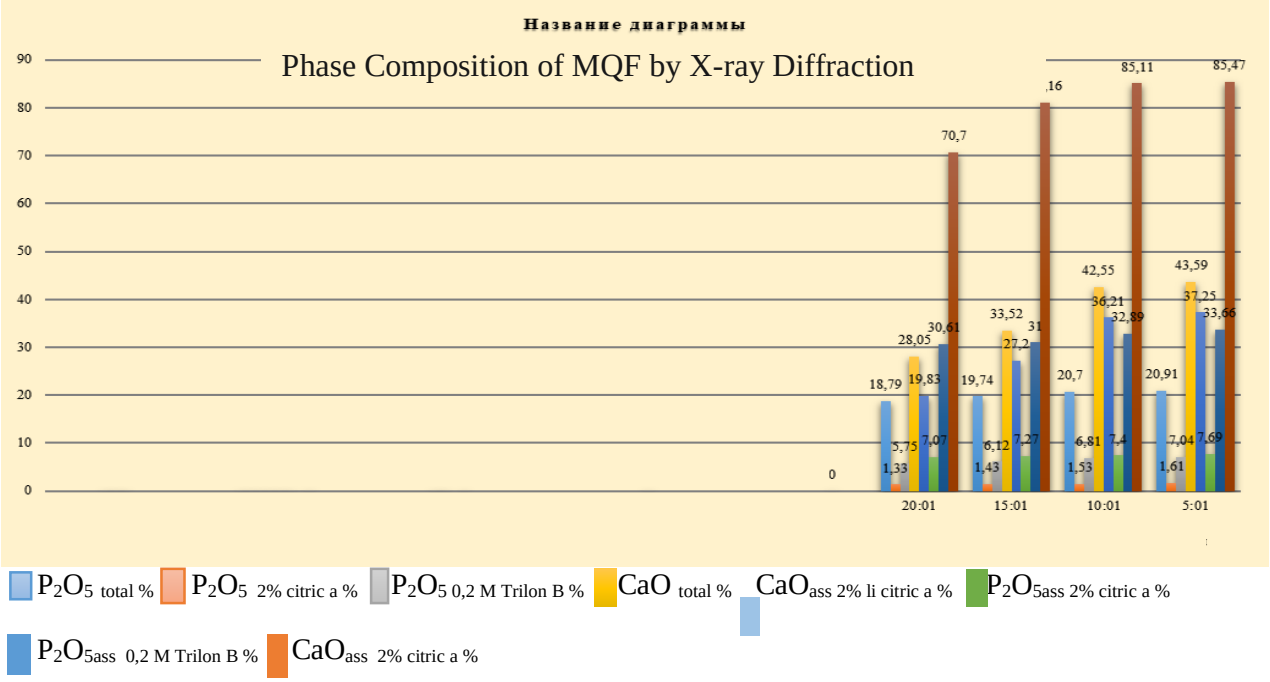
The mechanochemical activation of phosphate was carried out in a two-chamber planetary ball mill with a working volume of 500 cm³ at a rotation speed of 400 rpm. Each chamber was loaded with samples weighing 10, 14, 20, and 40 g and seven steel balls with diameters of 3 mm and 7 mm, having a total mass of 200 g. The grinding time was 30 minutes at a rotation speed of 200 rpm, with mass ratios of 20:1, 15:1, 10:1, and 5:1. A 2 g sample of the raw material was weighed using an analytical balance. A 250 ml beaker was filled with the sample and moistened with 4 ml of distilled water, followed by the addition of 25 ml of HNO_3 and then 10 ml of distilled water. The mixture was heated at 300 °C. After the chemical reaction was complete, the solution was cooled to room

temperature and filtered. The P_2O_5 content in the solution was determined using a UV spectrophotometer (UV 1000), while the CaO content was measured by a complexometric method.

Determination of Phosphorus Solubility Using Trilon B

Alongside the total phosphorus content ($P_2O_{5(□_o□_a□)}$), its solubility in Trilon B is one of the most important factors in assessing the potential use of phosphate as a fertilizer. Compared to the initial solubility of phosphate (30.61%), the solubility of phosphorus in Trilon B increased from 30.61% to 33.66% when the grinding mass ratio varied from 20:1 to 5:1. The rapid increase in phosphorus solubility was observed at the initial 10:1 mass ratio of grinding, reaching its maximum value of 33.66% after grinding at a 10:1 mass ratio (32.89%).

Table 2



The experiments were conducted using a Rigaku MiniFlex X-ray diffractometer (Rigaku Corporation, Japan). This high-precision X-ray diffraction instrument is designed to determine the phase composition of powder samples. The device was operated under the following conditions: X-ray source Cu (Kα) radiation, λ = 1.5406 Å; measurement range -2θ,° = 3°-100°; detector DTex Ultra; software-PDXL or Match! for phase analysis and comparative identification. The samples were irradiated with X-rays, and diffraction patterns were obtained based on their crystalline structure. These spectral data were subsequently used for phase identification and compositional analysis. X-ray Phase Analysis of the Synthesized Phosphate Mineral Sample The X-ray phase analysis of the synthesized phosphate mineral sample (Figure 1) showed that the main crystalline phases were: Calcite: d/n = 0.385; 0.303; 0.279; 0.251; 0.228; 0.209; 0.193; 0.191; 0.187; 0.160; 0.152; 0.144; 0.142; 0.133; 0.123; 0.115… Apatite ($Ca_5(PO_4)_3F$): d/n = 0.808; 0.279; 0.269; 0.262; 0.251; 0.228; 0.224; 0.193; 0.183; 0.176; 0.174; 0.172; 0.163; 0.160; 0.152; 0.145; 0.144; 0.142; 0.133; 0.123; 0.115…The peaks corresponding to these d-spacings (nm) indicate the onset of spinel phase formation, suggesting the initiation of crystallization of the spinel structure.

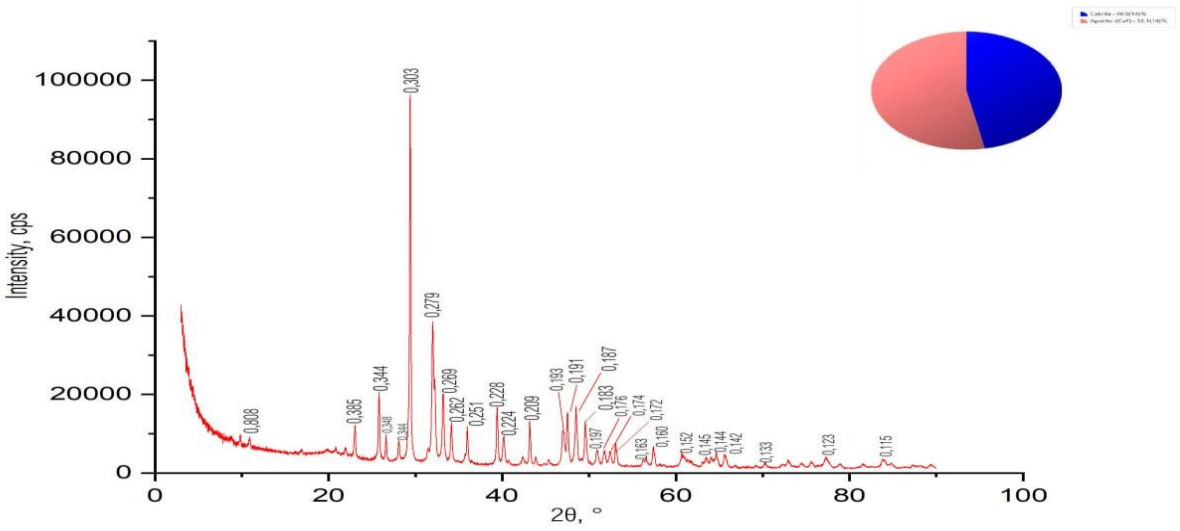


Figure 1. Results of X-ray Phase Analysis

Table 3

N	2θ, °0	d, Å	h k l	Norm. I.
1	23.05639	3.85	0 1 2	9.19
2	29.40199	3.03	1 0 4	100.00
3	31.43519	2.79	0 0 6	1.99
4	35.97409	2.51	1 1 0	14.77
5	39.41292	2.28	1 1 3	18.67
6	43.16367	2.09	2 0 2	15.06
7	47.11888	1.93	0 2 4	6.81
8	47.50667	1.91	0 1 8	20.20
9	48.50816	1.87	1 1 6	21.23
10	57.40581	1.60	1 2 2	10.30
11	60.51361	1.52	2 4 0	6.61
12	64.47684	1.44	3 2 3	7.93
13	65.61533	1.42	5 1 1	8.45
14	70.24442	1.33	1 5 2	2.25
15	77.29389	1.23	1 4 4	6.34
16	84.00488	1.15	4 3 3	5.57

PXRD Results of Calcite Mineral

Table 4

No.	2θ, °	d, Å	h k l	Norm. I.
1	10.92839	8.08	1 0 0	13.28
2	31.99402	2.79	2 1 1	100.00
3	33.19794	2.69	3 0 0	81.88
4	34.14125	2.62	2 0 2	36.14
5	35.97409	2.51	1 1 0	14.77
6	39.41292	2.28	1 1 3	18.67

7	40.16026	2.24	1 3 0	22.54
8	46.95477	1.93	2 2 2	39.50
9	49.57161	1.83	2 1 3	34.77
10	51.74499	1.76	4 1 0	8.51
11	52.40796	1.74	4 0 2	18.31
12	53.07367	1.72	0 0 4	23.15
13	56.24590	1.63	3 2 2	10.55
14	57.40581	1.60	1 2 2	10.30
15	60.51361	1.52	2 4 0	6.61
16	64.05096	1.45	3 0 4	11.94
17	64.47684	1.44	3 2 3	7.93
18	65.61533	1.42	5 1 1	8.45
19	70.24442	1.33	1 5 2	2.25
20	77.29389	1.23	1 4 4	6.34
21	84.00488	1.15	4 3 3	5.57

PXRD Results of Apatite ($Ca_5(PO_4)_3F$) Mineral

In our study, the solubility of phosphorus increased by more than 7.07% at a 20:1 mass ratio of grinding, exceeding Brazilian standards. Considering the amount of plant-available phosphorus obtained by grinding phosphate at a 10:1 mass ratio (P_2O_5 < 7.2%), results comparable to those of calcium superphosphate can be achieved [6]. The energy consumption and phosphate processing analysis indicated that grinding for 30 minutes at a 10:1 mass ratio was optimal for this experiment. The next stage of such studies should include the investigation of the bioefficiency of mechanochemically activated phosphate under field conditions.

Conclusion

The conducted chemical analyses confirmed that the efficiency of mechanochemical activation of Central Kyzylkum phosphate in a planetary ball mill is significantly dependent on the grinding duration, in accordance with other processing parameters. The results demonstrated that 30 minutes of mechanochemical activation at a 10:1 mass ratio substantially increased the phosphorus availability in Trilon B solution. To balance activation efficiency with energy consumption, the 10:1 mass ratio was scientifically determined as optimal for fractionation. Changes in the phosphate's surface morphology, functional groups, crystal lattice, and phase composition were found to be associated with fine grinding. Such structural modifications, characteristic of this mechanochemical activation process, provide important scientific and practical conditions for the development of waste-free and environmentally friendly technologies for phosphate fertilizer production based on local raw materials in the country.

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Rezyume: *Fosforitlarni mexanik faollashtirish past navli fosforitlarni qayta ishlashning samarali va ekologik toza usuli sifatida qaraladi. Rigaku MiniFlex (Rigaku Corporation, Yaponiya) rentgen difraktometri yordamida fosforitni mexanik faollashtirish 200 aylanish tezligi va 30 minutda (20:1, 15:1, 10:1, 5:1 massa nisbatda) ta'siri o'rganildi. Bunda Trilon B eritmasi bo'yicha o'zlashuvchan fosfor va mexanik faollashtirilgan fosforit unining strukturaviy xususiyatlari aniqlandi. Trilon B eritmasidagi fosforning o'zlashuvchan shakli 20:1 massa nisbatda mexanik ta'sirdan so'ng 30,61 %, 5:1 massa nisbatdan so'ng esa 33,66 % ni tashkil etadi. Eruvchanlikning ortishi, avvalo, fosforit zarrachalarining o'lchami keskin darajada kichraygani, minerallarning kristallanish darajasi kamaygani va* $PO_4^{3-} \leftrightarrow CO_3^{2-}$ *almashinuvi, shuningdek* OH^- *guruhlarining struktura panjarasiga qo'shilishi orqali kristall panjara buzilishlarining kuchayishi bilan bog'liq. Rentgen difraktometri natijalari mexanik aktivlashtirish tufayli yuzaga kelgan strukturaviy va fazaviy o'zgarishlar fosforning Trilon B eritmasida eruvchanligini sezilarli darajada oshiradi. Bu esa past navli Markaziy Qizilqum fosforitlarini o'g'it sifatida qayta ishlashda ushbu usulning* tejamkor va istiqbolli *ekanini ko'rsatadi.*

Резюме:.*Механохимическая активация фосфатов рассматривается как эффективный и экологически чистый метод переработки низкосортных фосфатов. С помощью рентгеновского дифрактометра Rigaku MiniFlex (Rigaku Corporation, Япония) была изучена механическая активация фосфата при 200 об/мин в течение 30 минут с различными массовыми соотношениями (20:1, 15:1, 10:1, 5:1). Были определены усвояемая форма фосфора в растворе Трилона B и структурные характеристики механохимически активированного фосфатного порошка. Усвояемая форма фосфора в растворе Трилона B составила 30,61 % после механического воздействия при массовом соотношении 20:1 и 33,66 % при соотношении 5:1. Увеличение растворимости в первую очередь связано с резким уменьшением размера частиц фосфата, снижением степени кристаллизации минералов, обменом* $PO_4^{3-} \leftrightarrow CO_3^{2-}$*, а также включением гидроксильных групп (*OH^-*) в кристаллическую решётку, что усиливает нарушения кристаллической структуры. Результаты рентгеновской дифракции показали, что структурные и фазовые изменения, вызванные механической активацией, значительно повышают растворимость фосфора в растворе Трилона B. Это демонстрирует экономичность и перспективность данного метода переработки низкосортного центральнокызылкумского фосфата в удобрение.*

Kalit so'zlar: *Markaziy Qizilqum fosforiti, rentgen difraktometri analiz, sharli tegirmon, Trilon B eritmasi, mexanik aktivatsiya.*

Ключевые слова: *центральнокызылкумский фосфат, рентгеновский дифракционный анализ, шаровая мельница, раствор Трилона B, механическая активация.*

BEETLES (INSECTA: COLEOPTERA) OF THE NORTHWESTERN KYZYLKUM DESERT: TAXONOMIC COMPOSITION, ECOLOGICAL FEATURES, AND PEST STATUS ON DOMINANT DESERT PLANTS

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Summary: *The northwestern part of the Kyzylkum Desert (southern Priaralye region, Karakalpakstan, Uzbekistan) is subject to intense desertification processes associated with the Aral Sea crisis. This study, based on long-term field research (2023–2025), presents the first comprehensive review of the beetle fauna (Insecta: Coleoptera) of the northwestern Kyzylkum, with particular attention to phytophagous species on key desert plants (Haloxylon, Tamarix, Artemisia, Calligonum, Salsola spp., Ammodendron, Halothamnus, Atraphaxis, etc.). A total of 378 beetle species belonging to 56 families were recorded, of which 312 species are phytophagous or have trophic links with desert vegetation. The families Buprestidae (87 species), Chrysomelidae (68 species), Curculionidae (51 species), Tenebrionidae (44 species), and Bostrichidae (21 species) dominate. 195 species were recorded on Haloxylon aphyllum (black saxaul) alone, confirming its role as the main host plant in psammophytic communities of the region. 68 new records for Karakalpakstan and 41 species new for the northwestern Kyzylkum are reported. A taxonomic catalogue, ecological groupings (xylophages, rhizophages, phyllophages, etc.), and pest status of the dominant species are provided. The results highlight the high conservation value of beetle diversity in anthropogenic deserts and provide a basis for monitoring programmes in restored "green cover" areas on the dried Aral Sea bed.*

INTRODUCTION

The Kyzylkum Desert, one of the largest sandy deserts in Central Asia, occupies vast territories in Uzbekistan, Kazakhstan, and Turkmenistan. Its northwestern part (territories of Karakalpakstan and Khorezm adjacent to the southern coast of the Aral Sea) has experienced dramatic environmental changes due to the Aral Sea desiccation, leading to the formation of the Aralkum Desert and intensification of desertification processes [1,2]. These changes have significantly affected insect communities, particularly beetles (Coleoptera), which constitute a dominant group in arid ecosystems due to their ecological plasticity and trophic specialisation [3–5].

Despite numerous studies on the Coleoptera of Central Asian deserts [6–9], the northwestern Kyzylkum remains insufficiently studied. Most available data concern Tenebrionidae and Staphylinidae of the central and eastern Kyzylkum [10,11], while phytophagous complexes on dominant desert plants (saxaul, tamarisk, wormwood, etc.) in the Priaralye part of the desert have not been systematically summarised. The present work fills this gap on the basis of original material collected by the author during 2023–2025 in the Beruniy, Ellikkala, Turtkul, and Takhtakupir districts of Karakalpakstan.

EXPERIMENTAL RESEARCH

The research materials were collected from the desert and tugai areas of Karakalpakstan in 2023–2025. Standard entomological methods were employed, including visual observations, sweeping nets, pitfall traps, and soil excavations for collecting weevils (e.g., *Megamecus viridans*, *Lixus incanescens*, *Ammocleonus quadrimaculatus*).

3. In our studies, we used the Barber method of soil traps [1] to catch beetles. Glass containers with a diameter of 72–73 mm and a capacity of 0.5 liters and 0.25 liters (55 mm diameter) were used as traps, which were dug level with the soil surface. In each biotope, 10 traps were typically placed in a row, 10 meters apart. In some experiments, between 20 and 70 traps were used. Ethyl acetate solution was employed as the fixation liquid. The traps were often used for faunal collection.

4. In our research, we mainly used the light trap method described by N.L. Sakharova [2]

Specimens were photographed using a Canon PowerShot A640 camera and MicroMed MC-2-ZOOM microscope, with images edited in Adobe Photoshop 7.0. Species identification relied on

international catalogs such as “Catalogue of Palaearctic Coleoptera” [6] and scientific references therein.

RESEARCH RESULTS

Analysis of the material collected during 2023–2025 in the northwestern Kyzylkum Desert (Beruniy, Ellikkala, Turtkul, and Takhtakupir districts of Karakalpakstan) revealed 378 species of beetles belonging to 56 families. Of these, 312 species (82.5%) are directly or indirectly associated with desert vegetation (phytophagous, carpophagous, xylophagous, rhizophagous, and pollinophagous forms).

The most species-rich families are:

- *Buprestidae* – 87 species (23.0% of the total fauna)
- *Chrysomelidae* – 68 species (18.0%)
- *Curculionidae* – 51 species (13.5%)
- *Tenebrionidae* – 44 species (11.6%)
- *Bostrichidae* – 21 species (5.6%)
- *Cerambycidae* – 19 species
- *Meloidae* – 17 species
- *Scarabaeidae* – 15 species
- *Carabidae* – 14 species
- *Dermestidae* – 12 species

The remaining 46 families are represented by 1–9 species each.

Haloxylon aphyllum (black saxaul) is confirmed as the main “oasis-forming” plant and the principal host for phytophagous beetles: 195 beetle species (51.6% of the total recorded fauna) were found on this plant alone. The dominant complexes on saxaul are formed by jewel beetles (Buprestidae: Sphenoptera spp., Julodis variolaris), longhorn beetles (Cerambycidae: Turkaranyia nomas, Phytoecia spp.), false blister beetles (Meloidae: Meloe spp.), and bark beetles (Bostrichidae: Sinoxylon sexdentatum).

Other important host plants and the number of associated beetle species:

- *Tamarix spp*. – 112 species
- *Artemisia terrae-albae*, A. diffusa – 98 species
- *Calligonum* spp. – 87 species
- *Salsola* spp. (incl. S. rigida, S. paulsenii) – 74 species
- *Ammodendron conollyi*, A. karelinii – 53 species
- *Halothamnus subaphyllus* – 41 species
- *Atraphaxis spinosa*, A. replicata – 38 species

New records:

- 68 species are recorded for the first time for the fauna of Karakalpakstan
- 41 species are new to the northwestern Kyzylkum
- 12 species (mainly Buprestidae and Cerambycidae) are rare Central Asian endemics previously known only from the central and southern parts of the desert

Ecological grouping of phytophagous beetles:

- *Xylophages* (wood-borers) – 118 species (31.2%)
- *Phyllophage*s (leaf feeders) – 89 species
- *Carpophages* and pollinophages – 57 species
- *Rhizophages* (root feeders) – 36 species
- *Anthophages* (flower visitors with occasional damage) – 12 species

Among the recorded species, 27 are of economic importance as pests of desert pasture and forest plantations:

- Serious pests of black saxaul (*Haloxylon aphyllum*): Sphenoptera tapula, Julodis variolaris, Turkaranyia nomas, Sinoxylon sexdentatum, Phytoecia asiatica
- Pests of white saxaul (*Haloxylon persicum*) and tamarisk: Capnodis mnsourmiana, Pseudocneorhinus bifasciatus

- Pests of Calligonum and Salsola: Eremochorus kusnezovi, Trichosirocalus korotyaevi
- Polyphagous pests in reclamation zones: Agapanthia dahli, Bothyna undata, Psilothrix viridicoerulea

CONCLUSIONS

The beetle fauna of the northwestern Kyzylkum Desert numbers at least 378 species from 56 families, representing one of the richest coleopteran complexes among the anthropogenically transformed deserts of Central Asia. The dominant position of the families Buprestidae, Chrysomelidae, Curculionidae, Tenebrionidae, and Bostrichidae reflects the extreme aridity and predominance of psammophytic and halophytic vegetation. *Haloxylon aphyllum* serves as the main refugium and trophic base, supporting more than half of the recorded beetle species (195 species). Its conservation and restoration are critical for maintaining regional beetle diversity. The discovery of 68 species new to Karakalpakstan and 41 species new to the northwestern Kyzylkum underlines the previous understudied status of the region and the high degree of endemism in the Priaralye part of the desert. A group of dangerous pests of desert forestry plantations has been identified (27 species), the most harmful being xylophagous Buprestidae, Cerambycidae, and Bostrichidae on saxaul. This necessitates the inclusion of these species in monitoring programmes on the dried Aral Sea bed and in "green belt" restoration projects.

The obtained data provide the first comprehensive baseline for long-term monitoring of beetle communities in the Aralkum and restored areas of the southern Priaralye, and emphasise the high conservation value of coleopteran diversity in anthropogenic desert ecosystems.

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Rezyume : *Ushbu tadqiqot 2023–2025-yillarda shimoli-g'arbiy Qizilqum cho'li (Janubiy Orolbo'yi, Qoraqalpog'iston) hududida qo'ng'izlar (Coleoptera) faunasining ilk kompleks tahlilini taqdim etadi. Umumiy 378 tur aniqlanib, ularning 312 tasi cho'l o'simliklari bilan trofik bog'liq. Haloxylon aphyllum asosiy mezbon o'simlik bo'lib, unda 195 tur qayd etildi. 68 tur Qoraqalpog'iston uchun, 41 tur shimoli-g'arbiy Qizilqum uchun yangi hisoblanadi. 27 tur o'rmonlashtirish va rekultivatsiya hududlarida zararli hasharot sifatida baholandi. Tadqiqot cho'l ekotizimlarida qo'ng'izlar bioxilma-xilligini saqlash va monitoringini yo'lga qo'yish uchun ilmiy asos yaratadi.*

Резюме: *Исследование представляет первый комплексный обзор жуков (Coleoptera) северо-западного Кызылкума, основанный на материалах 2023–2025 гг. Всего выявлено 378 видов, из которых 312 связаны с пустынной растительностью. Основным кормовым и биоценотическим центром является Haloxylon aphyllum, на котором отмечено 195 видов. Для Каракалпакстана выявлено 68 новых видов, для северо-западного Кызылкума — 41 новый вид. Определены 27 вредных видов, влияющих на лесомелиоративные насаждения и пастбищные биоценозы. Результаты служат базой для мониторинга насекомых Арелкума и оценки их эколого-биогеографической роли.*

Kalit so‘zlar: *Coleoptera; Qizilqum; Aralkum; saxaul; cho‘l o‘simliklari; bioxilma-xillik; fitofaglar; ksilosfera; zararli hasharotlar; monitoring.*

Ключевые слова: *Coleoptera; Кызылкум; Аралкум; саксаул; пустынная флора; биоразнообразие; фитофаги; ксилофаги; вредители; экологический мониторинг.*

UDC: 639.3.043.2:639.4/.5.

BIOECOLOGICAL PROPERTIES AND PRACTICAL SIGNIFICANCE OF THE SPECIES MUSCA DOMESTICA LINNAEUS, 1758, OF THE SOUTHERN ARAL SEA TRUE FLIES (DIPTERA, MUSCIDAE) FAMILY

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Summary. *The article presents the results and scientific literature data on the practical significance of some species of the Southern Aral Sea true fly family, Musca domestica Linnaeus, 1758. Furthermore, scientific data are presented on the synonyms of the species *Musca domestica Linnaeus*, 1758, their distribution characteristics, and how global climate change leads to an increase in the number of harmful species.*

Key words*. Palearctic, True flies, Diptera, Muscidae, family, Musca domestica Linnaeus, 1758, Synonyms, bioecological characteristics.*

Introduction. True flies are considered one of the largest families within the order Diptera. Today, science knows about 4000 species of representatives of this family in the world fauna. 52 genera and about 850 species are distributed in the Palearctic. In the CIS countries, more than 400 species of the Muscidae family have been recorded. They are found in almost all natural areas and in most landscapes. The morphological and ecological diversity of the family is enormous, therefore it is difficult to characterize each species of all representatives [1. 715; 2. 142; 6. 605; 7. 2094; 10. 970].

The flies include predators, blood-sucking insects, necrophages, and those that consume decomposable organic matter. The life forms of the larvae are also very diverse. They develop on rotten wood, under tree bark, in the carcasses of vertebrates, in the feces of large ungulates, in bird nests, and in small mammals; some species live in freshwater bodies. In spring, the larvae of some species of flies can be found on various trees. Most species of the family develop on decomposed organic remains of plants and animals, where their larvae themselves process the remains [2. 144; 3. 5].

A number of species of real flies are plant pest species. Only specialized parasites are present in the family, although parasitism is also known in the most primitive, imperfect forms of these flies. Many species of true flies are synanthropic, that is, closely related to humans. Therefore, it rapidly increases in residential areas, causing sanitary-epidemic situations.

Research materials and methods. Among all known entomological methods of collecting biomaterials, the Malez trap, entomological traps, and colored plates, suitable for species of the order Diptera, were widely used. Colorful plates are a widely used method for collecting pollinating insects from plants. The color of the trap is of particular importance, since different groups of insects are attracted to a certain color [8. 277]. Much work has been done to determine the involvement of various groups of pollinators and pests of particular flowers [8. 277; 10. 271]. Different researchers have different opinions, and the number of true fly species is considered more effective when catching with a Malez trap and entomological trapping than when catching with a colored plate.

Research results. *Musca domestica* Linnaeus, 1758, known as the housefly in the work of representatives of the true fly family, is considered a cosmopolitan species and has always attracted researchers' attention. It has been proven that this species has synonyms such as *Musca aurifacies* Robineau-Desvoidy, 1830, *Musca contigua* Walker, 1853, *Musca flavifacies* Bigot, 1888, *Musca harpyia* Harris, 1869, *Musca taitensis* Macquart, 1843, *Musca vicina* Macquart, 1851 [3. 4; 5. 426; 9. 18].

The morphological structure of this species is quite complex. The body length is 7-9 mm. The head is hemispherical, rounded at the back. Her eyes and cheeks are covered with a gray coating

behind them. The moustaches are dark brown, the top of the second segment and the base of the third segment are reddish. The rib cage is covered with a black, gray coating. The abdomen is ovate, with black-brown or yellow sections. The legs are black and brown. Wings are transparent, sometimes slightly darkened [5. 426].

From the desert regions of Central Asia, the housefly has the status of a species distributed today in almost all regions of our planet under the influence of environmental factors. *Musca domestica* Linnaeus, 1758, completely transitioned from natural biocenoses to urbanized areas. Manure, feces, and various debris have become foci where housefly larvae, a constant companion of these settlements, develop. The rate of reproduction of this species is very impressive. The average female lays about 100-150 eggs at a time, but with adequate nutrition, oviposition is repeated with an interval of 2-4 days, so its total fertility is 600 eggs, and in countries with a hot climate, 2000 eggs or more are known. If the larvae, pupae, and flies themselves had not died, only one female could have exceeded 5 trillion (5,000,000,000,000) specimens by the end of summer. One liter of horse or cow manure or the same amount of kitchen waste from a housefly can develop from 1000 to 1500 fly larvae simultaneously, and up to 4000 in pig manure. Houseflies are a dangerous distributor of infections. Each of them is found in feces and various stools, carrying about 6 million microorganisms on the surface of their bodies and at least 25-28 million in the intestines [3. 4; 5. 426; 9. 18].

However, I should say that the pathogenic bacteria in the fly's intestines are not digested and are fully viable outside. In the flies, TIF and paratyphoid bacilli, dysentery bacillus, cholera, tuberculosis bacillus, anthrax spores, diphtheria pathogen, and larval eggs were found. Therefore, the fight against houseflies is an important link in the overall system of human disease control. Along with housefly larvae, many other species of this family develop in manure and dung [9. 18; 11. 62]. The larvae of houseflies begin their lives as consumers of decomposing plant matter, but then become stronger and begin to feed on the larvae of other diphtheria, that is, they become predators. Competition between species in the manure biocenosis is, as a rule, very fierce.

Species close to *Musca domestica* Linnaeus, 1758, are also common and cause similar and epidemiological problems in species classification. Of the main ones, with the arrival of autumn season, the first to appear is the autumn broomrape (*Stomohus calcitrans*), which is a blood-sucking fly and is harmful as a mechanical carrier of the pathogens of anthrax, tularemia, and other diseases [6. 607]. The species *Stomoxys calcitrans* (Linnaeus, 1758), which reproduces by the end of summer and is clearly distinguished from house flies, has a gray body length of 6 mm with black spots in the abdominal cavity. They sting painfully and sometimes infect people with infectious diseases such as anthrax through their injections. Larvae live in manure. The blood-sucking fly carries a special type of trypanosoma, the causative agent of "sleep disease," widespread in Africa. Trypanosomes themselves are always located in the blood of antelopes and do not harm them. The Glossina fly, by drinking the blood of such an antelope, often bites a person and infects him with trypanosomes. The disease manifests as deep fatigue and usually ends in death [5. 427; 6. 607].

A representative of another family of the same species, *Glossina morsitans* from the family Glossinidae, transmits a similar disease, but it affects only animals. Interestingly, in these mosquitoes, the larva fully develops in the female's swollen abdominal cavity and feeds on special secretions from accessory glands. After hatching from the mother's body, the larva immediately buries itself in the soil. Morphologically similar to true flies of the Anthomyiidae family - true flies that develop in living plant tissues are very serious pests. Among them, the species *Delia radicum* (Linnaeus, 1758) sharply differs from the true fly family. The body is an imago, with stamens 5-5, 5 mm, dark gray with wide dark stripes on the back. A broad black longitudinal line runs across the entire animal, with a narrow transverse line in all segments. Their eyes are closing. Lob v 4-5. Females are larger (6-6.5 mm), light gray in color. The width of the forehead is almost equal to the width of the eye. It lays an average of 100-150 eggs. Several females can lay eggs on a single plant. The eggs are white, curled. Larvae appear after 5-10 days. The larva is legless, thick, white or yellow, and shiny. The larva feeds for 20-30 days. The development of the pupa in spring offspring lasts 15-20 days, in autumn - several months. Overwinters in the soil at a depth of 10-15 cm [6. 608].

In conclusion, it should be noted that from some species of true flies of the Southern Aral Sea region, six synonyms of the species *Musca domestica* Linnaeus, 1758 appeared, which spread from the desert regions of Central Asia to almost all regions of the planet today, that is, it has become a cosmopolitan species. The breeding productivity of this species is 600 eggs, and as a result of global warming, it is possible to lay 2000 or more eggs. Monitoring the number of houseflies requires, first of all, constant study of their biology and ecological nutritional properties.

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Rezyume: *Maqolada Janubiy Orolbo‘yi haqiqiy pashshalar oilasiga mansub Musca domestica Linnaeus, 1758 turining amaliy ahamiyati bo‘yicha olingan natijalar va ilmiy adabiyot ma’lumotlari keltirilgan. Bundan tashqari, Musca domestica Linnaeus turining sinonimlari, 1758, ularning tarqalish xususiyatlari, global iqlim o‘zgarishi zararli turlar sonining ortishiga olib kelishi haqida ilmiy ma’lumotlar keltirilgan.*

Резюме: *В статье представлены результаты и данные научной литературы о практическом значении некоторых видов семейства истинных мух Южного Арала, Musca domestica Linnaeus, 1758. Кроме того, представлены научные данные о синонимах вида Musca domestica Linnaeus, 1758, особенностях их распространения и о том, как глобальное изменение климата приводит к увеличению числа вредных видов.*

Kalit so‘zlar. *Palearktik, Haqiqiy pashshalar, Diptera, Muscidae, oila, Musca domestica Linnaeus, 1758, Sinonimlari, bioekologik xususiyatlari.*

Ключевые слова. *Палеарктические, Настоящие мухи, Diptera, Muscidae, семейство, Musca domestica Linnaeus, 1758, Синонимы, биоэкологические характеристики.*

UDC 541.123:54621

NUMERICAL MODELING OF THE DENSITY OF STATES OF A TWO-DIMENSIONAL ELECTRON GAS IN A QUANTIZING MAGNETIC FIELD

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Summary: *The results of numerical modelings of the density of states of a two-dimensional electron gas in a strong transverse magnetic field are presented. Various theoretical models are discussed that can be used to obtain information about the density of states of electron energy levels in a quantum well. The fraction of electrons in localized and delocalized states is determined numerically.*

Key words: *Heterostructure, two-dimensional electron gas, quantum well, Landau subbands, magneto oscillation, filling factor, density of states, chemical potential, localized states.*

Introduction

If a magnetic field is applied perpendicular to the layer, the electron spectrum in a semiconductor heterostructure quantum well (QW) or in the inversion layer becomes fully quantized [1–5].

In the ideal case, discrete Landau levels $E_N = (N + 1/2)\hbar\omega$ (without considering spin) are separated by a gap – the cyclotron energy $\hbar\omega \sim B$. In reality, the gas is not completely ideal; due to electron scattering (by phonons, impurities, other electrons, etc.), the Landau levels acquire a finite width Γ. In strong magnetic fields, typically $\Gamma < \hbar\omega$. The shape of the broadened levels $g(E,\Gamma)$ is usually described by either a Lorentzian or a Gaussian. The density of states (DOS) is maximal at the center of the peak and rapidly decreases away from it.

Useful information about the density of states (DOS) can be obtained from measurements of magnetization [6,7], heat capacity [8], and chemical potential [9–11]. In these studies, the experimentally measured quantities were compared with theoretical calculations based on various DOS models. A simple model with a Gaussian distribution of the DOS, involving a single fitting parameter Γ, also explains the main features of the measured oscillations. However, when fitting Γ, deviations from the experiment always appeared in the regions of strong or weak magnetic fields. To explain the shape of the oscillations, in some works the broadening parameter Γ had to be considered dependent on the magnetic field B, while in other works even on the concentration n_S or on temperature. A discussion of such mechanisms can be found in the review [12].

In the present work, numerical modeling is used to study the oscillations of the chemical potential and the density of states (DOS) at the Fermi level based on: (i) a simple model with a Gaussian distribution of the DOS involving a single fitting parameter Γ, and (ii) a model of localized and delocalized states with two fitting parameters ξ, Γ. Oscillations of the concentrations in the localized and delocalized parts of the DOS have been found.

Models

Let us begin with a simple model, where the shape of the single-particle DOS is expressed as a sum of Gaussian functions [1,8,11,12,16–17].

$$g(E) = D\hbar\omega \sum_{N=0}^{\infty} \frac{e^{-\frac{(E-E_N)^2}{2\Gamma^2}}}{\sqrt{2\pi}\Gamma} \qquad (1)$$

Here, $\hbar\omega$ denotes the cyclotron energy.

$$\hbar\omega = \hbar\frac{eB}{m^*} = \frac{0.116}{m^*/m_0}B\left[\frac{\text{meV}}{\text{Tesla}}\right] \tag{2}$$

m^* is the effective mass of the electron. D is the two-dimensional density of states of the miniband in the absence of a magnetic field $B = 0$, which is related to $\hbar\omega$ by a certain relation

$$D\hbar\omega = \frac{eB}{\pi\hbar},\ D = \frac{m^*}{\pi\hbar^2} = \frac{m^*}{m_0}\frac{413\cdot10^9}{\text{meV}\cdot\text{cm}^2} \tag{3}$$

The filling factor is a quantity

$$\nu = n_S / D\hbar\omega \tag{4}$$

The integer part of this quantity determines the number of completely filled Landau levels. The degeneracy of any Landau level is $D\hbar\omega$. As the magnetic field increases, all electrons eventually occupy the lowest level $N = 0$. Then, from formula (4), taking into account (2) and (3), one can obtain the so-called "fundamental field" ($\nu = 1$).

$$B_f = \frac{\pi\hbar n_S}{e} \tag{5}$$

The chemical potential of the gas μ is determined from the condition of conservation of the two-dimensional electron concentration in the quantum well (QW)

$$n_S = \int_{-\infty}^{\infty} g(E)\frac{dE}{e^{\frac{E-\mu}{k_BT}}+1} = D\hbar\omega\sum_{N=0}^{\infty}\int_{-\infty}^{\infty}\frac{e^{-\frac{(E-E_N)^2}{2\Gamma^2}}}{\sqrt{2\pi}\Gamma}\frac{dE}{e^{\frac{E-\mu}{k_BT}}+1} \tag{6}$$

Here, k_B is the Boltzmann constant. The internal energy is equal to

$$U_\mu = \int_{-\infty}^{\infty} g(E)\frac{EdE}{e^{\frac{E-\mu}{k_BT}}+1} = D\hbar\omega\sum_{N=0}^{\infty}\int_{-\infty}^{\infty}\frac{e^{-\frac{(E-E_N)^2}{2\Gamma^2}}}{\sqrt{2\pi}\Gamma}\frac{EdE}{e^{\frac{E-\mu}{k_BT}}+1} \tag{7}$$

By setting T and n_S, one can obtain the oscillation of $\mu(B)$ from equations (6). Substituting $\mu(B)$ into (6a), we find the oscillation of $U_\mu(B)$.

In the model presented above, it is assumed that the system is isolated, and therefore the electron concentration in the quantum well (QW) is fixed in equation (6). As a result, when a magnetic field is applied, oscillations of the chemical potential occur (the $n_S = const$ model).

In the real case, the quantum well (QW) has direct or indirect contact (through a spacer) with the doped layers. Under thermodynamic equilibrium, the electron gas in the QW and the donors in the doped layers (the reservoir) share a common Fermi energy. In this situation, it is assumed that when a magnetic field is applied, the Fermi energy remains unchanged, while the concentration $n_S(B)$ oscillates (the $E_F = const$ model). Below, we will not use all of these models; their detailed discussion can be found in [12,14].

Here, $\theta(E)$ is the Heaviside function, and ξ denotes the fraction of electrons in localized states, which serves as a fitting parameter. Replacing $g(E)$ with $g_L(E)$, instead of equations (6) we obtain

$$n_S = \xi D k_B T \ln\left(1+e^{\frac{\mu}{k_BT}}\right) + (1-\xi)D\hbar\omega\sum_{N=0}^{\infty}\int_{-\infty}^{\infty}\frac{e^{-\frac{(E-E_N)^2}{2\Gamma^2}}}{\sqrt{2\pi}\Gamma}\frac{dE}{e^{\frac{E-\mu}{k_BT}}+1} = n_L(B)+n_D(B) \tag{9}$$

The temperature-dependent internal energy is equal to

$$U_\mu = \xi D \cdot \left(\frac{\mu^2}{2} + (k_B T)^2 \,\mathrm{dilog}\left(1 + e^{-\frac{\mu}{k_B T}}\right) + \frac{\pi^2 (k_B T)^2}{6} \right) + (1-\xi) D\hbar\omega \sum_{N=0}^{\infty} \int_{-\infty}^{\infty} \frac{e^{-\frac{(E-E_N)^2}{2\Gamma^2}}}{\sqrt{2\pi}\Gamma} \frac{EdE}{e^{\frac{E-\mu}{k_B T}} + 1} \tag{10}$$

Here it is also assumed that the system is isolated and $n_S = const$. When a magnetic field is applied, oscillations occur in the chemical potential and in the electron concentration, both in the localized states $n_L(B)$ and in the delocalized states $n_D(B)$. In the presence of $n_L(B)$, the shape of the oscillations $\mu(B)$ now differs from the one obtained from (6). By adjusting the parameters ξ, Γ to the experiment, the authors of [8] were able to explain the oscillations of the heat capacity.

Numerical results and discussion

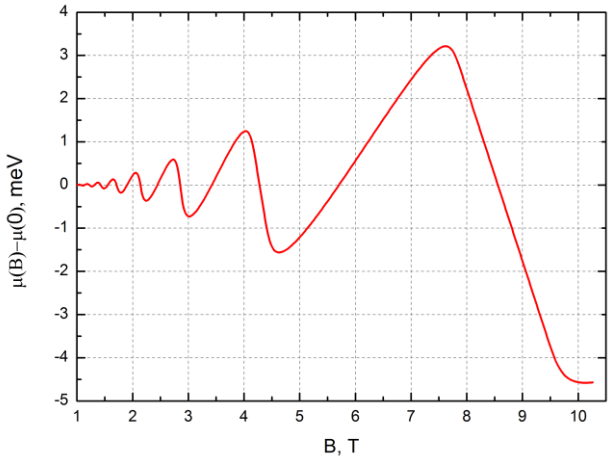
As an example, we will model the quantities $\mu(B,T)$, $U_\mu(B,T)$ and $g_L(\mu)$ (see below). Other thermodynamic quantities (for example, entropy, heat capacity, magnetization) can be obtained using well-known formulas of statistical physics by calculating the free energy or the thermodynamic potential [13]. Since all thermodynamic quantities are directly determined through the DOS, it is also useful to model the thermodynamic density of states (TDOS). Its oscillation directly reproduces the oscillation of the studied thermodynamic quantity. The thermally broadened DOS is the TDOS, which is defined as [15]

$$g_L(\mu(B),T) = \frac{\partial n_S}{\partial \mu} = \int_{-\infty}^{\infty} g_L(E) \frac{\partial f(E,\mu(B))}{\partial \mu} dE \tag{11}$$

$g_L(E)$ is the DOS at zero temperature (8). Only under $T = 0$, equation (11) determines the DOS at the Fermi level. To calculate $g_L(\mu(B),T)$, one first determines $\mu(B)$ from (9) and then substitutes it into (11).

As can be seen from the structure of equations (9) and (10), for $\xi = 0$ (no localization) one obtains a simple model with a single Gaussian. Therefore, in what follows we will use the equations of the localized and delocalized states model (ii). To model the DOS, we will also need formulas (1), (8), and (11).

For numerical calculations and in order to compare the obtained results, we will use the material parameters from [11]: $m^* = 0.068\, m_0$, $n_S = 4.1 \times 10^{11}\, cm^{-2}$.



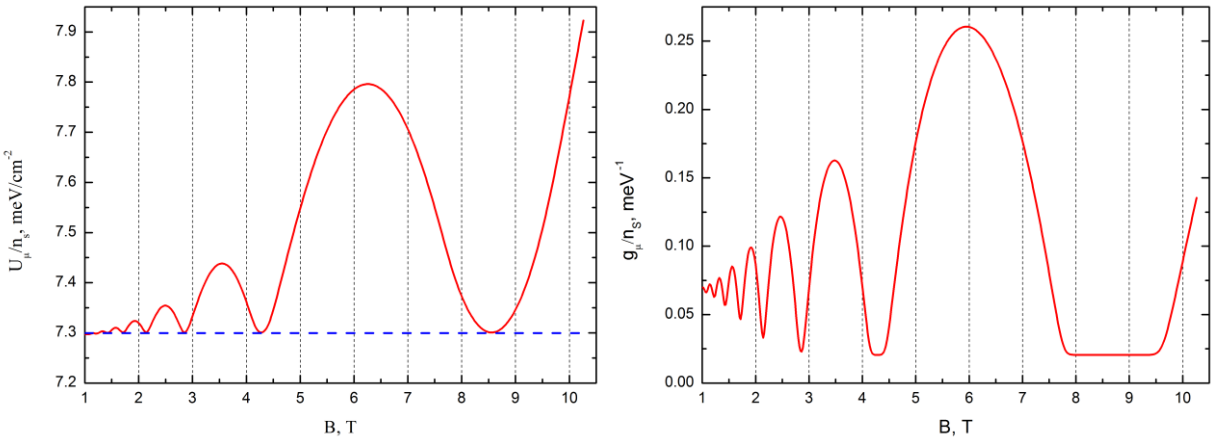


Figure 1. Relation of the thermodynamic quantities of a two-dimensional electron gas to the magnetic field. $\zeta = 0.3$, Γ=0.72 meV, T=2.17 K.

The quantity μ can be numerically calculated as a function of the magnetic field and temperature $\mu(B,T)$. At $T = 0$, under the action of a magnetic field μ, sawtooth-like oscillations appear in the vicinity of the Fermi level. At nonzero temperatures, the teeth become smoothed. This is due to the fact that, under the influence of thermal energy, part of the electrons is redistributed to nearby levels.

With an increase in the magnetic field strength, μ increases. Electrons transition to higher energy levels. The internal energy U_μ also increases. When half-integer values of the filling factor are reached, μ falls in the middle of the last Landau level. In this case, the density of states reaches its maximum value, and the internal energy also attains a maximum.

In stronger magnetic fields, the capacity of each Landau level increases. As a result, in accordance with the principle of minimum energy, electrons begin to occupy lower-energy levels. The chemical potential decreases. Since the number of high-energy electrons is reduced, U_μ also decreases. When the filling factor reaches integer values, the last Landau level becomes completely filled. The internal energy takes on its minimum value, and the density of states becomes zero.

If the presence of a localized density of states between Landau levels is taken into account, changes in the oscillations are observed. When the chemical potential lies between the levels, the density of states does not become zero (Fig. 1). In numerical calculations, in the case of $\xi = 0$, a sharp decrease in the oscillations of the chemical potential was observed. If one considers the density of states localized between Landau levels ($\xi \neq 0$), it can be seen that the maxima in the oscillations are shifted to the left, while the minima are shifted to the right. Thus, this model provides closer agreement of the results with the experiment. In this case, the total concentration is divided into localized and delocalized parts.

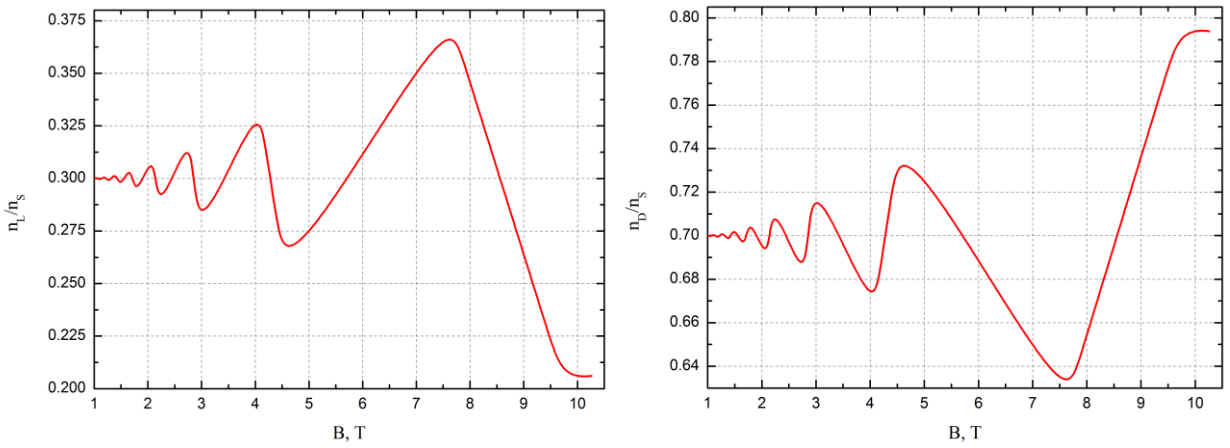
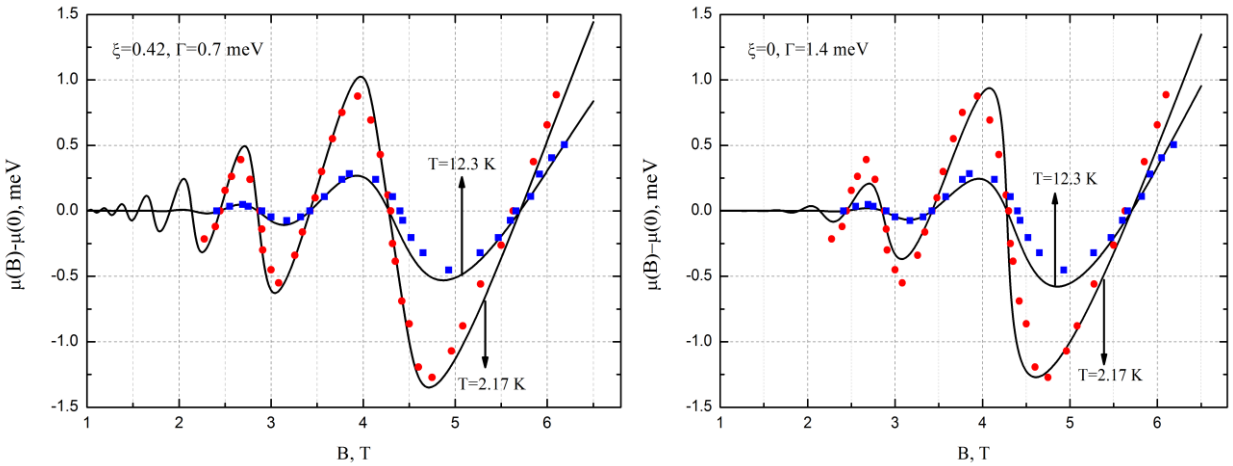


Figure 2. Dependence of the concentration of localized (n_L / n_S) and delocalized (n_D / n_S) electrons on the magnetic field strength. $\zeta = 0.3$, Γ=0.72 meV, T=2.17 K.

Figure 2 shows how the concentrations of localized (n_L / n_S) and delocalized (n_D / n_S) electrons in a two-dimensional electron gas system change with increasing magnetic field. From the graphs, it can be seen that under the influence of the magnetic field, periodic oscillations are observed in both concentrations.

As the magnetic field increases, the density of Landau levels changes, and their filling depends on whether the filling factors are integer or half-integer. Delocalized electrons participate in states with higher energy, and their fraction sharply increases with increasing magnetic field. In contrast, localized electrons are concentrated near the Landau levels, and their concentration decreases as the magnetic field grows. At integer filling factors, the Landau levels are completely filled, and the contribution of delocalized electrons increases. At half-integer filling factors, the upper Landau level is only partially filled, and in this case strong localization is observed.



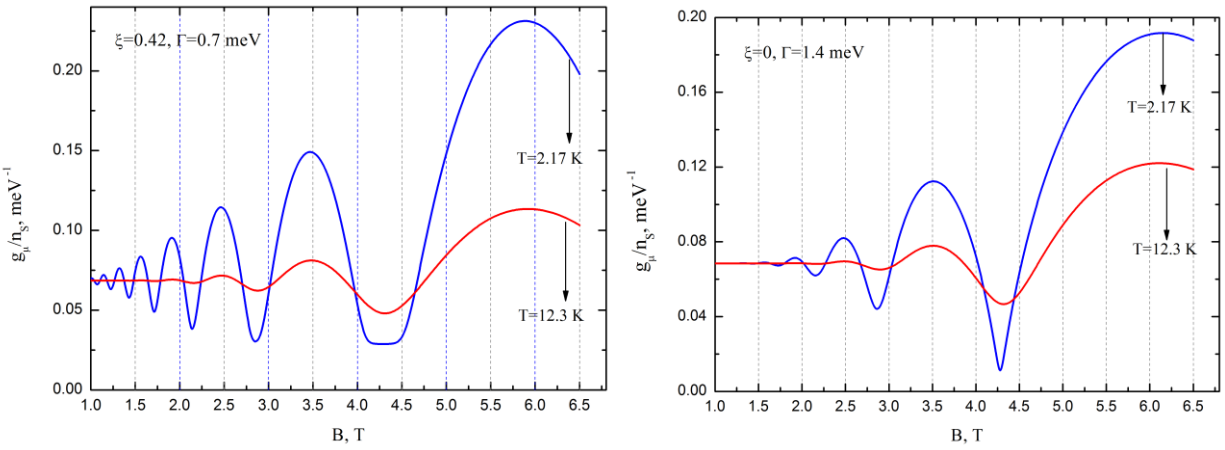


Figure 3. Comparison of the chemical potential and the density of states of a two-dimensional electron gas at different temperatures.

In Fig. 3, the oscillations of the chemical potential and the density of states are shown. In the calculations, first the contribution of the density of localized states ($\xi = 0.42$, $\Gamma = 0.7$ meV) was taken into account. Then the case without localization ($\xi = 0$, Γ = 1.4 meV) was considered. At low temperatures(T=2.17 K), strong oscillations appear in the density of states, while at higher temperatures (T=12.3 K) the oscillations are smoothed due to thermal transitions. When the density of localized states is included, a shift of the maximum and minimum points in the oscillations of the chemical potential is observed. As a result, at the chosen values of ξ, Γ the calculated values of the chemical potential are in good agreement with the experimental data.

Conclusions

This work presents the results of numerical modeling of the chemical potential, internal energy, and density of states of a two-dimensional electron gas in a transverse magnetic field. Theoretical models providing access to these quantities are discussed. It has been shown that, when the localized density of states between successive Landau levels is taken into account, the maxima of the chemical potential oscillations are shifted to the left, while the minima are shifted to the right. Oscillations of the localized and delocalized electron concentrations have been analyzed. The approximation of experimental and numerical results for the chemical potential at two different temperatures, achieved by fitting the fraction of localized electrons (ξ) and the broadening parameter (Γ), is presented in the graphs.

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Rezyume: *Kuchli ko'ndalang magnit maydondagi ikki o'lchovli elektron gazning holatlari zichligini raqamli modellashtirish natijalari keltirilgan. Kvant o’radagi elektron energiya sathi holatlarining zichligi haqida ma'lumot olish uchun ishlatilishi mumkin bo'lgan turli nazariy modellar ko'rib chiqiladi. Lokalizatsiyalangan va delokalizatsiyalangan holatlardagi elektronlarning ulushi raqamli hisoblar bilan aniqlanadi.*

Резюме: *Представлены результаты численных моделирований плотности состояний двумерного электронного газа в сильном поперечном магнитном поле. Обсуждаются различные теоретические модели, на основе которых можно получить информация о распределение плотности состоянии энергетических уровней электронов в квантовой яме. Численным расчетом найдена доля электронов в локализованных и делокализованных состояниях.*

Kalit so‘zlar: *Geterostruktura. Ikki o'lchovli elektron gaz. Kvant qudug'i. Landau subbandlari. Magnit tebranish. Darajani kengaytirish. To'ldirish omili. Shtatlarning zichligi. Kimyoviy salohiyat. Mahalliylashtirilgan holatlar.*

Ключевые слова: *Гетероструктура. Двумерный электронный газ. Квантовая яма. Подзоны Ландау. Магнитная осцилляция. Уширение уровня. Фактор заполнения. Плотность состояния. Химический потенциал, Локализованные состояния.*

UDC. 595.79(571.1) (234.421)

FAUNA OF VESPID WASPS (HYMENOPTERA: VESPIDAE) OF THE UZBEKISTAN PART OF THE KYZYLKUM DESERT

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Karakalpak State University named after Berdakh

Summary: *In this article, about 1000 specimens of the fauna of the true wasp family were studied from more than 30 coordinate points of the Kyzylkum desert in 2020-2025. As a result of the analysis of the results obtained, 19 species and subspecies belonging to 3 subfamilies and 15 genera of the Vespidae family were identified in the region. Of the identified species, the species Polistes nimpha (Christ, 1791) was recorded for the first time in the fauna of Uzbekistan. It was decided to conduct separate studies on the species Dolichovespula sylvestris, which was recorded in the literature and not identified in the studies.*

Key words: *Hymenoptera, Kyzylkum desert, Vespid wasps, Eumeninae, Polistinae, Vespinae, new records.*

Introduction. Within the order Hymenoptera, the family Vespidae is distinguished by its ecomorphological characteristics and complex behavior. The existence of both solitary and gregarious species has attracted a number of researchers [1. 44]. According to the modern taxonomic status of true bees, approximately 5300 species belonging to six subfamilies and 256 genera are currently recognized in the world fauna [16. 226; 2. 181]. Like other families, the Vespid wasps were previously divided into three groups, with changes introduced in their taxonomy. These were divided into subfamilies: Vespidae, Masaridae, and Eumenidae. In modern taxonomy, all of them belong to the true wasp family. The following are considered solitary: Euparagiinae, Masarinae, and Eumeninae. The subfamilies Stenogastrinae, Vespinae, and Polistinae are considered gregarious [16. 221; 4. 20]. A number of studies have been conducted throughout Uzbekistan to study the true bee fauna. In the preliminary research conducted on true bees in Uzbekistan, André documented a mere five species during the years 1881-1886 [1. 35]. A subsequent study, conducted a decade later by Morawitz (1895), documented seven widespread species [20. 446]. In 1926, the scope of Białynicki-Birula's studies was restricted to a mere three species [3. 901].

It is evident that among the species identified, *Ancistrocerus dusmetiolus* and *Leptochilus chorezmicus* are the first to be recorded, and no other researcher has identified these species since that point. In 1970, Giordani Soika provided a comprehensive description of the bioecological characteristics of the *Katamenses sicheliide* species [10. 48]. By 1972, Van Der Vecht and Fischer had recorded the distribution of 28 species in their studies in this area. Davletshina et al. (1979) documented the extensive distribution of two species within the Kyzylkum Desert in Uzbekistan [6. 78]. In 1999, Kulumbetova recorded four species that were considered background species of the biocenosis [15. 66]. In the course of her research, Carpenter collated data on the distribution of 20 species. In 2010, Castro conducted a detailed study of 12 true bees [5. 42]. Of the species under consideration, four – namely Euodynerus dantici, Euodynerus fastidiosus, Euodynerus rufinus and Stenodynerus chitgarensis – have been recorded for the first time in this area. No other records of these species are extant, except for those made by the present author. Gusenleitner recorded 11 species over a period of almost 40 years [13. 98; 14. 132]. In 2012, Oehlke recorded three species: *Eumenes asiaticus, Eumenes pomiformis,* and *Stenancistrocerus transcaspicus* [21. 596]. Antropov et al. (2017) recorded 10 species in this area [2. 181]. Mokrousov, in 2015, provided various data - on 11 bee species [18. 41]. Among the mentioned species, *Ancistrocerus tenellus, Psiliglossa pulchra,* 2 species have not been recorded by any author from this region after the first recorded. Girish Kumar, et al. in 2019 recorded only one species, *Katamenses dimidiatus* [11. 18;]. Among the authors, Fateryga et al (2018, 2024), who studied the true bees of Uzbekistan in detail, studied the largest number of 55 true bee species in 2018 [7. 198; 8. 41; 9. 326]. In the work of the species recorded by

the author, 27 species were introduced for the first time for the fauna of Uzbekistan. In the work on the species recorded by the author, 27 species were introduced for the first time for the fauna of Uzbekistan. Thus, the total number of species identified by all authors consists of 122 species and subspecies [17. 421].

The primary objective of this article is to generate novel faunistic information derived from a meticulous examination of the Vespid fauna of the Kyzylkum Desert, specifically within the Vespidae family.

Materials and Methods

Kyzylkum, one of the largest deserts in the Turanian Plain, is located mainly between the Amu Darya and Syr Darya rivers. Kyzylkum district borders on the Lower Amu Darya district in the northwest, Lower Zarafshan district in the southeast, and Tashkent-Mirzachul district in the east. The southwest of the district coincides with the state border with Turkmenistan, and the northeast with Kazakhstan. Kyzylkum descends from the southeast to the northwest. Its average absolute height is 200-300 m, while in the southeast it drops to 350-400 m, and in the northwest it drops to 90-100 m.

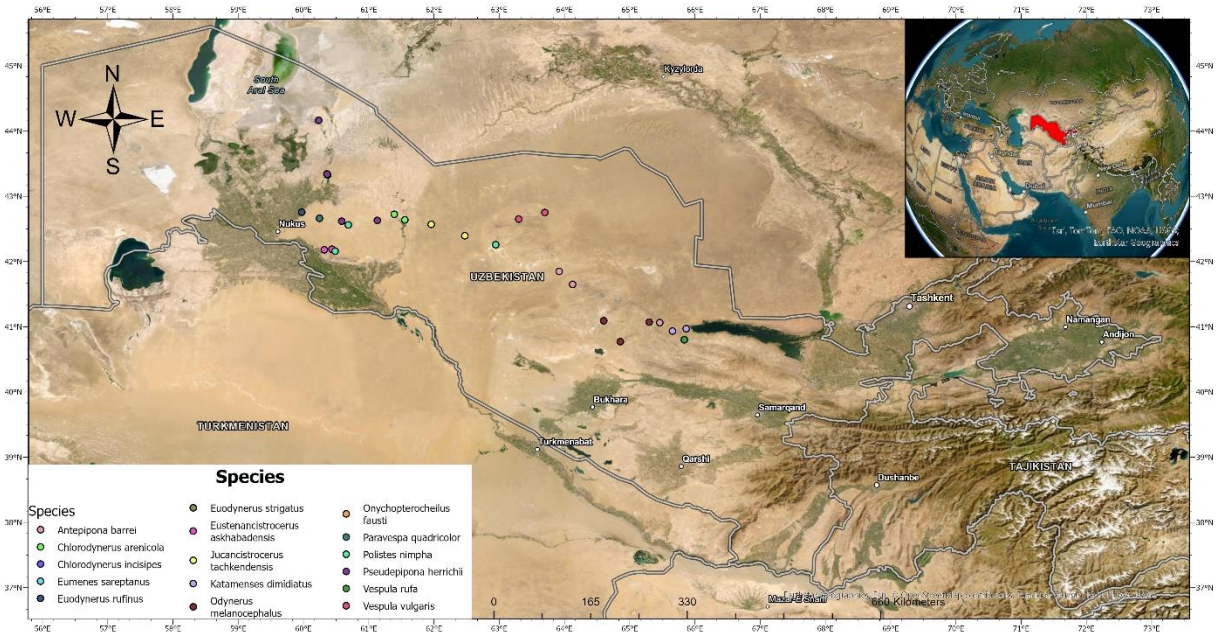


Figure 1. Geographical Map of Sample Collection Points

The Kyzylkum district is not uniform in terms of its topography. There are depressions, plains, flat plateaus and residual mountains. However, most of it is occupied by sandy plains with an absolute height of up to 200 m. Most of the plains are occupied by alluvial spreading sands, mainly eolian relief forms are Sand dunes have a more meridional direction and are reinforced with vegetation. Their relative height is 15-20 m, and sometimes their maximum height reaches 60-70 m. In the central parts of Kyzylkum, there are sand dunes, which are also reinforced. There are relatively few barkhans in Kyzylkum district, they are more often located in populated areas, around wells, on the shores of Amudarya, and their movement is related to human economic activity. The presence of bare soils in the Kyzylkum district is limited, such soils are found in low-lying areas between sand dunes.

Bare soils are covered with water in the spring months, and by the summer the water evaporates, as a result of which they dry out and harden, which leads to cracking.

Our research will be carried out in 2020-2025 from about 40 coordinate points in the natural and anthropogenic areas of the Kyzylkum desert of the Republic of Uzbekistan (Fig.1).



Figure 2. Kyzylkum desert of the Republic of Uzbekistan

When collecting materials, V.B. Golub (2012), V. Moericke (1951) and the traditional method of entomological nets [12. 67; 19. 24], Merrick plastic container, bushes, tree branches, residential and farm buildings, tweezers, a camera, etc. were used (Fig-2).

Biomaterials belonging to about 1000 real bees were collected. The coordinates of the samples were recorded in the Maps.me application and a map was created using the ArGIs Pro program. To identify the species composition of Vespidae bees, comparisons, catalogs and identifiers from the fund collections stored at the Institute of Zoology of the Academy of Sciences of the Republic of Uzbekistan were used. The morphological characteristics of the species were determined using a SMZ-161-TL microscope.

Results

The study of the fauna of the true wasp family was carried out in 2020-2025 in mainly non-irrigated areas of the Kyzylkum Desert, and partially in irrigated areas. As a result of the analysis of the results of the study, 19 species and subspecies belonging to 3 subfamilies and 15 genera of the

Vespidae family were identified (Table 1). The systematic status and faunistcal data of the identified species are presented below.

Vespidae - Family

Eumeninae – subfamily

***Antepipona* de Saussure, 1855 – genus**

1. *Antepipona barrei* (Radoszkowski 1893) – species. Fig. 2.1

Place and time of identification of the species: 1♀, 1♂. (N 63.91868095583991, Y 41.84954692240552), 20.05.2022; 2♀. (N 65.46242527868519 Y 41.06193517140839), 17.05.2022; 1♂. (N 64.12398082604486 Y 41.64898262065053) 18.05.2022; 2♀, 4♂. (N 64.85648752865521 Y 40.77230788664899) 26.06.2023.

Distribution: Armenia, Iran, Afghanistan, Tajikistan, Kazakhstan, Uzbekistan.

***Chlorodynerus* Blüthgen, 1951 genus**

2. *Chlorodynerus arenicola* (Kostylev, 1935) - species. Fig. 2.2.

Place and time of identification of the species: Kyzylkum desert, Karaozek district, Republic of Karakalpakstan 1♀, 1♂. (N 61.39217334518785 E 42.72188305758066), 17.06.2023; 2♀, 3♂. (N 61.55176304318125 Y 42.63875081756731), 17.06.2023; 1♀. (N 60.37323335847554 Y 43.32803431146164), 14.06.2023; 3♀, 3♂. (N 60.24671619137703 Y 42.66406210078632) 14.06.2023.

Distribution: China, Turkmenistan, Kazakhstan, Uzbekistan.

3. *Chlorodynerus incisipes* (Kostylev, 1935) - species. Fig. 2.3.

Place and time of identification of the species: 3♀, 2♂. (N 60.31852503795486, Y 42.18176934814461), 23.05.2024; 1♀, 4♂. (N 60.48316909168007 Y 42.16171245390667) 23.05.2024.

Distribution: Iran, Turkmenistan, Uzbekistan.

***Eumenes* Latreille, 1802 – genus**

4. *Eumenes sareptanus* André, 1884 - species. Fig. 2.4.

Place and time of identification of the species: 1♂. (N 59.97615033632654 Y 42.75565467164781), 23.05.2024; 2♀, 2♂. (N 60.36410266953806 Y 43.33710009351066) 23.05.2024.

Distribution: Western, Southern, and Eastern Europe, Russia (European part, Urals, Western Siberia), Turkey, Turkmenistan, Uzbekistan, Kazakhstan.

***Euodynerus* Dalla Torre, 1904 genus**

5. *Euodynerus strigatus* Radoszkowski 1893 - species. Fig. 2.5.

Place and time of identification of the species: 1♀, 4♂. (N 60.58620397439243 Y 42.61599660383926) 24.05.2022; 2♂. (N 61.13439408150873 Y 42.63137377097146) 24.05.2022; 2♀, 1♂. (N 59.97615033632654 Y 42.75565467164781), 23.05.2024.

Distribution: China, Central Asia, Tajikistan, Kazakhstan, Uzbekistan.

6. *Euodynerus rufinus* Blüthgen, 1942 - species. Fig. 2.6.

Place and time of identification of the species: 1♂. (N 60.58620397439243 Y 42.61599660383926) 24.05.2022; 1♂. (N 61.13439408150873 Y 42.63137377097146) 24.05.2022; 2♀, 3♂. (N 59.97615033632654 Y 42.75565467164781), 23.05.2024.

Distribution: Armenia, Israel, Egypt, Arabia, Iran, Turkmenistan, Mongolia, China, Kazakhstan, Uzbekistan.

***Eustenancistrocerus* Blüthgen, 1938 – genius**

7. *Eustenancistrocerus askhabadensis* (Radoszkowski, 1886) - species. Fig. 2.7.

Place and time of identification of the species: 2♀, 4♂. (N 60.31852503795486, Y 42.18176934814461), 23.05.2024; 1♀, (N 60.43751340573701 Y 42.18856678120513) 23.05.2024; 3♀, 2♂. (N 60.48316909168007 Y 42.16171245390667) 15. 08.2024; 1♀, 1♂. (N 59.97615033632654 Y 42.75565467164781) 17. 08.2024.

Distribution: Russia, Azerbaijan, Turkey, Syria, Jordan, Israel, Iran, Pakistan, Turkmenistan, Uzbekistan, Kazakhstan, Mongolia, China (North-West).

***Jucancistrocerus* Blüthgen, 1938 – genus**

8. ***Jucancistrocerus tachkendensis*** **(Dalla Torre, 1889) - species. Fig. 2.8.**

Place and time of identification of the species: 3♂. (N 61.95803912377802 Y 42.56761944314907), 15.06.2023. 2♀, 1♂. (N 62.47216071039457 Y 42.39620155179878), 24.06.2023.

Distribution: China, Afghanistan, Pakistan, Turkmenistan, Kazakhstan, Uzbekistan.

Katamenes **Meado Waldo, 1910 – genus**

9. ***Katamenses dimidiatus*** **Brulle, 1832 - species. Fig. 2.9.**

Place and time of identification of the species: 1♀, (N 65.83664082470418 Y 40.80121683620003), 17.05.2022; 4♀, (N 65.86463004539483 Y 40.97076299690683), 17.05.2022; 2♀, 2♂. (N 65.65517174796395 Y 40.93413263206056), 27.06.2023.

Distribution: Europe, Russia, Caucasus, Turkey, Cyprus, Syria, Israel, Iran, Mongolia, China, Afghanistan, Pakistan, Central Asia, Kazakhstan.

Odynerus **Latreille, 1802 – genus**

10. ***Odynerus melanocephalus*** **(Gmelin, 1790) - species. Fig. 2.10.**

Place and time of identification of the species: 3♀, 4♂. (N 64.85648752865521 Y 40.77230788664899) 26.06.2023; 1♀, 2♂. (N 65.2997013764403 Y 41.07313827904636) 17.05.2022; 1♀, 2♂. (N 64.60468036467203 Y 41.09033962261461) 17.05.2022.

Distribution: N. Africa, almost all of Europe (except the Perenean Peninsula), the Caucasus, Kazakhstan, Central Asia, South Siberia, Iran, Palestine.

Onychopterocheilus **Bluthgen, 1955 genus**

11. ***Onychopterocheilus fausti*** **(Moravitz, 1873) - species. Fig. 2.11.**

Place and time of identification of the species: 1♀, 1♂. (N 60.37323335847554 Y 43.32803431146164), 27.05.2022; 1♀, 3♂. (N 60.35942556971107 Y 43.34230314197199) 14.06.2023.

Distribution: Central Asia.

Paravespa **Radoszkoowski, 1886 – genus**

12. ***Paravespa quadricolor*** **(Moravitz, 1885) - species. Fig. 2.12.**

Place and time of identification of the species: 3♀, 3♂. (N 60.36724119128425 Y 43.3323281375823), 27.05.2022. 1♀, 2♂. (N 60.24671619137703 Y 42.66406210078632) 14.06.2023.

Distribution: Central Asia, Kazakhstan.

Pseudepipona **Saussure, 1856 – genus**

13. ***Pseudepipona herrichii*** **De Saussure, 1856- species. Fig. 2.13.**

Place and time of identification of the species: 4♀, 6♂. (N 60.36410266953806 Y 43.33710009351066) 23.05.2022; 2♀, 3♂. (N 60.58620397439243 Y 42.61599660383926) 17.06.2023. 2♂. (N 61.13439408150873 Y 42.63137377097146) 24.05.2024.

Distribution: Europe (WE, SE, EE), Russia, North Africa, Caucasus, Turkey, Syria, Mongolia, China, North America, Central Asia, Kazakhstan.

Polistinae – subfamily

Polistes **Latreille, 1802 genus**

14. ***Polistes watti*** **Cameron 1900 - species. Fig. 2.14.**

Place and time of identification of the species: Found in all parts of the Kyzylkum Desert. 127♀, 189♂.

Distribution: Arabian Peninsula, Mauritius, Iraq, Iran, Afghanistan, Pakistan, China, India, Kazakhstan, Tajikistan, Turkmenistan, Uzbekistan.

15. ***Polistes nimpha*** **(Christ, 1791) - species. Fig. 2.**

Place and time of identification of the species: 1♂. (N 60.48316909168007 Y 42.16171245390667) 23.05.2024; 2♂. (N 60.68579847958387 Y 42.56224599066014) 17.06. 23. 1 ♂. (N 62.94612813792256 Y 42.25813227412003.16.06.2023.

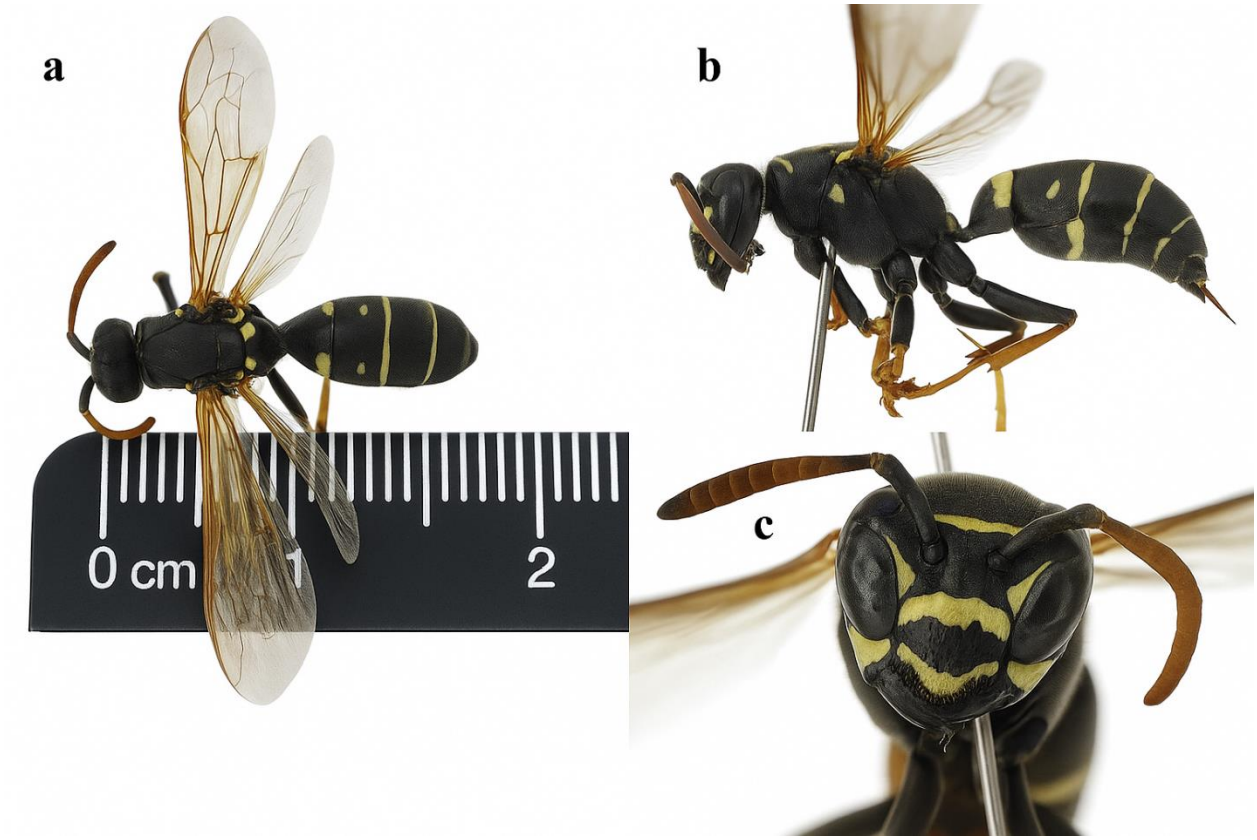


Figure 2. First recorded ♂ *Polistes nimpha* (Christ, 1791) in Uzbekistan. a) Habitus, lateral view; b) Habitus, dorsal view; c); Head, frontal view [Images by D.Musaev and M.Medetov]

The transverse yellow band on the pronotum. It is narrowed dorso-laterally and slightly widened ventrally, with the mesoscutum usually lacking any yellow markings.The scapus is generally dark brown to blackish on the baso-ventral surface. The apical half of the hypopygium is often entirely black or dark brown, occasionally bearing a small yellow spot, and more rarely, the apical quarter may be yellow. Paired yellow spots on the mesoscutum are usually absent, but when present, they are minute or of moderate size. The apical half of the antenna is typically darkened dorsally. Posterolateral yellow bands on the pronotum are usually continuous with the anterior transverse band. The anterior transverse band itself is medio-laterally narrower than at the dorso-lateral margins. Yellow markings on the mesoscutum are sometimes absent.

Distribution: Europe (Western, Northeastern, Southeastern, Eastern Europe), North Africa, Armenia, Israel, Jordan, Georgia, Azerbaijan, Iraq, Russia, Turkey, Iran, Pakistan, Mongolia, Northeastern China, India, Kyrgyzstan, Kazakhstan, *Uzbekistan.

*Recorded for the first time for the fauna of Uzbekistan.

Vespinae – subfamily

***Vespa* Linnaeus, 1758 – genus**

16. *Vespa orientalis* Linnaeus, 1771 - species. Fig. 2.15.

Place and time of identification of the species: Found in all parts of the Kyzylkum Desert. 32♀, 49♂.

Distribution: Europe, North Africa, Arabian Peninsula, Crete and Cyprus, Asia Minor, Middle East, Caucasus, Transcaucasia, Russia, China, Iran, Iraq, Afghanistan, Pakistan, India, Nepal, Ethiopia, USA, Mexico, several European countries, Southeast Asia, Lebanon, Syria, Jordan, Israel, Saudi Arabia, Bahrain, Yemen, Oman, Nepal, Madagascar, Southern Turkey, Armenia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan.

***Dolichovespula* Rohwer, 1916 – genus**

***Vespula* Thomson, 1869 – genus**

17. *Vespula germanica* Fabricius, 1793 - species. Fig. 2.17.

Place and time of identification of the species: 4♀, 6♂. (N 65.01367125668651 Y 40.96225216546127) 17.05.2022; 2♀, 3♂. (N 64.52993572428258 Y 41.23757781529378) 27.06.2023. 2♂. (N 64.34155950794151 Y 42.63137377097146) 19.07.2024.

Distribution: Europe, Russia, Siberia, Altai, Far East, Baikal, Beyond Baikal, North Africa, Israel, Jordan, Lebanon, Iceland, Georgia, Armenia, Turkey, Caucasus, Middle East, Syria, Iran, Iraq, Pakistan, China, Mongolia, Korean Peninsula, North India, South Africa, Australia, Iceland, Tasmania, New Zealand, North and South America, Argentina, Chile, Afghanistan, Kazakhstan, Tajikistan, Turkmenistan, Uzbekistan.

18. *Vespula rufa* Linnaeus, 1758 - species. Fig. 2.18.

Place and time of identification of the species: 1♀, 1♂. (N 65.83664082470418 Y 40.80121683620003) 17.05.2022.

Distribution: Central and Northern Europe, North America, Russia, Caucasus, Sakhalin, Island, Japan, Korean, North China, Mongolia, Iran, Crimea, Turkey, Taiwan, Georgia, Nepal, Kazakhstan, Kyrgyzstan, Turkmenistan, Uzbekistan.

19. *Vespula vulgaris* Linnaeus, 1758 - species. Fig. 2.19.

Place and time of identification of the species: 1♀. (N63.800000 Y42.600000) 9.06.2024; 1♀. 1♂. (N63.500000 Y 42.700000) 9.06.2024; 1♂. (N 63.300000 Y 42.650000)10.06.2024; (N63.900000 Y 42.550000) 10.06.2024; 2♀, 1♂. (N 63.699991 Y42.749992)10.06.2024.

Distribution: Europe, Russia, Turkey, Georgia, Iran, Mongolia, China, Korean Peninsula, Japan, India. Iceland, New Zealand, Australia, Kyrgyzstan, Kazahkstan, Uzbekistan.

The identified species were identified as belonging to 3 subfamilies (Eumeninae, Polistinae, Vespinae) of the Vespidae family. Regarding the distribution among subfamilies, the Eumeninae subfamily is the leader with 13 species (68.4%), the Vespinae subfamily is second with 4 species (21.05%), and the Polistinae subfamily is third with 2 species (10.5%) (Table 1).

Table 1

Species composition of the Vespidae family identified from the Kyzylkum Desert

Family	Subfamily	Genus	Species
Vespidae	Eumeninae	*Antepipona* de Saussure, 1855	*Antepipona barrei* (Radoszkowski 1893)
		Chlorodynerus Blüthgen, 1951	*Chlorodynerus arenicola* (Kostylev, 1935)
			Chlorodynerus incisipes (Kostylev, 1935)
		Eumenes Latreille, 1802	*Eumenes sareptanus* André, 1884
		Euodynerus Dalla Torre, 1904	*Euodynerus strigatus* Radoszkowski 1893
			Euodynerus rufinus Blüthgen, 1942
		Eustenancistrocerus Blüthgen, 1938	*Eustenancistrocerus askhabadensis* (Radoszkowski, 1886)
		Jucancistrocerus Blüthgen, 1938	*Jucancistrocerus tachkendensis* (Dalla Torre, 1889)
		Katamenes Meado Waldo, 1910	*Katamenses dimidiatus* Brulle, 1832
		Odynerus Latreille, 1802	*Odynerus melanocephalus* (Gmelin, 1790)
		Onychopterocheilus Bluthgen, 1955	*Onychopterocheilus fausti* (Moravitz, 1873)
		Paravespa Radoszkoowski, 1886	*Paravespa quadricolor* (Moravitz, 1885)
		Pseudepipona Saussure, 1856	*Pseudepipona herrichii* de Saussure, 1856
	Polistinae	*Polistes* Latreille, 1802	*Polistes watti* Cameron 1900
			Polistes nimpha (Christ, 1791)
	Vespinae	*Vespa* Linnaeus, 1758	*Vespa orientalis* Linnaeus, 1771
		Vespula Thomson, 1869	*Vespula germanica* Fabricius, 1793
			Vespula rufa Linnaeus, 1758
			Vespula vulgaris Linnaeus, 1758
Total:	**3**	**15**	**19**

A study of the species belonging to the genera of the Vespidae family revealed that the most numerous genus, Vespula, comprises three species (15.8%). It is evident that Chlorodynerus, Euodynerus and Polistes each possess two species, representing 10.5% of the total. Antepipona,

Eumenes, Pseudepipona, Jucancistrocerus, Eustenancistrocerus, Katamenes, Odynerus, Onychopterocheilus, Paravespa, Pseudepipona and Vespa have one species each (5.3%).

Discussion. Despite the fact that a number of studies have been conducted on the fauna and species composition of true bees in the areas adjacent to the Kyzylkum Desert in Uzbekistan, the study of true bees in the Kyzylkum Desert region is limited to the data presented by A.G. Davletshina et al (1979). In his research conducted by Davletshina in 1979, he mentioned 3 species: *Vespa orientalis, Dolichovespula sylvestris* and *E. laeri* Red. (unknown), which belong to the genus Eumenes. Of these species, *Dolichovespula sylvestris* was not collected in our research. The species mentioned as belonging to the genus *Eumenes*, we recognize as the widespread species *Eumenes sareptanus* in our research. Of the 19 species identified in our study, 1 species, *Polistes nympha* (Christ, 1791), was recorded for the first time in the fauna of Uzbekistan.Other 16 species, such as *Antepipona barrei, Chlorodynerus arenicola, Ch. incisipes, Euodynerus strigatus, E.rufinus, Eustenancistrocerus askhabadensis, Jucancistrocerus tachkendensis, Katamenses dimidiatus, Odynerus melanocephalus, Onychopterocheilus fausti, Paravespa quadricolor, Pseudepipona herrichii, Polistes watti, Vespula germanica, Vespula rufa, Vespula vulgaris*, were recorded for the first time for the Kyzylkum region. Thus, according to the literature and research results, the true wasps of the Kyzylkum desert in the territory of the Republic of Uzbekistan are 20 species belonging to 3 subfamilies and 16 genera.

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Conclusion. In conclusion, research on the true bee fauna of the Kyzylkum Desert was conducted during 2020-2025. As a result of the analysis of the research results, 19 species and subspecies belonging to 3 subfamilies and 15 genera of the Vespidae family were identified. Of the identified species, the species *Polistes nympha* (Christ, 1791) was recorded for the fauna of Uzbekistan and 16 species for the Kyzylkum region for the first time. The species *Dolichovespula sylvestris*, which was recorded in the literature, was not included in our research, and together with the literature data, the list of true bees of the region was reduced to 20 species.

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Rezyume: *Ushbu maqolada 2020-2025-yillarda Qizilqum cho'lining 30 dan ortiq koordinata nuqtalaridan haqiqiy arilar oilasi faunasining 1000 ga yaqin namunalari o'rganildi. Olingan natijalar tahlili natijasida hududda Vespidae oilasining 3 kenja oila va 15 avlodiga mansub 19 tur va kenja turlari aniqlandi. Aniqlangan turlardan Polistes nimpha* (Christ, 1791) *turi O'zbekiston faunasida birinchi marta qayd etildi. Adabiyotlarda qayd etilgan, ammo tadqiqotlarda aniqlanmagan Dolichovespula sylvestris turi bo'yicha alohida o'rganishlar olib borishga qaror qilindi.*

Резюме: *В данной статье было изучено около 1000 экземпляров фауны семейства настоящих ос из более чем 30 координатных точек пустыни Кызылкум в 2020-2025 годах. В результате анализа полученных результатов в регионе выявлено 19 видов и подвидов, относящихся к 3 подсемействам и 15 родам семейства Vespidae. Из выявленных видов в фауне Узбекистана впервые был зарегистрирован вид Polistes nimpha* (Christ, 1791). *Было решено провести отдельные исследования на вид Dolichovespula sylvestris, который был зафиксирован в литературе и не был идентифицирован в исследованиях.*

Kalit so'zlar: *Hymenoptera, Qizilqum cho'li, Vespidae arilari, Eumeninae, Polistinae, Vespinae, yanga ma'lumotlar.*

Ключевые слова: *Hymenoptera, пустыня Кызылкум, осы-веспиды, Eumeninae, Polistinae, Vespinae, новые находки.*

MATHEMATICAL FOUNDATIONS OF CRYPTOGRAPHY

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Summary: *This paper examines the mathematical foundations of modern cryptographic systems. The focus is on number theory, algebraic structures, and probabilistic methods, which underlie encryption, digital signatures, and key exchange protocols. Key cryptographic algorithms, including RSA, elliptic curves, and discrete logarithm-based algorithms, are discussed, along with their mathematical justification and vulnerabilities.*

Key words: *cryptography, number theory, algebraic structures, modular arithmetic, elliptic curves, RSA, discrete logarithm, digital signature, data confidentiality, information security*

Cryptography is a key discipline of modern information security, ensuring confidentiality, integrity, and authentication of data in digital systems. As computing technologies and global communication networks develop, the demand for reliable methods of data protection continues to grow. All modern cryptographic algorithms rely on strictly defined mathematical constructions and problems that are difficult to solve from the standpoint of computational complexity.

The main objective of cryptography is to create algorithms that allow information to be transmitted securely even in the presence of potential adversarial monitoring. To achieve this, methods from number theory, modular arithmetic, algebraic structures, probabilistic approaches, and information theory are used.

In today's information society, data protection has become one of the key conditions for the secure operation of government institutions, banking systems, corporate networks, and personal communications. With the increasing level of digitalization and network technologies, the number of threats related to unauthorized access, data forgery, and tampering is growing significantly. In these conditions, cryptography acts as a fundamental field that ensures confidentiality, integrity, and authenticity of information.

Cryptographic methods are based on strict mathematical models and computational algorithms. The foundations of modern cryptography are rooted in number theory, abstract algebra, probability theory, and discrete mathematics. It is precisely the existence of mathematically complex or computationally infeasible inverse problems that ensures the stability of cryptosystems and renders direct computational attacks impractical.

Historically, cryptography long predates computers. Its initial purpose was to protect communication in state and military correspondence. Early ciphers were based on simple substitution and permutation methods, such as the Caesar cipher.

With the development of computing, cryptography acquired a rigorous mathematical basis, and the security of information began to be evaluated in terms of computational complexity. Today, cryptography is used in banking systems, e-commerce, digital documentation, and many other fields.

Modern cryptography relies on fundamental mathematical concepts, among which number theory, abstract algebra, and computational complexity theory play a key role. These fields form the basis for constructing one-way functions, encryption algorithms, and key distribution protocols. As noted by W. Stallings, mathematical rigor makes it possible to formally prove cryptographic strength rather than rely on heuristic assumptions [1].

One of the fundamental concepts of modern cryptography is the one-way function — a mapping that is easy to compute but hard to invert when only the output is known [2]. An example of such a function is the RSA system, which relies on the computational difficulty of factoring large composite numbers. The security of RSA is based on the infeasibility of factoring the product of two large primes in reasonable time [3].

Another key area is cryptography based on the discrete logarithm problem. The Diffie–Hellman protocol shows that two users can securely agree on a shared key over an open communication channel if an adversary cannot solve the discrete logarithm problem in the chosen

group [4]. This approach is widely used in modern TLS protocols and secure network communications.

In recent decades, elliptic curve cryptography has seen significant development. Cryptosystems based on elliptic curves provide comparable security with much shorter key lengths, making them particularly effective for high-performance and mobile computing systems [5]. While RSA typically requires keys of 2048 bits or more, ECC ensures equivalent security with keys of about 256 bits.

Thus, the mathematical foundations of cryptography determine both the structure of cryptographic algorithms and the criteria for their resistance. The development of new technologies, including quantum computing, necessitates further improvement of mathematical methods and the search for new problems whose difficulty will remain resilient to quantum attacks [1; 5]. Therefore, studying the theoretical foundations of cryptography is an essential condition for ensuring long-term information security.

To effectively apply cryptography (both to implement secure cryptographic tools and to analyze their resistance), it is necessary to develop efficient methods and algorithms for:

• primality testing;

• searching for large prime numbers (typically numbers with more than 80–90 decimal digits are used);

• integer factorization.

Factorization is the decomposition of a natural number into prime factors. This problem has high computational complexity. One of the most widely used public-key methods, RSA, is based on the hardness of factoring large integers.

The challenge posed to the mathematical community by the creators of RSA led to the development of the fastest known factorization methods in the 1980s and 1990s:

• Lenstra's elliptic curve method (1987);

• Pollard's number field sieve (1993);

• Pomerance's quadratic sieve (1996).

Currently, research in fast factorization algorithms continues intensively worldwide.

It should be noted that computer progress has both technological and algorithmic aspects. Even with the best computing equipment, without modern algorithms we would not be able to factor numbers longer than 40 digits.

Number theory plays a key role in cryptography, especially in public-key algorithms.

Prime numbers are used for key generation.

Euler's totient function φ(n) determines the number of integers that are relatively prime to *n*.

Integer factorization refers to the problem of recovering the prime factors of a composite number.

In the RSA algorithm, two large prime numbers p and q are used. Their product $n = p \cdot q$ serves as a public parameter, but factoring n back into p and q is extremely difficult when the numbers are large, which ensures the security of RSA.

Number theory is a fundamental mathematical basis of modern cryptography, especially public-key cryptosystems. It studies the properties of integers and operations on them, as well as problems whose computational complexity determines the security of cryptographic algorithms.

One of the key concepts is the prime number — a natural number that has exactly two divisors: 1 and itself. In cryptographic algorithms, extremely large prime numbers (512, 1024, 2048 bits or more) are used, since operations with them can be performed efficiently, while the inverse problems turn out to be extremely difficult.

An important role is played by Euler's totient function φ (n), which determines the number of integers that are relatively prime to *n*. For the product of two prime numbers p and q, the value of the function is:

$$\varphi(p\ q) = (p-1)\ (q-1).$$

This property is used in constructing the private key in the RSA algorithm.

Factorization as the Basis of Cryptographic Security

The security of many cryptosystems is based on the difficulty of factoring a large composite number into its prime components. For example:

$$n = p \cdot q,$$

where p and q are large prime numbers.

If p and q are known, computing the private key is straightforward.

However, if only n is known, determining p and q is practically infeasible with current computational capabilities.

Example:

If the number n has a length of **2048 bits,** brute-force factorization would require millions of years, even on modern supercomputers.

The Discrete Logarithm Problem

Another important problem in number theory is the discrete logarithm problem, which is formulated as:

$$a^x \equiv b \pmod{n}.$$

The goal is to determine x, given a, b, and n.

For sufficiently large n, this problem becomes computationally difficult, making it the basis for the security of many cryptographic protocols.

It is required to find **x**, given **a**, **b**, and **n**.
For large values of **n**, this problem becomes computationally difficult.
The Diffie–Hellman algorithm and elliptic curve cryptography are based on this principle.

Modular arithmetic plays an important role in cryptography, as most cryptographic operations are performed within finite numerical systems. The main idea is that numbers are considered not on an infinite number line, but within a limited range in which values repeat cyclically. This approach ensures mathematical rigor and stability of cryptographic computations.

Two integers **a** and **b** are said to be congruent modulo **n** if they give the same remainder when divided by **n**:

$$a \equiv b \pmod{n}.$$

For example:

$$17 \equiv 2 \pmod{5},$$

since:

$$17 = 5 \cdot 3 + 2.$$

Modular Arithmetic Operations

All standard arithmetic operations—addition, subtraction, and multiplication - are correctly transferred into the modular system:

$(a + b) \bmod n = (a \bmod n + b \bmod n) \bmod n,$

$(a \cdot b) \bmod n = (a \bmod n \cdot b \bmod n) \bmod n.$

This allows computations with very large numbers without exceeding the permissible range of values, which makes modular arithmetic convenient for use in digital systems.

One of the most important and frequently used operations is modular exponentiation:

$$c = a^k \bmod n.$$

For large values of k, this operation is performed using the fast exponentiation algorithm, which significantly reduces computational costs.

While computing the result of exponentiation modulo n is relatively easy, the inverse operation - finding the exponent - is known as the discrete logarithm problem, which is computationally difficult. This property ensures the security of many cryptographic protocols.

For example:

$$a^x \equiv b \pmod{n}$$

Finding x for large values of a, b, and n is practically impossible with current computational resources.

Thus, modular arithmetic is a fundamental basis of cryptography, as it allows the construction of algorithms that are easy to compute in one direction but are practically impossible to reverse.

One-way functions play a key role in cryptography because they enable transformations that are easy to perform in the forward direction, yet extremely difficult to invert. This means that given the input data and the computation algorithm, the result can be obtained efficiently, but recovering the original input from the result without additional information is extremely difficult.

A one-way function is a function that is easy to compute but very hard to invert.

Example of a one-way function:

$$f(x) = x^e \bmod n.$$

When x, e, and n are known, computing $f(x)$ is straightforward. However, performing the inverse operation is directly related to the factorization of n, which is a computationally difficult problem.

One-way functions form the foundation of:

• public-key encryption algorithms (for example, RSA),

• key exchange protocols (such as Diffie–Hellman),

• digital signatures and data authentication mechanisms.

Hash functions are special types of one-way functions that transform input data of arbitrary length into a fixed-length bit sequence called a hash or hash value.

Notation:

$$h = H(M),$$

where M is the message, H is the hash function, and h is the resulting hash code.

Modern cryptography is based on mathematically grounded algorithms that ensure the protection of information during transmission and storage. These methods can be divided into two major categories: symmetric and asymmetric cryptosystems. In addition, key exchange protocols and elliptic curve cryptography play an important role.

Symmetric cryptosystems use the same key for both encryption and decryption (for example, AES).

Asymmetric cryptosystems use a pair of keys - a public key and a private key (for example, RSA).

The Diffie–Hellman protocol enables secure key exchange, and elliptic curve cryptography (ECC) provides a high level of security with significantly shorter key lengths.

In symmetric cryptography, the same key is used to encrypt and decrypt data. This type of encryption is characterized by high processing speed and is used in systems where large volumes of data must be encrypted.

The most widely used symmetric algorithm is AES (Advanced Encryption Standard). Key characteristics of AES include:

• a block cipher with a block size of 128 bits;

• key lengths of 128, 192, or 256 bits;

• operations performed over the finite field $GF(2^8)$

AES is used in banking systems, wireless networks, HTTPS protocols, and modern messaging applications.

In asymmetric cryptosystems, a pair of keys is used:

• the public key, which is available to all users;

• the private key, which must be kept confidential.

Encryption is performed using the public key, while decryption is carried out using the private key. This approach ensures a high level of security when transmitting data over open communication channels.

The most well-known algorithm is RSA. Its security is based on the difficulty of factoring a large number $n = p \cdot q$, where p and q are large prime numbers. RSA is widely used for digital signatures and for securing network connections (TLS/SSL).

The Diffie–Hellman protocol is designed to securely establish a shared secret key between two users. The key itself is not transmitted over the network. The security of the protocol relies on the computational difficulty of solving the discrete logarithm problem.

Diffie–Hellman is used in VPN, SSH, and in messaging applications with end-to-end encryption (for example, Signal and Telegram Secret Chat).

Elliptic curve cryptography (ECC) provides the same level of cryptographic security as RSA, but with a much shorter key length, making it more efficient for modern systems, especially mobile and embedded devices.

Algorithm	**Key Length**	**Security Level**
RSA	2048 bits	high
ECC	256 bits	equally high

Thanks to the compact key sizes, ECC (Elliptic Curve Cryptography) is particularly effective in mobile devices, blockchain systems, and digital signature schemes (such as ECDSA and ECDH).

The development of computing technologies makes the use of modern cryptographic algorithms a necessary condition for protecting information. Symmetric ciphers provide high processing speed, asymmetric systems ensure secure key exchange, Diffie–Hellman protocols provide a trusted communication channel, and elliptic curves offer strong security while minimizing computational resource usage.

Cryptography is a critically important tool for information protection. Based on mathematical principles, it allows data to be securely protected even under conditions of increasing computational power and emerging cyber threats. In the future, the evolution of cryptography will be closely linked to the need to counter quantum computing and develop new algorithms resistant to quantum attacks.

A deep professional understanding of cryptographic algorithms, as well as their evaluation in terms of security, efficiency, and potential vulnerabilities, requires a solid mathematical foundation. This is because modern cryptography relies on fundamental results from fields such as computational complexity theory, number theory, abstract algebra, and other related areas. The material presented contains key concepts from number theory and algebra that form the basis for learning the principles and methods of modern cryptography.

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Rezyume: *Ushbu maqolada zamonaviy kriptografik tizimlarning matematik asoslari ko‘rib chiqilgan. Asosiy e’tibor sonlar nazariyasi, algebraik tuzilmalar va ehtimollik usullariga qaratilgan bo‘lib, ular shifrlash, raqamli imzo va kalitlar almashinuvi protokollarining asosini tashkil etadi. Maqolada RSA, elliptik egri chiziqlarga asoslangan usullar va diskret logarifm masalasi bilan bog‘liq algoritmlar kabi asosiy kriptografik mexanizmlar, shuningdek ularning matematik asoslari va ehtimoliy zaifliklari tahlil qilingan.*

Резюме: *В данной работе рассматриваются математические основы современных криптографических систем. Основное внимание уделяется теории чисел, алгебраическим структурам и вероятностным методам, лежащим в основе алгоритмов шифрования, цифровых подписей и протоколов обмена ключами. Обсуждаются ключевые криптографические алгоритмы, включая RSA, эллиптические кривые и алгоритмы, основанные на задаче дискретного логарифма, а также их математическое обоснование и возможные уязвимости.*

Kalit so‘zlar: *kriptografiya, sonlar nazariyasi, algebraik tuzilmalar, modul arifmetikasi, elliptik egri chiziqlar, RSA, diskret logarifm, raqamli imzo, ma’lumotlarning maxfiyligi, axborot xavfsizligi*

Ключевые слова: *криптография, теория чисел, алгебраические структуры, модульная арифметика, эллиптические кривые, RSA, дискретный логарифм, цифровая подпись, конфиденциальность данных, безопасность информации*

"THE OTHER SIDE" OF IRRIGATION: THE BIOACCUMULATION OF POLLUTIONS IN THE SUDOCHYE AND JULTURBAS LAKES AS A RISK FACTOR FOR THE ECOSYSTEM

Xojamuratova R.T, Kalenderova K.T.

Summary: *In the context of intensive irrigation work and the growth of collector-drainage runoff in the Southern Aral Sea region, an increase in the inflow of pollutants into surface water bodies is observed. The Sudochye and Julturbas lakes, which are important elements of the Amu Darya delta's hydro-ecological system, experience increased anthropogenic load due to the accumulation of biogenic elements, heavy metals, and salts entering with irrigation and drainage water. The work examines the mechanisms of bioaccumulation of pollutants in hydrobionts and bottom sediments, and analyzes the ecosystem consequences of this process. It has been shown that the long-term increase in mineralization, concentrations of chlorides, sulfates, cadmium, lead, and zinc forms sustainable ecological hazard zones, reduces biodiversity, disrupts food chains, and threatens the reproduction of fish resources. Based on the analysis of the data, recommendations are proposed for minimizing the negative impact of irrigation flows and improving hydro-ecological monitoring.*

Key words: *irrigation; collector-drainage waters; bioaccumulation; heavy metals; mineralization; pollution; Lake Sudochye; Lake Julturbas; hydro-ecology; Southern Aral Sea region; ecosystem risks; environmental sustainability.*

The tragedy of the disappearance of the Aral Sea is one of the most convincing and vital arguments against the unbalanced and unsustainable actions of the human race, which were so numerous during the second half of the 20th century, both constructive and simultaneously destructive. During this half-century period, humanity not only reached unprecedented heights in technological development but also caused more damage to nature than ever before. This predatory violence against the planet was caused by the rapid technological revolution, which was declared a turning point in human history at one time. This continued until the best minds discovered that there were very serious consequences behind its facade.

Humanity's ambitious aspiration has caused almost all global climatic, hydrological, and geological changes (and not only in former socialist countries), which manifested in the greenhouse effect, the loss of rivers, lakes, and wetlands, and the widespread desertification. Today, the people and governments of countries like Canada, Holland, Switzerland, and Japan, which are setting an example for all humanity in how to restore their relationship with nature, should receive recognition and respect. This is evident in how urbanization is combined with the protection of fauna, flora, and landscapes based on the harmonization of conflicting interests such as economic development, demographic growth, and even increasing natural potential in this process. The awareness of humanity's partnership with nature, based on deep respect for it and pride in natural resources, is instilled from childhood and derived from understanding its essence.

With a wonderful and truly caring attitude that inspires French, Swiss, and Dutch specialists, managers, and representatives of public organizations in their struggle for Granting nature its rights in harmony with the needs of development.

The revival of the Rhône vet lands on the Mediterranean coast, the restoration of the salmon population as a result of the clearing of the Rhône, the presence of a huge number of polders, their The beautiful grandeur combined with natural protected areas in Holland, Switzerland's protected landscapes around Zurich and Lucerne are just a few inspiring examples that we all must follow (Science for Peace Project, Tashkent -2003).

The drying up of the Aral Sea, formerly a vast body of water with good water quality, has reached such a level that the widespread nature degradation within the drying zone (below 53 m), as well as beyond it, has led to a situation where the region is now characterized as a disaster area. The sea, which served as a source of rich flora and fauna and a natural regulator for the adjacent irrigated

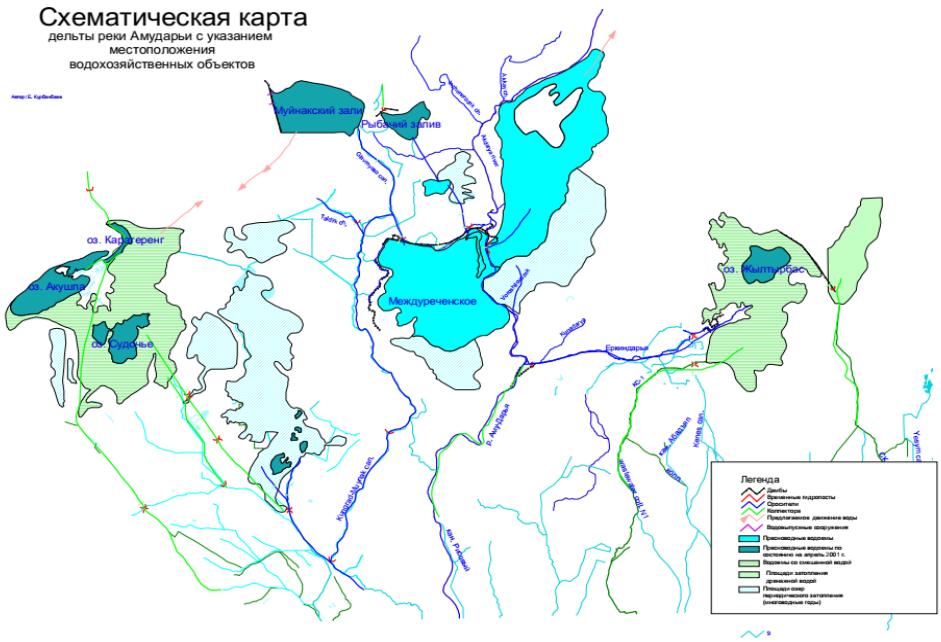
area, is in such a state of decline that a desertification zone is formed, located between the Kyzylkum, Karakum, and Ustyurt deserts. Seas have appeared on the former bottom vast salt marshes, heavily saline lands, foci of salt-dust outcrops.

In the coastal zone (above 53 m), the ecosystem of the delta and coastal strip, formed over many centuries, was completely destroyed, lakes dried up, water mineralization increased, salt marshes appeared in the place of dried-up swamps, fishing and fur-bearing animals decreased significantly, migratory birds disappeared, flora and fauna are declining, and the local climate underwent changes. The Aral Sea ecological crisis, caused by the large-scale and unregulated seizure of river runoff for irrigation in Central Asia since the 1960s, remains one of the most acute global problems. The catastrophic drop in sea level led to its splitting into isolated bodies of water, the drainage of vast territories, and the formation of the Aralkum salt desert.

Before the crisis began, the landscape of the Southern Aral Sea region was a different picture. The Amu Darya River delta was formed under the influence of long-term natural fluctuations in river flow, resulting in the formation of a unique delta landscape and its hydrological and hydrogeological profile with numerous reservoirs under the influence of various processes of marine, river nature, and erosion dynamics. Thus, the natural stability and biodiversity of the delta were entirely dependent on the full flow of the river and periodic floods. The sharp and large-scale decrease in river water inflow due to irrigation boom disrupted this natural connection, leading to the disappearance of most bodies of water and critical salinization of the remaining ones (Sudochye, Julturbas), completely changing their hydrological regime.

Amudarya's flow, under the influence of river regulation by reservoirs (Nurek, Baypaza, Tuyamuyun), combined with several large intra-system reservoirs on the Amubuhar, Karakum, and Karshi canals, received some (78... 81%) and the degree of regulation, which significantly changed the hydrological regime of the lower reaches of the river. The development of irrigation in the Amu Darya basin and, accordingly, the increase in the volume of irreversible water intake led to a sharp decrease in water inflow into the delta. Due to insufficient provision of optimal water-salt exchange in delta lakes . The quality of water and, accordingly, the overall ecological situation began to deteriorate. The retreat of the sea and the loss of natural connection with its bays led to the disappearance of the delta's marine nutrition and its complete dependence on the regime of water inflow from the river.

As a result of the constant decrease in this inflow since 1960, lakes began to play the role of natural evaporators, sharply reducing the volume of water in them and, consequently, increasing its mineralization. The main factor of the hydrological state of the delta is the inflow of water through. Amudarya river and less significant, but still important - the inflow of water through collectors feeding some lakes in mixed with fresh water or independently. The characteristic of river flow variability is given by the river water hydrograph in the Samanbay channel (the end hydro post on the river at the mouth of the modern delta), which fluctuated over a 22-year period from 330 million m3 per year (1982) to 24 million 272 million m3 per year in 1992 (Figure 3-1).



Accordingly, the area of water bodies, their biological and economic productivity, changed. Currently, all existing water bodies in the Amu Darya delta can be divided into 2 parts according to their feeding regime (Figure 1).

a) lakes existing on collector-drainage waters (Sudochye, Western Karateren, Akushpa, Eastern Karateren, partly Julturbas, etc.);

b) lakes fed by the Amu Darya River (Mezhdurechensk , Dautkul, Ribache, Muynak, Dumalak, etc.)

In high-water years, these lakes were almost completely drained by abundant river runoff, acquiring the properties of flowing bodies of water. During periods of reduced freshwater inflow during low-water periods, these lakes were partially flooded by seawater, resulting in a sharp change in the physical and chemical properties of the water, corresponding changes in their flora and fauna and biological productivity.

In this context, the delta lake systems of the Southern Aral Sea region, which include Sudochye and Julturbas (located in the territory of Karakalpakstan, Uzbekistan), have acquired critical importance. They are the last large reservoirs preserved in the Amu Darya delta, playing the role of a natural biological reserve and a key link in the global migration of waterfowl (Sudochye Lake has the status of Ramsar land). For many decades, the Karateren, Akchakul, Sudochye, and Kokchiel lakes have been used as water intakes for wastewater and drainage water from irrigated lands. In the near future, if fresh water supply is not restored, these lakes will not be able to be used for fish farming purposes, and the reeds for livestock farming at all. The flow through the left-bank and right-bank collector system is mainly determined by water availability and water supply for irrigation of lands under the jurisdiction of the Suenli and Kizketkent canals.

During the catastrophic low-water period of 2000-2001, collector runoff almost ceased (Figure 1). According to the hydrograph's fluctuations, the water mineralization in the collectors varies - from 1.8 g/l in high-water years to 6 g/l in low-water years, with an average mineralization of 2.2 g/l for the Ustyurt collector and 3.8 g/l for the KKS collector. According to the nature of water supply and the quality of water used, the territory of the Amu Darya River delta can be divided into 3 zones:

1. The left bank is the system of the Lenin Canal, the CLC Collector, the Sudoche Lake, and the Adjibay Bay.

2. The Amudarya is an ocean and inland delta lake fed by the Amu Darya and large irrigation canals.

3. Right-bank zone - the Kyzketken canal system, the KS-1, KS-3, KS-4 collectors on Lake Karateren.

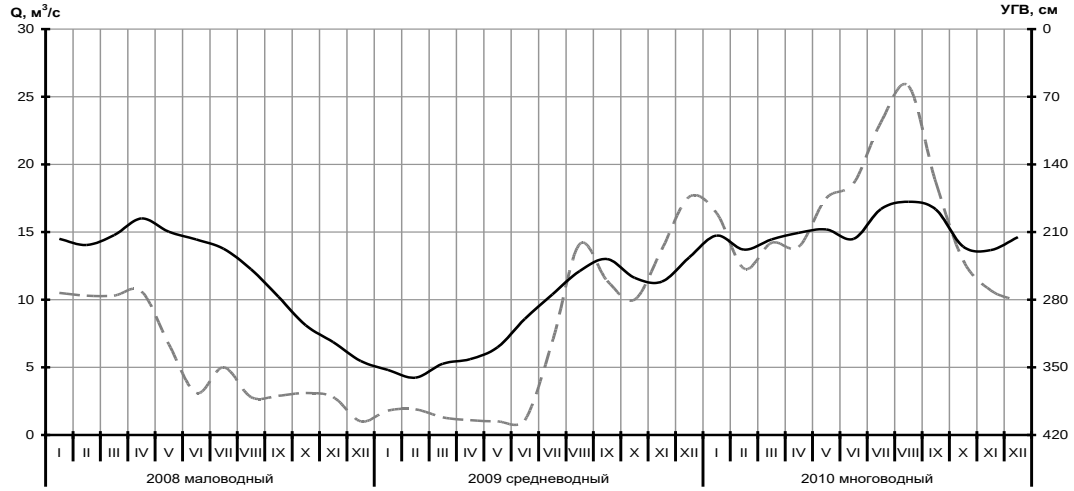


Figure 1. - Schedule of water flow fluctuations in the KS-1 and UGV collector for the characteristic years

According to the nature of water exchange, the water bodies of the Aral Sea region are divided into flowing - the Inter-River Reservoir and Lake Makpalkol, weakly (periodically) flowing lakes Karateren, Bolshoye Sudochye, Begdulla Aydin, Mashankol, Khojakol and Ilmenkol, Bays of Ribachiy, Muynak and Julturbas, and non-flowing collector water accumulators - lakes Akushpa and Tayla. With the decrease or complete cessation of the Amu Darya's natural flow into these bodies of water, their existence became entirely dependent on collector-drainage water (CDW) discharged from irrigated agricultural lands.

CDPs act as an artificial source of nutrition, preventing lakes from drying up completely and preserving their area. This artificial water regime allowed for local stabilization of the hydrological situation. However, the "rescue" waters return from the fields having been chemically transformed. They contain a high concentration of dissolved salts (which contribute to salinization) and a significant amount of agrochemicals (pesticides, fertilizer residues), as well as heavy metals.

Thus, the Sudochye and Julturbas lakes turned into hydrochemical traps. In them, a continuous accumulation of pollutants occurs, which, having no exit, concentrate in water and bottom sediments.

Conclusion

The analysis showed that the irrigation processes ensuring the development of the region's agriculture have a hidden negative effect in the form of a stable accumulation of pollutants in lake ecosystems. The Sudochye and Julturbas lakes function as natural accumulators of salts, biogens, and heavy metals, leading to long-term transformation of their hydrochemical composition and deterioration of the ecological situation. The bioaccumulation of toxic elements in algae, mollusks, and fish poses a high risk for the stability of food chains and biodiversity, increases the likelihood of aquatic ecosystem degradation, and reduces their productive potential. To stabilize the situation, it is necessary to improve the system of monitoring collector-drainage waters, implement technologies for their preliminary treatment, and optimize water use regimes. A comprehensive approach will reduce the anthropogenic load and ensure the preservation of the natural functions of lakes in the South Aral Sea region.

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Rezyume: *Janubiy Orolbo‘yi mintaqasida intensiv sug‘orish ishlari va kollektor-zovur oqimining o‘sishi sharoitida yuza suv havzalariga ifloslantiruvchi moddalar oqimining ko‘payishi kuzatilmoqda. Amudaryoning deltasi gidroekologik tizimining muhim qismlari hisoblangan Sudoche va Julturbas ko‘llariga sug‘orish va zovur suvlari bilan keladigan biogen elementlar, og‘ir metallar va tuzlarning to‘planishi tufayli antropogen yuk ortmoqda. Tadqiqotda gidrobiontlar va tub cho‘kindilarida ifloslantiruvchi moddalarning bioakkumulyatsiya mexanizmlari o‘rganilgan hamda bu jarayonning ekotizimga ta’siri tahlil qilingan. Mineralizatsiya darajasi, xloridlar, sulfatlar, kadmiy, qo‘rg‘oshin va rux konsentratsiyalarining uzoq muddat davomida ortib borishi barqaror ekologik xavf zonalarini yuzaga keltirishi, biologik xilma-xillikni kamaytirishi, oziq zanjirlarini buzishi va baliq resurslarining ko‘payishiga tahdid solishi aniqlangan. Ma’lumotlar tahlili asosida sug‘orish oqimlarining salbiy ta’sirini kamaytirish va gidroekologik monitoringni takomillashtirish bo‘yicha tavsiyalar ishlab chiqilgan.*

Резюме: *В условиях интенсивных ирригационных работ и роста коллекторно-дренажного стока в Южном Приаралье наблюдается увеличение притока загрязняющих веществ в поверхностные водные объекты. Озера Судочье и Джултурбас, являющиеся важными элементами гидроэкологической системы дельты Амударьи, испытывают повышенную антропогенную нагрузку из-за накопления биогенных элементов, тяжелых металлов и солей, поступающих с оросительными и дренажными водами. В работе рассмотрены механизмы биоаккумуляции загрязняющих веществ в гидробионтах и донных отложениях, проанализированы экосистемные последствия этого процесса. Показано, что долговременное повышение минерализации, концентрации хлоридов, сульфатов, кадмия, свинца и цинка формирует устойчивые экологически опасные зоны, сокращает биоразнообразие, нарушает пищевые цепи и угрожает воспроизводству рыбных ресурсов. На основе анализа данных предложены рекомендации по минимизации негативного воздействия ирригационных стоков и совершенствованию гидроэкологического мониторинга.*

Kalit so‘zlar: *sug‘orish; kollektor-zovur suvlari; bioakkumulyatsiya; og‘ir metallar; mineralizatsiya; ifloslanish; Sudoche ko‘li; Julturbas ko‘li; gidroekologiya; Janubiy Orolbo‘yi mintaqasi; ekotizim xavflari; ekologik barqarorlik.*

Ключевые слова: *ирригация; коллекторно-дренажные воды; биоаккумуляция; тяжелые металлы; минерализация; загрязнение; озеро Судочье; озеро Джултурбас; гидроэкология; Южное Приаралье; экосистемные риски; экологическая устойчивость. озеро Джултурбас; гидроэкология;*

UDC 595.72:591.4:574(86)

MORPHOBIOLOGY AND ECOLOGY OF THE SPECIES *XYA VARIEGATA* (LATREILLE 1809), DISTRIBUTED IN THE HUMID SANDS OF THE BLACK RIVER IN EASTERN UZBEKISTAN

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Summary: *This article examines the distribution characteristics, morphology, biology, ecology, feeding habits, population density, and factors affecting the living conditions of the orthopteran insect species Xya variegata, which is found in the moist sandy areas along the Black River in Eastern Uzbekistan.*

Key words: *Insecta, Xya variegata, species, population, entomophage, nature, biotope, biogeocenosis, biology, ecology, forest, water, eremobiont.*

Introduction. Orthopteran insects are adapted to living in various biotopes in nature and are very widespread on Earth. They are considered one of the living components of the biogeocenosis and are of great importance in the food chain and the national economy. Because a number of species of orthopteran insects severely damage agricultural crops and grass in pastures, they are also valuable food for other animals, most invertebrates and vertebrates. Even representatives of the Tettigonidae family are considered beneficial entomophages. However, recent land reclamation, deforestation, drainage of swamps, and disruption of the water regime have led to a reduction in the ecological habitat of many animals, including orthopteran insects [2. 97; 5. 38; 6. 18; 7. 204].

Research materials and methods. Materials for the study of the *Xya variegata* species were collected in the Fergana Valley during the spring, summer, and autumn seasons from 2018 to 2025. During the research, a total of about 1000 populations were collected from the studied area, and its bioecology was studied. Standard entomological methods were used in the collection of materials [1. 67]. The "Saranch of Kazakhstan, Central Asia and adjacent territories" identifier was used to determine the collected insect species [4. 264].

Research results. Based on ecological data recorded in literary (Childebayev, 2013) and scientific (Bekuzin, 1968) sources, we found *Xya variegata* in a damp sandy area on the banks of the Black River at the junction of the Namangan region with the Andijan region (Baliqchi district) (07.07.2018).N40055.097'E 071049.801') Using general entomological methods [1.67], we captured approximately 120-150 individuals of this species through an entomological trap for 1 hour. Population density is very high during the summer season. This species' systematic position is as follows:

Kingdom of Animals
Type - Arthropods
Class - Nasekomas
Group - Orthoptera
Small group - Short-winged Orthoptera
Family - Triperts
Generation - Xya
Species - *Xya variegata* (Latreille 1809)

Biology. On riverbanks, in sandy areas close to water, they undertake a secret life by digging in the sand, creating small holes with the help of their forelegs and jaws. It is very mobile on an open substrate and quickly moves from one place to another in humid areas of sand.

A total of about 100 species are known in tropical and subtropical regions and are very widespread [2. 97; 7. 204]. In appearance, it resembles a small bear. The body is small, somewhat flattened, the head has a flat bump, the crown and forehead are fused, and the mouthparts are extended forward.

A large amount of viscous fluid is secreted from the outer side of the body. Their legs are short. Their front legs are strong, and they dig in the sand with their thick and short claws, deafening their ears. They have claws on all their legs. The thighs of their hind legs are thickened, the lower legs are thinned, and the heels resemble a spear when they are folded. The hind legs, from the lower leg towards the tip of the foot, are tubular in shape, resembling the body of a cyclops (glass-shaped), and they jump smoothly and forcefully through the hind legs. The abdomen of males and females consists of 9-10 tergits [2. 97; 7. 204].

Body color is black, shiny, 4-7 mm long (Picture-1). Males and females are very similar in appearance, but females are slightly larger.



Picture-1. *Xya variegata* (Latreille 1809), original image taken under a microscope.

Xya variegate do not have vocal and auditory organs [3. 308]. Trembling signals have been detected in males on the substrate surface, and they are directly related to each other. No signals were detected in the females.

Males emit signals very close to females in two ways: by striking and rubbing. Vocal kicks of the hind legs along the substrate are observed in males when approaching females. Such signals are transmitted by males to females with a duration of 30-51 seconds, ranging from 3 to 12 beats.

In relation to water, larvae of various sizes train their larvae to swim well. Mating occurs in summer, with adults (imago) and larvae wintering.

Nutrition. A predatory insect that feeds on small insects and earthworms [7. 204].

Ecology. Based on their lifestyle, they can be considered eremobionts (related to the moist soil surface in open areas). This species is under minor threat, even hiding during heavy rainfall. Furthermore, the declining water regime in our region is significantly impacting the habitat and population of this species.

Conclusion. Considering that the Xya *variegata* lives in a humid sandy environment along rivers and lakes, as water resources are dwindling in our Republic today, protecting and preserving the dwindling animal species is of great importance.

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Rezyume: *Ushbu maqolada Sharqiy O‘zbekistondagi qora daryoning nam qumliklarida tarqalgan to‘g‘riqanotli hasharotlardan Xya variegata turining o‘rganilgan hududda tarqalish xususiyati, morfologiyasi, biologiyasi, ekologiyasi, oziqlanishi, populyatsiya zichligi va uning yashash sharoitiga ta’sir etayotgan omillar o‘rganilgan.*

Резюме: *В данной статье рассматриваются особенности распространения, морфология, биология, экология, питание, плотность популяции и факторы, влияющие на условия жизни прямокрылых насекомых Xya variegata, который встречается во влажных песчаных районах вдоль реки Кара в Восточном Узбекистане.*

Kalit so‘zlar: *Hasharot, Xya variegata, tur, populyatsiya, entomofag, tabiat, biotop, biogeotsenoz, biologiya, ekologiya, o‘rmon, suv, eremobiont.*

Ключевые слова: *Насекома, Xya variegata, вид, популяция, энтомофаг, природа, биотоп, биогеоценоз, биология, экология, лес, вода, эремобионт.*

UDC: 549.678.

INVESTIGATION OF THE PHYSICOCHEMICAL PROPERTIES AND MINERAL COMPOSITION OF KOSON BENTONITE

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Summary: *This study investigates the physicochemical and mineralogical properties of bentonite from the Koson deposit using XRF, XRD, and FTIR analytical techniques. The XRF results indicate that the sample is dominated by SiO_2 (54.88%) and Al_2O_3 (14.71%), confirming its aluminosilicate nature, while minor oxides such as Fe_2O_3, MgO, CaO, Na_2O, and K_2O reflect the presence of accessory minerals and exchangeable cations. The XRD analysis reveals that montmorillonite is the primary crystalline phase, accompanied by quartz, illite, and small amounts of other silicate and carbonate minerals. FTIR spectroscopy further supports these findings by identifying characteristic absorption bands corresponding to structural –OH groups, interlayer water, and Si–O and Al–O vibrations, all typical of smectite-type clays. Overall, the results demonstrate that Koson bentonite is a montmorillonite-rich natural clay with favorable structural and chemical characteristics, making it a promising material for applications in adsorption, drilling fluids, environmental remediation, and other industrial processes.*

Key words: *Koson bentonite, montmorillonite, XRF, XRD, FTIR, physicochemical properties, mineral composition.*

Introduction

Bentonite is one of the most widely used natural clay minerals due to its unique physicochemical properties, high adsorption capacity, large specific surface area, swelling ability, and ion-exchange characteristics [1]. These properties make bentonite an essential raw material in various industrial sectors, including drilling fluids, metallurgy, environmental protection, wastewater treatment, construction, agriculture, pharmaceuticals, cosmetics, and polymer composite production [2]. The dominant component of bentonite is montmorillonite, a layered aluminosilicate mineral that determines its reactivity and technological performance [3].

In recent years, global demand for high-quality bentonite has significantly increased, driven by the rapid development of oil–gas extraction technologies, the expansion of environmental purification systems, and the need for effective sorbents and catalysts [4]. As a result, scientific evaluation of local bentonite deposits has become crucial to ensure resource sustainability, optimize industrial processing, and develop cost-effective materials with improved functional characteristics [5,6].

The Koson deposit, located in the Kashkadarya region of Uzbekistan, is known for its rich reserves of natural clays [7]. Preliminary geological surveys show that Koson bentonite possesses valuable mineralogical components and promising adsorption behavior. However, comprehensive physicochemical studies of this local resource remain limited [8]. Detailed investigation of its composition, structural features, and functional properties is therefore essential for determining its suitability for industrial applications and for developing potential modification methods to enhance performance [9].

A systematic evaluation of the physicochemical and mineralogical characteristics of Koson bentonite will not only provide important scientific insights into its structure and properties but also contribute to the development of new technologies for its rational utilization [10]. Such studies enable the assessment of the quality of raw materials, identification of impurities, determination of active functional groups, and prediction of bentonite behavior under various technological conditions [11].

Therefore, the present research aims to carry out an in-depth investigation of the physicochemical properties and mineral composition of bentonite from the Koson deposit [12]. This includes the analysis of its structural, thermal, mineralogical, and adsorption characteristics using modern instrumental methods [13]. The findings of this work are expected to expand the scientific understanding of regional clay resources and support their effective application in industrial and environmental technologies [14,15].

Materials and Methods

Sample Collection and Preparation

Bentonite samples were collected from the Koson deposit located in the Kashkadarya region (Uzbekistan). Representative bulk samples were taken from the upper and middle layers of the clay formation to ensure the reliability of analytical results. Prior to instrumental analysis, the raw bentonite samples were subjected to preliminary purification by removing visible impurities, plant residues, and coarse particles.

The prepared samples were then oven-dried at 120 °C for 4 hours to remove physically adsorbed moisture and ensure thermal stabilization of the mineral components. The dried samples were crushed using an agate mortar and sieved through a 75 μm mesh to obtain a homogeneous powdered material suitable for XRF, XRD, and FTIR examinations.

X-Ray Fluorescence (XRF) Analysis

Chemical composition of the Koson bentonite was investigated by X-ray fluorescence spectroscopy. XRF analysis was performed using an energy-dispersive XRF spectrometer, calibrated with certified reference materials to ensure analytical accuracy. The powdered bentonite samples were pressed into pellets under high pressure and analyzed for their major oxides (SiO_2, Al_2O_3, Fe_2O_3, MgO, CaO, K_2O, Na_2O) and trace elements. The obtained results allowed the determination of the elemental distribution and purity of the samples, enabling assessment of their suitability for industrial applications.

X-Ray Diffraction (XRD) Analysis

The mineralogical composition and crystalline phases were determined using X-ray diffraction (XRD). Measurements were conducted on an XRD diffractometer equipped with CuKα radiation (λ = 1.5406 Å) operating at 40 kV and 30 mA. Scans were recorded in the 2θ range of 5°–70°, with a step size of 0.02° and a scanning speed of 2°/min.

The diffractograms were processed using standard reference data from the ICDD (International Centre for Diffraction Data) database. The XRD analysis enabled identification of montmorillonite as the dominant mineral phase, along with accompanying minerals such as quartz, illite, calcite, and feldspar.

Fourier Transform Infrared Spectroscopy (FTIR)

The functional groups and structural features of the bentonite samples were analyzed by Fourier transform infrared spectroscopy (FTIR). Spectra were recorded in the range of 4000–400 cm^{-1} using the ATR (attenuated total reflection) method. Approximately 5–10 mg of the dried powder was placed on the diamond/ZnSe crystal, and spectra were obtained at a resolution of 4 cm^{-1} with 32 scans per sample.

Results and Discussion

A comprehensive analysis was conducted to determine the physicochemical and mineralogical characteristics of bentonite samples collected from the Koson deposit. The obtained results provide important insights into the elemental composition, crystalline structure, and functional groups of the examined material, allowing an evaluation of its quality and potential industrial applications. This section presents the outcomes of X-ray fluorescence (XRF), X-ray diffraction (XRD), and Fourier transform infrared (FTIR) analyses performed on oven-dried bentonite samples.

The chemical composition of Koson bentonite was first evaluated using XRF spectroscopy in order to identify the major oxides and trace elements present in the sample. As shown in Figure 1, the XRF results demonstrate that the bentonite is predominantly composed of silica (SiO_2) and alumina (Al_2O_3), confirming the montmorillonitic nature of the clay. In addition, the presence of Fe_2O_3, MgO,

CaO, K_2O, and Na_2O indicates the existence of accessory minerals and exchangeable cations that play a significant role in determining the adsorption, swelling, and ion-exchange properties of the material.

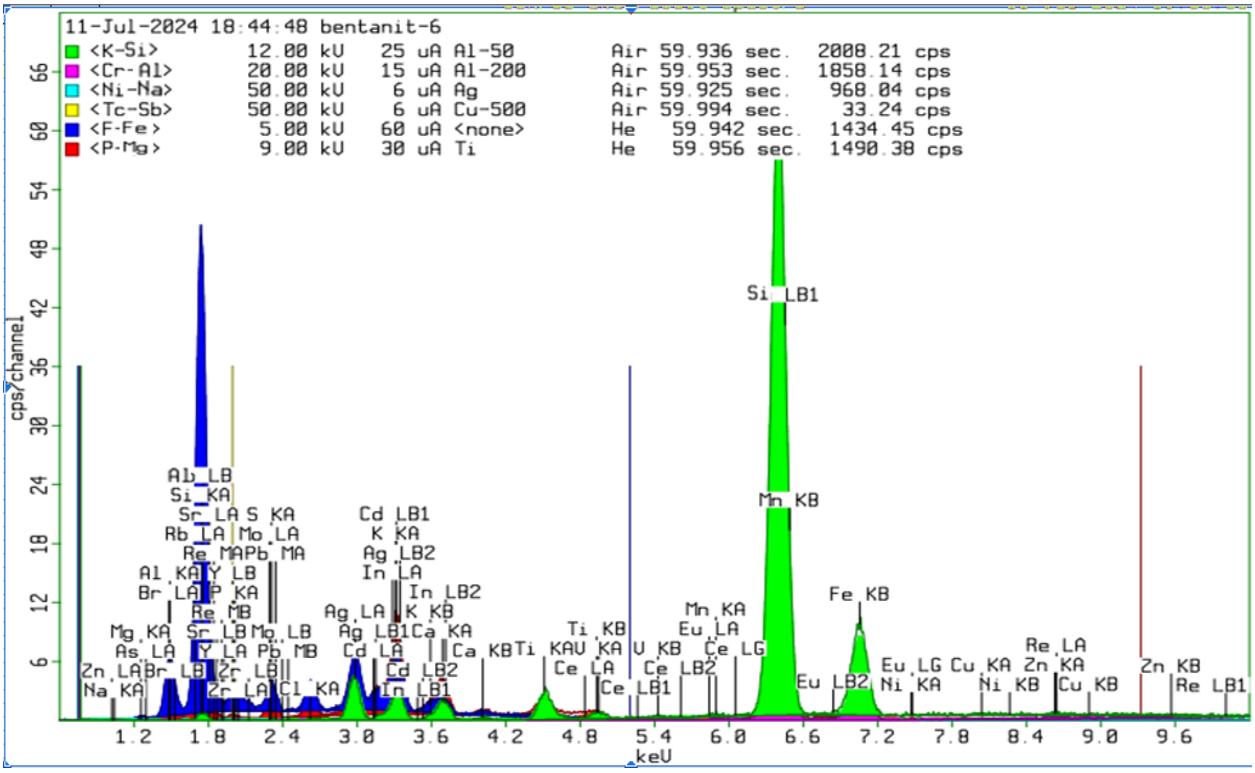


Figure 1. XRF spectrum indicating the elemental oxide composition of Koson bentonite

The XRF spectrum presented in Figure 1 illustrates the elemental composition of the Koson bentonite sample. The most intense peaks correspond to silicon (Si), confirming the silica-rich nature of the clay and indicating a high SiO_2 content typical of montmorillonitic materials. Prominent aluminum peaks (Al_Kα and Al_LB) further support the presence of an Al_2O_3–SiO_2 structural framework characteristic of montmorillonite. A noticeable peak for iron (Fe_Kβ) indicates the presence of Fe_2O_3, which may originate from iron-bearing impurities or octahedral substitutions within the clay structure. Additional peaks corresponding to Mg, Ca, Na, and K reveal the presence of MgO, CaO, Na_2O, and K_2O, reflecting a variety of exchangeable cations that influence the swelling capacity and adsorption properties of the bentonite. Low-intensity peaks of trace elements such as Sr, Ti, Zn, Mn, Cu, Ag, and Re are also detected, which is typical for naturally occurring bentonite deposits shaped by complex geological processes. Overall, the XRF results confirm that the Koson bentonite is a montmorillonite-rich aluminosilicate containing minor amounts of quartz, illite, and calcite as accessory phases.

The mineralogical composition of the Koson bentonite was examined using X-ray diffraction (XRD), and the corresponding diffraction pattern is presented in Figure 2. The XRD results clearly indicate that montmorillonite is the dominant crystalline phase in the sample, as evidenced by the characteristic basal reflection typically observed at low 2θ angles. In addition to the main smectite peak, the diffractogram also displays secondary reflections associated with accessory minerals such as quartz, illite, and calcite, which commonly occur in natural bentonite deposits. The presence of these phases suggests a mixed mineralogical structure influenced by sedimentary and diagenetic processes during the formation of the Koson clay. Overall, the XRD pattern in Figure 2 confirms that the sample is predominantly montmorillonitic with minor contributions from accompanying silicate and carbonate minerals.

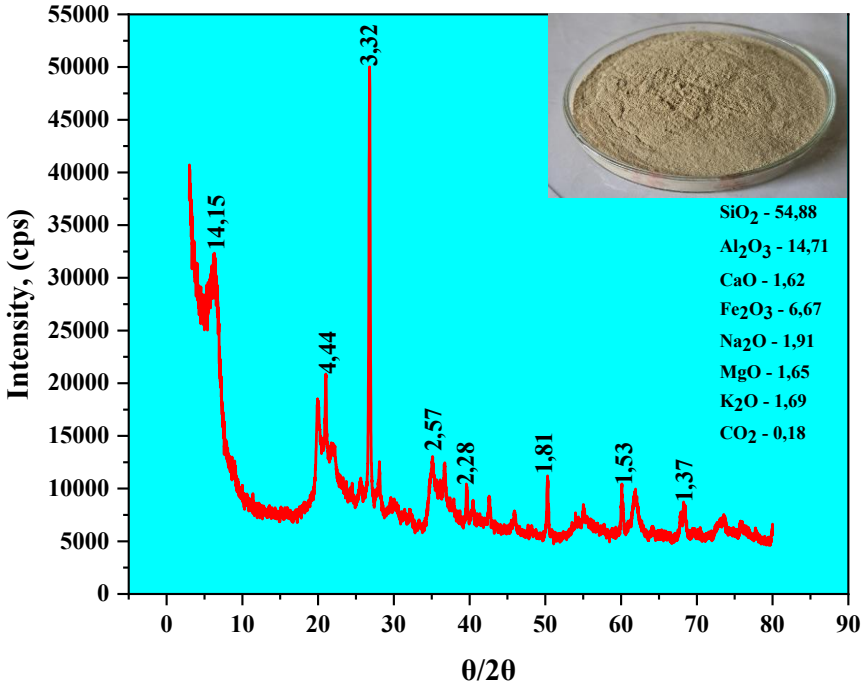


Figure 2. XRD diffraction pattern showing the crystalline phases of Koson bentonite

The XRD pattern presented in Figure 2 provides a clear representation of the crystalline phases present in the Koson bentonite sample. The diffractogram is dominated by a strong peak at approximately 3.32 Å, which is characteristic of quartz (SiO_2). The high intensity of this reflection indicates that quartz is present in significant amounts within the bentonite matrix. This observation is consistent with the elemental composition obtained from XRF analysis, which shows that SiO_2 accounts for 54.88% of the sample, confirming that quartz is one of the major components.

Another set of peaks appears around 14.15 Å and 4.44 Å, which are indicative of montmorillonite, the principal clay mineral in bentonite. The basal reflection near 14 Å corresponds to the (001) plane of smectite minerals, while the secondary smectite peaks at ~4.44 Å confirm the layered aluminosilicate structure. The presence of these reflections indicates that the sample contains a significant amount of montmorillonite, which contributes to swelling, adsorption, and cation-exchange properties.

Additional peaks observed at 2.57 Å, 2.28 Å, 1.81 Å, 1.53 Å, and 1.37 Å correspond to minor crystalline phases such as illite, feldspar, and possible traces of calcite. These accessory minerals commonly occur in bentonite deposits and reflect the geological processes involved in clay formation. Their presence is also supported by the XRF results, where oxides such as Al_2O_3 (14.71%), Fe_2O_3 (6.67%), Na_2O (1.91%), MgO (1.65%), and K_2O (1.69%) were detected.

The mineralogical profile obtained from the XRD pattern demonstrates that Koson bentonite is a montmorillonite-rich aluminosilicate clay with a substantial quartz content and smaller amounts of illite and other accessory minerals. The combination of montmorillonite and quartz suggests that the bentonite has both high adsorption potential and good mechanical stability, making it suitable for industrial applications such as drilling fluids, sorption processes, and environmental remediation.

The structural features and functional groups of the Koson bentonite sample were examined using FTIR spectroscopy, and the corresponding spectrum is presented in Figure 3

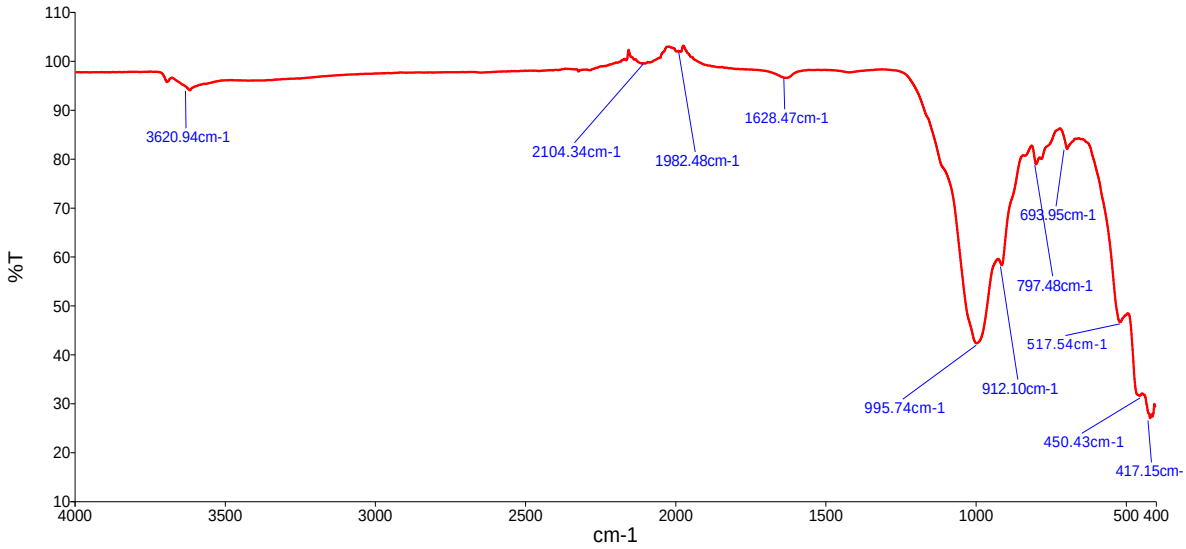


Figure 3. FTIR spectrum showing the characteristic functional groups of Koson bentonite

The FTIR spectrum displayed in Figure 3 provides detailed information about the functional groups and structural features of the Koson bentonite sample. The spectrum shows several characteristic absorption bands typically associated with montmorillonite-type aluminosilicate clays.

A broad absorption band observed around 3620.94 cm^{-1} corresponds to the stretching vibrations of structural hydroxyl groups (–OH) located within the octahedral sheets of montmorillonite. This peak indicates the presence of inner-surface and inner-hydroxyl groups, which are important for the clay's hydration and cation-exchange properties.

The weak bands appearing at 2104.34 cm^{-1} and 1982.48 cm^{-1} are associated with combination or overtone vibrations of the Si–O and Al–O lattice modes. These features are typical for layered silicate structures and confirm the integrity of the montmorillonite framework.

A clear absorption peak at 1638.43 cm^{-1} corresponds to the bending vibration of adsorbed water (H–O–H). This confirms the presence of interlayer water molecules, which play a critical role in the swelling and hydration behavior of bentonite.

The strong and broad region around 995.74 cm^{-1} is attributed to the Si–O stretching vibration, which is the main fingerprint region for phyllosilicates. This peak signifies the dominance of tetrahedral silica sheets within the clay.

Two additional bands at 912.10 cm^{-1} and 797.48 cm^{-1} correspond to Al–Al–OH and Si–O–Al bending vibrations, respectively. These peaks are characteristic of montmorillonite and indicate the presence of both aluminum-rich octahedral layers and tetrahedral substitutions.

In the lower wavenumber region, several peaks such as 695.96 cm^{-1}, 517.54 cm^{-1}, 450.43 cm^{-1}, and 417.15 cm^{-1} appear. These bands correspond to Si–O–Mg, Si–O deformation, and O–Si–O bending vibrations. Such modes are typical of smectite-type minerals and support the classification of the sample as a montmorillonitic clay.

Overall, the FTIR spectrum in Figure 3 confirms that the Koson bentonite possesses a classical montmorillonite structure characterized by Si–O and Al–O lattice vibrations, structural hydroxyl groups, and interlayer water molecules. The results are consistent with the XRD and XRF analyses, collectively indicating that the sample is predominantly a montmorillonite-rich aluminosilicate containing quartz and minor accessory minerals.

Conclusion

In this study, the physicochemical and mineralogical properties of bentonite obtained from the Koson deposit were comprehensively investigated using XRF, XRD, and FTIR analyses. The XRF results revealed that the sample is rich in SiO_2 and Al_2O_3, with smaller amounts of Fe_2O_3, MgO, CaO, Na_2O, and K_2O, confirming the aluminosilicate nature of the clay and indicating a predominantly montmorillonitic composition. The XRD diffractogram further supported these

findings by displaying characteristic reflections of montmorillonite along with quartz, illite, and minor accessory minerals. The presence of a strong basal peak near 14 Å highlighted the layered structure typical of smectite clays.

The FTIR spectrum exhibited distinct absorption bands corresponding to structural hydroxyl groups, interlayer water molecules, and Si–O and Al–O vibrations, providing additional evidence for the dominance of montmorillonite in the sample. The combination of these instrumental analyses confirms that Koson bentonite is a high-quality, montmorillonite-rich aluminosilicate clay with favorable structural and chemical characteristics.

Overall, the findings demonstrate that bentonite from the Koson deposit possesses significant industrial potential due to its mineralogical purity, functional group composition, and physicochemical properties. These characteristics make it suitable for applications in adsorption processes, drilling fluids, environmental remediation, construction materials, and other technological fields requiring high-performance clays.

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Rezyume: *Ushbu tadqiqotda Koson konidan olingan bentonit namunalarining fizik-kimyoviy va mineral tarkibi XRF, XRD va FTIR analitik usullari yordamida o‘rganildi. XRF natijalari namunada SiO_2 (54,88%) va Al_2O_3 (14,71%) miqdori yuqori ekanini ko‘rsatib, uning alyumosilikat tabiatini tasdiqladi. Shuningdek, Fe_2O_3, MgO, CaO, Na_2O va K_2O kabi ikkilamchi oksidlarning mavjudligi bentonit tarkibida qo‘shimcha minerallar va almashinuvchan kationlar borligini bildiradi. XRD tahlili asosiy kristall faza sifatida montmorillonitni aniqladi, kvart s, illit va boshqa silikat hamda karbonat minerallar esa aralash fazalar sifatida qayd etildi. FTIR spektrlari ushbu xulosalarni qo‘llab-quvvatlab, strukturaviy –OH guruhlari, qatlamlararo suv hamda Si–O va Al–O bog‘lanishlariga xos yutilish chiziqlarini namoyon etdi. Umuman olganda, natijalar Koson bentoniti montmorillonitga boy, qulay strukturaviy va kimyoviy xususiyatlarga ega tabiiy gil ekanligini*

ko‘rsatadi. Bu esa uni adsorbsiya jarayonlari, burg‘ulash eritmalari, ekologik remediatsiya va boshqa sanoat sohalarida qo‘llash uchun istiqbolli materialga aylantiradi.

Резюме: *В данной работе исследованы физико-химические и минералогические свойства бентонита из Косонского месторождения с использованием аналитических методов XRF, XRD и FTIR. Результаты рентгенофлуоресцентного анализа показали, что образец содержит высокие количества SiO_2 (54,88%) и Al_2O_3 (14,71%), что подтверждает его алюмосиликатную природу, а также меньшие количества Fe_2O_3, MgO, CaO, Na_2O и K_2O, указывающие на присутствие сопутствующих минералов и обменных катионов. Согласно данным рентгеноструктурного анализа, основную кристаллическую фазу составляет монтмориллонит, в то время как кварц, иллит и небольшие количества других силикатных и карбонатных минералов присутствуют в качестве примесей. Спектры FTIR дополнительно подтверждают эти результаты, демонстрируя характерные полосы поглощения, соответствующие структурным –OH группам, межслойной воде, а также колебаниям связей Si–O и Al–O, типичным для смектитовых глин. В целом установлено, что бентонит из Косонского месторождения является монтмориллонитсодержащей природной глиной с благоприятными структурными и химическими характеристиками, что делает его перспективным материалом для применения в адсорбции, буровых растворах, экологической ремедиации и других промышленных процессах.*

Kalit so‘zlar: *Koson bentoniti, montmorillonit, XRF, XRD, FTIR, fizik-kimyoviy xususiyatlar, mineral tarkib.*

Ключевые слова: *Косонский бентонит, монтмориллонит, XRF, XRD, FTIR, физико-химические свойства, минеральный состав.*

UDC: 581.92:556.322.2(575.121)

ANALYSIS OF RESEARCH ON SOIL ALGAL FLORA

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Summary: *This brochure presents an analysis of research conducted on soil algal flora and the methodology for research on soil algal flora.*

Key words*: algology, algoflora, fundamental, transformed soils, species, soil systematics*

To date, a number of works have been carried out on the study of soil algal flora in various regions of the Earth. The participation of algae in the processes occurring in the soil is very important. Accordingly, algae also play an important role in the process of soil formation. Research on soil algal flora can be divided into two stages according to the purpose of the study.

1. Classical-fundamental research.
2. Research on soils transformed by the influence of ecological factors.

Below is an analysis of the work carried out on soil algal flora, their composition, distribution and taxonomy of soil algae.

1. Classical-fundamental research was first initiated by B.A. Keller (1926) with the study of the taxonomic composition of algae distributed in the desert and steppe regions of Central Asia, especially in Uzbekistan. He reported that the species *Nostoc commune*, belonging to the class Hormogoniophyceae, family Nostocacea, distributed on the surface of the soil, is a component of the flora of deserts and steppes. The shell of algae protects the soil, which is explained by the lack of turbidity in the water [1].

The algal flora of barren soils distributed in our republic was first identified by N.N. Bolishev and T.N. Evdokinova, based on the fact that the coatings on the surface of barren soils are formed by taxa belonging to the order Oscillatoriales of the Cyanophyta department. The study of the role of algae in the formation of structure in the soil has aroused great interest in laboratory experiments. K.V. Marathe studied the effect of species (*Symploca muralis*, *Chlorogloea fritchii*, *Hapalosiphon welwitschii*) on the state of soil aggregation [2]. The aggregate effect was 35.7-78.1%. Other researchers have shown the important structural role of the species *Chlorella pyrenoidosa*, *Nostoc commune*, *Oscillatoria prolifica*. One of the first major studies on the systematics and ecology of soil algae was carried out by Blaine Metting (1981). The scientist conducted the first and most extensive study, which was published in the article "Systematics and Ecology of Soil Algae". Soil algae are found in almost all terrestrial environments on Earth and are always found both on and below the soil surface. The soil algal flora includes representatives of the Cyanochloronta, Chlorophycophyta, Euglenophycophyta, Chrysophycophyta, and Rhodophycophyta. 38 orders of prokaryotes and 147 orders of eukaryotes include terrestrial species, most of which are edaphic.

Algae play a major role in soil formation. In this, mainly microscopic organisms produce a large amount of organic matter. In addition to the direct effect of algae on the erosion process, an indirect effect has also been identified - that is, the indirect effect strengthens biological fertilizers in the fields from being washed away. Small unicellular algae retain soil particles by secreting mucus. *Synechococcus quarderi* was found to be the first to occur on sandy substrates, forming a crust and reducing erosion. This process, in turn, contributes to better water infiltration, better settlement of algae, bacteria, fungi and plant seeds in the soil.

G.I. Markova (1976; 1977) noted the occurrence of filamentous blue-green algae on eroded slopes without flow [3].

L.I. Domracheva et al. showed that the development of green and blue-green algae leads to soil “blooming”, in which the total biomass of microorganisms accounts for 70-90% of the biomass formed by algae.

As autotrophic organisms, algae synthesize additional amounts of organic matter that participate in many biological processes in the soil. Algae are permanent components, form soil micropopulations, play an important role in soil self-purification processes and are used as bioindicators of its condition.

Soil algae have been found to play a specific role in soil transformation. Blue-green algae form a complex community with bacteria. V.P. But studied the algal flora of the Western Pamirs, Bazova studied the algal flora of the Eastern Pamirs, G.A. Bazova studied the algal flora of the southern gray soils of Tajikistan. The flora of algae distributed in the arable lands of Uzbekistan, in particular, the Tashkent region, was studied by K.Yu. Musayev. His monographic work on the algal flora of arable lands on gray soils is considered a practical program for research, in which the taxonomic composition of the algal flora is substantiated by the irrigation system.

K.Yu. Musayev's scientific research is devoted to gray soil and Mirzachul in the Samarkand region. In the first work, detailed information was provided on the taxonomic composition of algae identified from light gray soil, typical gray soil and dark gray soil, their distribution in relation to ecological factors. As a result, 97 taxa were identified, and according to their systematic composition, taxa belonging to the Cyanophyta department were numerically dominant. The second work was of an ecological nature, and data were presented on the fact that the distribution of algae, depending on soil salinity, causes changes in the composition of dominant species. It was noted that the number of species in the soil is greater than in the spring and autumn seasons. The taxonomic composition of the algal flora distributed in the newly developed and irrigated lands of Mirzachul soils for many years was studied by K.Yu. Musayev. Algae taxa are distributed in the soils of the cultivated areas of the Karakul district of the Bukhara region [4].

K.Yu. Musayev, V.P. But (1966) devoted their work to the study of the patterns of distribution of algae species along steep slopes. In dark gray soils at an altitude of 1300 m above sea level, filamentous taxa from the family *Oscillatoriceae* of the Cyanophyta department stand out from others in the large number of species. In the soils of the mountainous regions at altitudes of 2000 m and above, it was noted that taxa of the order Nostocales, which are heterocysts and can absorb molecular nitrogen from the soil atmosphere, and taxa belonging to the Xanthophyta division are widespread. When studying the composition of algae taxa distributed in the soils of the mountainous region, differences in the composition of taxa on different slopes were revealed. It was found that the number of algae taxa on the humid northern slopes was higher than in the drier southern areas. [5].

When analyzing the systematic composition of algae taxa in the Uzbek part of the southwestern Tien Shan range, it was found that taxa belonging to the Cyanophyta department in the gray soils in the areas from 230 m to 500 m altitude were dominated by taxa belonging to the order of Oscillatoriales with a fibrous structure and heterocysts, including *Phormidium, Oscillatoria, Borzia*. In the soils of the mountain region between 1300-2000 m altitude, it was noted that the species of the Chlorophyta, Xanthopyta and partially Cyanophyta departments were dominant. In the pasture soils of the mountain at an altitude of 2500 m and above, the occurrence of algae belonging to the Cyanophyta department decreased, and algae of the Chlorophyta and Xanthopyta departments were widespread. As a result of research conducted in collaboration with K.Yu. Musayev and U.N. Toshmukhammedov, it was found that species of the Chlorococcales and Cyanophyta divisions of the Chlorophyta division are more common in uncultivated soils. In cotton fields with a long period of cultivation, it was found that species of the Cyanophyta divisions are more diverse.

K.Yu. Musayev and Sh.U. Umarova (1967) noted that the biological diversity of algal flora in cotton-planted soils consists of 212 species. Sh.J. Tojiboyev identified 67 species of algae from the rhizosphere of 67 species of grasses belonging to 14 families: 23 blue-green, 27 green, 7 diatom, 7 yellow-green, and 3 euglena species. 41 taxa were recorded from the rhizosphere of plants of the Asteraceae family, 37 from Cucurbitaceae, and 35 from Ascomycota. 21-27 taxa were identified in the root rhizospheres of representatives of the Tomato, Solanaceae, and Labiatae families, and a total of 7-14 taxa were recorded from the root rhizospheres of representatives of the Solanaceae and Solanaceae families. Among the identified algae, filamentous structures were most common. It was argued that the distribution of algae in the rhizosphere is also influenced by the vegetation period of

plants. In 1973, Sh.J. Tojiboev studied the taxonomic composition of algae in undeveloped gray soils of the Tashkent region and their comparative analysis. [6].

L.N.Bolishev, T.N.Evdokimova (1969) studied the systematic composition of the algal flora of the South-Western Kyzylkum. [2].

The works of Y.K.Troiskaya (1961) are devoted to the taxonomic study of the flora of algae distributed in the soils of the southern part of Kyzylkum in Uzbekistan. 224 species and varieties were identified from the soils of the region, and 126 species (56.25%) were recorded as belonging to the Cyanophyta department. It was noted that in this department the number of species belonging to the *Oscillatoriaceae, Schizothrichaceae* families is greater than others.

M.P.Masharipov, M.A. Kochkarova, Z.A. Ormonov in 1998 identified 78 species and forms of blue-green algae in cotton, wheat, alfalfa and undeveloped gray lands. Of these, 19 species were considered nitrogen-fixing algae. 48 species of algae were identified from cotton fields, and 34 species from the order Oscillatoriales were identified in wheat soils. 32 species of algae were identified from gray soils, and among them, representatives of *Chroococcales* and *Nostocales* were reported to have the most species. [7].

Species of the yellow-green algae department are widespread in various soil types. This is especially true for soils of the humid region. According to L.A. Gaysina, L.Kh. Abuzarova, G.R. Bakieva, L.S. Khaybullina, the number of species of yellow-green algae is much higher than the number of other algoflora. In Kashkadarya soils, L.M. Safiullina also found that these algae departments are found in barren soils. According to Neustupa, Skaloud, algae belonging to the Bacillariophyta department have developed a high level of resistance to the effects of various toxic substances. [8].

The species of the yellow-green algae department were studied by R.R. Kabirov, and according to his data, it was found that soils are the most "sensitive" to various pollutants. E.A. Shtina noted that the cells of yellow-green algae determine the "purity and fertility" of soils. Cells of Bacillariophyta algae, due to their rapid reproduction, quickly occupy new habitats. N.V. Sukhanova and her co-authors, studying the taxonomic composition of soil algae distributed in the humid zone of the cities of Ufa, Sibaya and Beloretsk and their forests, determined the high biodiversity of diatom algae (39 species) and noted the high abundance of species of the *Naviculaceae* and *Pinnularia* genera from the *Naviculaceae* family.

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Rezyume: *Ushbu risolada tuproq alg florasi bo'yicha olib borilgan tadqiqotlar tahlili va tuproq alg florasini tadqiq qilish metodologiyasi keltirilgan.*

Резюме: *В данной брошюре представлен анализ исследований почвенной альгофлоры и методология исследований почвенной альгофлоры.*

Kalit so‘zlar: *algologiya, algoflora, fundamental, o'zgargan tuproqlar, turlar, tuproq sistematikasi*

Ключевые слова: *альгология, альгофлора, фундаментальные исследования, трансформированные почвы, виды, систематика почв.*

UDC:661.169.23:661.741.1

THE EFFECT OF COMPONENTS ON THE PHYSICAL, CHEMICAL AND BIOLOGICAL PROPERTIES OF MORDANT SOLUTIONS

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Summary: *This paper investigates the influence of various chemical components – urotropin ($C_6H_{12}N_4$), monoetanolamine ($NH_2C_2H_4OH$) and copper acetate monohydrate ($(CH_3COO)_2Cu\ 5H_2O$) – on the physicochemical properties of aqueous solutions used as seed dressings. The main focus is on changes in solution parameters such as pH, viscosity and density, depending on the concentration of the components. The results show that these compounds have significant potential to increase the effectiveness of seed dressings by improving their physical and chemical characteristics. The study proposes new combinations of these substances that can increase plant resistance to pathogens and pests, providing long-term protection.*

Key words: *Seed dressings, urotropin, monoetanolamine and copper acetate monohydrate, physicochemical properties, solition pH, viscosity, density, fungicidal activity.*

Introduction. Seed dressings play an important role in agriculture, protecting plants from various pathogens and pests. The problem of developing effective seed dressings is becoming increasingly relevant in the context of increasing environmental preparations. This study aims to investigate the effect of various chemical components, such as urotropin, monoetanolamine, and copper acetate monohydrate, on the physicochemical properties of solutions used as seed dressings.

Synthesis: To study the effect of various on the properties of seed dressings, aqueous solutions with different concentrations of urotropin, monoethanolamine and copper acetate monohydrate were prepared. Measirements of pH, viscosity, density and refractive index were carried out using standart analytical methods. Isomolar series, spectrophotometric analysis and X-ray phase analysis were used to determine the physical and chemical properties of the solutions under study.

Characterization: Urotropin has antiseptic, stabilizes the pH of solutions and prevents the development of fungal and bacterial infections. Studies have shown that as the concentration of hexamethylenetetramine increases, the pH first decreases and then increases, which is associated with the buffering effect of this compound. Monoethanolamine improves the adhesive properties of solutions, improving the coating if seeds with active components. The study confirmed that aminoethanol also contributes to the formation of more stable solutions, which increases the effectiveness of seed dressings.

Copper acetate monohydrate exhibits high fungicidal activity, effectively suppressing the growth of fungal pathogens. It increases the viscosity and density of solutions, which improves their adhesive properties and ensures uniform seed coating. The results show that copper compounds can significantly increase the effectiveness of seed dressings due to their long-lasting antimicrobial action and stability in the environment.

Change in pH of solutions: Studies have shown that an increase in the concentration of hexamethylenetetramine first lowers the pH, then stabilizes it, which is associated with the buffering effect of this compound. Similar results were obtained for monoethanolamine.

Viscosity: The viscosity of the solutions increased with increasing concentrations of all components. This indicates an increase in intermolecular interactions, which contributes to a more uniform coating of the seeds.

Density and refractive index: An increase in the solutions, which improves their adhesive properties.

Table 1. Chage in pH and viscosity of solutions depending on the concentration of componends

Concentrion (mol/l)	Urotropin (pH)	MEA (pH)	MAM (pH)	Viscosity (urotropin, mPa s)	Viscosity (MEA, mPa s)	Viscosity (MAM, mPa s)
0,1	7,0	7,2	6,8	1,1	1,2	1,3
0,2	6,5	6,9	6,4	1,3	1,4	1,6
0,3	6,0	6,5	6,0	1,5	1,7	1,9
0,4	5,8	6,2	5,7	1,8	2,0	2,3
0,5	5,5	6,0	5,5	2,0	2,2	2,6

Discussion. The results of the study indicate the importance of selecting and combining fungicide components to achieve maximum effectiveness. Urotropin and monoethanolamine stabilize pH and improve adhesion, which is necessary to increase the resistance of preparations to external influences. Copper acetate monohydrate demonstrates high efficacy as a fungicide, helping to suppress pathogens in the early stages of plant growth. These components can be used in various combinations to create new seed treatment formulations with improved properties.

Conclusion. The study confirms that urotropin, monoethanolamine and copper acetate monohydrate have significant potential for use as components of seed dressings. These substances improve the physicochemical properties of solutions, which contributes to their more effective use in protecting plants from pathogens and pests. Determining the optimal combinations and concentrations of these components will allow the creation of new, more effective and safer seed dressings.

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Rezyume: *Ushbu maqola turli kimyoviy komponentlar – urotropin, monoetanolamin va mis acetate monogidratining urug'larni davolash uchun ishlatiladigan suvli eritmalarning fizik-kimyoviy xususiyatlariga ta'sirini o'rganadi. Tadqiqot asosan bu komponentlalar koncentraciyasiga bog'liq ravishda eritmaning pH, qovushqoqliq va zishlik kabi parametrlarining o'zgarishlariga qaratilgan. Natijalar shuni ko'rsatadiki ushbu birikmalar urug' dorilovchi vositalarni samaradorligini, kimyoviy xususiyatlarini yaqshilash oqrali sezlarli darajada oshirish imkoniga ege. Shuningdek, o'simliklarni patogenlar va zararkunandalardan himoya qilish va uzoq muddatli ta'sirini ta'minlash uschun yangi kombinaciyalar taklif qilinmoqda.*

Резюме: *Данная статья исследует влияние различных химических компонентов – уротропина ($C_6H_{12}N_4$), моноэтаноламина ($NH_2C_2H_4OH$) и ацетата меди моногидрата ($(CH_3COO)_2Cu \cdot H_2O$) – на физико-химические свойства водных растворов, используемых для протравливания семян. Исследование сосредоточено на изменениях таких параметров раствора, как pH, вязкость и плотность, в зависимости от концентрации этих компонентов. Результаты показывают, что эти соединения способны значительно повысить эффективность средств для протравливания семян за счет улучшения их химических и физических свойств. Кроме того, предлагаются новые комбинации этих веществ для повышения устойчивости растений к патогенам и вредителям, обеспечивая долговременную защиту.*

Kalit so‘zlar: *Orug’ dorilovchi vosita, urotropin, monoetanolamin, mis acetat monogidrat, fizik-kimyoviy xuxusiyatlar, eritma pH, qovushqoqliq, zichlik, fungicid faollik.*

Ключевые слова: *Средства для протравливания семян, уротропин, моноэтаноламин, ацетат меди моногидрат, физико-химические свойства, pH раствора, вязкость, плотность, фунгицидная активность.*

PROCESSING PHOSPHATE RAW MATERIALS USING SULFURIC ACID AND OXIDIZED MEAL

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Summary: *The article presents the results of studying the processes of obtaining granulated phosphorus-humus fertilizers by decomposing phosphorus-containing raw materials with sulfuric acid with a concentration of 92% at a stechometric norm of 10-50% to form monocalcium phosphate and oxidizing licorice meal with hydrogen peroxide in the presence of acetic acid (in a mass ratio: to the organic part of the raw material: H_2O_2: CH_3COOH = 100: 10: 1) by adding the mass of oxidized licorice meal to the acid superphosphate mass, as well as determining the optimal conditions for obtaining phosphorus-humus fertilizers.*

Key words: *meal, hydrogen peroxide, phosphorite, extractive substances, sulfuric acid, oxidation,humic acids, phosphorus, nitrogen, calcium, sulfur.*

Introduction. World experience in the sustainable development of agriculture and agrochemical tests have shown that the application of organic and organomineral fertilizers is the main factor in preserving soil fertility, increasing the beneficial effects of mineral fertilizers, and obtaining high and quality yields of agricultural crops. Therefore, obtaining and applying organic and organomineral fertilizers based on organic plant resources, phosphate raw materials, and agricultural ores containing all the nutrients necessary for the normal growth and development of plants is a criterion for increasing agricultural productivity. In this regard, the development and implementation of a technology for obtaining organic and organomineral fertilizers based on plant-based organic resources, phosphate raw materials, and agricultural ores is of great importance.

In global agricultural practice, soil fertility is typically assessed based on three main types of indicators: agrophysical, biological, and agrochemical. These soil fertility indicators are closely interrelated. Agrophysical indicators of soil fertility include structure, fractional and mineralogical composition, porosity, air and moisture capacity, and water permeability. The agrophysical indicators of soil usually remain stable for long periods, and when they do change, restoration is extremely difficult. The agrochemical indicators of soil fertility include the content of nitrogen, phosphorus, potassium, and other macro- and microelements, as well as their availability to plants. These agrochemical indicators determine the supply of essential nutrients for plant growth and development. The biological indicator of soil fertility is determined by the quantity, composition, and properties of organic matter, as well as its biological activity and phytosanitary condition. It should be noted that in most cases, the primary indicator of soil fertility is the amount of organic matter and its qualitative state. This is because organic substances have the strongest influence on the most crucial soil properties: agrophysical, biological, and agrochemical states. The reserves of organic or humic substances in the soil are the main indicator of soil fertility. Soil organic matter accumulates carbon, nitrogen, potassium, phosphorus, and other macro- and microelements, ensures the formation of optimal conditions for plant development in the soil, and mitigates the effects of toxic substances [1].

Plant residues in soil undergo humification and mineralization under the influence of microflora, simultaneously releasing nutrients. The increase in humus content in the upper soil horizon is related to the nature of input, distribution, and decomposition of plant residues. The role of crops in humus accumulation in soils is determined by their yield and crop rotation structure. The annual approximate replenishment of soil carbon after plant residue humification ranges from 0.71 to 1.34 t/ha. Plant residues contain a large amount of nutrients available to cultivated plants. The

quantity of nitrogen, phosphorus, and potassium entering the soil depends on the type of crop rotation, crop yield, and the level of mineral and organic fertilizer application. Plant residues contribute 27.2-49.0 kg/ha of nitrogen, 13.6-24.5 kg/ha of phosphorus, and 27.2-49.0 kg/ha of potassium to the soil. On average, 90.9 kg/ha of nitrogen, phosphorus, and potassium combined are returned to the soil with agricultural crop residues [2].

In the work [3], it was shown that the application of organomineral fertilizers was positive both for the total weight of the bunch and for the elements of the crop structure. The highest grain, straw, and bunch yields were obtained in the variant with a manure-lignin mixture at a rate of 60 t/ha - 20.04%; 23.60 and 43.89 g/vessel, respectively, which is 65%-79% higher than in the control group. Relative grain yields of oats were obtained when applying semi-rotted manure at a rate of 60 and 80 t/ha and manure-lignin mixture at a rate of 40 t/ha - from 44 to 46 g/container. The action of the manure-lignin mixture at a rate of 80 t/ha and the lignin-melt mixture at a rate of 40 t/ha showed a tendency towards a decrease in the grain of oats, while the mass of straw and hay increased by 58 and 28%; 32% and 62% respectively.

The use of humic substances (HS) in combination with mineral fertilizers improves the agrochemical properties of soils and maintains their fertility. Humic acids form organomineral complex particles with soil mineral particles, capable of absorbing moisture and dissolved substances. HS bind the mineral particles of the soil and contribute to the formation of a water-resistant loose crumb-granular structure, enhancing the moisture-absorbing and agrochemical properties of soils. The nutrients present in such soils are not chemically bound to soil minerals, are not washed away by water, and remain in a form accessible to plants [4].

In work 5, the possibility of obtaining phosphorus-containing bicomposite fertilizers with increased resistance to water washing by impregnating porous substrates made of birch bark and bark with a K_2HPO_4 aqueous solution was shown. The conditions for obtaining bicomposite fertilizers with the highest resistance to phosphate leaching were determined: isothermal holding of the impregnated samples at 100°C for 2 hours; drying at 200°C and subsequent treatment with a 0.1 N HNO_3 solution. From fertilizers obtained under these conditions and containing 3.5-4 wt.% phosphorus, about 35% of phosphates are washed away by water within 72 hours, which ensures the effect of their prolonged action. It has been shown that to obtain fertilizers with high resistance to phosphate leaching, the amount of phosphorus applied to the substrate should not exceed 4.0 wt.%. It has been established that biocomposite fertilizers based on lump and bark substrates surpass industrial granulated fertilizers in their resistance to phosphate leaching.

The problem of phosphorus in agriculture has been of interest since the formation of agrochemistry as a science. This is due to the following factors. Firstly, the total content of this element in the vast majority of soils is lower than in other nutrient elements. Secondly, due to the element's chemical nature, along with its low content, it is characterized by very low mobility in the soil, i.e., poor availability for plants. Thirdly, the reserves of phosphate raw materials for fertilizer production are very limited, and some of them are practically unsuitable for industrial processing, for obtaining water-soluble phosphorus fertilizers. To maintain food production for the growing population of the planet, it is necessary to combine phosphorus management approaches not only to extend the service life of the remaining non-renewable phosphate reserves, but also to improve the efficiency and sustainable phosphorus cycle. Solutions include improving the efficiency of fertilizer application to agricultural lands along with better understanding of phosphorus cycling in soil-plant systems and the interaction between soil physics, chemistry, and biology in conjunction with plant characteristics [6].

The initial raw materials for the production of phosphorus fertilizers and other phosphorus-containing products are natural mineral phosphate ores - apatites and phosphorites. Phosphate ores differ in their physical and chemical properties depending on their mineralogical composition, structure, and impurity content. Phosphate ore reserves are mainly represented by phosphorites, the amount of apatite does not exceed 6% of reliable reserves, and its share is about 15%. The useful mineral in both types of raw materials is calcium fluorapatite, the composition of which corresponds to the formula $Ca_5(PO_4)_3F$. The most common in nature are calcium fluorapatite $3Ca_3(PO_4)_2CaF_2$

and hydroxyapatite $3Ca_3(PO_4)_2 \cdot Ca(OH)_2$. The richest industrial apatite-nepheline ore deposit in terms of concentration and reserves is located in the Kola Peninsula [7,8].

The identified phosphate ore reserves are accounted for in more than 76 countries and are estimated at 70587.4 million tons of P_2O_5, including 65328.4 million tons of phosphorite and 5259 million tons of apatite ores. In ten countries (Morocco, USA, China, Russia, Mexico, Kazakhstan, Peru, South Africa, Western Sahara, and Tunisia), 61015.4 million tons of P_2O_5 are concentrated, representing 87% of global reserves. Significant reserves of phosphate rocks have been identified at the bottom of seas and oceans, mainly on shelves [9].

Phosphorite deposits are found in many regions of Uzbekistan. A promising deposit for industrial development is the Central Kyzylkum region. To date, four phosphorite deposits have been identified: Jeroy-Sardarinsky, Jetymtau, Tashkurinsky, and Karakatinsky. Of these, the most studied is the Jeroy-Sardara deposit, where three areas have been explored: Jeroy Yuzhny, Kurukkuduk, and Tashkura, with total reserves estimated at 384,413 thousand tons of ore or 739,916 thousand tons of P_2O_5 [10,11].

The demand for phosphorus fertilizers in the agriculture of the Republic of Uzbekistan averages 660 thousand tons of 100% P_2O_5 per year. However, chemical enterprises produce only 150-160 thousand tons of 100% P_2O_5 per year, which is about 23% of the total demand. This means that the amount of phosphorus fertilizer applied to the soil in terms of P_2O_5 is 4.3 times less than the annual requirement. The main reason for this situation is the shortage of high-quality phosphate raw materials.

The limited production of phosphorite concentrate in the Central Kyzylkum and the lack of significant prospects for its growth necessitate, under the current conditions of soil phosphorus depletion, the search for alternative sources of mineral raw materials for phosphorus fertilizer production and increasing its efficiency [12; pp. 2260-265, 13; pp. 85-94].

There are phosphate raw material deposits in Karakalpakstan, with total estimated reserves of phosphorites in the region at 70-80 million tons. There are 7 zones of phosphorite deposits in Karakalpakstan. The P_2O_5 content in the phosphorite samples is relatively low, ranging from 6.19% to 22.84%. The highest content of P_2O_5 is observed in the ore from the Khujakul, Porlytau, and Nazarkhan deposits, especially in fractions smaller than 3 mm. [14; pp. 29-31].

Given the acute shortage of phosphorus fertilizers, these phosphorites can serve as a significant reserve for increasing phosphorus fertilizer production.

Currently, the most common phosphorus-containing fertilizer worldwide is simple superphosphate. This is mainly water-soluble calcium monophosphate $Ca(H_2PO_4)_2$. It is obtained by decomposing phosphate raw materials with sulfuric acid. When applied to neutral, bases-saturated soils, it relatively quickly transforms into $CaHPO_4$ and $Ca_3(PO_4)_2$.

$$Ca(H_2PO_4)_2+Ca(HCO_3)_2 = 2CaHPO_4 \times 2H_2O+2CO_2$$

$$Ca(H_2PO_4)_2+2Ca(HCO_3)_2 = Ca_3(PO_4)_2 +4H2O + 4CO_2Ca(H_2PO_4)_2$$

In such conditions, hydroxyapatite or fluorapatite, not assimilated by plants, may appear in the soils. In acidic soils rich in one and a half oxides, poorly soluble, difficult-to-absorb phosphorus compounds can form. For this reason, phosphate consumption generally does not exceed 25%. Consequently, the consumption of water-soluble phosphate fertilizers is much higher than the actual required amount of phosphorus [15].

The works [16-19] detail the significance and mechanism of action of organomineral fertilizers when used in agricultural production. The humic substances contained in fertilizers contribute to the better assimilation of essential nutrients by plants. They prevent the retrogradation of digestible phosphates, contain microelements, physiological and growth-active substances, form a loose structure, create favorable conditions for the life of microorganisms, stimulate the growth and development of plants.

Raw material sources for obtaining organic or organomineral fertilizers are manure, peat, lignin, sapropel, brown coals, and other organic substances of plant origin.

Licorice meal can serve as a good raw material for obtaining humic fertilizers. It should be noted that in Uzbekistan, more than thirty enterprises and companies of various forms of ownership are engaged in the procurement and processing of licorice root in various regions. It grows in the northwestern part of Uzbekistan - Khorezm, Bukhara regions, as well as in the Republic of Karakalpakstan [20].

Licorice is a herbaceous plant belonging to the legume family. Licorice leaves are used for medicinal infusions and decoctions, in addition, licorice hay is rich in proteins and is a good fodder for livestock, but the main medicinal properties are possessed by the plant's root. The chemical composition of the root includes malic, citric, and succinic acids, beta-carotene, a large number of vitamins, as well as mineral substances necessary for the human body: potassium, calcium, iron, phosphorus, magnesium, and others. The main biologically active substances of licorice root are triterpenoid compounds, mainly glycyrrhizic acid and flavonoids, the content of which is up to 25%. It should be noted that after processing the licorice root, i.e., after the extraction of glycyrrhizic acid and other biologically active substances, a significant amount of meal remains, more than 80% of the initial raw material (over 100 thousand tons per year in Karakalpakstan), which is a production waste, as well as a liquid solution of ammonium sulfate (0.5-1%), about 400 thousand tons, containing a certain amount of physiologically active substances [21-23].

From the above, it can be seen that to date, there is no method for converting the insoluble part of licorice meal into beneficial products such as humic acids, fulvic acids, or humino-like substances necessary for increasing and maintaining soil fertility. It should be noted that such studies have not been conducted on licorice root meal - a waste product of pharmaceutical production of medicines based on licorice root.

The purpose of the research is to study the processes of oxidation of licorice meal with hydrogen peroxide in the presence of acetic acid and to process the resulting oxidation product from the decomposition of phosphate raw materials with sulfuric acid into phosphorus-humus fertilizers.

Licorice root meal was used as the initial raw material, which was dried to air-dry state, then ground to a particle size of 0.25 mm. After drying and grinding, an average representative sample of more than 10 kg of meal was formed for analysis and research, from which weighed samples were taken to determine moisture content, ash content, extractive substances with water and alkaline solution. The obtained results of the initial meal analysis are presented in Table 1.

Table 1.

Chemical composition of the initial licorice root meal

Moisture, %	Ash content, %	The content of extractive substances extracted by a 1% NaOH solution, %	Content of extractive substances extracted by water, %	Insoluble organic, %
5.41	4.66	5.87	15.78	68.28

Table 2 presents the results of mass spectrometric analysis (ICP-MS) of licorice meal ash. The table demonstrates that licorice meal contains a wide range of microelements essential for plant growth and development.

Table 2.

Results of mass spectrometric analysis of licorice meal ash

Name and content of elements, in g/t									
Li	Be	B	Na	Mg	Al	P	K	Ca	Cr
59	1,80	16	12000	14000	80000	770	21000	65000	55
Mn	Fe	Co	Ni	Cu	Zn	Mo	Ag	Ba	Ti
1200	34000	16	40	75	100	3,30	0,490	440	3600

Porlitau phosphate raw material with the following composition, %: P_2O_5 - 15.76; $P_2O_{5sol.\ for\ citric\ acid}$ - 6.81; P_2O_5 by trilon-B - 5.96; CaO - 27.19; MgO - 1.57; Al_2O_3 - 1.03; Fe_2O_3 - 2.66; F - 1.88; CO_2 - 4.10; SO_3 - 1.3; $P_2O_{5total\ by\ lime}$ / P_2O_{5total} - 43.21; $P_2O_{5sol.\ by\ Tr\text{-}B}$ / P_2O_{5total} - 37.82%.

At the beginning of the work, the oxidation processes of the ground licorice meal to a size less than 0.1 mm were studied by a water solution of hydrogen peroxide in the presence of acetic acid at a mass ratio of the organic part of the licorice meal: H_2O_2: CH_3COOH = 100: (10-20): (0.1: 1) The experiments were carried out in a glass cylindrical reactor equipped with a thermostating jacket and a stirrer. An oxidizer solution was poured into the reactor, the specified temperature was set, the mixer was turned on, and a sample of ground licorice meal was loaded. At the end of the process, the reaction mass was dried to air-dry state and its ash content, moisture content, organic matter, and the yield of extractive substances with a 1% sodium hydroxide solution were determined, and analyses were conducted according to the methods described in the works [24,25].

Under optimal conditions, the oxidation state of the meal was 70.94%. The resulting oxidation product contains 87.78% organic matter, 35.88% humic acids, 26.39% fulvic acid, and 29.06% residual meal. We used this moist, thick mass of oxidized meal as a starting component for processing the decomposition product of phosphate raw materials.

In the next stage of the work, the processes of obtaining phosphorus-humus fertilizers by decomposing porlite phosphate raw materials of the above composition with sulfuric acid were studied. Sulfuric acid with a concentration of 92% was used to activate the phosphate raw material.

In the first stage of research on the process of obtaining phosphorus-humus fertilizers, phosphate raw materials were decomposed with sulfuric acid to convert the undigested form of P_2O_5 into the raw material into a form readily available to plants. The sulfuric acid norm was taken in amounts of 10, 20, 30, 40, and 50% of the stoichiometry for the formation of monocalcium phosphate according to the reaction.

$$CaO_{\text{ in phosphorus}} + 2H_2SO_4 \rightarrow Ca(H_2PO_4)_2 \cdot H_2O$$

At a sulfuric acid norm of 40% of the stoichiometry, 15.27 g of H_2SO_4 with a concentration of 92% is required to treat 100 g of phosphorus raw material.

Treatment of the phosphate raw material with sulfuric acid was carried out for 60 min. After the decomposition of the phosphate raw material with sulfuric acid was completed, oxidized meal was introduced into the mixture. It was taken in weight ratios of phosphorite: meal (organic part of oxidized meal) = 1: (0.20 - 1). Then, the resulting mixture was stirred for 30 minutes and neutralized with 25% aqueous ammonia to a pH of 4-4.5. Drying was carried out at 80°C, and granulation was carried out by the rolling method during the ammonization and drying process. The chemical composition and strength of the fertilizer granules were determined. The strength of 2-3 mm granules was determined using the IPG-1M granule strength gauge, with an average value of 2.1-2.5 MPa. The determination of all forms of P2O5 was carried out by the weight method by precipitating the phosphate ion with a magnesium-ammonium phosphate mixture, followed by calcination of the precipitate at 1000-1050 C according to GOST 20851.2-75. Nitrogen was determined according to GOST 26715-85. SO3 was determined by precipitation in the form of barium sulfate, and the CaO content was determined by titration with a 0.05 N Trilon B solution in the presence of a fluorescent indicator. The analysis results are presented in Table 3.

From the results, we see the following. The higher the sulfuric acid norm and the less phosphate raw material used, the lower the P_2O_{5total} content in the product, but the higher the relative content of the assimilable form P_2O_5. As can be seen from Table 4, at a phosphorite: meal ratio of 1:0.2 and a sulfuric acid norm of 10% of the stoichiometry for the formation of monocalcium phosphate, the composition (wt. %, P_2O_{5total} - 12.62; $P_2O_{5sol.\ for\ citric\ acid}$ - 6.91; $P_2O_{5sol.\ by\ Tr\text{-}B}$ - 5.53; organic substances - 16.02; extractive substances - 11.36; nitrogen - 0.62; $CaO_{tot.}$ - 21.75; relative content of $P_2O_{5ab.\ for\ citric\ acid}$ - 54.75%. With the same ratio of meal to phosphorite, but at a rate of 50% of the stoichiometry for the formation of monocalcium phosphate, the composition (wt. %, $P_2O_{5total.}$ - 11.11; $P_2O_{5sol.\ for\ citric\ acid}$ - 10.07; $P_2O_{5\ by\ Tr\text{-}B}$ - 6.64; organic substances - 14.08; extractive substances - 9.98; nitrogen - 2.64; $CaO_{tot.}$ - 19.15; the relative amount of $P_2O_{5ab.\ for\ citric\ acid}$ is 90.64, the assimilable form of phosphorus increases approximately 2 times.

The table also shows that with an increase in the amount of oxidized meal, the relative content of the assimilable form P_2O_5 increases. For example, at a phosphorite: meal ratio of 1:0 and a sulfuric

acid norm of 10% of the stoichiometry for the formation of monocalcium phosphate, the relative content of the assimilable form of P_2O_5 is 52.58%, at the same sulfuric acid norm for the formation of monocalcium phosphate, but at a phosphorite: meal ratio of 1:1, the relative content of the assimilable form of P_2O_5 is 62.09%.

Table 3.

Composition of phosphorus-humus fertilizers obtained on the basis of processing Porlitau phosphate raw materials with sulfuric acid and oxidized meal

Ratio Phosphorite: Meal	P_2O_5 total, %	P_2O_5 sol. for citric acid, %	P_2O_5 sol. by Tr-B, %	CaO total, %	$\frac{P_2O_{5усв.}}{P_2O_{5общ.}}$, %	SO_3 total, %	N total, %	OS, %	ES, %
Норма H_2SO_4 от стехиометрии на образование $Ca(H_2PO_4)_2$, 10%									
1 : 0	15,31	8,05	6,17	26,42	52,58	2,94	0,55	0	0
1 : 0,2	12,62	6,91	5,53	21,75	54,75	2,42	0,62	16,02	11,36
1 : 0,4	10,98	6,25	5,13	18,94	56,92	2,11	0,78	25,77	18,28
1 : 0,6	9,33	5,46	4,58	16,09	58,52	1,79	0,86	35,52	25,20
1 : 0,8	10,98	6,25	5,13	18,94	56,92	1,63	0,78	40,65	28,83
1 : 1,0	7,36	4,57	4,11	12,71	62,09	1,42	1,04	46,73	33,15
Норма H_2SO_4 от стехиометрии на образование $Ca(H_2PO_4)_2$, 20%									
1 : 0	14,76	9,18	6,32	25,47	62,20	5,84	1,11	0	0
1 : 0,2	12,24	7,87	5,67	21,09	64,30	4,87	1,22	15,53	11,01
1 : 0,4	10,68	7,12	5,21	18,43	66,67	4,26	1,33	25,12	17,82
1 : 0,6	9,12	6,25	4,63	15,72	68,53	3,64	1,47	34,71	24,62
1 : 0,8	8,21	5,76	4,38	14,13	70,16	3,28	1,54	39,80	28,23
1 : 1,0	7,25	5,23	4,07	12,48	72,14	2,92	1,63	45,89	32,55
Норма H_2SO_4 от стехиометрии на образование $Ca(H_2PO_4)_2$, 30%									
1 : 0	14,21	10,31	6,48	24,51	72,55	8,75	1,56	0	0
1 : 0,2	11,85	8,83	5,81	20,44	74,51	7,31	1,65	15,04	10,67
1 : 0,4	10,38	7,98	5,27	17,92	76,88	6,42	1,71	24,48	17,36
1 : 0,6	8,92	7,04	4,68	15,36	78,92	5,49	1,88	33,91	24,05
1 : 0,8	8,04	6,52	4,35	13,83	81,09	4,94	1,94	39,48	28,01
1 : 1,0	7,13	5,87	4,02	12,25	82,33	4,38	2,02	45,05	31,95
Норма H_2SO_4 от стехиометрии на образование $Ca(H_2PO_4)_2$, 40%									
1 : 0	13,67	10,94	7,06	23,58	80,03	10,75	2,09	0	0
1 : 0,2	11,48	9,45	6,23	19,80	82,32	9,04	2,22	14,56	10,32
1 : 0,4	10,08	8,51	5,61	17,41	84,42	8,02	2,31	23,83	16,90
1 : 0,6	8,69	7,53	4,94	14,94	86,65	6,96	2,47	33,09	23,47
1 : 0,8	7,69	6,79	4,45	13,52	88,30	6,23	2,53	38,63	27,40
1 : 1,0	6,68	5,98	3,98	12,03	89,52	5,50	2,66	44,17	31,33
Норма H_2SO_4 от стехиометрии на образование $Ca(H_2PO_4)_2$, 50%									
1 : 0	13,13	11,60	7,65	22,66	88,35	12,76	2,52	0	0
1 : 0,2	11,11	10,07	6,64	19,15	90,64	10,78	2,64	14,08	9,98
1 : 0,4	9,79	9,02	5,94	16,89	92,13	9,58	2,71	23,17	16,43
1 : 0,6	8,47	8,01	5,19	14,62	94,57	8,41	2,86	32,26	22,88
1 : 0,8	7,34	7,07	4,56	13,18	96,32	7,52	2,93	37,78	26,80
1 : 1,0	6,22	6,09	3,93	11,77	97,91	6,63	3,08	43,29	30,71

Figures 1-2 show the X-ray diffraction patterns of the initial Porlitau phosphate raw material and the phosphorus-humus fertilizers obtained at a phosphorite:cake ratio of 1:0.4 and a sulfuric acid norm of 40% of the stoichiometry for the formation of monocalcium phosphate. X-ray structural

analysis was performed on a controlled XRD-6100 computer. Phase determination was carried out using local directories and ASTM.

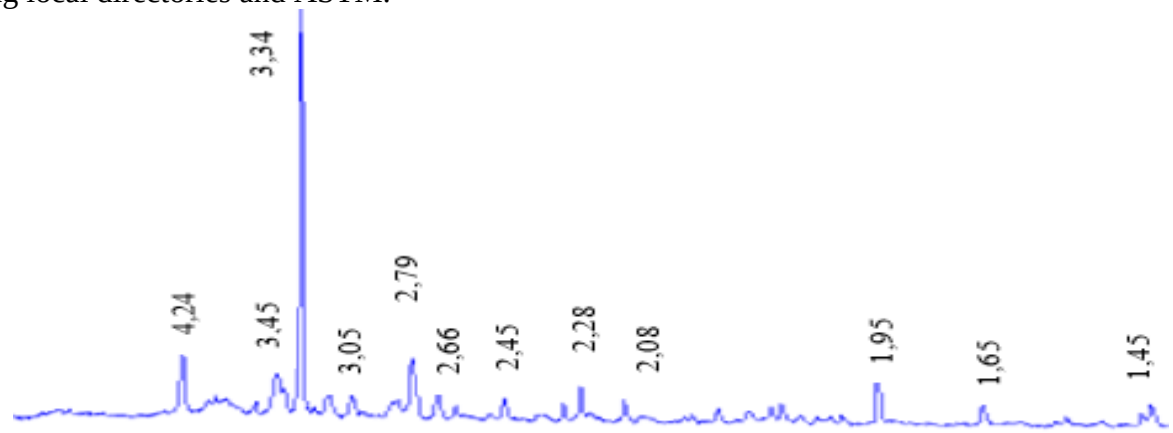


Fig. 1. X-ray diffraction pattern of Porlytau phosphate raw material

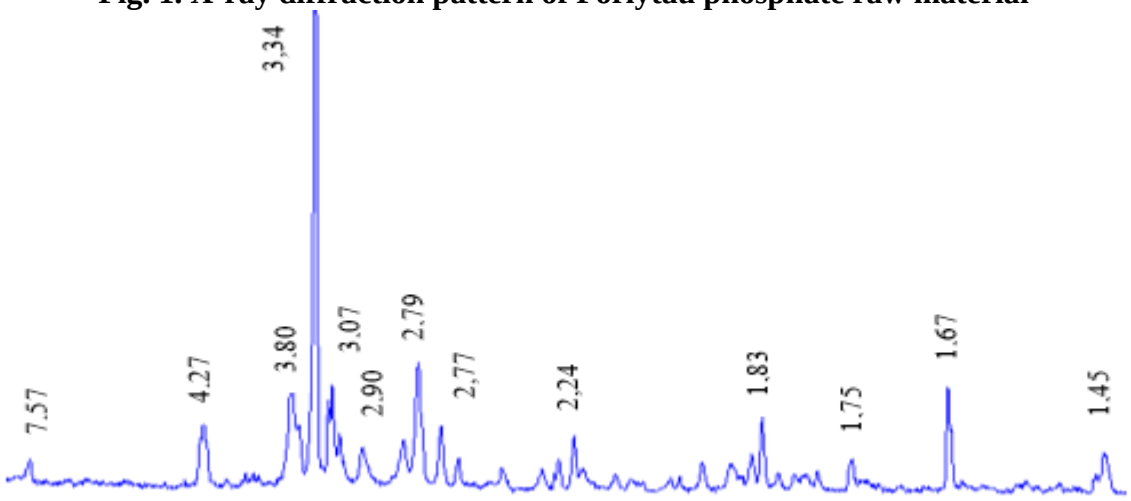


Fig. 2. X-ray diffraction pattern of phosphorus-humus fertilizers obtained by processing Porlytau phosphate raw materials with sulfuric acid and oxidized meal

On the X-ray diffraction pattern of phosphorite flour from the Porlytau deposit (Fig. 1), the diffraction lines are 3,05; 3.34; 2.79; 2.66; 2.45; 2.28; 1.95 Å belongs to fluorocarbonate apatite. The presence of calcite leads to a decrease in interplanar distances of 4.24; 2.79 Å, dolomite -1.95; 1.45 Å. The most intensive peaks were 2.45; 2.08; 3.45; 3.34; 4.24 Å indicates the presence of a large amount of silicon oxide. The lines 1.65 and 1.95 Å correspond to calcium fluoride and are equal to 2.08; 2.28 and 3.45 Å can be bound to $CaSiO_3$.

According to the X-ray diffraction pattern of phosphorus-humus fertilizer obtained by decomposition of Porlytau phosphorite flour with sulfuric acid and the addition of oxidized meal (Fig. 2). diffraction maxima are observed: monocalcium phosphate - 3.80; 2.79; 2.77; Å; dicalcium phosphate – 4,27; 3.07; 2.90 Å, tricalcium phosphate 3.44 Å, dolomite -1.83; 1.75 Å ammonium sulfate 2.32 Å, gypsum 1.67; 1.45 Å.

It should be noted that in the production of phosphorus fertilizers, the assimilable form of P_2O_5 decreases due to the retrogradation of phosphorus during ammonization and drying. And the combination of oxidized meal with phosphate raw materials in the production of phosphorus fertilizers leads to a significant increase in the relative content of the assimilable form P_2O_5. Obviously, when oxidized meal is added to the acidic superphosphate mass, organic acids, due to interaction with monocalcium phosphate and other phosphates, prevent the retrogradation process, due to which the assimilable form of phosphorus does not decrease, but, on the contrary, significantly increases during the ammonization of the superphosphate mass.

According to the requirements of modern agriculture, it is advisable that the relative content of assimilable forms of phosphorus compounds in complex fertilizers should be at least 50%. Therefore, we consider the optimal sulfuric acid rate for processing Porlitau deposit phosphorite flour to form monocalcium phosphate to be 40% of the stoichiometric norm, with a mass ratio of phosphorite to oxidized meal of 1:0.4. Under optimal conditions, the fertilizer composition (by weight %) is as follows: P_2O_{5total} - 10.08; $P_2O_{5sol.\ for\ citric\ acid}$ - 8.51; organic substances - 23.83; humic acids - 16.90; nitrogen - 2.31; CaO_{total} - 17.41; relative content of citric acid-soluble P_2O_5 - 84.42; moisture content - 5.46; SO_{3total} - 8.02; granule strength 2.1 MPa.

The optimal technological regime of the phosphorus-humus fertilizer production process is as follows: grinding of licorice meal to particle size less than 0.25 mm; hydrogen peroxide concentration 10%; organic part of licorice meal: weight ratio of H_2O_2 and acetic acid 100: 1: 0.1; sulfuric acid rate for decomposition of phosphate raw materials 40% of stoichiometry of the mineralized mass to $Ca(H_2PO_4)_2$; weight ratio of organic part of the meal to phosphorite 1: 0.4; oxidation temperature 60°C; oxidation duration 60 minutes; phosphorite decomposition duration 30 minutes; neutralization of pulp with ammonia to pH 4.5; neutralization duration 20 minutes; product drying temperature 80-100°C.

Conclusion. Thus, to increase the content of humic substances and organic acids in licorice meal, the process of hydrogen peroxide oxidation in the presence of acetic acid was studied depending on the oxidizer concentration, temperature, and the weight ratio of the organic part of the meal to the anhydrous part of hydrogen peroxide. The content of humic substances and functional groups in the oxidation products of meal was determined, and a technology for obtaining phosphorus-humus fertilizer by adding oxidized meal to the acidic superphosphate mass before ammonization and drying was developed. This, on the one hand, allows for a significant increase in the relative content of assimilable forms of P_2O_5, and on the other hand, reduces the sulfuric acid norm for the decomposition of phosphate raw materials. When these fertilizers are applied in agriculture, the humus content in the soil will undoubtedly increase, and the soil structure and physical-mechanical properties will significantly improve. By containing all the necessary nutrients for plants, the possibility of obtaining higher and better yields is created, and the nutritional properties of plants and their resistance to diseases are increased.

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Rezyume: *Maqolada fosforli xomashyolarni monokalsiyfosfat hosil bo‘lishi uchun stexiometriyaning 40-80% me’yorida 92% konsentratsiyali sulfat kislotasi bilan parchalash va kislotali superfosfat massasiga qizilmiya shrotini sirka kislotasi ishtirokida vodorod peroksid bilan oksidlash (massa nisbatida: xomashyosining organik qismiga: H_2O_2: CH_3COOH = 100: 10: 1) natijasida olingan oksidlangan qizilmiya shroti massasini qo‘shish orqali donador fosfor-gumusli o‘g‘itlar olish jarayonlarini o‘rganish, Fosfor-gumusli o‘g‘itlar olishning maqbul sharoitlarini aniqlash natijalari keltirilgan.*

Резюме: *В статье представлены результаты изучения процессов получения гранулированных фосфорно-гумусовых удобрений путем разложения фосфорсодержащего сырья серной кислотой с концентрацией 92% при норме 40-80% стехиометрии для образования монокальцийфосфата и окисления солодкового шрота перекисью водорода в присутствии уксусной кислоты (в массовом соотношении: к органической части сырья: H_2O_2: CH_3COOH = 100: 10: 1) путем добавления массы окисленного солодкового шрота к кислой суперфосфатной массе, а также определения оптимальных условий получения фосфорно-гумусовых удобрений.*

Kalit so‘zlar: *shrot, vodorod peroksid, fosforit, ekstraktiv moddalar, sulfat kislota, oksidlanish, gumin kislotalar, fosfor, azot, kalsiy, oltingugurt.*

Ключевые слова: *шрот, пероксид водорода, фосфорит, экстрактивные вещества, серная кислота, окисление, гуминовые кислоты, фосфор, азот, кальций, сера.*

"ARAL SEA FRAGMENTS" HYDROECOLOGICAL SIGNIFICANCE AND PROTECTION OF THE LAKES SUDOCHYE AND JULTURBAS IN THE CONDITIONS OF THE SOUTHERN ARAL SEA REGION

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Summary: *This report represents a comprehensive analysis of the hydro-ecological state, dynamics, and environmental significance of the two key water bodies of the Southern Aral Sea region: Sudochye and Julturbas lakes. In the context of the ongoing Aral crisis, these lakes, which are remnants of the ancient Amu Darya delta, play a crucial role in preserving regional biodiversity. Particular attention is paid to the factors determining their vulnerable hydrochemistry (high mineralization, anthropogenic pollution) and hydrobiological value (preservation of the Aral's native fauna and its role in bird migration). The report emphasizes the international recognition of these objects through their inclusion in the Ramsar Convention [2] list of wetlands and justifies the need for further comprehensive measures to preserve them.*

Key words: *Southern Aral Sea Region, Sudochye Lake, Julturbas Lake, Hydrochemistry, Mineralization, Ramsar Convention, Aral Sea, Collector-Drainage Flow.*

Introduction. The South Aral Sea region is characterized by one of the most acute global ecological crises caused by the catastrophic drying up of the Aral Sea [1]. The decrease in sea level led to the formation of an extensive salt-dust bed (Aralkum), desertification, and degradation of the Amu Darya delta. Against this backdrop, the system of residual water bodies, such as the Sudochye and Julturbas lakes, is gaining strategic importance as the last stronghold of water and biodiversity.

Both lakes are relic formations that were former bays or large expanses of the Amu Darya delta, closely connected with the Aral Sea. As it regressed, water bodies were cut off and began to exist due to residual runoff and collector-drainage waters.

The conducted studies of the hydrochemical and hydro-ecological state of the Sudochye and Julturbas lakes allow for the formation of a comprehensive, scientifically based assessment of the transformation of the Amu Darya delta's aquatic ecosystems in the context of the ongoing Aral crisis. Comparison of long-term data on the level, mineralization, ionic composition, biogenic elements, and technogenic pollutants shows that both bodies of water are subject to the persistent impact of anthropogenic and natural-climatic factors that determine the direction and rate of their degradation.

The state of lakes is extremely unstable and directly depends on the volumes of water supply and the effectiveness of regulating structures. The water levels in the lakes during the study period changed: in Julturbas from 50.63 m to 52.03 m, in Sudochye from 50.71 m to 53.24 m.

Changes in the long-term water level regime lakes depend on various factors. The contribution of these factors can be assessed, analyzing the water balance equation. Total for 2008-2022 in lakes 55.81 km^3 of water was received, of which 30.07 km^3 was discharged into the lower lakes and the sea. The largest amount of water entered the lakes in 2010 - 17.02 km3, of which 12.81 km^3 was discharged into the lower lakes and the sea, and 4.21 km^3 of water remained in the lakes themselves. As a result, the maximum water level was observed in 2010. Including, the water level rose to 52.37 m in Julturbas, 56.78 m in Sudochye, and 65.38 m.

It has been established that the decrease in Amu Darya's flow over many years, resulting from the regulation of the riverbed and increased water consumption in irrigated agriculture, is a key factor in the formation of water resource deficit in the delta zone. The observed decrease in water intake volumes into lakes, combined with high evaporation values, leads to a reduction in the area of the water mirror, a decrease in depth, and an intensification of salt concentration processes. The variability of Sudochye and Julturbas lakes' levels during the 2008-2022 period demonstrates a significant dependence of their regime on the volumes of collector-drainage runoff supplied. The maximum levels recorded in 2010 correlate with increased water supply volumes, confirming the direct relationship between the hydrological state of lakes and the regulation of delta water flows.

Relatively shallow depth makes water bodies extremely vulnerable to intense evaporation in the region's arid conditions.

Long-term drought periods (for example, 2020-2024) led to a critical reduction in the water mirror area - to **40-60%** of the average long-term values. In the driest years, Julturbas may dry up almost completely. The decrease in water volume leads to further concentration of salts. To maintain the lake system, efforts were made to create artificially regulated water bodies, including the construction of dams and embankments, which allow for the retention of river water and the directing of regulated flow to former sea bays (especially in Julturbas).

The Southern Aral Sea region is characterized by a hyperarid climate, high evaporation (up to 1500-2000 mm/year), and low natural delta flow of the Amu Darya. Under such conditions, increased mineralization, active sulfation, chloridation processes, and an increase in the concentration of biogenic and technogenic pollutants are formed.

The hydrochemical indicators of both lakes are characterized by a stable tendency towards an increase in mineralization. For Sudochye Lake, 17-25 g/l, and for Julturbas, 12-20 g/l have been established, which corresponds to highly mineralized and hypersaline waters. The intensification of the chloride-sulfate profile of lakes indicates the predominance of evaporative concentration and salt accumulation processes under conditions of limited water exchange.

The Julturbas and Sudochye lakes belong to saline-saline residual water bodies fed by: collector-drainage waters, residual floods, groundwater (table 1,2). The mineralization of Lake Sudochye is one of the highest in the delta zone. Water type: sodium chloride-sulfate, less commonly sodium-magnesium.

The ionic composition of waters is determined by dominance Na^+, Mg^{2+}, Cl^- и SO_4^{2-}. Sudochye Lake is characterized by an increased concentration of chlorides and sodium, while Julturrbas demonstrates relatively high values of sulfate ions, reflecting the geochemical features of the basin's groundwater and the spatial disunity of the lake system.

Table 2

Mineralization range of Sudochye Lake by years

Period	Mineralization, g/l
1960s	2–4
1980s	8–12
1990s	15–20
2000–2010	18–28
2020–2024	**17–25**

The increase in mineralization is related to: the shrinkage of the lake area, the lack of river feeding, high evaporation, and the inflow of KDS with a salinity of 5-12 g/l.

Table 3

Average concentrations of basic ions (last 5-7 years):

Indicator	Value
$Na^+ + K^+$	1500–3000 mg/l
Mg^{2+}	300–600 mg/l
Ca^{2+}	200–350 mg/l
Cl^-	2500–4500 mg/l
SO_4^{2-}	1500–2800 mg/l
HCO_3^-	80–150 mg/l

Magnesium and sodium dominate almost the entire year; sulfates and chlorides are the main anions. Sudochye undergoes eutrophication.

Concentration component

$N–NO_3$ 2–6 mg/l

$N–NH_4$ 0.5–1.2 mg/l

$P–PO_4$ 0.15–0.35 mg/l

Fe общ. 0.8–2.0 mg/l

In both bodies of water, stable concentrations of biogenic substances, typical for eutrophic and hyper eutrophic systems, are recorded. The highest values of nitrates, ammonium, and phosphates are observed in Lake Sudochye, which is related to the inflow of organic and mineral compounds with collector-drainage runoff. These processes intensify bioproduction and contribute to the formation of secondary pollution, including oxygen deficiency in the bottom layers.

High values are associated with CDP sewerage and organic biodegradation. Organic pollutants and heavy metals **, Pb:** 0.01–0.05 mg/l; **Cd:** 0.001–0.005 mg/l; **Zn:** 0.1–0.25 mg/l; **Cu:** 0.01–0.05 mg/l; Petroleum products: 0.1–0.3 mg/l, **Phenols:** to 0.002–0.009 mg/l. Sudochye is characterized by complex technogenic saline waters, the consequences of long-term drainage runoff. Julturbas Lake is smaller than Sudochye, and its chemical composition changes more rapidly due to its shallow depth and seasonality (table-3,4). Water type: sulfate-chloride sodium-magnesium.

Table -4

Mineralization range by years of Lake Julturbas

Period	Mineralization, g/l
1960s	1–2
1980s	4–6
1990s	7–10
2000s	10–16
2020–2024	**12–20**

In highly saline years, the mineralization can reach 22-25 g/l.

Concentration Indicator

$Na^+ + K^+$	1000–2000 mg/l
Mg^{2+}	250–500 mg/l
Ca^{2+}	150–250 mg/l
Cl^-	1500–3000 mg/l
SO_4^{2-}	1200–2500 mg/l
HCO_3^-	60–120 mg/l

The water is more "sulfate" than in Sudochye, which is associated with the evaporation and mineralization of groundwater. Biogenic substances are characterized by summer peaks of nitrogen and phosphorus.

Component	**Value**
$N–NO_3$	1–4 mg/l
$N–NH_4$	0.3–0.9 mg/l
$P–PO_4$	0.1–0.25 mg/l

The load is lower than in Sudochye, but eutrophication is pronounced.

Pollutants , **Zn:** 0.05–0.12 mg/l, **Cu:** 0.01–0.04 mg/l, **ПАВ:** 0.1–0.2 mg/l

Нефтепродукты: до 0.1–0.2 mg/l.

Julturbas is more isolated, therefore it contains fewer technogenic metals, but the concentration of organic matter is higher in summer (Table-5).

Comparative analysis of the hydrochemistry of two lakes

Indicator	Sudoche	Julturbas
Mineralization	17-25 g/l	12-20 g/l
Dominant type	chloride-sulfate	sulfate-chloride
$Na^+ + K^+$	above	below
Mg^{2+}	average	higher in arid periods
Biogenic elements	high (eutrophication)	moderate
Petroleum products	0.1–0.3 g/l	0.1–0.2 mg/l
SFM	0.2–0.4 g/l	0.1–0.2 mg/l

Sudochye is more technologically loaded, Julturbas is more stable, but quickly salinizes. An increase in the permissible concentrations of a number of heavy metals (Zn, Cu, Pb, Cd) and petroleum products, especially in Lake Sudochye, has been recorded. The sources of these components are industrial, agricultural, and municipal-domestic wastewater flowing directly into the delta or through collector-drainage water systems. Julturbas Lake is less susceptible to technogenic load, however, its shallow depth increases its sensitivity to seasonal changes and contributes to the rapid accumulation of salts and organic matter.

The conducted research allowed us to establish that the hydrochemical state of the Sudochye and Julturbas lakes is formed under the influence of a complex of natural-climatic and anthropogenic factors that determine the progressive transformation of the aquatic environment in the conditions of the Southern Aral Sea region.

The main processes determining the current state of water bodies are the reduction of the steady flow of the Amu Darya, high evaporation, the inflow of mineralized collector-drainage waters, and the geochemical activity of bottom sediments. The analysis results show that the mineralization of lake waters has reached values characteristic of slightly saline and hypersaline systems. The ionic composition is determined by the predominance of sodium and magnesium chlorides and sulfates, which indicates an intensifying evaporative concentration and a change in the hydrochemical regime towards a more complex salt profile. Sudochye Lake is characterized by higher concentrations of biogenic substances, heavy metals, and petroleum products, reflecting the persistent technogenic impact in the delta collector-drainage system zone. The Julturbas lake is characterized by a pronounced seasonal mineralization dynamic and increased sensitivity to hydroclimatic changes due to its shallow depth and limited water exchange.

The obtained results confirm the need to develop and implement a set of measures aimed at stabilizing the hydrochemical regime of delta water bodies. Priority measures include: optimizing the distribution and quality of collector-drainage waters, creating buffer environmental zones, implementing local treatment solutions, and improving the environmental monitoring system, with an emphasis on heavy metals, petroleum products, and biogenic substances. Thus, the study demonstrates that further preservation of the Sudochye and Julturbas lakes is possible only under the condition of systematic regulation of water management flows, maintaining the minimum necessary ecological flow, and implementing targeted environmental protection measures. The obtained data can serve as a scientific basis for developing regional water resource management programs and improving the ecological sustainability of the delta ecosystems of the Southern Aral Sea region.

Conclusion

The study established that the Sudochye and Julturrbas lakes belong to the category of highly mineralized, environmentally vulnerable water bodies, the hydrochemical regime of which is entirely dependent on the volumes and quality of incoming collector-drainage waters and the climatic conditions of the region. The decrease in the natural flow of the Amu Darya River over many years is a key factor in the degradation of the lake system, determining the decrease in water levels, the reduction of the water mirror area, and the intensification of salt concentration processes.

The mineralization of lake waters has increased more than 3-6 times over the past decades and currently reaches: Sudochye - 17-25 g/l, Julturbas - 12-20 g/l, reflecting the steady strengthening of the salt background and the transition of water bodies to the category of hypersaline systems.

The ionic composition of waters is characterized by the predominance of sodium and magnesium chlorides and sulfates. The chemical structure of water is formed under the influence of evaporation processes, the inflow of mineralized KDS, and the geochemical activity of bottom sediments. The concentrations of biogenic substances (nitrates, ammonium, phosphates) correspond to the eutrophic state of water bodies, most pronounced in Lake Sudochye. This indicates a persistent organomineral load and the risk of secondary eutrophication.

To stabilize the hydro-ecological state of lakes, it is necessary to implement a set of environmental protection measures: optimizing the regime of collector-drainage water supply, creating buffer filtration zones, local wastewater treatment, maintaining minimal ecological runoff, and expanding the monitoring system.

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Rezyume: *Ushbu hisobot Janubiy Orolbo‘yi mintaqasidagi ikki muhim suv havzasi: Sudoche va Julturbas ko‘llarining gidroekologik holati, dinamikasi va ekologik ahamiyatining keng qamrovli tahlilini o‘z ichiga oladi. Davom etayotgan Orol inqirozi sharoitida qadimgi Amudaryo deltasining qoldiqlari hisoblangan bu ko‘llar mintaqaviy biologik xilma-xillikni saqlab qolishda hal qiluvchi ahamiyatga ega. Ularning nozik gidrokimyoviy xususiyatlari (yuqori minerallashuv, antropogen ifloslanish) va gidrobiologik qiymatini (Orolning mahalliy faunasini saqlash va qushlar migratsiyasidagi roli) belgilovchi omillarga alohida e’tibor qaratilgan. Hisobotda ushbu ob’ektlarning Ramsar konvensiyasi [2] suvli-botqoqli hududlar ro‘yxatiga kiritilishi orqali xalqaro miqyosda e’tirof etilganligi ta’kidlanadi va ularni saqlash uchun keng qamrovli chora-tadbirlarni davom ettirish zarurligi asoslanadi.*

Резюме: *Данный отчет представляет собой комплексный анализ гидроэкологического состояния, динамики и экологической значимости двух ключевых водных объектов Южного Приаралья: озер Судочье и Джултурбас. В условиях продолжающегося Аральского кризиса эти озера, являющиеся остатками древней дельты Амударьи, играют crucial роль в сохранении регионального биоразнообразия. Особое внимание уделяется факторам, определяющим их уязвимую гидрохимию (высокая минерализация, антропогенное загрязнение) и гидробиологическую ценность (сохранение аборигенной фауны Арала и ее роль в миграции птиц). В отчете подчеркивается международное признание этих объектов путем их включения в список водно-болотных угодий Рамсарской конвенции [2] и обосновывается необходимость дальнейших комплексных мер по их сохранению.*

Kalit so‘zlar: *Janubiy Orolbo‘yi, Sudoche ko‘li, Julturbas ko‘li, gidrokimyo, minerallashuv, Ramsar konvensiyasi, Orol dengizi, kollektor-drenaj oqimi.*

Ключевые слова: *Южное Приаралье, озеро Судочье, озеро Джултурбас, гидрохимия, минерализация, Рамсарская конвенция, Аральское море, коллекторно-дренажный сток.*

UDK 574

WONDERS OF THE GREEN PLANET

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Summary: *This treatise is written about the distribution of the plant world and their practical importance in maintaining bioecology in nature.*

Key words: *biogenic, cell, biological factors, plant species, biosphere*

The total area of our Earth is equal to 510 million km^3. Of this, the land area is 149 million km^2, where there are nearly 500.000 species of plants. A common feature for all of them is the specific structure of their cells, specifically, the hard cell wall is a common structure for all plants. If the cell wall is lost for some reason, the protoplast beneath it will be covered with a membrane after a certain period. A cell covered with a hard membrane wall has the ability to take in substances necessary for life from the external environment in a dissolved state. [1].

The "absorption" of nutrients is probably another one of its characteristics which is the reason for their low motility/movement. Many long-lived trees grow in one place for hundreds, even thousands of years (sequoia), due to this hard cell wall. Using a very low concentration solution for nutrition is also one of their important aspects. The growth of plants in one place has created unique aspects of their distribution. For plant propagation, the plant has created a single cell – a spore, a part of its body (a modified shoot) – a spore, and a seed.

In our usual understanding, "Plants" are organisms with similar adaptations in terms of nutrition; they are ecological groups, not based on their origin (phylogenetically).

Plants grow over very large areas across the continents of the globe. Even the ice-free areas of the Arctic are occupied by some mosses and lichens.

Life on Earth exists as a result of the influence of the Sun and the atmosphere on plants in the land and oceans. Despite the abundance of sunlight, green plants utilize only 1-2% of it. From this small amount, they still create a very large quantity of organic material. For this, they use very little water. Water is stored in the cytoplasm, vacuole, and cell wall. A considerable amount of water is also present in the tissues of the stem, root, and leaves. Living cells use water and nutrient substances as much as needed [2].

The water content in plants is 90-95% even within a single species. In juicy fruits and algae, it reaches up to 98%. Water participates in all chemical reactions, including photosynthesis, that occur in the plant. The necessary component in photosynthesis is carbon dioxide, whose share in the atmosphere is only 0.0321%. Green plants containing chlorophyll use this very small amount of carbon dioxide every year to create hundreds of billions of tons ($4.5x10^{11}$) of organic matter. Photosynthesis is an oxidation-reduction process. Water splits (is oxidized), releasing oxygen, and gives hydrogen, which reduces the carbon dioxide.

There are two sources of oxygen in the atmosphere: water vapor under the influence of ultraviolet rays and photosynthesis.

In photosynthetic organisms, chlorophyll is located in the chloroplasts, and their number ranges from 20 to 100. In large trees, there are tens of billions of chloroplasts, but only one in single-celled green algae. The primary product of photosynthesis is used in the chemical processes inside the cell and in the formation of nucleic acids, proteins, and other complex compounds [3].

The adaptation of plants to specific external environmental conditions during their ontogenesis is considered the result of their evolution (in terms of variability, heredity, and selection). During the evolution of the phylogeny of plants belonging to each species, an adaptation to the ecological conditions occupied by that plant has occurred.

The characteristics of the plant related to being moisture-loving or cool-loving, tolerant to heat or cold, and a number of other ecological features have been formed over a long period during the

process of evolution. This is because heat-loving plants and short-day plants in our conditions differ from the less heat-demanding, long-day plants in the northern regions.

In nature, each individual plant in a given geographical area grows in an ecologically suitable location based on its biology: moisture-lovers grow near water bodies, shade-lovers grow in places where sunlight does not fall directly, and so on.

The heredity of plants is formed under specific external environmental conditions. In this regard, the influence of external environmental factors during the plant's ontogenesis (development) is also of great importance. Plants, seedlings, and transplants of agricultural crops often form adaptations as a result of the struggle for life that arose from historical development in response to the unfavorable effects of one or another environmental factor. Plants effectively protect themselves from unfavorable abiotic and biotic factors of the external environment. Agricultural crops are sown in a certain region taking their resistance (tolerance) into account.

The adaptation of plants to the specific climate and soil conditions of the external environment occurs as a result of the physiological mechanisms (physiological adaptation) taking place in them, and through hereditary variability and natural selection (genetic adaptation) within the population of organisms.

The factors that occur in the external environment happen both lawfully (regularly) and randomly (by chance). The need for protection during the naturally occurring changes in the external environment, such as the change of seasons, creates hereditary adaptations in plants to these phenomena. [4].

The plants on our Earth have been historically formed as a result of natural and artificial selection. This selection was realized under the influence of the following: 1) hereditary variability; 2) homologous series of variability; 3) mutations, hybridization, and recombination.

Species that are well adapted to their habitat in natural conditions successfully reproduce. The development cycle of plants occurs under the combined influence of the genotype and environmental factors.

Each continent of our Earth's globe has its own flora, meaning its families and species form phytocenoses (plant communities).

The complex of phytocenoses, in forming the plant cover, is under the combined influence of factors such as light, heat, moisture, air, soil, and relief, together with biogenic (zoogenic, phytogenic) factors, and leads its life with periodicity (cyclically). [5].

As is known, the air we breathe was created by green plants. About 500 million years ago, green plants began to conquer the land.

Currently, all the Earth's continents are covered with plants, except for the glaciers of Antarctica, Greenland, and certain high mountain ranges and dry deserts. Individual plants, such as the moss-like *Arenaria musciformis*, are also found at an altitude of 6218 m.

As is known, plants thrive in tropical forests. The height of the plant layer in these areas is up to 50 m, with individual trees rising 20-30 m above that. The Mammoth Tree growing in Western North America reaches heights of 100-115 meters. They determined that the tallest one is 142 m. According to some data, the Eucalyptus (*Eucalyplus amygdalina*) growing in Australia reaches 150-155 m.

The main mass of plants in the world's oceans is distributed in the top 50 meter layer of water, and often on the surface of the top 20 meters of it. Below 200 meters, there are no groups of plants that carry out photosynthesis. Algae with assimilating pigments have also been found at depths of 500-600 meters in the oceans. In many cases, these turned out to be sunken, heterotrophically feeding organisms. They also determined that living bacteria (heterotrophic organisms) exist at depths of 10,400 m. [6].

The thickness of the layer where living life exists constitutes only 0.00001 of the Earth's radius at most. It is difficult to say how many plant species grow within the composition of the phytosphere in this layer. There are many reasons for this. Firstly, the plants in all regions of the Earth have not yet been fully studied. It is not surprising that around 2000 new species of plants are being identified and discovered every year. [2].

There are also contradictions in the data regarding the number of species; for example, while one group of specialists says fungi have 35000 species, others write that they number 40-50 thousand, or even more than 100000. [7].

Taken as a whole, it is currently estimated that there are approximately 400,000 species of plants on Earth. This figure is significantly less than the total number of species in the animal kingdom – the number of animal species in our land and oceans constitutes nearly one million. The number of species in the main groups of plants is approximately as follows:

Bacteria (*Bacteriophyta*)	1200
Blue-greenalgae (*Cyanophyta*)	2000
Gold-colored algae (*Chrysophyta*)	1000
Diatom algae (*Bacillariophyta*)	14000-1600
Yellow-green algae (*Xanthophyta*)	300
Brown algae (*Rhaeophyta*)	1500
Red algae (*Rhodophyta*)	3800
Cryptophyte algae (*Cryptophyta*)	1200
Green algae (*Chlorophyta*)	8000
Euglena algae(*Euglenophyta*)	500
Fungi (*Fungi, Mycata*)	40000-5000
Lichens (*Lichenes*)	20000
Moss-like ones(*Bryophyta*)	2500
Spore tissue plants (*Pleridophyta*)	1100
Open-seed plants (*Gymnospermae*)	600
Closed-seed or flowering ones (*Angispermae*)	260000

Approximately 34000-35000 species of algae, with the exception of some, are found in water, and 55-60 percent of those are distributed in the seas. We cannot say that the numerical data we have provided is exactly that much. Precise data is currently unavailable. Nearly 1000 species of higher plants are distributed in freshwater, and around 40 species are distributed in saltwater in our vicinity.

In short, plants have adapted to live in any environment, from deserts to mountains to gardens to hills and even hot springs. Flora is one of the most important natural factors on Earth and is a source of oxygen that is essential for both humanity and the animal world.

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Rezyume: *Ushbu risola o‘simlik dunyosining tarqalishi va ularning tabiatdagi bioekologiyani saqlashdagi amaliy ahmiyatihaqida yozilgan.*

Резюме: *Этот трактат посвящен распространению растительного мира и его практическому значению в поддержании биоэкологии природы.*

Kalit so‘zlar: *biogen, hujayra, biologik omillar, o’simlik turlari, biosfera*

Ключевые слова: *биогенный, клетка, биологические факторы, виды растений, биосфера*

ASSESSMENT OF HYDROLOGICAL INDICATORS OF AMU-BUKHARA CANAL IN BUKHARA OASIS

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Summary: *This article analyzes the interannual fluctuations in the water levels of the Amu-Bukhara machine canal and the Kerki hydropost in the Bukhara oasis. At the same time, the relationship between the water levels of the Amu Darya River (Kerki hydropost) and the water levels of the Amu-Bukhara machine canal is studied.*

Key words. *Hydrological regime, hydrochemical regime, irrigation water, collector-drainage water, groundwater.*

Introduction. Intensive use of water resources to meet the needs of various sectors of the economy leads to a violation of the natural hydrological and hydrochemical regime of water bodies, significant changes in the water regime in their basins, water abstraction, and most importantly, to an increase in the mineralization of water. These changes are expressed in the length and temporal distribution of river flows, as well as in the salinization of water basins as a result of an increase in the share of return waters. [2; 6085-6095].

These changes are particularly significant in areas where rivers are almost non-existent, especially in arid and semi-arid regions, where water flow is almost not used in economic sectors.

As a result of human activity, the construction of reservoirs, the diversion of water to irrigated lands, industrial, urban and agricultural water supply, urbanization, and others affect the hydrological and hydrochemical regime of rivers.

The study analyzed the annual changes in the amount of water supplied to the irrigated lands of the Bukhara oasis through the ABMK. For this purpose, water consumption data measured in the ABMK for the years 1990-2021 were used. Calculations were made for the vegetation and non-vegetation periods. At the same time, annual fluctuations in the amount of water at the Kerki hydropost were studied (1-picture).

Picture 1 below shows the dynamics of water withdrawals from the Amu Darya to the ABMK for the vegetation (Wv) and novegetation (Wnv) periods. The largest amounts of water withdrawn during the vegetation period fell on 2006 and 2017. In these years, the amount of water withdrawn from the Amu Darya amounted to 4118.8•106m3 and 4325.2•106m3, respectively. The largest indicators during the novegetation period also fall on these years.

The largest values of the annual flow volumes received from the Amu Darya to the ABMK were also observed in these years, amounting to 6541.6•106m3 and 6585.3•106m3, respectively. The amount of water received to the Bukhara oasis through the ABMK increased in all calculation periods. It should be noted that it is also important to determine the relative values of the total amount of water received from the Amu Darya to the ABMK during the year during the vegetation and non-vegetation periods. During the calculation period, i.e. 1990-2021, the amount of water received during the vegetation period changed by 57.9÷76.3% compared to the annual average. The relative values of the amount of water received during the vegetation period changed by 23.7÷42.1%. In the total accounting years, the amount of water taken during the growing season averaged 65.9%, and during the non-growing season it was 34.1%.

The annual fluctuations in the amount of water taken from the Amu Darya to the ABMK during the vegetation and non-vegetation periods, as well as the water volume at the Kerki hydropost, were studied (Picture 1).

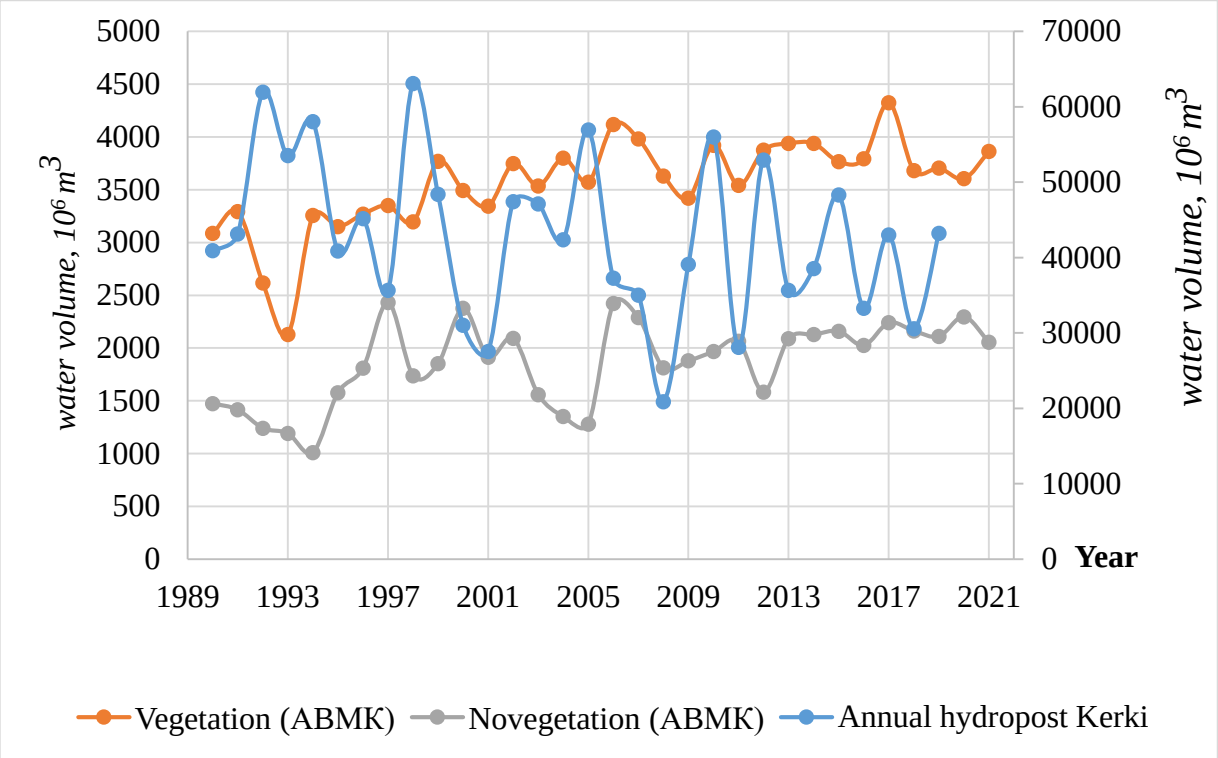


Figure 1. Interannual fluctuations in the amount of water taken from the Amudarya River and its discharge to the AMBK (1990-2021)

Table 1

Relations between the volumes of water taken from the Amudarya River (Kerki hydropost) and the ABMK

т/р	Connection type	Regression coefficient	Correlation coefficient and its error $r \pm \sigma_r$
1.	$W^{V}_{ABK} = f(W\text{керк})$	0,23	0,479 ÷ 0,09
2.	$W^{V}_{ABK} = f(W\text{керк})$	0,1	0,316 ÷ 0,14
3.	$W^{NV}_{ABK} = f(W\text{керк})$	0,32	0,565 ÷ 0,09

The analysis of the relationship between the amount of water in ABMK and the Amudarya River (Kerki hydropost) showed that the relationship between them is not high.

Conclusion. The annual fluctuations in the amount of water taken from the Amu Darya to the ABMK during the vegetation and novegetation periods were analyzed. Over the observation period, i.e. 1990-2021, the amount of water taken during the vegetation period varied within the range of 54.9÷76.3% compared to the annual average. The relative values of the amount of water taken during the novegetation period ranged from 23.7÷42.1%. Over the entire calculation period, the amount of water taken during the vegetation period averaged 65.9%, and during the novegetation period - 34.4%.

The dynamics of the amount of water received from the Amu Darya to the Bukhara oasis through the Amu-Bukhara machine canal was studied. During the accounting years, the annual flow varied in the range of 3319.5÷6565.3•106m3. The smallest value of these figures fell on 1993, and the largest on 2017;

Correlation relationships between total mineralization and major ions will make it possible to determine all the ions in the future by determining only the mineralization in the laboratory.

It is required to analyze the hydrological and hydrochemical quality of drinking water as well as the quality of drinking water.

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Rezyume: *Ushbu maqolada Buxoro vohasidagi Amu-Buxoro mashina kanalining va Kerki gidropostining suv miqdorlari yillararo tebranishlari tahlil etilgan. Shu bilan birgalikda Amudaryo daryosi (Kerki gidroposti) bilan Amu-Buxoro mashina kanaliga olingan suv miqdorlari orasidagi suv miqdorlari orasidagi bog`lanishlar o`rganib chiqilgan.*

Резюме: *В статье анализируются межгодовые колебания уровней воды Аму-Бухарского машинного канала и Керкинского гидропоста в Бухарском оазисе. Одновременно изучается связь между уровнями воды реки Амударьи (Керкинский гидропост) и уровнями воды Аму-Бухарского машинного канала.*

Kalit so‘zlar: *gidrologik rejim, gidrokimyoviy rejim, sug‘orish suvi, kollektor-drenaj suvlari, yer osti suvlari.*

Ключевые слова. *Гидрологический режим, гидрохимический режим, оросительная вода, коллекторно-дренажные воды, подземные воды.*

GEOLOGICAL STRUCTURE OF THE ALTYNTAU KAOLIN DEPOSIT IN CENTRAL KYZYLKUM

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Summary: *The Altyntau kaolin deposit in the Central Kyzylkum region represents a unique geological and industrial site, the study of which is important for both fundamental and applied geology. The article highlights the deposit's geological structure, lithology, tectonics, mineralogy, geochemistry, and industrial evaluation. It emphasizes the genetic features of kaolin formation, their distribution within the weathering crust, and industrial applicability, as well as provides recommendations for further research, including associated minerals and rare-earth elements.*

Key words: *Kaolin, weathering crust, granitoids, mineralogy, geochemistry, prospective resources, rare earth elements, Altyntau, Uzbekistan.*

INTRODUCTION

The "Altyntau" kaolin clays deposit, located in the western part of Uzbekistan, is a unique geological object with high industrial potential. Kaolin is used in the ceramic, refractory, paper, and rubber industry. Studying the geological structure, mineralogical composition, and predicted resources is crucial for the rational development of the deposit. The kaolinization of rocks is due to the interaction of geochemical processes, hydrothermal fluids, and tectonic activity. The work examines the features of the formation of primary and secondary kaolins, their placement in various morphological and stratigraphic complexes, and provides a predictive assessment of their reserves and industrial significance [1].

Degree of study of the problem and research methods. Geological study of the area began in the 1930 s. In 1953, a 1:100000 scale state survey was conducted, and in 1961, a geological map was published. In 1970-1974, a 1:50000 scale survey was carried out, which allowed for detailed dissection of sedimentary-metamorphic rocks and igneous complexes.

The first information about ancient weathering crusts dates back to the 1940s, and their systematic study began in the 1960s. It was shown that thick kaolin crusts formed during the pre-glacial period. In 1970-1977, Uzbekistan's territory was regionalized for the preservation of weathering crusts, and a map of their distribution was compiled, where linear and area types were identified, and a mineralogical-chemical characterization was provided.

In 1994, the "Химгеолнеруд" expedition prepared a report on the study of kaolin clays and the assessment of refractory and ceramic raw materials of the Altyntau massif [2-3].

Geological structure of the deposit. The "Altyntau" deposit is located on the southern slope of the Zirabulak gorst-anticlinorium within the Zeravshan-Turkestan zone. It is confined to granites of the Late Paleozoic complex, which have undergone deep kaolinization. The geological structure is complicated by a system of submeridional and sublatitudinal faults that control the depth of kaolinization and fragment the usable layer into individual blocks.

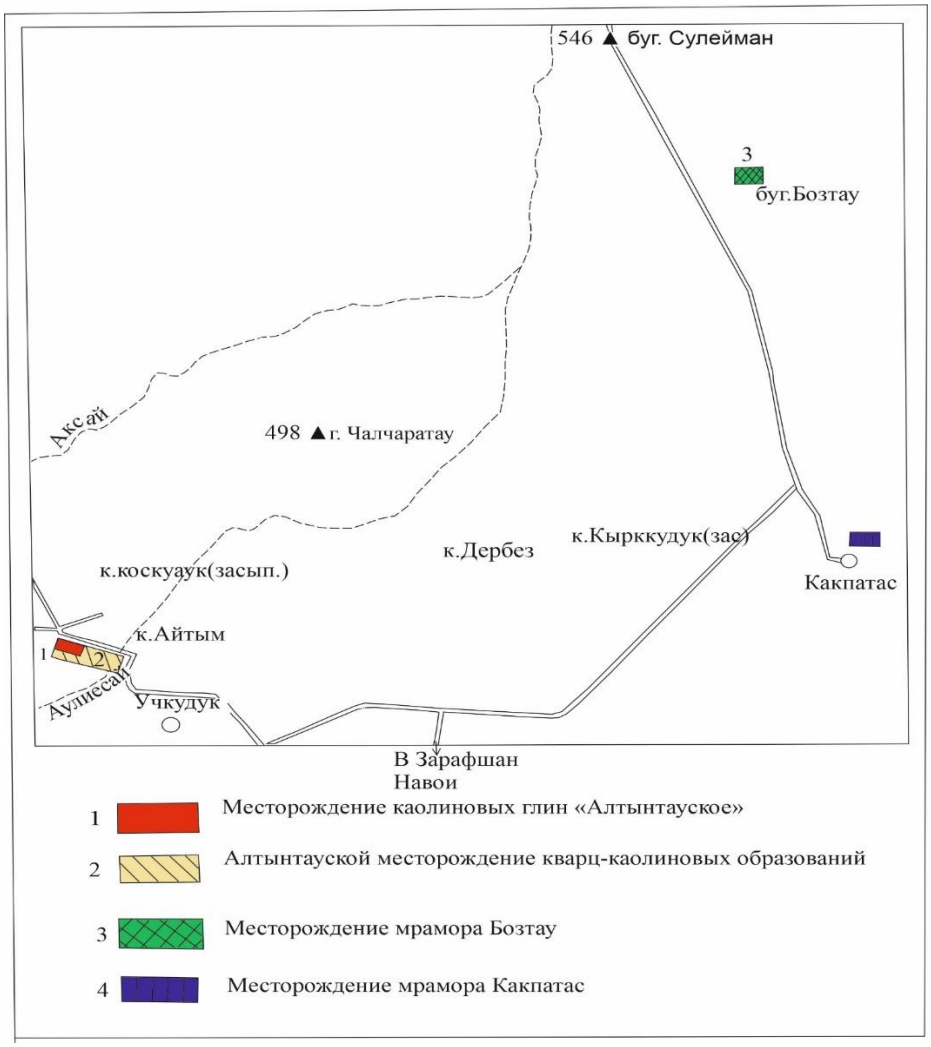


Fig. 1. Overview map of the work area, scale 1:2000000

The foundation of the deposit is represented by metamorphosed Proterozoic strata: siliceous shales, quartzites, and phyllites. These are exposed by drilling at depths of 5-10 m and are overlain by Cenomanian and kaolinite deposits. Mineralogically, these rocks are enriched with quartz and hydromicas, indicating a high degree of metasomatic alteration.

The main industrial object is the pre-bull weathering crust, formed on granites under long-term subtropical climate conditions. It is characterized by a distinct zonality: above it, a completely clay zone with a kaolinite content of over 60% is distinguished, white in color, and soft in structure. Below, the texture of the parent rock is preserved, but the degree of kaolinization differs; quartz, feldspar, and biotite are present.

The thickness of the kaolinized layers reaches 12-15 m, especially in the central and southern parts of the deposit. In the northwest, the crust is partially eroded, where granites and Proterozoic rocks emerge to the surface. The southern and eastern sections are complicated by re-deposited Cenomanian sandy-clayey rocks and conglomerates.

Geomorphologically, the territory is a slightly hilly plain with a south-eastern slope. Erosion forms have developed here - ancient channels and furrows that erode the kaolin thickness and form zones of secondary accumulation. Faults with an amplitude of up to 40 m play a dual role: they simultaneously contribute to the development of kaolinization and complicate the geological structure.

Thus, the geological structure of the "Altyntau" deposit is mosaic in nature, reflecting the interaction of the ancient foundation, granitoid magmatism, weathering crust, and covering sediments. This necessitates the heterogeneity of kaolin mineralization placement, variation in raw

material quality, and the need for detailed geological-structural studies when assessing reserves [4-5].

Litological characteristic

Within the deposit, several lithological complexes are distinguished:

Metamorphic rocks of the Proterozoic – quartzites, siliceous schists, fillite-like argillites; they form tectonic contacts with granites and are characterized by high density, the presence of iron veins and sulfides (pyrite, marcasite).

Paleozoic granitoids – biotite-muscovite granites of light pink and grey-greenish color, products of the third phase of granitoid magmatism of late carbon - early perm; it is on them that the main zone of kaolinization is developed.

Prehistoric age of weathering crust – the main industrial facility with vertical zonality.

Cenomanian sandy-clayey deposits – erosion furrows are made, the kaolin thickness is covered.

Quaternary covers – are represented by modern deposits that partially remove and redistribute kaolin material.

Thus, the geological structure of the "Altyntau" deposit is mosaic in nature, reflecting the interaction of the ancient foundation, granitoid magmatism, weathering crust, and covering sediments. Such a complex structure has led to the formation of heterogeneous in composition and thickness kaolinized layers, which directly affects the quality and industrial value of raw materials. The presence of tectonic faults and erosional forms further complicates the deposit's morphology, creating both favorable kaolin accumulation zones and areas with their destruction. All this determines the need for detailed geological-structural, mineralogical, and geochemical studies to obtain a reliable assessment of reserves and their rational development [6-7-8-9].

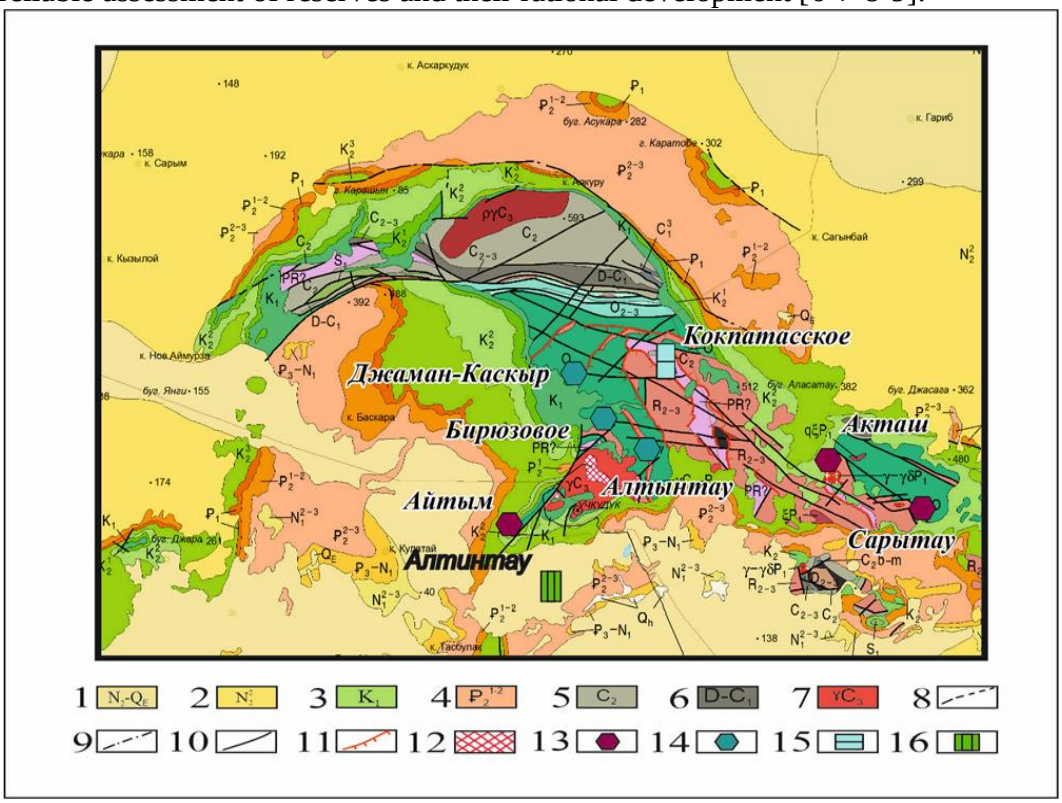


Fig. 2. Overview geological map of the Altyntau deposit

1-Neogene-Quaternary systems. Polyocene-eopleistocene (N2-QE); 2- Upper Pliocene (N22); 3-Unsegmented Cretaceous deposits (K1); 4- Lower-Middle Eocene (β21-2); 5- Carboniferous system. Middle section (C2); 6- Devonian system - Carboniferous system, lower section; 7- Granites, alyascites (ɣS3); 8- Identified and proposed based on geophysical data; 9-Precipitates under the sedimentary cover; 10- Fractures of undefined morphology; 11-Adviges; 12- Acidic compound. Rioliths, trachyroliths, granite-porphyries;13- Kacholong; 14 - Turquoise; 15-Marble; 16-kaolin;

Analysis and results. As a result of the analyses, the following content of components was obtained (1-table).

Chemical composition of kaolins of the Altyntau deposit

Table-1

	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	K_2O	Na_2O	SO_3	CaO	MgO	P_2O_5	p.p.
Clay of brick-red color, aleuritic	77,72	12,3	0,96	1,42	0,24	0,16	0,58	0,81	0,72	0,07	0,9
St. gray kaolin clay	81,72	11,22	0,46	0,95	0,11	0,08	0,2	0,19	0,58	0,05	0,06
St. gray kaolin clay	73,45	16,85	1,09	1,19	0,18	0,12	0,22	0,29	0,8	0,06	0,22
In thoracic kaolin clays	63,04	24,2	1,39	0,79	0,17	0,22	0,16	0,25	0,71	0,14	0,25
In thoracic kaolin clays. Purple	61,2	22,1	1,14	3,12	0,3	0,17	0,94	0,74	0,85	0,87	1,17
Violet-colored kaolin granite	23,72	8,24	0,46	2,16	0,26	0,14	0,68	0,2	0,61	0,03	0,52
Kaolin clays of gray color with a violet tinge	69,52	19,23	1,08	0,98	0,32	0,12	0,4	0,38	0,59	0,06	0,31
Kaolin clays of gray color with a violet tinge	74,35	16,73	0,97	0,55	0,31	0,08	0,19	0,19	0,73	0,03	0,11
White-colored caolin granite	85,37	8,81	0,54	0,66	0,22	0,11	0,19	0,16	0,45	0,03	0,19
Caolinized gray granite with a violet tinge	62,84	21,74	0,81	2,04	3,42	0,11	0,39	0,24	0,81	0,09	0
Aleurolite clays	65,36	23,08	0,72	0,76	0,06	0,09	0,13	0,22	0,56	0,04	0,52
In thoracic kaolin clays	65,45	23,31	0,72	0,48	0,09	0,16	0,14	0,13	0,66	0,03	0,5
In thoracic kaolin clays	64,79	21,35	0,62	3,33	0,14	0,1	0,3	0,29	0,75	0,07	0

CONCLUSION

The "Altyntau" kaolin clays deposit is an important geological and industrial object, characterized by its complex structure, diverse lithological complexes, and high industrial potential. Conducted research shows:

Kaolinization is developed mainly on Late Paleozoic granites and is distinguished by a pronounced zonality;

The thickness of the useful layer reaches 12-15 m, the quality and composition of the raw material vary depending on the degree of preservation of the weathering crust and geological conditions;

chemical analysis confirms the industrial value of kaolins, which have a high content of **SiO_2** and **Al_2O_3** making them suitable for use in ceramic, refractory, and other industries;

the presence of erosion processes, tectonic disruptions, and re-deposited layers requires a comprehensive approach to further study and development.

Thus, the "Altyntau" deposit can become a promising raw material base for various industries of Uzbekistan, provided that it is rationally developed and detailed structural-geological studies are carried out.

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Rezyume: *Markaziy Qizilqum hududidagi Oltyntau kaolin koni noyob geologo-sanoat obyekti bo‘lib, uni o‘rganish fundamental va amaliy geologiya uchun muhimdir. Maqolada konning geologik tuzilishi, litologiyasi, tektonikasi, mineralogiyasi, geokimyosi va sanoat bahosi yoritilgan. Kaolinlarning shakllanish xususiyatlari, tarqalishi va sanoatga yaroqliligi ko‘rsatilib, hamroh foydali qazilmalar va nodir elementlarni o‘rganish bo‘yicha tavsiyalar berilgan.*

Резюме: *Олтынтауское месторождение каолинов в районе Центральных Кызылкумов представляет собой уникальный геолого-промышленный объект, изучение которого важно как для фундаментальной, так и для прикладной геологии. В статье освещены геологическое строение, литология, тектоника, минералогия, геохимия и промышленная оценка месторождения. Подчёркнуты генетические особенности формирования каолинов, их распространение в коре выветривания и промышленная пригодность, а также даны рекомендации по дальнейшему изучению, включая сопутствующие полезные ископаемые и редкоземельные элементы.*

Kalit so`zlar: *kaolin, nurash qobig‘i, granitlar, mineralogiya, geokimyo, prognoz resurslar, nodir yer elementlari, Oltintau, Markaziy Qizilqum.*

Ключевые слова: *каолин, кора выветривания, гранитоиды, минералогия, геохимия, прогнозные ресурсы, редкоземельные элементы, Алтынтау, Узбекистан.*

UDC: 678.014

SYNTHESIS OF NITROGEN-CONTAINING ACRYLIC MONOMERS

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Summary: *This study describes the synthesis and characterization of a new nitrogen-containing heterocyclic monomer based on the alkylation reaction between benzotriazole and acrylic acid. Optimal synthesis conditions were established at a 1:1 molar ratio of reagents, 80 °C, and 5 hours of reaction time, yielding up to 80% of the target product. The structure of the synthesized monomer was confirmed by FT-IR spectroscopy, which revealed characteristic absorption bands corresponding to C=O, C=C, N=N, and C–N functional groups. Thermal analysis demonstrated that the monomer exhibits a well-defined melting point and thermal stability up to 250 °C, followed by major decomposition near 280 °C. The obtained benzotriazole–acrylic monomer shows good solubility in polar organic solvents. These findings indicate that benzotriazole derivatives can be effectively functionalized through acrylic acid incorporation to create new monomers with promising properties for advanced polymeric materials.*

Key words: *benzotriazole, acrylic monomer, heterocyclic compounds, FT-IR, thermal analysis, synthesis.*

Introduction

Nitrogen-containing heterocyclic compounds constitute one of the most structurally diverse and functionally significant classes of organic molecules [1]. Their characteristic feature is the incorporation of nitrogen atoms into the ring system, which imparts unique electronic, coordination, and reactive properties [2]. Among this broad family, benzotriazole and its derivatives occupy a special place due to their wide range of applications. These compounds are frequently employed as anticorrosive additives, detergents, anti-fog and anti-valent agents in photographic processes, antifreeze components, optical brighteners for various materials, and UV absorbers in cosmetic formulations. In addition, benzotriazole-based molecules have demonstrated considerable pharmaceutical relevance, functioning as biologically active agents with anticancer, antiviral, antibacterial, antifungal, antioxidant, antihypertensive, and anticoagulant activities [3].

Growing interest in nitrogen-containing monomers is associated with their capacity to expand research directions in polymer chemistry, supramolecular chemistry, medicinal chemistry, and molecular biology [4]. Heterocyclic systems containing both azole fragments and amide or lactam functionalities are particularly noteworthy [5]. Their structural similarity to peptide fragments—due to the presence of amide bonds—makes them valuable model compounds for studying biochemical processes occurring in living organisms [6]. Consequently, benzotriazole derivatives attract attention not only as functional organic molecules but also as key intermediates for the design of advanced polymeric and biologically active materials [7].

In our previous studies, several benzotriazole and benzimidazole derivatives were synthesized, including 1-octyl-1,3-dibutyl-1H-benzotriazole, 1-butyl-3-octyl-1H-benzotriazole, 1,3-dioctyl-1H-benzotriazole, 1,3-dibutyl-1H-benzotriazole, and 1-octyl-1H-benzimidazole [8]. A comparative assessment showed that using acetonitrile as the reaction medium resulted in relatively low product yields, whereas the DMF/KOH system significantly increased the yield, reaching up to 92%. Notably, quaternary benzotriazole derivatives were not formed in pure acetonitrile, while they were readily synthesized under DMF/KOH conditions. The molecular structures of the obtained compounds were confirmed by NMR, GC–MS, and FTIR spectroscopy [9].

Further developments in this field have focused on the synthesis of water-soluble diallyl monomers [10]. One such compound, N, N-diallylbenzotriazolium bromide, was synthesized via an alkylation reaction between benzotriazole and allyl bromide at 50–60 °C in various organic solvents, including acetone, ethanol, and toluene. Structural confirmation of the resulting quaternary

ammonium salt was achieved by UV and NMR spectroscopy, while its thermal stability and degradation behavior were investigated using thermoanalytical methods [11].

Recently, more structurally sophisticated benzotriazole-based systems have also been reported [12]. For example, the compound bis(3-(2H-benzo[d] [1,2,3] triazol-2-yl)-2-(prop-2-yn-1-yloxy)-5-(2,4,4-trimethylpentan-2-yl) phenyl) methane (TAJ1) was synthesized via the reaction of 6,6′-methylenebis (benzotriazolyl phenol), propargyl bromide, and potassium carbonate. The structure of TAJ1 was confirmed through FTIR, ^{1}H-NMR, ^{13}C-NMR, and single-crystal X-ray analysis, which revealed a molecular architecture consisting of two benzotriazole-containing aromatic systems linked by a central methylene bridge. Biological evaluation of TAJ1 demonstrated significant inhibitory effects on several cell lines, including HeLa, MCF-7, and Vero cells. Furthermore, DFT analysis provided insights into electronic structure and reactivity, showing a HOMO–LUMO energy gap of 0.159 eV, indicative of high chemical activity [13].

Another important development is the synthesis of the monomer 2-(bis((1H-benzo[d][1,2,3] triazol-1-yl) methylamino) ethyl acrylate) (BMEA), which contains two pendant benzotriazole fragments [14]. Polymerization of this monomer afforded PBMEA, a new material exhibiting high hygroscopicity and potential applicability in humidity-responsive systems and functional membranes.

Benzotriazole derivatives are also known to form stable complexes with various transition metals, a property that has been exploited in catalysis, coordination chemistry, and materials science [15]. Coordination of benzotriazole with certain metal ions has been linked to enhanced anticancer activity, thereby broadening its therapeutic potential [16]. Additionally, benzotriazole can serve as a radical precursor [17] or as a synthon for generating stable nitrenium ions [18], further highlighting its versatility in synthetic organic chemistry.

Taken together, the literature clearly demonstrates that the synthesis, modification, and study of nitrogen-containing heterocycles—particularly benzotriazole derivatives—are of great scientific and practical relevance [19]. Their broad functional potential makes them promising candidates for applications in polymer science, coordination chemistry, pharmaceuticals, materials engineering, and environmental technologies [20].

Materials and Methods

Materials

The following reagents were used in the study: benzotriazole and acrylic acid, both of which were purified using standard procedures described in the literature.

Purification of benzotriazole was carried out by recrystallization.

Benzotriazole:

- Molecular weight: 119.13 g/mol
- Density (20 °C): 1.36 g/cm³
- Melting point: 100 °C
- Appearance: Colorless needle-shaped crystals
- Solubility: Freely soluble in alcohols, benzene, toluene, and methanol; practically insoluble in water

Acrylic acid (propenic acid, ethenecarboxylic acid), analytical grade, was dried over calcined magnesium sulfate and further purified by vacuum distillation:

- Boiling point: 141 °C
- Density (20 °C): 1.0511 g/cm³

N,N-Dimethylformamide (DMF), chemically pure grade (TU 2636-056-05761637-2005), was dried over barium oxide and purified by vacuum distillation:

- Boiling point: 153 °C
- Melting point: –61 °C
- Density (20 °C): 0.9445 g/cm³
- Refractive index (nD20): 1.43

The synthesized benzotriazolium acrylic acid derivative is a white crystalline compound with:

- Boiling point: 279 °C

Synthesis of benzotriazole monomer with acrylic acid

The synthesis of the target monomer was carried out in an organic solvent medium at 80–90 °C for 3–5 hours. The reaction was performed in a glass reactor consisting of a conical flask equipped with a reflux condenser and a magnetic stirrer.

Benzotriazole (1 mol) was dissolved in 100 mL of dimethylformamide. The reaction mixture was stirred at room temperature for 5 minutes. Acrylic acid (1 mol), previously stabilized with 0.2 g of hydroquinone to prevent premature polymerization, was added dropwise to the solution. The reaction mixture was then heated to 80 °C and maintained with continuous stirring for 5 hours.

Upon completion, the reaction mixture was cooled to room temperature, resulting in the formation of light-yellow crystalline precipitates. The solid product was isolated by vacuum filtration, thoroughly washed with water, and dried under reduced pressure. Yield: 80%.

Characterization Techniques

FT-IR Spectroscopy

IR spectra were recorded using a Spectrum Two FT-IR spectrometer (PerkinElmer Spectrum IR Version 10.6.1, USA, 2019), equipped with an attenuated total reflection (ATR) MIRacle-10 attachment with a diamond/ZnSe crystal.

- Spectral range: 4000–400 cm^{-1}
- Resolution: 4 cm^{-1}
- Signal-to-noise ratio: 60,000:1
- Scan speed: 20 scans/s

Thermal Analysis

Thermal behavior of the synthesized samples was analyzed using a Netzsch STA 409 PG (Germany) simultaneous thermal analyzer equipped with a K-type thermocouple (LowRGSilver) and aluminum crucibles.

Experimental conditions:

- Atmosphere: Nitrogen (inert)
- Gas flow: 50 mL/min
- Temperature range: 25–600 °C
- Heating rate: 5 K/min
- Sample mass: 5–10 mg

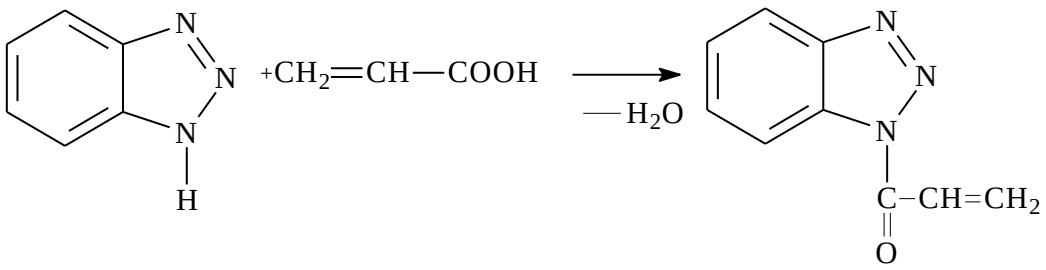
The system was calibrated using standard reference materials: KNO_3, In, Bi, Sn, and Zn.

Melting Point and Chromatographic Purity

The melting point of the synthesized monomer was determined using a Boetius heating stage (Germany). Reaction progress and product purity were monitored by thin-layer chromatography (TLC) using Silufol UV-254 plates with a benzene–ethanol (3:1) mobile phase.

Results and Discussion

This study presents the results obtained during the synthesis and characterization of a nitrogen-containing heterocyclic monomer derived from benzotriazole and acrylic acid. The target compound represents a benzotriazole-based acrylic acid derivative containing a quaternized nitrogen fragment, which is of considerable interest for the development of functional monomers and advanced polymeric materials. The proposed structure of the synthesized monomer is illustrated schematically below.

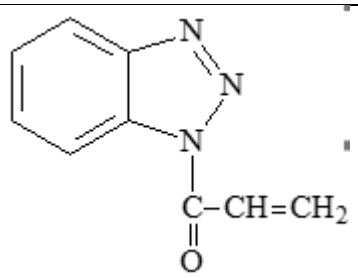


The synthesized monomer demonstrated excellent solubility in polar organic solvents, which is an important prerequisite for its potential application in polymerization processes and for its

incorporation into copolymer matrices. The principal physicochemical properties of the product are summarized in Table 1.

Table 1.

Physical and chemical characteristics of DABTB

Formula of the synthesized compound	Gross formula	Aggregate state	Mol. weight	T_{boil} °C	Solubility
	$C_9H_7N_3O$	white crystal	173	279	dimethylformamide, ethanol, acetone

To establish the most efficient synthesis conditions, the effects of reaction temperature, duration, and molar ratios of the reactants were systematically investigated. A comparative assessment revealed that the most favorable conditions correspond to a 1:1 molar ratio of benzotriazole to acrylic acid, a reaction temperature of 80 °C, and a reaction duration of 5 hours. Under these parameters, the highest yield and product purity were achieved. At lower temperatures or shorter reaction times, incomplete conversion was observed, whereas higher temperatures promoted undesired side processes, including partial polymerization of acrylic acid despite the presence of a polymerization inhibitor.

IR Spectral Analysis

Structural identification of the synthesized monomer was confirmed by FT-IR spectroscopy (Fig. 1).

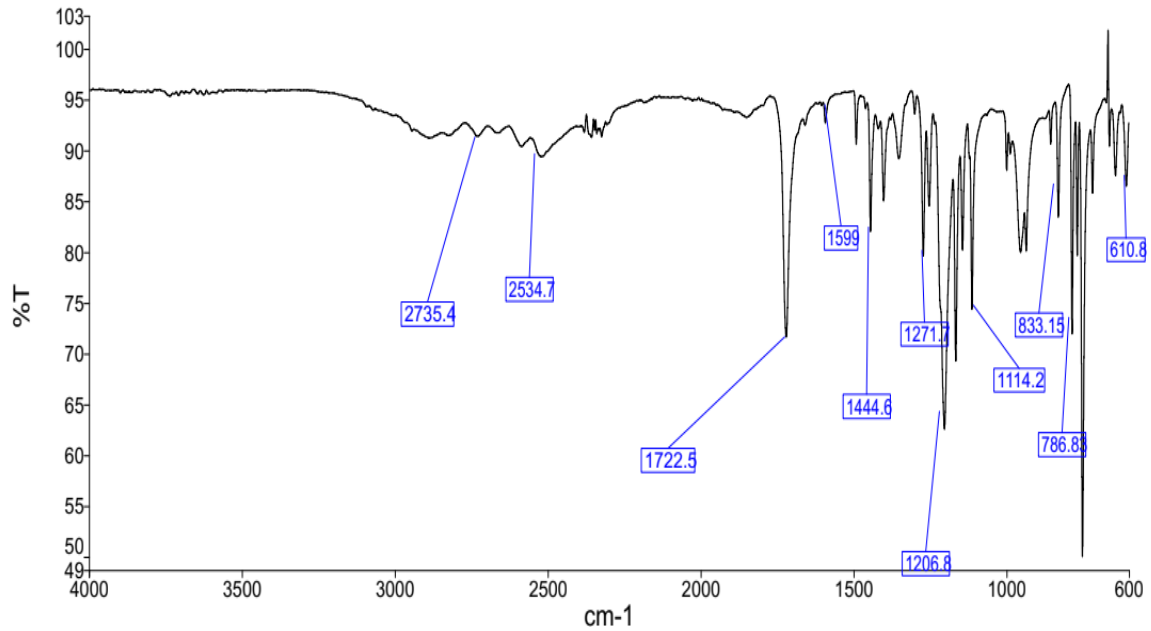


Figure 1. IR spectrum of benzotriazole monomer with acrylic acid

The IR spectrum of the obtained BTAA monomer exhibits several distinct absorption bands corresponding to the functional groups involved in the structure. A strong absorption band at 1720 cm^{-1}, attributed to the C=O stretching vibration of the acrylic acid fragment, confirming successful incorporation of the carbonyl group. A characteristic band at 1457 cm^{-1} corresponds to the –N=N– vibrations of the benzotriazole ring. The vinyl group displays a typical stretching vibration at 1622 cm^{-1}, assigned to the C=C bond of the acrylic acid moiety. A well-defined band at 1146 cm^{-1} is associated with C–N stretching, indicating the interaction between benzotriazole and acrylic

fragments. The band near 620 cm^{-1} corresponds to N–C=O bending vibrations. These spectral features collectively confirm the formation of the intended benzotriazole-based acrylic monomer and the preservation of key heterocyclic and vinyl functionalities necessary for further polymerization.

Thermal Analysis

Thermogravimetric analysis (TGA) was carried out in order to assess the thermal stability and decomposition behavior of the synthesized monomer (Fig. 2).

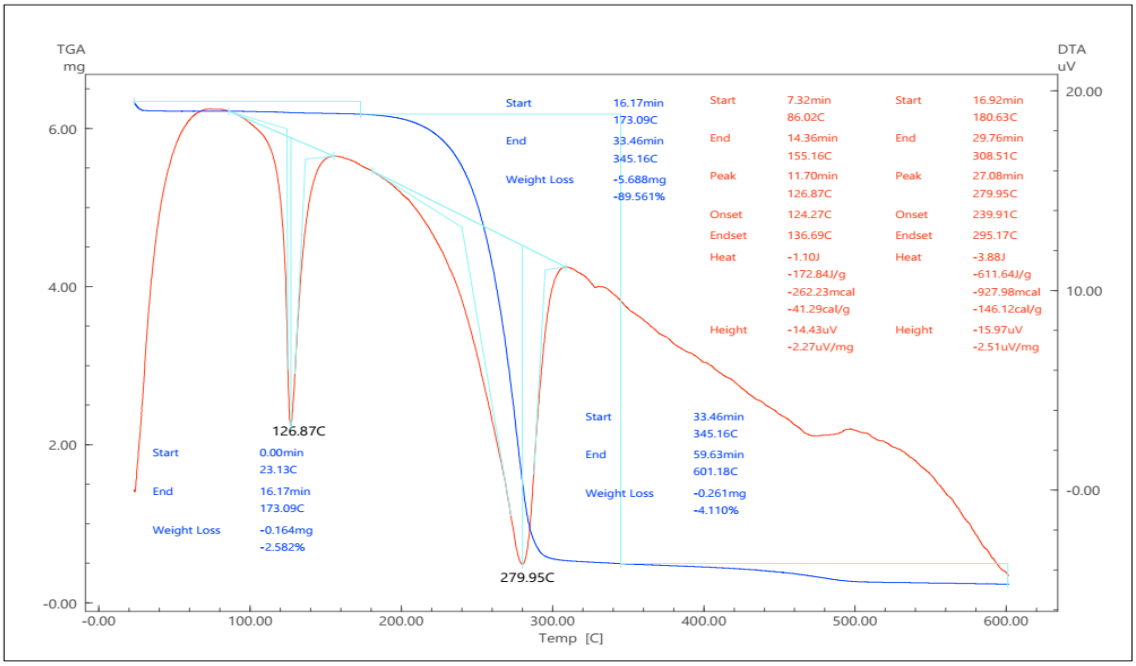


Figure 2. Thermogravimetric analysis of benztriazole monomer with acrylic acid

The TGA data demonstrate that the monomer undergoes thermal decomposition in several stages. A minor mass loss of 2.6% occurs within the temperature range 86–155 °C, which can be attributed to the removal of physically adsorbed moisture or trace amounts of solvent remaining in the crystalline lattice. An endothermic peak observed at 126 °C (ΔQ = –172.84 J/g) corresponds to the melting point of the compound, confirming the thermal data obtained independently.

No significant mass change occurs immediately after melting; however, pronounced thermal decomposition begins at approximately 279.95 °C, which corresponds to the second major stage of degradation. At this stage, a mass loss of 89.56% is observed, indicating complete breakdown of the monomeric structure and the loss of volatile fragments.

The thermal behavior of the monomer indicates good stability up to ~250 °C, making it potentially suitable for polymerization techniques requiring moderate thermal input. The presence of a distinct melting point and clean decomposition profile further supports the purity of the synthesized compound.

Conclusion

In this work, a new nitrogen-containing heterocyclic monomer based on benzotriazole and acrylic acid was successfully synthesized and comprehensively characterized. Optimal reaction conditions were established as a 1:1 molar ratio of benzotriazole to acrylic acid, a reaction temperature of 80 °C, and a synthesis duration of 5 hours, which ensured high yield and purity of the final product. The synthesized monomer was obtained as a white crystalline compound with good solubility in polar organic solvents, making it suitable for further polymerization processes.

Structural identification by FT-IR spectroscopy confirmed the presence of characteristic functional groups, including C=O, C=C, N=N, and C–N vibrations, which verify the successful formation of the benzotriazole–acrylic acid framework. Thermal analysis demonstrated that the monomer possesses a well-defined melting point and remains thermally stable up to approximately

250 °C, with major decomposition occurring near 280 °C. Such behavior indicates that the compound can withstand moderate thermal processing conditions typically required for polymer synthesis.

Overall, the results show that benzotriazole derivatives can be effectively functionalized through acrylic acid incorporation to form monomers with desirable physicochemical and thermal properties. The synthesized monomer represents a promising precursor for the development of new functional polymers and advanced materials. Further studies may focus on polymerization behavior, copolymer synthesis, and evaluation of the resulting materials for potential applications in coatings, membranes, and functional organic systems.

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Резюме: *В данном исследование описывает синтез и характеристику нового азотсодержащего гетероциклического мономера на основе реакции алкилирования между бензотриазолом и акриловой кислотой. Оптимальные условия синтеза были установлены при молярном соотношении реагентов 1:1, 80 °C и времени реакции 5 часов, с получением 80% целевого продукта. Структура синтезированного мономера была подтверждена ИК- ТА-спектроскопией, которая выявила характерные полосы поглощения, соответствующие функциональным группам C = O, C = C, N = N и C-N. Термический анализ показал, что*

мономер обладает хорошо выраженной температурой плавления и термостойкостью до 250 °C, после чего происходит крупное разложение около 280 °C. Полученный бензотриазолоакриловый мономер проявляет хорошую растворимость в полярных органических растворителях. Эти результаты показывают, что производные бензотриазола могут быть эффективно использованы путем введения акриловой кислоты для создания новых мономеров с перспективными свойствами для передовых полимерных материалов.

***Rezyume**: Ushbu tadqiqotda benzotriazol va akril kislotaning alkillanish reaksiyasi asosida yangi azot saqlovchi geterotsiklik monomerni sintez qilish va uning xossalarini o‘rganish natijalari keltirilgan. Optimal sintez sharoitlari 1:1 mol nisbatda, 80 °C harorat va 5 soat davomda olib borilganda eng yuqori (80%) unum qayd etilgan. Sintez qilingan monomer tuzilishida C = O, C=C, N=N va C-N funksional guruhlariga mos keladigan o‘ziga xos yutilish chiziqlari aniqlagan va IK-TA- spektroskopiyasi bilan tasdiqlangan. Termaanalitik tahlili monomerning aniq suyuqlanish harorati 250 °C gacha issiqlik barqarorligiga ega ekanligini, 280 °C atrofida esa asosiy parchalanish boshlanishini ko‘rsatdi. Olingan benzotriazol-akril monomeri qutbli organik erituvchilarda yaxshi eruvchanlikka ega. Tadqiqot natijalari benzotriazol hosilalarini akril kislota orqali samarali funksionallashtirish orqali istiqbolli yangi monomerlar olish mumkinligini tasdiqlaydi.*

***Kalit so‘zlar:** benzotriazol, akril monomer, geterotsiklik birikmalar, FT-IR, termal tahlil, sintez.*

***Ключевые слова:** бензотриазол, акриловый мономер, гетероциклы, ИК-спектроскопия, термоанализ, синтез.*

UDC: 547.466.2+547.458.2

SYNTHESIS AND PROPERTIES OF COMPLEX ESTERS BASED ON BIOLOGICALLY DECOMPOSED DICARBONIC ACIDS

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Summary: *This research work is aimed at the synthesis of new esters based on tartaric acid and acrylic acid, which are considered biobase polycarboxylic acids. The esterification process was carried out at a temperature of 80 °C in the presence of a KU-2-8 ion exchange resin (H-form), which is easily extracted from the reaction medium as a catalyst and has extensive processing capabilities. Acrylic acid and tartaric acid were prepared in a 2:1 ratio. To prevent the polymerization process due to acrylic acid, hydroquinone was used as an inhibitor in the production of ether. The synthesized ether is believed to serve as a monomer for the preparation of a dental filling. As a result of the reaction, the ester yield was 86%. Ether purification was confirmed by high performance liquid chromatography and IR spectroscopy. Ether bands appeared in the IR spectrum, and the results were confirmed by high performance liquid chromatography and showed high purity and efficient formation of the resulting product.*

The synthesized new monomer ether serves as a promising raw material for copolymerization processes, the production of promising bioassisted monomers, in the field of dentistry.

Key words: *Tartaric acid, acrylic acid, ester, ion-exchange resin, KU-2-8, bio-basic monomer, esterification reaction, renewable raw materials*

Introduction

Currently, special attention is paid to obtaining environmentally friendly substances with high added value from biobasic monomers. Tartaric acid produced microbiologically from natural sources is considered one such promising dicarboxylic acid. Its presence of two carboxyl groups and two hydroxyl groups allows it to participate in various reactions, including serving as a valuable monomer for the synthesis of esters. In this regard, synthesized esters based on tartaric acid are of great importance in the development of environmentally friendly polymers and special additives obtained from renewable raw materials. The production of tartaric acid from natural sources is of great ecological and economic importance. This acid is mainly extracted from the waste of viticulture and winemaking, in particular from wine stones (potassium tartrate crystals).

This approach allows the use of renewable raw materials and contributes to the development of waste-free technologies [1]. Also of great practical importance are tartaric acid-based ester compounds, which are widely used in the synthesis of biodegradable polymers, plasticizers and biocompatible monomers. Synthesis of tartaric acid esters from a natural source is even more environmentally beneficial because the process reduces the need for artificial catalysts, reduces waste, and produces safe and stable products for use in biomedical and green chemistry. [2].

As a result, the production of tartaric acid and its esters from natural sources, along with the creation of biological raw materials that comply with the principles of sustainable development, will make a significant contribution to the preservation of the environment and the effective use of renewable resources [3].

Acrylic acid is currently considered one of the main monomers for the polymer industry and is highly reactive. It is particularly important to produce esters while maintaining the double bond. In this regard, the synthesis of esters based on tartaric and acrylic acids makes it possible to combine two types of promising monomers. This makes it possible to impart new functional properties to the materials obtained from them [4]. Esterification reactions are one of the important areas of organic synthesis and are widely used on an industrial scale for the production of various esters [5]. Tartaric and acrylic acid and their esters are characterized by high reactivity, the presence of secondary functional groups and versatility in polymerization processes [6]. In particular, tartaric acid obtained

by biosynthesis is of great importance as an environmentally friendly and renewable raw material [7-9]. The proposed synthesis method enables efficient use of renewable natural resources, ensuring environmental and economic feasibility of the process. The preservation of double bonds in the structure of the obtained ethers gives them a high reactivity and opens up wide opportunities for subsequent polymerization and functionalization. Due to this, such compounds can be considered as an environmentally safe and sustainable alternative to traditional petrochemical esters, which makes them promising components for creating new bio-based polymer and functional materials. [10].

Traditionally, such reactions have been carried out in the presence of homogeneous acid catalysts (H2SO4, H3PO4, etc.), but their susceptibility to corrosion, waste generation and difficulty in reuse cause great problems [11-12]. Therefore, in recent years, there has been a growing interest in the use of heterogeneous ion exchange resin catalysts (KU-2-8, Dowex, etc.). The use of ion exchange catalysts (KU-2-8, Amberlyst, Dowex, DIAION, etc.) makes it easy to recover and reuse the catalyst by filtration after the reaction [13]. In general, ionite catalysts are widely studied in esterification reactions - they are studied from the point of view of reaction kinetics, mass conductivity limitations and reactor design [14].

Earlier, E. Sert and colleagues investigated the kinetic patterns of the esterification reaction in the acrylic acid-alcohol system in the presence of an ionite catalyst, showing the effect of temperature and catalyst concentration on the rate and degree of conversion [15]. In turn, A. D. Buluklu et al developed a kinetic model of the mechanism of esterification of acrylic acid with hexanol, which made it possible to quantitatively describe the effect of process parameters on the yield of the target product [16]. The authors studied the esterification of tartaric acid with various alcohols using modified heterogeneous catalysts (SO ′ ² ′/TiO ′ -SiO ′, lanthanide-based catalysts) and successfully synthesized a number of diesters - dimethyl, dibutyl and di-isooctyl - with high yield and selectivity. [17]. There are also patent data on tartaric acid esters. Analysis of the literature shows that the synthesis of acrylic acid esters and alcohols in some cases is very well studied, but there is not enough information in the literature about esterification methods with the addition of tartaric acid and acrylic acid. Thus, this research work contributes to solving a number of scientific problems, and the results obtained serve as an important source of information for the synthesis of polymer materials, functional monomers and new ether additives.

The aim of the work is to synthesize esters based on tartaric acid, which is a renewable natural source, and highly reactive acrylic acid in the presence of an H-form KU-2-8 ion-exchange catalyst, optimize reaction conditions and substantiate the value of the obtained products as promising monomers.

Materials and Methods

Materials

The following objects of research were selected: benzotriazole, acrylic acid, which were purified according to known methods.

Tartaric acid (tartaric acid, $C_4H_6O_6$, brand "x.h") - (tartaric acid, tartaric acid, 2,3-dihydroxybutanedioic acid) HOOC-CH (OH) -CH (OH) -COOH was purified by recrystallization in distilled water. Liquid. = 168-170 °C; ρ = 1.76 g/cm3; solubility in water = 1390 g/l (20 °C).

Acrylic acid (propenoic acid, ethenecarboxylic acid) CH_2=CH−COOH of the "x.h" brand was dried over calcined magnesium sulfate and purified by distillation in vacuo.: Type = 141 °C; ρ = 1.0511 g/cm3.

Hydroquinone ($C_6H_6O_2$, brands "x.h") was used as an inhibitor in an amount of 0.1% to preserve the double bond of acrylic acid. Mf = 170 °C; Boiling point = 285 °C.

Catalyst - KU-2-8 (H-form) - acid ion-exchange resin. Before the reaction, it was dried at 110 °C for 12 hours. The density ≈ 1.27 g/cm3.

Ester Preparation Procedure The ether preparation process was carried out in a 250 ml round bottom flask equipped with a magnetic stirrer, reflux condenser and Dean-Stark apparatus. Tartaric acid and acrylic acid are taken in molar ratio 2:1. Ion exchange resin KU-2-8 (H-form) was used as the catalyst. The catalyst was added in an amount of 10% by weight based on the total weight of the reaction mixture. The reaction temperature was maintained at 80 ± 2 °C, and the reaction mixture was

constantly stirred. The release of water during the reaction was collected using a Dean-Stark device, which shifted the reaction to the left of equilibrium and increased the ether yield. To maintain the double bond of acrylic acid, 0.1% hydroquinone inhibitor was added to the reaction mixture. After completion of the reaction, the ether formed was separated from the catalyst by filtration at the end of the reaction.

HPLC was performed on an Agilent 1260 Infinity II (USA) chromatograph. Chromatographic analysis conditions: column - Poroshell 120 EC-C18, 4 μm, 4.6 × 150 mm, detector - diode-matrix, eluent - acetonitrile: water (50:50), flow rate - 1 mL/min, detection wavelength - 246 nm, column volume - 5 μL, thermostat temperature - 30 0C, analysis time - 5 min.

IR spectra were recorded on a Spectrum two FT-IR Spectrometr spectrometer (PerkinElmer Spectrum IR Version 10.6.1, USA, 2019) complete with a MIRacle-10 distorted total internal reflection (IRR) prefix with a diamond prism/ZnSe (spectral range on the wavenumber scale - 4000 ÷ 400 cm-1; resolution 4 cm-1, signal-to-noise ratio - 60,000: 1; scanning speed - 20 spectra per second).

Results and Discussion

This study presents the results obtained from the synthesis and description of an ester derived from tartaric acid and acrylic acid. The target compound is a tartaric acid derivative containing a biobasic acid of great interest for the development of functional monomers and modern polymer materials. The structure of the synthesized ether is shown schematically below.

$$2CH_2=CH–COOH+C_4H_6O_6 \rightarrow C_{10}H_{12}O_8+2H_2O$$

The physicochemical data of the synthesized Vino-bis (acrylate) ester are shown in the following table.

Table-1

Properties of synthesized Vino-bis (acrylate) ether

№	Formula of the synthesized compound	Gross formula	Aggregate state	Mol. weight	d^{20}_4, г/sm^3	Solubility	Density g/cm ^{3}
1	$CH_2=CH–COO–CHOH–CHOH–OOC–CH=CH_2$	$C_{10}H_{10}O_8$	Colorless light yellow, liquid	258	1,46-1,47	Insoluble in water, (ethanol, acetone, chloroform, highly soluble	1.28 г/см^3

The purity of the synthesized product was determined using an Agilent 1260 infinity II (USA) liquid chromatograph.

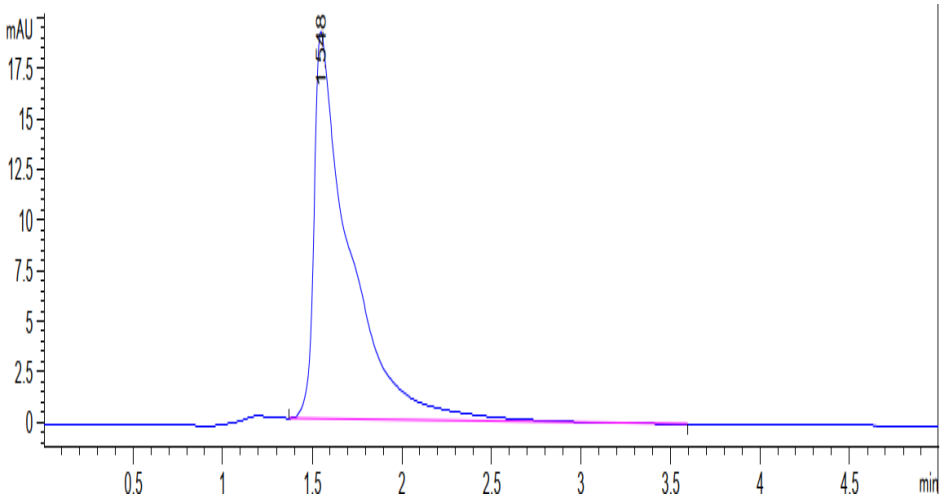


Figure 1. HPLC Chromatogram of Synthesized Ether Wine Bis (Acrylate)

According to the results of the obtained chromatographic image in (Figure 1) for 1.548 minutes, the peak gave only one product, which confirms that the product is free of impurities and has a high degree of purity. Also, in order to confirm the structure of the synthesized ether, the obtained sample was analyzed by infrared spectroscopy (Fig.2).

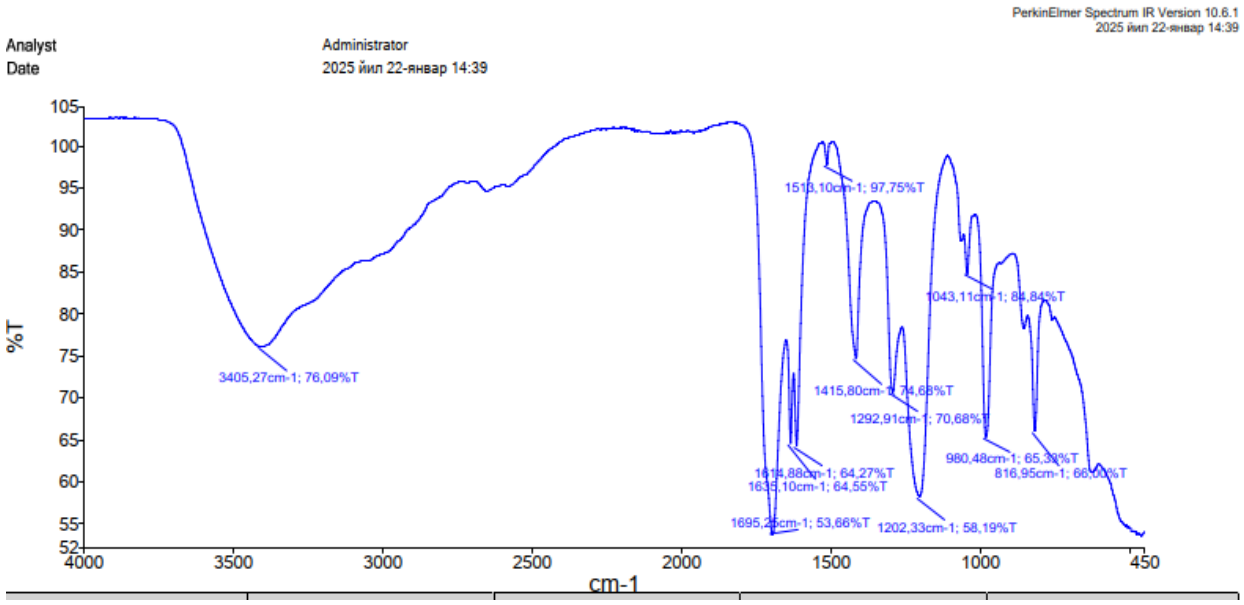


Figure 2. IR spectrum of synthesized ether Wine bis (acrylate)

As can be seen from the figure, in the IR spectrum of the synthesized Vino bis (acrylate) ester, absorption bands are observed at 3405 cm $^{-1}$ corresponds to the valence fluctuations of hydroxyl groups (-OH) in the composition of carboxyl fragments (-COOH), which indicates the presence of a small amount of unreacted carboxylic acid. The intense band at 1695 cm $^{-1}$ refers to the valence fluctuations of the carbonyl groups (C = O) and indicates the formation of an ether structure as a result of the esterification reaction. Characteristic bands in the region of 1638 cm $^{-1}$ are associated with valence fluctuations of C = C (α, β - unsaturated double bonds, which confirms the preservation of unsaturated acrylate fragments in the molecular structure of the synthesized compound. capable of subsequently entering into polymerization reactions. In addition, in the region of 1292-1202 cm $^{-1}$, new pronounced bands corresponding to the valence fluctuations of C-O-C bonds are observed, which is a direct confirmation of the successful progress of the esterification reaction between carboxylic and acrylic acids.

Conclusion

Thus, the synthesis process of a new biobasic ester based on tartaric and acrylic acids was investigated. The esterification reaction in the presence of ion-exchange catalyst KU-2-8 (in H-form) at a temperature of 80 ± 2 °C and a molar ratio of 2:1 proceeded in high yield (up to 89%). The use of a hydroquinone inhibitor ensured the retention of double bonds of acrylic acid, which allows the resulting product to participate in further polymerization processes. IR spectroscopic analysis confirmed the successful progress of the esterification reaction: the characteristic absorption bands of tartaric acid carboxyl groups (1700-1720 cm $^{-1}$) disappeared, and bands corresponding to ether groups (1695 cm $^{-1}$) appeared in their place. The presence of a strip at 1638 cm $^{-1}$ indicates the preservation of double bonds of acrylate fragments. Chromatographic analysis showed a high degree of purity (≥ 98%) and reaction efficiency. The obtained tartaric acid bis (acrylate) combines functional carboxylic and vinyl groups, which provide both chemical activity and polymerizability.

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Reyzume: *Ushbu tadqiqot ishi bioasosli polikarbon kislotalar hisoblangan vino kislotasi va akril kislotasi asosida yangi murakkab efirlarni sintez qilishga qaratilgan. Eterifikatsiya jarayoni 80 °C haroratda KU-2-8 ion almashinuvchi smola (N-shakl) ishtirokida olib borildi, u katalizator sifatida reaksiya muhitidan oson ekstraksiyalanadi va keng texnologik imkoniyatlarga ega. Akril kislotasi va vino kislotasi 2:1 nisbatda olindi. Efir olishda akril kislotasi tufayli polimerlanish jarayonini oldini olish uchun ingibitor sifatida gidroxinondan foydalanildi. Taxmin qilinishicha, sintez qilingan efir tish plombasi olish uchun monomer bo‘lib xizmat qiladi. Reaksiya natijasida murakkab efirning unumi 86% ni tashkil etdi. Efirning tozalik darajasi yuqori samarali suyuqlik xromatografiyasi va kimyoviy strukturasi IQ-spektroskopiya usullari bilan tasdiqlandi. IQ-spektrda efirga xos yutilish chiziqlari paydo bo‘ldi va yuqori samarali suyuqlik xromatografiyasi natijalari olingan mahsulotning yuqori tozaligini va samarali hosil bo‘lganini ko‘rsatdi.*

Sintez qilingan yangi monomer efir sopolimerlanish jarayonlarida bioparchalanuvchan monomerlar ishlab chiqarishda, stomatologiya sohasida istiqbolli xomashyo bo‘lib xizmat qiladi.

Резюме: *Эта исследовательская работа направлена на синтез новых сложных эфиров на основе винной кислоты и акриловой кислоты, которые считаются биобазовыми поликарбоновыми кислотами. Процесс этерификации проводили при температуре 80 °C в присутствии KU-2-8 ионообменной смолы (H-форма), которая легко экстрагируется из реакционной среды в качестве катализатора и имеет широкие технологические возможности. Акриловую кислоту и винную кислоту получали в соотношении 2:1. Для предотвращения процесса полимеризации из-за акриловой кислоты при получении эфира в качестве ингибитора использовали гидрохинон. Предполагается, что синтезированный эфир служит мономером для получения зубной пломбы. В результате реакции выход сложного эфира составил 86%. Очистка эфира была подтверждена высокоэффективной жидкостной хроматографией и химическая структура ИК-спектроскопией. В ИК-спектре появились эфирные полосы, а результаты подтверждена высокоэффективной жидкостной хроматографией показали высокую чистоту и эффективное образование полученного продукта.*

Синтезированный новый мономерный эфир служит перспективным сырьем для процессов сополимеризации, производства перспективных биоразлагаемый мономеров, в области стоматологии.

Kalit so‘zlar: *Vino kislota, akril kislota, murakkab efir, ion almashinuvchi smola, KU-2-8, bio-asosli monomer, eterifikatsiya reaksiyasi, tiklanadigan xomashyo.*

Ключевые слова: *Винная кислота, акриловая кислота, сложный эфир, ионообменная смола, KU-2-8, био-основной мономер, реакция этерификации, возобновляемое сырье.*

EFFECTIVENESS OF BENTONITE-POLYMER COMPOSITIONS FOR FIXING MOBILE SANDS OF THE MUYNAK DEPOSIT

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Summary: *The article examines methods for stabilizing the mobile sands of the Moynak deposit using polymer-mineral compositions based on bentonite clay and water-soluble polymers. The relevance of the research is explained by the prevention of dust and sand particles from rising into the atmosphere and the creation of favorable conditions for plant growth.*

Experimental data on the study of the penetration kinetics of fixing suspensions and the change in the plastic strength of sandy soils at different concentrations of bentonite and polyacrylamide are presented. The mechanisms of adsorption interaction between the components of the mixture and sand particles, which determine the processes of structure formation and strengthening of the porous space, have been revealed. It has been established that the use of bentonite-polymer compositions contributes to the formation of a strong surface crust, a decrease in the penetration depth of the cone, and a long-term fixation of the upper layers of the sand system. The obtained results confirm the prospects of using these compositions for environmentally safe reclamation of shifting sands and preventing their further migration.

Key words: *bentonite clay; water-soluble polymers; polyacrylamide; carboxymethylcellulose; stabilization of mobile sands; structure formation; plastic strength; land reclamation; sandy soils; polymer-mineral compositions.*

INTRODUCTION

One of the most significant environmental challenges of our time is to prevent land degradation and reduce the rate of desertification, which is accompanied by the migration of shifting sands, deflation, and deterioration of natural ecosystems. Mobile sand massifs pose a serious threat to infrastructure, agricultural lands, and atmospheric quality due to intensive dust formation and destruction of the surface soil layer. In this regard, technologies aimed at stabilizing sandy soils and increasing their resistance to wind erosion are of particular relevance. [1-2]

The application of polymer-mineral compositions based on bentonite clay and water-soluble polymers for stabilizing mobile sands is of particular interest. This approach combines the availability of raw materials, environmental safety, and high efficiency in creating surface structures capable of resisting deflationary processes. Bentonite, possessing a developed surface and high sorption capacity, in combination with polymer components forms stable coagulation-adsorption structures that ensure the long-term strengthening of the sandy environment. [3-6]

An additional advantage of these compositions is their integration with erosion control and phytomelioration measures aimed at restoring disturbed lands. The use of strengthening suspensions contributes to the reduction of dust removal, improvement of plant stabilization conditions, and the formation of more stable landscapes in arid territories. [7-12]

The presented work is devoted to the study of the structure-forming properties of bentonite-polymer mixtures, the analysis of their penetration into the porous space of sands, and the assessment of changes in the plastic strength of the soil at various concentrations of components. The obtained results allow substantiating the effectiveness of the developed compositions and determining their potential for practical application in the melioration of shifting sands.

II. RESEARCH MATERIALS AND METHODS

As the main polymer component in the study, a widely known synthetic flocculant - polyacrylamide (PAA) - was used, which is characterized by low toxicity, availability, and high efficiency in the processes of flocculation and structuring of dispersed systems. The applied hydrolyzed PAA had a molecular mass of Mo = 2000 kDa and a hydrolysis degree of at least 60%. Additionally, KMS-700 grade carboxymethylcellulose was used as a modifying component. The

mineral component of the strengthening compositions was represented by bentonite clay, which has high sorption activity and significant ion exchange capacity.

To determine the optimal composition of the strengthening mixture, compositions containing 1-5% bentonite and 0.1-2% water-soluble polymers were prepared. The mixtures were varied in the ratio of components to determine the influence of bentonite and PAA concentrations on the structure formation processes in the sandy environment. The experimental part of the study included the analysis of the penetration kinetics of the strengthening suspensions and the determination of the plastic strength of the modeled sand samples. The sand from the Moynak deposit, pre-dried and fractionated, was used as the initial material.

The kinetics of fluid penetration and the dynamics of strength characteristics change were determined by the plastic strength value using the cone immersion method using a Geppler consistometer. This device ensures the recording of changes in the material's plastic resistance over time and allows for research under various temperature conditions, which is an important factor in the analysis of structure-forming processes.

The applied experimental methods made it possible to comprehensively assess the adsorption interactions between the polymer, bentonite, and sand particles, as well as to establish the influence of concentration factors on the effectiveness of structure formation in the reinforced sand environment.

III. EXPERIMENT RESULTS

The results presented in the article demonstrate that the development and application of binding compositions based on bentonite clays and water-soluble polymers (VP) have significant potential for solving a number of environmental problems.

To study changes in sand surface strength, the following experiments were conducted: initially, a metal beaker with a diameter of 50 mm and a height of 15 mm was used, and dried sand was placed in it. Before conducting the research, the sand was separated into fractions, and a fraction with a size of 0.3-0.5 mm was selected for the research.

The sand in the beaker was tightly compacted and then impregnated with liquids containing the considered stabilizers, in volumes from 100 to 200 ml per 1 kg of sand. The fastening capacity and penetration kinetics were investigated by analyzing changes in plastic strength using a Geppler consistometer. This consistometer allows studying processes at different temperatures, which is an important factor in this research.

Analysis of the kinetics of fixing processes using various sand samples and changes in their plastic strength showed that the penetration conditions of the fixer with the formation of free flow in space under the influence of gravitational or capillary forces depend on the type of binder agent and the composition of the sand itself.

The analysis of the influence of the fixing mixture composition allowed us to determine the most suitable options for our research. In Table. Table 1 presents the compositions of these variants.

Table 1.

Percentage content of components in the fixing mixture, %

Components	Mixture sample, №					
	1	2	3	4	5	6
Bentonite	3,0	3,0	3,0	5,0	5,0	5,0
PAA	1,0	0,5	0,3	1,0	0,5	0,3

Figure 1 shows data characterizing the changes in the volume of penetration of PAA-containing bentonite suspension into the sand system of the Muynak deposit. The volume of the suspension on the surface of 15 cm^2 of sand (with a total mass of 50 g) was 6 ml.

Plastic strength reflects the resistance of the initial structure formed during the transformation of unstructured sand into its structured forms. Under the influence of the fixing additive, two characteristic areas are observed on the curves of change in the plastic strength of sands over time: the structure formation period and the hardening period. As the diagrams show, the duration of these periods depends on the type of liquid used.

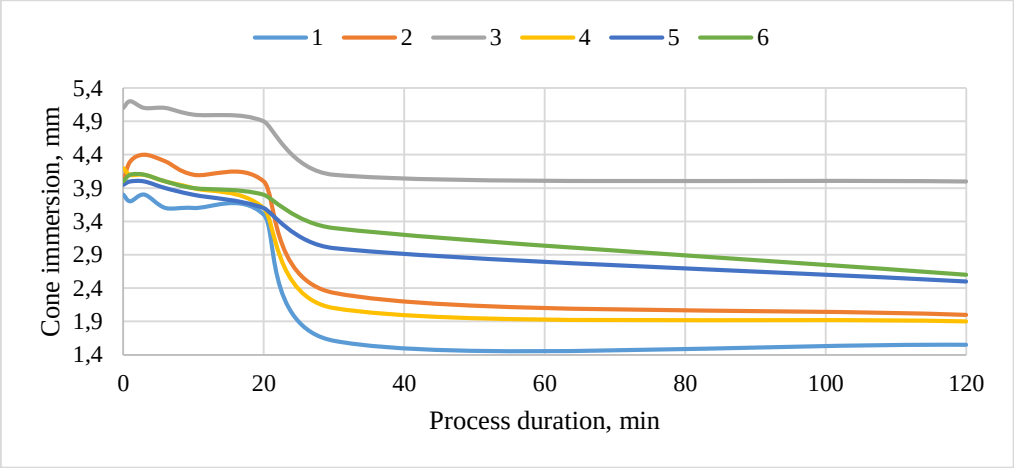


Fig. 1. Time-dependent cone subsidence dynamics for sand samples: Moynak deposit.

The influence of bentonite suspension penetration is determined by several main parameters, including channel sizes and the interaction of the sand particle surface with the liquid. Analysis of the data presented in Figure 1 shows that after the impregnation process, an increase in the cone immersion depth is observed within the next 20-30 minutes. As can be seen from the results, the penetration height is lower when the polymer is present in the mixture in a volume of 1%. With a decrease in the PAA content (1% to 0.3%, while maintaining 3% bentonite), an increase in the initial cone immersion depth from 3.85 to 5.2 mm is observed, which indicates a decrease in the plastic strength of the sand system with a decrease in the % content of the polymer.

If, at the initial moment of impregnation of the 1st composition, the cone is submerged by 3.95 mm, then during the first 20 minutes, an increase in the submersion height to 4.1 mm is observed. However, after 20-22 minutes, a sharp decrease in diving height occurs. Further reduction in penetration depth is explained by the strengthening of the sand system due to structure formation and partial transition of the formed coagulation structures to crystalline forms.

The results of studying the composition of impregnated sands indicate that the main amount of bentonite suspension is retained in the upper layer at the very beginning of the impregnation process. This delay increases with increasing suspension viscosity, i.e., with increasing polymer concentration. The decrease in the amount of suspension as it moves deeper is likely explained by the formation of a film at the contact boundary of the liquid with the sand particle surface. Under the pressure of the remaining liquid, this film breaks. However, upon interaction with subsequent layers of the impregnated liquid, a new film is observed.

The study of changes in the plastic strength of impregnated sands showed that the film formation and rupture process is observed within the first hour. The breaking films are trapped between the sand particles, gradually filling and sealing the gaps.

Sand compaction should be observed when impregnating any liquid, including water. In the case of using water, it can be concluded that the smallest particles are washed away, which leads to an increase in porosity. However, as shown by the results of impregnation with 6 ml of water, the cone immersion height at the initial moment is 6.11 mm, which is significantly higher than the values obtained with the studied compositions. This indicates an increase in the strength of impregnated sands, which is due not only to mechanical compaction but mainly to the interaction of the sand particle surface with the components of the strengthening additive. As previously noted, the interaction of liquid components with the channel surface leads to a change in the liquid flow through the system channels and their clogging, which prevents further movement of the liquid flow.

Perhaps, the increase in the penetration depth of the cone at the initial moment of impregnation can be attributed to the expansion of the initial impregnation due to mechanical factors, such as the loosening of sands due to the filtration of the liquid and the removal of the smallest particles. However, this situation is not observed for the 6-component system. If at the initial moment, a slight increase in strength can be observed, then after 20-25 minutes, a sharp decrease in the immersion

height (3.8 to 2.5 mm) is observed. It is likely that in this case, the pores are blocked by a large amount of bentonite in the suspension.

Increasing the concentration of bentonite does not necessarily affect the change in cone immersion, which is also affected by the composition of the sand itself. Based on the data related to the change in the plastic strength of the sand crust of the Muynak deposit after 2 hours, it is possible to establish the sequence of structure-forming compositions in the following order: 1>4>2>5>6>3.

However, after a day of holding, the plastic strength of all sand samples significantly decreases. The decrease in the impregnation depth over time can be explained by the increase in the strength of these systems due to the structure formation and partial transformation of the formed coagulation structures into crystalline forms.

IV. CONCLUSION

Based on the conducted research, it has been established that the use of strengthening compositions based on bentonite clays and water-soluble polymers is a promising method for stabilizing mobile sands. Experimental data showed that the introduction of polymer-mineral suspensions ensures the formation of a stable structure of the sand material, which is confirmed by an increase in plastic strength and a decrease in the cone immersion depth after the initial impregnation period.

Analysis of the penetration kinetics of the strengthening solutions revealed the dependence of the strengthening efficiency on the concentration of bentonite and polymer, as well as on the morphological properties of the sand. It has been shown that an increase in the polymer content contributes to an increase in the suspension's viscosity and an increase in structure-forming processes, while a decrease in its concentration leads to a decrease in the plastic strength of the sand system. The adsorption interaction mechanism between the mixture components and the sand particle surface plays a significant role, ensuring the formation of coagulation-crystalline structures that stabilize the pore space.

It has been established that the majority of the bentonite suspension accumulates in the upper layer of the sand, where film formation and rupture occur sequentially, partially blocking the pores and contributing to an increase in the strength of the structure within the first hour. Further reduction of the cone penetration depth indicates compaction and fixation processes, which confirms the effectiveness of the proposed compositions compared to the control (water impregnation).

The obtained results allow for the classification of the studied mixtures by the degree of structure-forming effectiveness, as well as confirm the influence of bentonite and polymer concentrations on the formation of the strength characteristics of stabilized sand. The observed decrease in plastic strength after 24-hour hardening indicates the initial stages of structure transformation, which requires further research aimed at assessing the long-term stability of the formed coatings.

In general, the use of bentonite-polymer strengthening compositions represents a rational, environmentally safe, and technologically accessible approach to the reclamation of shifting sands and reducing their deflationary activity. This method can be recommended for practical application in arid regions to prevent land degradation, reduce dust formation, and enhance the stability of natural landscapes.

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Rezyume: *Maqolada Mo‘ynoq konining ko‘chma qumlarini bentonit gili va suvda eriydigan polimerlar asosidagi polimer-mineral kompozitsiyalardan foydalangan holda mustahkamlash usullari ko‘rib chiqilgan. Tadqiqotning dolzarbligi chang va qum zarrachalarining atmosferaga ko‘tarilishining oldini olish va o‘simliklarning o‘sishi uchun qulay sharoit yaratish bilan izohlanadi.*

Bentonit va poliakrilamidning turli konsentratsiyalarida mustahkamlovchi suspenziyalarning kirib borish kinetikasini va qumli gruntlarning plastik mustahkamligining o‘zgarishini o‘rganish bo‘yicha eksperimental ma’lumotlar keltirilgan. Aralashma komponentlari va qum zarralari o‘rtasidagi adsorbsion o‘zaro ta’sir mexanizmlari aniqlandi, bu struktura hosil bo‘lish va g‘ovak bo‘shlig‘ini mustahkamlash jarayonlarini belgilaydi. Bentonit-polimer kompozitsiyalarini qo‘llash mustahkam sirt qobig‘ini shakllantirishga, konusning kirib borish chuqurligini kamaytirishga, shuningdek, qum tizimining yuqori qatlamlarini uzoq muddatga mustahkamlashga yordam berishi aniqlandi. Olingan natijalar ko‘chma qumlarni ekologik xavfsiz melioratsiyalash va ularning keyingi migratsiyasini oldini olish uchun ushbu kompozitsiyalardan foydalanishning istiqbolli ekanligini tasdiqlaydi.

Резюме: *В статье рассмотрены способы закрепления подвижных песков Муйнакского месторождения с использованием полимерно-минеральных композиций на основе бентонитовой глины и водорастворимых полимеров. Актуальность исследования объясняется предотвращением подъема частиц пыли и песка в атмосферу и созданием благоприятных условий для роста растений.*

Представлены экспериментальные данные по изучению кинетики проникновения закрепляющих суспензий и изменению пластической прочности песчаных грунтов при различных концентрациях бентонита и полиакриламида. Выявлены механизмы адсорбционного взаимодействия между компонентами смеси и частицами песка, определяющие процессы структурообразования и укрепления порового пространства. Установлено, что применение бентонит-полимерных композиций способствует формированию прочной поверхностной корки, снижению глубины проникновения конуса, а также долговременному закреплению верхних слоёв песчаной системы. Полученные результаты подтверждают перспективность использования данных композиций для экологически безопасной мелиорации подвижных песков и предотвращения их дальнейшей миграции.

Kalit so‘zlar: *bentonitli gil; suvda eruvchan polimerlar; poliakrilamid; karboksimetilsellyuloza; ko‘chma qumlarni mustahkamlash; struktura hosil qilish; plastik mustahkamlik; melioratsiya; qumli gruntlar; polimer-mineral kompozitsiyalar.*

Ключевые слова: *бентонитовая глина; водорастворимые полимеры; полиакриламид; карбоксиметилцеллюлоза; закрепление подвижных песков; структурообразование; пластическая прочность; мелиорация; песчаные грунты; полимерно-минеральные композиции.*

EFFECT OF THE USE OF BIO- AND NANOPREPARATIONS ON RICE PLANTS IN SALINE SOILS

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Summary: *This article presents a scientific analysis of the effects of using bio- and nanopreparations on the growth, development, and yield of rice cultivated on saline soils. The study was conducted on irrigated meadow-alluvial soils in the Nukus district of the Republic of Karakalpakstan. The experiment involved the rice variety "Nukus-2" and the application of the preparations "Novagumin" and "Microustirgich" According to the results, these preparations increased plant height, panicle length, grain number, and grain weight, ensuring a 2–5 centner per hectare yield increase compared to the control variant. Bio- and nanopreparations enhanced the activity of soil microorganisms and played an important role in maintaining agroecosystem stability. The widespread implementation of these technologies can significantly improve the efficiency of rice cultivation.*

Key words. *saline soils, rice, Nukus-2 variety, bio- and nanopreparations, Novagumin, Microustirgich.*

INTRODUCTION

Currently, one of the urgent tasks in the agriculture of Uzbekistan is the effective use of saline lands, improving their melioration state, and increasing yields. In our republic, rice is grown on 129.4 thousand hectares, and the role of rice cultivation in ensuring food security creates the need for its further development. Especially on saline soils, the introduction of new agrotechnological approaches is required for the full use of the potential of crops.

In recent years, the degradation of land resources, especially the intensification of the salinization process, has become one of the pressing problems in agriculture. In countries with arid and semi-arid climates, such as Uzbekistan, this situation seriously hinders the sustainable development of the agricultural sector. In solving this problem, the use of modern agricultural technologies, in particular, biological and nanotechnological preparations, is of great scientific and practical importance. Bio- and nanopreparations are an important factor in increasing the resistance of plants to stress, improving the assimilation of nutrients, and restoring yields by improving the soil environment. Scientific research shows that bio- and nanopreparations play an important role in stimulating the growth and development of plants, improving the microbiological environment of the soil, and increasing the assimilation of nutrients. These preparations affect not only the physiology of plants, but also the activity of beneficial microorganisms in the soil.

Cultivation of crops on saline soils is one of the urgent problems in the agricultural sector, and this problem is especially widespread in some regions of Uzbekistan, including Karakalpakstan. Soil salinization negatively affects plant nutrition, root system activity, and overall development. Therefore, many scientific studies have been conducted in these regions to eliminate the problem by using bio- and nanopreparations.

Foreign scientists E.P. Aleshin, M.M. Shukin, V.K. Bugaevsky, S.I. Ignatenko, K.G. Cassman, J.C. Ottow and others conducted extensive research on the influence of bio- and nanopreparations on plant physiology and soil microbiology [1,6,9]. According to their research, such preparations activate the plant's nutritional system, enhance root activity, stimulate photosynthesis, and positively affect yield.

K.G. Cassman (2000) emphasized in his work that sustainable and high yields can be achieved in rice farming by ensuring a nutrient balance[2]. Also, J.C. Ottow (1997) showed improvement in plant growth as a result of bioactive preparations increasing the activity of microorganisms in saline soils [3].

Domestic scientists I.I. Churikov, A.V. Nesterov, Z.N. Djumanov, G.N. Rakhimov, G. Juraeva, T. Boboniyazov studied the use of bio- and nanopreparations in the soil and climatic conditions of Uzbekistan and proved their effectiveness in rice cultivation [7,8,10].

In particular, the preparations "Novagumin" and "Mikroustirgich" contribute to the reproduction of microorganisms in the soil and have a positive effect on soil fertility [4,5].

The above-mentioned literature shows that bio- and nanopreparations not only accelerate the growth and development of rice in saline soils, but also serve as an important factor in restoring the balance of the agroecosystem.

RESEARCH METHODOLOGY

Research work was carried out on irrigated saline meadow-alluvial soils of the Nukus district of the Republic of Karakalpakstan. In the experiment, the "Nukus-2" rice variety was sown. Based on agrochemical analyses of the soil, it was assessed that the area is slightly saline, the humus content is low, and the mechanical composition is of medium loamy type.

In the experiment, the following variants were studied: Control (without the use of bio- and nanopreparations), Novagumin 1 - 1000 ml/ha, Novagumin 2 - 1200 ml/ha, Microustirgich 1 - 2100 ml/ha, Microustirgich 2 - 2400 ml/ha. The preparations were applied by foliar spraying during the seed treatment of the rice plant, at the 3-4 leaf stage, and at the heading stage. At each stage, the phenological development of plants, growth parameters (height, panicle length, number of grains, grain weight), and final yield indicators were recorded.

ANALYSIS AND MAIN RESULTS

Timely and optimal nutrition of the rice plant with nitrogen and phosphorus during the growing season accelerates seed germination, strengthens the root system, accelerates the processes of tillering and tubing, or when the norms of nitrogen and phosphorus substances and the periods of nutrition are disrupted, the respiration of the rice plant and its color change.

In irrigated meadow-alluvial soils, the Nukus-2 variety was sown, and as a result of our research, we analyzed the influence of the application of bio- and nanopreparations on the growth, development, and yield of rice.

Table 1

Influence of the application of bio- and nanopreparations on the growth, development, and yield of rice in irrigated meadow-alluvial soils (2020-2022)

№	Options	Thick seedlings league, units	Average plant height, cm	Panicle length, cm	Number of grains in a panicle, units	Grain weight in a panicle, g	Harvest medicine c/ha
1	Control	152	68,7	12,6	96,2	2,01	54
2	Novagumin 1	231	91,4	14,1	107,8	2,15	58
3	Mikroustirgich 1	220	84,5	13,2	102,5	2,10	57
4	Novagumin 2	253	98,9	14,7	115,9	2,21	59
5	Mikroustirgich 2	238	90,5	14,3	110,4	2,16	58

In our phenological observations, in the control variant, the plant density was 152 plants, the average plant height was 68.7 cm, the panicle length was 12.6 cm, the number of grains in the panicle was 96.2 pieces, the weight of grains in the panicle was 2.01 grams, and the yield was 54 c/ha.

In the Novagumin 1 variant, where bio- and nanopreparations were used, the plant density was 231 units, the average plant height was 91.4 cm, the panicle length was 14.1 cm, the number of grains in the panicle was 107.8 units, the weight of grains in the panicle was 2.15 grams, and the yield was 58 c/ha. In the Microustirgich 1 variant, the plant density was 220 units, the average plant height was 84.5 cm, the panicle length was 13.2 cm, the number of grains in the panicle was 102.5 units, the weight of grains in the panicle was 2.10 grams, and the yield was 57 c/ha, In the Novagumin 2 variant, the plant density was 253 units, the average plant height was 98.9 cm, the panicle length was 14.7 cm, the number of grains in the panicle was 115.9 units, the weight of grains in the panicle was 2.21 grams, and the yield was 59 c/ha, in the Microustirgich 2 variant, the plant density was 238 units, the average plant height was 90.5 cm, the panicle length was 14.3 cm, the number of grains in the panicle was 110.4 units, the weight of grains in the panicle was 2.16 grams, and the yield was 58 c/ha.

CONCLUSION

Based on the results of the experiments, it can be concluded that the above-mentioned patterns were repeated in the growth, development, and yield of rice, that is, the variants with the use of bio- and nanopreparations prevailed over the control variant, especially the best result was noted in the Novagumin variant, where the yield was higher by 2-5 centners compared to the control. Bio- and nanopreparations influence the activity of microorganisms and enzymes in the soil, the amount of nutrients, and contribute to the growth, development, and increase of plant productivity.

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Rezyume: *Ushbu maqolada sho'rlangan maydonlarda bio- va nanopreparatlar qo'llashning sholining o'sish, rivojlanish va hosildorlikka ta'siri ilmiy-tadqiqot asosida tahlil etilgan. Tadqiqot Qoraqalpog'iston Respublikasi Nukus tumanining sug'oriladigan o'tloqi-allyuvial tuproqlarida olib borilgan. Bunda tajribada sholining Nukus-2 naviga "Novagumin" va "Mikroo'stirgich" preparatlarini qo'llash asosida olib borildi. Natijalarga ko'ra, bu preparatlar o'simlikning bo'yi, ro'vak uzunligi, don soni va og'irligini oshirib, nazorat variantiga nisbatan hosildorlikni 2–5 sentnerga yuqorilashini ta'minladi. Bio- va nanopreparatlar tuproqdagi mikroorganizmlar faolligini kuchaytirib, agroekotizim barqarorligini ta'minlashda muhim rol o'ynaydi. Ushbu texnologiyalarni keng miqyosda joriy etish orqali sholichilikda samaradorlikni oshirish mumkin.*

Резюме: *В данной статье на научно-исследовательской основе проанализировано влияние применения био- и нанопрепаратов на рост, развитие и урожайность риса на засолённых участках. Исследование проводилось на орошаемых лугово-аллювиальных почвах Нукусского района Республики Каракалпакстан. В эксперименте использовался сорт риса «Нукус-2», при этом применялись препараты «Новагумин» и «Микроустиргич». Согласно результатам, данные препараты способствовали увеличению высоты растений, длины метёлки, количества и массы зёрен, обеспечив повышение урожайности на 2–5 центнеров по сравнению с контролем. Био- и нанопрепараты активизируют деятельность почвенных микроорганизмов и играют важную роль в обеспечении устойчивости агроэкосистем. Широкое внедрение данных технологий способствует повышению эффективности рисоводства.*

Kalit so'zlar: *sho'rlangan tuproqlar, sholi, Nukus-2 navi, bio- va nanopreparatlar, Novagumin, Mikroo'stirgich.*

Ключевые слова: *засоленные почвы, рис, сорт Нукус-2, био- и нанопрепараты, Новагумин, Микроустиргич.*

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TECHNIQUE FOR INCREASING THE ENDURANCE OF YOUNG VOLLEYBALL PLAYERS IN COMPETITIVE CONDITIONS

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Summary: This article analyzes training methods, psychophysiological factors, and individual training models aimed at increasing the endurance of young volleyball players in competitive conditions. According to the research results, special interval loads, aerobic-anaerobic complex training, technical-tactical modeling, and methods for developing psychological stability enhance the athlete's adaptation to competitive stress. Scientifically based organization of the balance of load and recovery during the training process, the development of motivational and cognitive preparedness increases the ability of young volleyball players to play at a high tempo and accuracy for a long time. Therefore, a comprehensive and individualized approach is the most effective way to increase the endurance of athletes.

Key words: Volleyball; young athletes; endurance; competitive conditions; functional training; interval training; aerobic-anaerobic load; technical and tactical training; psychological stability; adaptation to stress; individualized training; physical training; sports pedagogy.

This is due to the increasing demands on the physical fitness of young volleyball players, especially in competitive conditions. Volleyball, as a team sport, places high demands on the physical qualities of athletes, among which endurance occupies one of the main places. Endurance allows athletes to maintain high performance throughout the game, which is especially important under conditions of strong competitive loads. "Modern research in the field of sports science emphasizes that the development of endurance in young athletes requires a special approach, taking into account their age, physiological, and psychological characteristics." [1, C. 112–113.].

The purpose of this article is to develop and experimentally substantiate a technique for increasing the endurance of young volleyball players in competitive conditions. To achieve this goal, the following tasks have been defined:

1. Study of the theoretical foundations of endurance development in young athletes, including physiological and psychological aspects.
2. Analysis of the features of competitive activity in volleyball and their influence on the level of endurance of athletes.
3. Development of a method for increasing endurance among young volleyball players adapted to the conditions of the competition.
4. Experimental verification of the effectiveness of the proposed methodology and assessment of its impact on the physical fitness of young athletes.

The process of training young volleyball players, and the topic of the article, is a method of increasing their endurance in competitive conditions. The relevance of the article lies in the fact that the developed technique, based on modern scientific approaches, significantly increases the level of endurance of young volleyball players and improves their competitive results.

Endurance is one of the main physical qualities that determines an athlete's success in various sports. In the scientific literature, endurance is characterized as the body's ability to withstand fatigue during prolonged physical exertion. Depending on the nature of the load, general and special endurance are distinguished. General endurance is characterized by the ability to perform long-term work of medium intensity, which is the basis for the development of special endurance. Special endurance, in turn, is associated with a specific sport and implies the ability to maintain a high level of performance in specific stressful conditions. In volleyball, special endurance is manifested in the ability of athletes to perform strong movements during the game, such as jumping, shaking, and striking.

Modern research emphasizes that endurance is a complex quality that depends on many factors, including physiological, biochemical, and psychological aspects. For example, endurance is related to the efficiency of the cardiovascular system, while anaerobic endurance is related to the ability of muscles to work in conditions of oxygen deficiency.

The development of endurance in young athletes has its own peculiarities associated with age-related changes in the body. During adolescence, the cardiovascular system develops actively, lung volume increases, and movement coordination improves. However, the nervous system and muscular apparatus of young athletes are not yet fully formed, which requires a careful approach to the training process. Excessive stress at this age can lead to overwork and injuries. Therefore, training should be aimed at the gradual development of endurance, taking into account the individual characteristics of each athlete.

Volleyball, as a sport, places high demands on the aerobic and anaerobic endurance of athletes. Endurance allows athletes to maintain their overall performance level, while anaerobic endurance is necessary for performing short-term intensive movements such as jumping and shaking. The main factors affecting endurance in volleyball are:

- Intensity and duration of training.
- Proper nutrition and recovery.
- Psychological stability in competitive conditions.

Modern methods of endurance training include interval training, circuit training, and the use of special exercises aimed at developing the body's aerobic and anaerobic capabilities. Circuit training, in turn, is aimed at developing general physical fitness and includes performing a number of exercises with minimal breaks.

Competitive volleyball training is characterized by high intensity and variable periods of activity and rest. This requires athletes to quickly recover and maintain high performance throughout the game. Psychological stability, which allows athletes to maintain concentration and act effectively in stressful situations, is of particular importance.

The development of methods for increasing the endurance of young volleyball players is based on modern scientific approaches to the educational process, taking into account the physiological, psychological, and technical aspects of athlete training.

In this case, the research methodology includes four main stages, each of which is aimed at achieving specific goals.

1. Diagnostics of the level of endurance

At the initial stage, a comprehensive diagnosis of the level of endurance of young volleyball players is carried out. The following tests are used for this:

- 1000m run: assesses aerobic endurance, which is important for maintaining overall performance throughout the game. [2, C 256].
- Jumping tests (for example, vertical jump): allow assessing the anaerobic capabilities of athletes necessary for performing sudden movements, such as blocks and attacks.
- Cooper's test (12 minutes run): general endurance and long-term strength are used to assess the body's ability to endure [3, C. 34–40].
- Pulse recovery test after exercise: allows you to assess the ability of the cardiovascular system to recover, which is an important indicator of endurance. [4, C. 56–60].

The diagnostic results allow us to determine the current physical fitness of athletes and identify weaknesses that require correction. Based on diagnostic data, individual training programs were developed, taking into account the level of physical fitness of volleyball players, age characteristics, and the specifics of competitive activity. Programs include:

- Aerobic exercises: they are aimed at developing general endurance and improving the cardiovascular system. Examples: long-term running, swimming, cycling.
- Anaerobic exercises: they are aimed at developing the ability to perform short-term intensive loads. Examples: interval training, Sprint, jumping exercises.
- Strength exercises: this includes resistance exercises aimed at developing muscle strength, which is necessary for performing powerful movements such as jumping and strikes.

The programs also take into account the psychological characteristics of young athletes, such as motivation, stress resistance, and the ability to concentrate.

The following exercises are used to develop aerobic and anaerobic endurance:

- Interval training: variable periods of high and low intensity. For example, 30 seconds of maximum movement (sprint), then 1-2 minutes of rest or light running. Such exercises improve aerobic and anaerobic endurance.

- Circuit training: includes performing a series of exercises (for example, jumping, pushing) with minimal breaks. This allows us to develop general physical fitness and endurance.

- Game exercises: simulating competitive conditions, such as playing volleyball with a small number of players or extended rally duration. This contributes to the development of specific endurance and psychological stability.

Regular monitoring of athletes' physical condition allows for the assessment of the effectiveness of the training process and the introduction of necessary corrections. For this purpose, the following are applied:

- Test: repeated endurance tests to assess progress.

- Analysis of indicators: assessment of such parameters as heart rate, recovery rate, degree of fatigue.

-Athletes' feedback: manifested taking into account the subjective feelings of athletes, such as fatigue, motivation, and well-being.

Based on the data obtained, changes are made to the training programs, such as increasing or decreasing the intensity of loads, adding new exercises, or changing the recovery mode.

The main means of training endurance are exercises aimed at developing the body's aerobic and anaerobic capabilities. These exercises are selected taking into account the specifics of volleyball and the individual characteristics of the athletes.

1. Running exercise

Running exercises are the main means of developing aerobic endurance. These include:

Long-distance running: running a distance of 3-5 km at a medium speed. This improves the functioning of the cardiovascular system and increases overall endurance.

Monitoring and analysis of competitive activity:

The study analyzed competitive games to assess how changes in endurance levels affect game performance, such as successful attacks, blocks, and number of moves.

Organization of the study:

- Determination stage: conducting preliminary tests to determine the initial level of endurance and psychological preparedness of athletes.

- Formative stage: implementation of the developed endurance training methodology for 6 months.

- Control stage: repeated test to assess changes in the level of endurance and psychological stability of athletes.

The research results confirmed the high effectiveness of the developed method for increasing the endurance of young volleyball players. The improvement of physical parameters, such as aerobic and anaerobic endurance, shows that the proposed training programs allow athletes to better cope with loads in competitive conditions. In addition, the improvement of such psychological indicators as a decrease in anxiety and an increase in motivation shows that the technique has a positive effect not only on physical, but also on the psychological preparedness of athletes. Special attention should be paid to improving competitive indicators, such as the number of successful attacks and blocks. This confirms that increasing endurance directly affects the effectiveness of game activity.

In conclusion, increasing the endurance of young volleyball players in competitive conditions is achieved, first of all, through the gradual improvement of their physical, psychophysiological, and tactical training indicators. Studies show that the athlete's ability to adapt to stress significantly increases through functional training combined with interval training based on special loads, aerobic-anaerobic training corresponding to body size, and game models.

At the same time, endurance in competitive conditions is associated not only with a physical factor, but also with cognitive stability and emotional control. Quick analysis of game dynamics, speed of decision-making, and stress management skills constitute the overall system of endurance. Psychological preparation, visualization, breath control techniques, and motivational modeling help young volleyball players maintain a stable energy resource during the competition.

The research results confirm that a comprehensive approach - individualization of physical loads, cyclical training combined with technical and tactical training, scientific programming of psychological training and recovery processes - effectively increases the endurance of young volleyball players. This allows you to maintain a high tempo for a long time in competitive conditions, play without losing the amplitude and accuracy of movements, and increase the speed of return.

Thus, the technique of increasing the endurance of young volleyball players is an integrative and multifactorial process, the effectiveness of which depends on the individualization of training, the scientifically based organization of the load-restoration balance, and the strengthening of the athlete's psychophysiological stability.

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Rezyume: *Ushbu maqolada yosh voleybolchilarning musobaqa sharoitida chidamliligini oshirishga qaratilgan mashg‘ulot usullari, psixofiziologik omillar va individual tayyorgarlik modellari tahlil qilinadi. Tadqiqot natijalariga ko‘ra, maxsus interval yuklamalar, aerob-anaerob kompleks mashg‘ulotlar, texnik-taktik modellashtirish hamda psixologik barqarorlikni rivojlantiruvchi usullar sportchi organizmining musobaqa stresslariga moslashuvini kuchaytiradi. Mashg‘ulot jarayonida yuklama va tiklanish balansini ilmiy asosda tashkil etish, motivatsion va kognitiv tayyorgarlikni rivojlantirish yosh voleybolchilarning uzoq vaqt yuqori sur’at va aniqlik bilan o‘ynash qobiliyatini oshiradi. Shu sababli kompleks va individuallashtirilgan yondashuv sportchilarning chidamliligini oshirishning eng samarali yo‘li hisoblanadi.*

Резюме: *В данной статье анализируются методы тренировок, психофизиологические факторы и модели индивидуальной подготовки, направленные на повышение выносливости юных волейболистов в соревновательных условиях. Согласно результатам исследования, специальные интервальные нагрузки, аэробно-анаэробные комплексные тренировки, технико-тактическое моделирование и методы развития психологической устойчивости усиливают адаптацию организма спортсмена к соревновательным стрессам. Научная организация баланса нагрузки и восстановления в тренировочном процессе, развитие мотивационной и когнитивной подготовки повышает способность юных волейболистов играть с высоким темпом и точностью в течение длительного времени. Поэтому комплексный и индивидуализированный подход является наиболее эффективным способом повышения выносливости спортсменов.*

Kalit so‘zlar: *Voleybol; yosh sportchilar; chidamlilik; raqobat sharoiti; funksional tayyorgarlik; intervalli trening; aerob-anaerob yuklama; texnik-taktik tayyorgarlik; psixologik barqarorlik; stressga moslashish; individuallashtirilgan mashg‘ulot; jismoniy tayyorgarlik; sport pedagogikasi.*

Ключевые слова: *Волейбол; юные спортсмены; выносливость; конкурентные условия; функциональная подготовка; интервальная тренировка; аэробно-анаэробная нагрузка; технико-тактическая подготовка; психологическая устойчивость; адаптация к стрессу; индивидуализированная тренировка; физическая подготовка; спортивная педагогика.*

A CRITERION OR THISOMETRICITY OF *LOG*-ALGEBRAS OF TYPE I_n

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Summary: *This paper establishes a criterion for determining the isometricity of non-commutative log-algebras constructed on von Neumann algebras of type I_n. Specifically, we derive necessary and sufficient conditions for these spaces to be isometric, presenting five such conditions. The analysis employs the decomposition of a type I_n von Neumann algebra as a tensor product of a function space and $B(H_n)$.*

Key words: *log-algebras, commutative and non-commutative von Neumann algebras of type I_n, Boolean algebra, isometry, exact normal finite trace.*

I.INTRODUCTION

Commutative and non-commutative log-algebras were introduced and studied in [1]. Further, in [2,3,4], isometries and isomorphisms of commutative log-algebras are studied. This article establishes a criterion for the isometricity of non-commutative *log*-algebras constructed on the von Neumann algebra of type I_n.

Definition 1. [5] A von Neumann algebra of type I_n is a von Neumann algebra M, which has the representation $M = L_\infty(X) \otimes B(H_n)$, where $B(H_n)$ is an algebra of $n \times n$ matrices. The center of the algebra M is identified with $L_\infty(X)$, where X is a complete non-atomic Boolean algebra.

In [6], commutative log-algebras were introduced as follows

$$L_{log}(X,\mu) = \{f \in L_0(X): \int_\Omega log(1+|f|)d\mu < \infty\}$$

where Ω is the identity element of the Boolean algebra X, and $L_0(X)$ is the algebra of measurable functions on the Boolean algebra X. The F-norm on X is introduced as follows

$$\|f\| = \int_\Omega log(1+|f|)d\mu.$$

It is clear that

$$L_p(X,\mu) = \left\{f \in L_0(X,\mu): \|f\|_p = \left(\int_\Omega |f|_1^2 d\mu\right)^p < \infty\right\}.$$

By the Radon-Nikodym theorem, we have

$$L_p(X,\nu) = \left\{f \in L_0(X,\nu): \|f\|_p = \left(\int_\Omega |f|^p d\nu\right)^{\frac{1}{p}} = \left(\int_\Omega h \cdot |f|^p d\mu\right)^{\frac{1}{p}} < \infty\right\}$$

where $\nu(x) = \mu(hx)$, i.e., $h = \frac{d\nu}{d\mu}$.

II. STATEMENT OF THE PROBLEM

In the case of any strictly positive measures μ and ν, the mapping $U: L_p(X,\mu) \to L_p(X,\nu)$, defined by the equality $U(f) = h^{-\frac{1}{p}} f, f \in L_p(X,\mu)$, is a linear isometry from $L_p(X,\mu)$ to $L_p(X,\nu)$, i.e. for any μ and ν, the spaces $L_p(X,\mu)$ and $L_p(X,\nu)$ are isometric.

A similar statement for the spaces $L_{log}(X,\mu)$ and $L_{log}(X,\nu)$ is generally incorrect. The main result of this work is the establishment of a necessary and sufficient conditions for the isometry of these spaces.

III. MAIN RESULT

Let M be a von Neumann algebra of type I_n with exact normal finite traces i and j. Let us denote by $L_{log}(M,i)$ non-commutative log-algebras constructed with respect to the algebra M from trace i. Let us denote by μ and ν the restrictions of traces i and j to algebras M. By Definition 1, we can show that the following equality holds

$$L_{log}(M,i) = L_{log}(X,\mu) \otimes B(H_n).$$

Take $h = \frac{d\nu}{d\mu}$ and $\Omega_> = \{\omega \in \Omega: h(\omega) > 1\}, \Omega_< = \{\omega \in \Omega: h(\omega) < 1\}, \Omega_= = \{\omega \in \Omega: h(\omega) = 1\} = \Omega \backslash (\Omega_> \cup \Omega_<)$.

++Denote

$$S_> = \mathrm{S}_> (\Omega, \mathrm{h}) = \frac{\int_{\Omega_>} (h(x)-1)d\mu}{\mu(\Omega_>)}$$

and

$$S_< = S_< (\Omega, h) = \frac{\int_{\Omega_<} (h(x)-1)d\mu}{\mu(\Omega_>)}.$$

The following theorem establishes five conditions equivalent to the isometry of the F-spaces $L_{log}(X,\mu)$ and $L_{log}(X,\nu)$. For commutative log-algebras, this theorem was proven in [3].

Theorem 1. Let M be an arbitrary von Neumann algebra of type I_n, and let μ and ν be finite strictly positive measures on X. Then the following conditions are equivalent:

i. $L_{log}(X,\mu)$ and $L_{log}(X,\nu)$ are isometric;
ii. $\int_\Omega h(\omega)d\mu = \mu(\Omega)$;
iii. $\int_\Omega h^{-1}(\omega)d\nu = \nu(\Omega)$ where $h^{-1} = \frac{d\mu}{d\nu}$;
iv. $\nu(\Omega) = \mu(\Omega)$;
v. $S_> = S_<$;
vi. There exists a measure preserving automorphism α from (X,μ) to (X,ν).

Let X be an arbitrary complete Boolean algebra, $e \in X$, $Xe = \{g \in X : g \leq e\}$. By $\tau(X_e)$ we denote the minimal cardinality of a set dense in X_e. An infinite complete

Boolean algebra X is called homogeneous if $\tau(X_e) = \tau(X_g)$ for any nonzero $e, g \in X$. The cardinality $\tau(X)$ is called the weight of the homogeneous Boolean algebra X.

Let X be a complete nonatomic Boolean algebra and μ be a strictly positive countably additive finite measure on X. Then, the decomposition of X into homogeneous components is at most countable.

Definition 2. [7] Denote by $\{\nabla_{u_i}\}$ the homogeneous components of the Boolean algebra X for which $\tau_{u_i} = \tau(\nabla_{u_i}) < \tau_{u_{i+1}}$, $\mu(u_i) < \infty$. Here u_i are the units of the Boolean algebra ∇_{u_i}. Then the matrix

$$\begin{pmatrix} \tau_{u_1} & \tau_{u_2} & \dots \\ \mu_1 & \mu_2 & \dots \end{pmatrix},$$

is uniquely defined, which we will call the passport of the Boolean algebra X with a finite measure μ.

Let Y be another complete Boolean algebra with a finite measure ν and

$$\begin{pmatrix} \tau_{t_1} & \tau_{t_2} & \dots \\ \nu_1 & \nu_2 & \dots \end{pmatrix}$$

is the passport of the Boolean algebra (Y,ν).

Let M_X and M_Y be von Neumann algebras of type I_n and I_m with faithful normal finite traces φ and η, respectively. Let μ and ν denote the restrictions of the traces of φ and η to the corresponding centers

$$L_{log}(M,\varphi) = L_{log}(X,\mu) \otimes B(H_n),$$
$$L_{log}(N,\eta) = L_{log}(Y,\nu) \otimes B(H_m).$$

With these notations, the following theorem holds.

Theorem 2. The following conditions are equivalent:

(i) The log-algebras $L_{log}(M_X, \varphi)$ and $L_{log}(M_Y, \eta)$ are isometric.

(ii) The log-algebras $L_{log}(X, \mu)$ and $L_{log}(Y, \nu)$ are isometric and $n = m$.

(iii) The passports of the Boolean algebras (X, μ) and (Y, ν) coincide and $n = m$.

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Rezyume: *ushbu hujjat I_n tipidagi fon Neyman algebralarida qurilgan komutativ bo'lmagan log-algebralarning izometrikligini aniqlash mezonini belgilaydi. xususan, biz ushbu bo'shliqlarning izometrik bo'lishi uchun zarur va etarli shartlarni keltirib chiqaramiz va beshta shunday shartni taqdim etamiz. Tahlil I_n turini parchalashdan foydalanadi fon Neyman algebra funktsiya makonining tensor mahsuloti sifatida va B (H_n).*

Резюме: *В этой статье устанавливается критерий для определения изометричности некоммутативных логарифмических алгебр, построенных на алгебрах фон Неймана типа I_n. В частности, мы выводим необходимые и достаточные условия для того, чтобы эти пространства были изометричными, представляя пять таких условий. В анализе используется разложение алгебры фон Неймана типа I_n в виде тензорного произведения функционального пространства и B (H_n).*

Kalit so'zlar: *log-algebralar, I_n tipidagi komutativ va komutativ bo'lmagan fon Neyman algebralari, mantiqiy algebra, izometriya, aniq normal chekli iz.*

Ключевые слова: *логарифмические алгебры, коммутативные и некоммутативные алгебры фон Неймана типа I_n, булева алгебра, изометрия, точный нормальный конечный след.*

BIOLOGICAL AND ECOLOGICAL CHARACTERISTICS OF INTRODUCED ROSE HIP SPECIES

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Summary: *The article presents the bioecological characteristics of introduced species of the rose hip genus of different geographical origin under the conditions of Karakalpakstan. Their adaptive capabilities under extreme growing conditions were studied. A comparative assessment of the sustainability of introduced rose hip species is provided.*

Key words: *Rose hip, Rosa L., bioecological characteristics, introduction, experience, growth, phenological development, generative period, flower, flowering, fruiting, fruit.*

The material for our research consisted of 4 species of the rose hip genus (Rosa L.) grown in the botanical garden of the Karakalpak branch of the Academy of Sciences of the Republic of Uzbekistan.

The objective of our work: to study the bioecological characteristics of introduced rose hip species under the conditions of Nukus city. Rose hips are typically multi-stemmed shrubs up to 2-3 m in height and can live for 30-50 years. The genus Rosa or rose hip (*Rosa* L) belongs to the Rosaceae family, subfamily Rosoideae. There are about 400 species. Leaves are spirally arranged, compound, odd-pinnate with 5, 7, 9 serrated leaflets, with stipules, usually fused to the petiole.

Flowers are bisexual, 5-petaled, solitary or collected in shield-shaped or brush-shaped inflorescences with 2-3 or many flowers. The hypanthium is spherical, ovoid, or pitcher-shaped, narrowed at the throat and with a glandular ring at the top; rarely the ring is absent. The corolla is large with a greater or lesser number of petals, colored in pink, red, or white tones. Sepals number 5, leaf-like, entire or pinnately dissected, directed upward or downward. Stamens are numerous, with 2-chambered anthers, attached to the glandular ring of the hypanthium. Pistils are numerous, sessile or on short stalks, arranged freely on the bottom of the hypanthium.

Fruits are small nutlets enclosed in a fleshy orange, red, or black shell, which is often used as a vitamin raw material. Rose hip species are characterized by the presence of thorns on the stems. By nature, thorns are epidermal, vascular-free formations. They appear on growing shoots during their growth period and at this time are relatively soft. As the stems age, the thorns increase in size and become very strong. They usually sit on narrow-oval bases elongated along cork foundations, through which they successfully increase. Thorns are very diverse in thickness and height. From hairs and bristles or needles, straight and thin, transitions are observed to thin slit-like or narrow-plate thorns, sometimes reaching a length of up to 12-13 mm or more.

The research was conducted in 2024-2025 at the botanical garden of the Karakalpak branch of the Academy of Sciences of the Republic of Uzbekistan. The garden is located on the southwestern outskirts of Nukus city. The territory of the botanical garden is characterized by flat terrain.

The objects of our research were plants of 4 rose hip species: dog rose (*R. canina* L), prickly rose (*R. acicularis*), May rose (*R. majalis* J.Herrm.), Korean rose (*R. coriana*). The research was conducted on plants aged 4-14 years in 2024-2025.

Phenological observations were carried out according to the methods of I.N. Beideman (1974), B.A. Dospekhov (1985), I.G. Serebryakov (1962) [1,2,3]. The greatest attention was paid to the condition of plants after overwintering, the nature of vegetation, growth, flowering, and fruiting. The beginning of vegetation was taken as the completion of bud opening, and the end as the period of leaf fall. The beginning of flowering was taken as the moment when single flowers bloomed (no more than 10% of all buds) on the plant, mass blooming about 70% of buds, and the end of flowering as the fall of petals from the last flowers. The beginning of fruit ripening was taken as the start of ripening of single fruits (no more than 10%), and mass ripening when 70-75% of fruits had ripened.

During the periods of leaf opening and plant flowering, observations were conducted daily, and at other times every 5 days. The condition of plants at the time of observations was recorded in a journal. The growth rhythm of plants was studied through systematic observations and measurements of shoot growth in model shrubs.

On each shrub, 5 shoots were counted: 4 lateral and 1 apical. Lateral shoots were selected in the middle part of the crown. We studied the growth of vegetative shoots. Measurements of their growth were conducted every 10 days. One indicator of successful plant introduction in new conditions is its growth. The table presents average data on the linear growth of 4 studied rose hip species.

Table 1

Linear growth of shoots of some rose hip species (for 2025)

Species	Average shoot length in cm	Annual growth in %		
		April	May	June
Dog rose	7.96±0.75	17.8±0.35	82.2±0.95	85.7±0.75
Prickly rose	7.96±0.35	17.8±0.25	82.2±0.75	-
Korean rose	8.74±0.25	5.492±0.45	94.58±0.85	-
May rose	3.19±0.15	9.42±0.55	90.58±0.65	-

As can be seen from this table, in 1925 (note: likely meant 2025) the shoot length was greater in Korean rose. Introduced rose hip species under Nukus conditions grow intensively in May, when relative air humidity is quite high and temperature is relatively low. In June their growth ends. Shoot growth is completed by the formation of a terminal inflorescence or terminal bud.

Studies showed that after shoot growth completion, they can grow again. This was observed in dog rose. Secondary growth in dog rose begins in the first decade of June and ends in the third decade.

These species grow well, bloom abundantly, and fruit satisfactorily despite the extremely arid conditions of Karakalpakstan. Flowering periods under Nukus conditions were established as a result of two years of observations and are presented in Table 2.

Table 2

Flowering periods of rose hip genus species under Nukus conditions

Species	2024				2025			
	start	mass	end	Duration	start	mass	end	Duration
Dog rose	16.05	25.05	31.05	16	14.05	22.05	5.06	23
Prickly rose	18.05	25.05	5.06	19	15.05	25.05	12.06	29
Korean rose	10.05	16.05	30.05	20	11.05	18.05	4.06	26
May rose	11.05	16.05	25.05	15	15.05	23.05	29.05	15

The table shows that in Nukus in 2024, early flowering was observed in Korean rose (10.05) and May rose; dog rose bloomed on 16.05, and prickly rose began flowering last (18.05). In 2025, Korean rose also blooms first (11.05), followed by dog rose (14.05), May rose (15.05), and prickly rose (15.05).

The flowering duration of rose hip species depends primarily on their nature, weather conditions of the growing season, and cultural conditions, especially intermittent irrigation. It should be noted that the flowering duration of dog rose lasts 16-23 days, Korean rose 20-25 days, prickly rose 19-29 days, and May rose 15 days. Plant flowering proceeds from the top to the base of the crown. In addition, prickly rose exhibits secondary and tertiary flowering. The results are presented in Table 3.

Table 3

Dates of secondary and tertiary flowering of rose hip genus species under Nukus conditions (2025)

Species	**Secondary flowering**							
Prickly rose	**Flowering**			**Fruit formation**			**Ripening**	
	start	mass	End	start	mass	end	start	end
Species	**Secondary flowering**							
	9.07	14.07	26.07	13.07	21.07	29.07	18.08	29.08
	Tertiary flowering							
	4.08	7.08	13.08					

As can be seen from the table, secondary flowering began in July (9.07) until the end of July (26.07), and forms fruits (13.07) in the second half of July. Fruit ripening is observed in the second half of August (18.08). Tertiary flowering is observed in the first half of August (4.08) and does not form fruits. The duration of secondary flowering in prickly rose lasts 18 days, and tertiary flowering 10 days. The period from flowering to fruit ripening lasts 52 days.

Conclusion

As a result of our work on studying the introduction of rose hip genus species in Karakalpakstan during the period from 2024 to 2025, the following conclusions can be drawn:

- The sharply continental climate and soil salinity of the Nukus botanical garden area, with irrigation available, do not prevent the introduction of a number of rose hip genus species.
- The phenology of rose hip genus species under Karakalpakstan conditions is not uniform.
- The experiments we conducted showed that for all studied rose hip species, intensive growth occurs in May. During this period, about 90% of growth is provided.
- The flowering duration of rose hip species depends primarily on their biological characteristics, weather conditions of the growing season, and cultural conditions. It should be noted that the flowering duration of dog rose lasts 16-23 days, Korean rose 20-25 days, prickly rose 19-29 days, and May rose 15 days.
- Prickly rose exhibits secondary and tertiary flowering. The duration of secondary flowering lasts 18 days, and tertiary flowering 10 days.
- In rose hip species, the formation of covering scales begins in April. The differentiation of flower buds in rose hips, depending on the species, begins at different times. The differentiation of flower buds in dog rose (21.06), May rose (26.06), and prickly rose (21.06) begins at the same time, while in Korean rose it is later than in other species (6.07). The laying down of vegetative and generative buds in different rose hip species begins in April. The differentiation of their growth cone into individual flower elements occurs in June, July, August, and September.
- Rose hip species reproduce by seeds. In general, rose hip genus species can be propagated by seeds and cuttings.

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THE SPACE OF ORDER-PRESERVING FUNCTIONALS AND PERFECT COMFACTIFICATION

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Summary: *For a Tychonoff space X, we consider the space $O_f(X)$ of order-preserving functionals. Using a cover γ_X of the original space X we build an open cover γ_0 of $O_f(X)$. Then we show that if γ_X is disjoint system then γ_0 is also disjoint system. It is proven that the space $O_f(\beta X)$ of order-preserving functionals on the Stone-Čech compactification of X is a perfect compactification of $O_f(X)$.*

Keywords: *order-preserving functional, cover, perfect compactification.*

1. Introduction

The study of topological spaces and their properties has long been a central topic in mathematics, with particular interest in understanding completeness properties and compactifications. Among these, the concept of Π-completeness, investigated in [1], has emerged as a significant property that generalizes classical notions of compactness in topology. In [2] it was explored several types of such spaces, which called compact type spaces. Actions by hyperspace functor on such spaces were studied in [3].

It should be noted that mathematical results are increasingly used in various areas of modern research. For example, monetary risk measures [4] (or, order-preserving functionals) play an important role in risk assessment and management for banks, securities companies, investment funds, and other financial institutions in asset allocation and performance evaluation. In [5] some important topological properties of the space of order-preserving functional on a compact Hausdorff space were obtained. Particularly, normality properties picked up in [6] have shown (except so called "preserving preimages") for functor O of order-preserving functionals in the category $\mathcal{C}omp$ of compact Hausdorff spaces and their continuous maps. Using a construction suggested in [7] the author of [8] has extended this functor on the category $\mathcal{T}ych$ of Tychonoff spaces and their continuous maps.

In this paper, to make this criterion bears fruit firstly we showed that the space $O_f(\beta X)$ of order-preserving functionals on the Stone-Čech compactification of X is a perfect compactification of $O_f(X)$ of order-preserving functionals. It is worth to remind the set systems play a key role in studying of classes of compact type space. For a given system γ_X of subsets of a Tychonoff space X we build a set system γ_0 in $O_f(X)$. We get that the openness of γ_X implies the openness of γ_0. Moreover, we obtain that if γ_X is a disjoint system then γ_0 is also a disjoint system.

2. Preliminaries

In the present paper, by a space we mean a topological T_1-space, and by a map a continuous map. Recall that a Tychonoff space is [9] a space X such that every closed subset F in X and any point $x \in X \setminus F$ are functionally separated, i.e. there exists a continuous function $\varphi : X \to \mathbb{R}$ for which $\varphi(x) = 0$ and $\varphi(y) = 1$ in $y \in F$.

For a topological space X and its subset A, a set $Fr_X A = [A]_X \cap [X \setminus A]_X = [A]_X \setminus Int_X A$ is called a boundary of A in X. A compactification υX of a Tychonoff space X is called *perfect* with *respect to an open set H* in X if the equality $[Fr_X H]_{\upsilon X} = Fr_{\upsilon X}\mathfrak{O}_{\upsilon X}(H)$ holds. If υX is perfect for every open set in X, then *it is called a perfect compactification* of the space X ([10], p. 232).

A compactification υX of space X is perfect if and only if for any two disjoint open sets U_1 and U_2 in X the equality $\mathfrak{O}(U_1 \cup U_2) = \mathfrak{O}(U_1) \cup \mathfrak{O}(U_2)$ holds [10]. The Stone-Čech compactification βX of a Tychonoff space X is a perfect compactification of X. The equality $\mathfrak{O}(U_1 \cup U_2) = \mathfrak{O}(U_1) \cup \mathfrak{O}(U_2)$ holds for every pair of open sets U_1 and U_2 in X if and only if X is normal, and the compactification υX coincides with the Stone-Čech compactification βX, i. e. $\upsilon X \cong \beta X$.

For a compact Hausdorff space X a functional $\mu : C(X) \to \mathbb{R}$ is said [5] to be:

1) *normalized* if $\mu(c_X) = c$ for every constant function $c_X : X \to \mathbb{R}$, $c \in \mathbb{R}$. Here $c_X(x) = c$;

2) *weakly additive* if $\mu(\varphi + c) = \mu(\varphi) + c$ for every $c \in \mathbb{R}$ and each $\varphi \in C(X)$;

3) *order-preserving* if $\mu(\varphi) \le \mu(\psi)$ for any pair of functions φ, $\psi \in C(X)$ with $\varphi \le \psi\}$.

A weakly additive, order-preserving, normalized functional for brevity is called as an order-preserving functional. A set of all order-preserving functionals on $C(X)$ is denoted by $O(X)$. It is endowed with the topology τ_p of pointwise convergence. For $\mu \in O(X)$ sets

$$\langle \mu;\varphi_1,\dots,\varphi_n;\theta\rangle = \{\nu \in O(X) : |\nu(\varphi_i) - \mu(\varphi_i)| < \theta, i = 1,\dots,n\}$$

form a base of $O(X)$ at μ. Here $\varphi,\dots,\varphi_n \in C(X)$, $\theta > 0$.

Let A be a closed subset of a compact Hausdorff space X. An order-preserving functional $\mu \in O(X)$ is *supported* on A if $\mu \in O(A) \subset O(X)$. The support of $\mu \in O(X)$ is denoted by $supp\mu$. For a positive integer n let $O_n(X)$ denote a set of all order-preserving functionals which support consists no more than n points. Put $O_\omega(X) = \bigcup_{n=1}^{\infty} O_n(X)$. An order-preserving functional $\mu \in O_\omega(X)$ is said to be an order-preserving functional with finite support. For a point $x \in X$ the Dirac measure $\delta_x : C(X) \to \mathbb{R}$ is defined by equality $\delta_x(\varphi) = \varphi(x)$ for all $\varphi \in C(X)$. Clearly, $supp\delta_x = \{x\}$.

Following [11] an order-preserving functional $\mu \in O_\omega(X)$ with finite support $supp\mu = \{x_1,\dots,x_n\}$ can be represented as a relation $\mu = \mu(\delta_{x_1},\dots,\delta_{x_n})$ between the Dirac measures δ_{x_i}, $i = 1,\dots,n$. This relation has a view $\mu(\varphi) = \mu(\varphi(x_1),\dots,\varphi(x_n))$, $\varphi \in C(X)$.

We consider the following types of "restrictions":

$$\begin{aligned} \mu_{x_i}(\varphi) &= \mu(\epsilon,\dots,\epsilon,\varphi(x_i),\epsilon,\dots,\epsilon), \\ \mu^{x_i}(\varphi) &= \mu(\varphi(x_1),\dots,\varphi(x_{i-1}),\epsilon,\varphi(x_{i+1}),\dots,\varphi(x_n)), \end{aligned} \tag{1}$$

for each $\varphi \in C(X)$. Here $\epsilon = -\infty, 0$ or $+\infty$ (for more detail, see below).

For α, $-\infty < \alpha < +\infty$, and a subset $A \subset O(X)$ we put $\alpha A = \{\alpha\mu : \mu \in A\}$. If $\alpha = 0$ then $\alpha A = \{0\}$, and if $\alpha = 1$ then $\alpha A = A$. Note that for numbers α, β, subsets A, $B \subset O(X)$ we have $\alpha A + \beta B = \{\alpha\mu + \beta\nu : \mu \in A, \nu \in B\} \subset O(X)$ if and only if $\alpha, \beta \geq 0$ and $\alpha + \beta = 1$. Moreover, the set $O(X)$ of all order-preserving functionals is closed under affine combination. In other words, for $\{\mu_i : i = 1,\dots,n\} \subset O(X)$ and $\{\alpha_i : i = 1,\dots,n\} \subset [0,1]$ with $\sum_{i=1}^{n} \alpha_i = 1$ we have $\sum_{i=1}^{n} \alpha_i \mu_i \in O(X)$. Obviously, $\alpha_i \mu_i \in \alpha_i O(X)$, and $\sum_{i=1}^{n} \alpha_i O(X) = O(X)$. If $0 \leq \alpha_i < 1$ then $\alpha_i O(X) \neq O(X)$. In the case $0 < \alpha_i < 1$ we will say that $\alpha_i O(X)$ is parallel to $O(X)$. For an open neighborhood $\langle \mu_i; \varphi_{i1},\dots,\varphi_{in_i}; \theta_i \rangle$ the set $\alpha_i \langle \mu_i; \varphi_{i1},\dots,\varphi_{in_i}; \theta_i \rangle$ is an open in $\alpha_i O(X)$ neighborhood of $\alpha_i \mu_i$, $i = 1,\dots,n$. Consequently, the sum $\sum_{i=1}^{n} \alpha_i \langle \mu_i; \varphi_{i1},\dots,\varphi_{in_i}; \theta_i \rangle$ is open in $\sum_{i=1}^{n} \alpha_i O(X) = O(X)$.

Thus, the affine combination is one of the "rule"s for forming an order-preserving functional, using a given (at most countable) set of order-preserving functionals. In this case any order-preserving functional μ with finite support has a view $\mu = \sum_{i=1}^{n} \alpha_i \delta_{x_i}$ for $\alpha_i \geq 0$, $i = 1,\dots,n$, and $\sum_{i=1}^{n} \alpha_i = 1$. Consequently, for an arbitrary $\varphi \in C(X)$ we have

$$\mu_{x_i}(\varphi) = \alpha_i \varphi(x_i),$$

$$\mu^{x_i}(\varphi) = \alpha_1 \varphi(x_1) + \dots + \alpha_{i-1} \varphi(x_{i-1}) + \alpha_{i+1} \varphi(x_{i+1}) + \dots + \alpha_n \varphi(x_n).$$

The arbitrariness $\varphi \in C(X)$ gives that in this case equalities (1) turn into a view

$$\mu_{x_i} = \mu(0,\dots,0,\delta_{x_i},0,\dots,0) = \alpha_i \delta_{x_i},$$

$$\mu^{x_i} = \mu(\delta_{x_1},\dots,\delta_{x_{i-1}},0,\delta_{x_{i+1}},\dots,\delta_{x_n}) =$$

$$= \alpha_1 \delta_{x_1} + \dots + \alpha_{i-1} \delta_{x_{i-1}} + \alpha_{i+1} \delta_{x_{i+1}} + \dots + \alpha_n \delta_{x_n}.$$

Let

$$\max\{\alpha + A, \beta + B\} = \{\max\{\alpha + \mu, \beta + \nu\} : \mu \in A, \nu \in B\},$$

$$\min\{\alpha + A, \beta + B\} = \{\min\{\alpha + \mu, \beta + \nu\} : \mu \in A, \nu \in B\}$$

for some α, β, $-\infty \leq \alpha, \beta \leq +\infty$ and $A, B \subset O(X)$. Evidently, $\max\{\alpha + A, \beta + B\} \subset O(X)$ if and only if $-\infty \leq \alpha, \beta \leq 0$ and $\max\{\alpha, \beta\} = 0$. And also, $\min\{\alpha + A, \beta + B\} \subset O(X)$ if and only if $0 \leq \alpha, \beta \leq +\infty$ and $\min\{\alpha, \beta\} = 0$. In these two cases any order-preserving functional μ with finite support has views:

$$\mu = \max_{i \in \{1,\dots,n\}} \{\alpha_i + \delta_{x_i}\} \text{ for } -\infty \leq \alpha_i \leq 0, \quad i = 1,\dots,n, \text{ and } \max_{i \in \{1,\dots,n\}} \{\alpha_i\} = 0;$$

$$\mu = \min_{i \in \{1,\dots,n\}} \{\alpha_i + \delta_{x_i}\} \text{ for } 0 \leq \alpha_i \leq +\infty, \quad i = 1,\dots,n, \text{ and } \min_{i \in \{1,\dots,n\}} \{\alpha_i\} = 0.$$

For an arbitrary $\varphi \in C(X)$ we have

$$\mu_{x_i}(\varphi) = \alpha_i + \varphi(x_i),$$

$$\mu^{x_i}(\varphi) = \max\{\alpha_1 + \varphi(x_1),\dots,\alpha_{i-1} + \varphi(x_{i-1}), \alpha_{i+1} + \varphi(x_{i+1}),\dots,\alpha_n + \varphi(x_n)\}$$

in the maximum case, and

$$\mu_{x_i}(\varphi) = \alpha_i + \varphi(x_i),$$

$$\mu^{x_i}(\varphi) = \min\{\alpha_1 + \varphi(x_1),\ldots,\alpha_{i-1} + \varphi(x_{i-1}),\alpha_{i+1} + \varphi(x_{i+1}),\ldots,\alpha_n + \varphi(x_n)\}$$

in the minimum case.

Proposition 2.1. *Let* $\langle \mu;\varphi_1,\ldots,\varphi_n;\theta\rangle$ *and* $\langle \nu;\psi_1,\ldots,\psi_k;\delta\rangle$ *be open neighborhoods of order-preserving functionals* μ *and* ν*, respectively. Then the sets*

$$\max\{\alpha + \langle \mu;\varphi_1,\ldots,\varphi_n;\theta\rangle,\beta + \langle \nu;\psi_1,\ldots,\psi_k;\delta\rangle\}$$

$$(\textit{for each pair of } \alpha,\beta,-\infty \le \alpha,\beta \le 0 \textit{ with } \max\{\alpha,\beta\} = 0)$$

and

$$\min\{\alpha + \langle \mu;\varphi_1,\ldots,\varphi_n;\theta\rangle,\beta + \langle \nu;\psi_1,\ldots,\psi_k;\delta\rangle\}$$

$$(\textit{for each pair of } \alpha,\beta,0 \le \alpha,\beta \le +\infty \textit{ with } \min\{\alpha,\beta\} = 0)$$

are open in $O(X)$.

Proof. It is enough to establish the openness of one of the sets. The openness of the other one will be established similarly. We will work on showing the openness of the first set. Let $\Omega = \max\{\alpha + \langle \mu;\varphi_1,\ldots,\varphi_n;\theta\rangle,\beta + \langle \nu;\psi_1,\ldots,\psi_k;\delta\rangle\}$.

Three cases are possible.

1) $-\infty \le \alpha < \beta = 0$. Then $\Omega \cap O(X) = \langle \nu;\psi_1,\ldots,\psi_k;\delta\rangle$; in this case the set $\alpha + \langle \mu;\varphi_1,\ldots,\varphi_n;\theta\rangle$ lies in the "parallel" space $\alpha + O(X)$ as an open subset.

2) $-\infty \le \beta < \alpha = 0$. Then $\Omega \cap O(X) = \langle \mu;\varphi_1,\ldots,\varphi_n;\theta\rangle$, and $\beta + \langle \nu;\psi_1,\ldots,\psi_k;\delta\rangle$ is open in the "parallel" space $\beta + O(X)$.

So, in the above two cases, in general, the set $\alpha + \langle \mu;\varphi_1,\ldots,\varphi_n;\theta\rangle$ is open in the space $\alpha + O(X)$, and $\beta + \langle \nu;\psi_1,\ldots,\psi_k;\delta\rangle$ in $\beta + O(X)$. Consequently, the set Ω is open in $\max\{\alpha + O(X),\beta + O(X)\} = O(X)$.

3) $\alpha = \beta = 0$. Then $\Omega \cap O(X) = \Omega$ is open in $\max\{O(X),O(X)\} = O(X)$. Proposition is proved.

3. Perfect compactification of the space $O_f(X)$ of order-preserving functionals

For a compact Hausdorff space X put

$$O_f(X) = \{\mu \in O_\omega(X) : \textit{there exists a unique point } x \in \textit{supp}\,\mu = \{x_1,\ldots,x_n\}$$

$$\textit{such that } \left(\mu_x(1_X) \ge \tfrac{n}{n+1} \textit{ and } \mu^x(1_X) \le \tfrac{1}{n+1}\right) \textit{ or}$$

$$\left(\mu_x(1_X) = 1 \textit{ and } |\mu^x(0_X)| \ge \tfrac{n}{n+1}\right)\}. \qquad (2)$$

This construction was suggested in [12]. In [13] topological and categorical properties of the space $P_f(X)$ of probability measures, and in [14] topological and categorical properties of the space $I_f(X)$ of idempotent probability measures are explored. Note that $P_f(X)$ and $I_f(X)$ are subsets of $O_f(X)$.

Note that for a compact Hausdorff space X the set $O_f(X)$ is closed in $O(X)$.

For a point $x \in X$ we put

$$O_f^x(X) = \{\mu = \mu(\delta_{x_1},\ldots,\delta_{x_n}) \in O_f(X) : x \in \textit{supp}\,\mu,$$

$$\mu_x(1_X) \ge \tfrac{n}{n+1} \textit{ or } |\mu^x(0_X)| \ge \tfrac{n}{n+1}\}.$$

It is easy to see that

$$O_f^x(X) \cap O_f^y(X) = \varnothing \quad for\ every\ couple\ of\ \ x,y \in X\ \ with\ \ x \neq y$$

and

$$O_f(X) = \bigcup_{x \in X} O_f^x(X).$$

Let M be a subset in X. We put

$$\langle M \rangle = \{\mu \in O_f(X) : there\ exists\ \ x \in M\ \ such\ that\ \ \mu \in O_f^x(X)\}.$$

Proposition 3.1 *For an open set $U \subset X$ the set $\langle U \rangle$ is open in $O_f(X)$.*

Proof. Clearly, $\delta_x \in \langle U \rangle$ for every $x \in U$. Indeed, $\delta_x \in O_f^x(X)$ for each $x \in X$, in particular, for $x \in U$.

Fix x_0 and $\mu_0 \in O_f^{x_0}(X)$ with $|supp\mu_0| \geq 2$. Consider a function $\varphi \in C(X)$, $\varphi : X \to [0,1]$, such that $\varphi(x_0) = 1$ and $\varphi^{-1}((\frac{1}{2},1]) = U$. Then $\frac{2}{3} \leq \mu_{0x_0}(\varphi) \leq \mu_0(\varphi) \leq 1$, i. e., $\frac{2}{3} \leq \mu_0(\varphi) \leq 1$.

Let $\nu \in \langle \mu_0; \varphi; \frac{1}{6} \rangle \cap O_f(X)$. If $supp\nu = \{z\}$ and $z \notin U$ then $\nu = \delta_z$ and $\nu(\varphi) = \varphi(z) \leq \frac{1}{2}$. Adding $\frac{2}{3} \leq \mu_0(\varphi) \leq 1$ and $-\frac{1}{2} \leq -\nu(\varphi) \leq 0$ we get a contradiction $\frac{1}{6} \leq \mu_0(\varphi) - \nu(\varphi) \leq 1$. So, $z \in U$, i. e. $\nu \in \langle U \rangle$.

Consider the case $|supp\nu| \geq 2$. Let $\nu \in O_f^y(X)$. Then $\nu(\varphi) \geq \nu_y(\varphi) \geq \frac{2}{3}\varphi(y)$. Assuming $y \notin U$ we get $-\frac{1}{3} \leq -\nu(\varphi) \leq 0$, and consequently, $\frac{1}{3} \leq \mu_0(\varphi) - \nu(\varphi) \leq 1$. We received a contradiction again. So, $y \in U$, that equipped $\nu \in \langle U \rangle$. Thus, $\langle \mu_0; \varphi; \frac{1}{6} \rangle \cap O_f(X) \subset \langle U \rangle$. Proposition is proved.

Lemma 3.2 *For an arbitrary open cover $\gamma_X = \{U_\alpha : \alpha \in \mathfrak{A}\}$ of a Tychonoff space X the system*

$$\gamma_0 = \{\langle U \rangle : U \in \gamma\}$$

is an open cover of $O_f(X)$.

Proof. It requires to verify that:

$$\bigcup \gamma_0 \supset O_f(X).$$

Let μ be an arbitrary element of $O_f(X)$. There exists a point $x \in X$ such that $x \in supp\mu$ and $\mu \in O_f^x(X)$. Consequently, $\mu \in \langle U_x \rangle$ for each open neighborhood U_x of x. Since γ_X is open cover of X then there exists a set $U \in \gamma$ containing x. We have $\mu \in \langle U \rangle$. So, we conclude that every element of $O_f(X)$ is contained in some element of γ_0. We have completed the proof of lemma.

Note that $O_f(X)$ is everywhere dense in $O_f(\beta X)$ and $O_f(\beta X)$ is a compact Hausdorff space, then $O_f(\beta X)$ is one of compact extensions of $O_f(X)$. Now we can give the following result.

Theorem 3.3. *For a Tychonoff space X the space $O_f(\beta X)$ is a perfect compactification of the space $O_f(X)$.*

Proof. It is enough to consider open in $O_f(X)$ sets of the view $\langle U\rangle$ for open $U \subset X$. Let U_1 and U_2 be disjoint open sets in X. Since βX is the perfect compactification of X we have $\mathfrak{O}_{\beta X}(U_1 \cup U_2) = \mathfrak{O}_{\beta X}(U_1) \cup \mathfrak{O}_{\beta X}(U_2)$. Consider open sets $\langle U_i\rangle \; in \; O_f(X), i = 1,2.$

Lemma 3.2 provides $\langle U_1\rangle \cap \langle U_2\rangle = \varnothing$. We will show that

$$\mathfrak{O}_{O_f(\beta X)}(\langle U_1\rangle \cup \langle U_2\rangle) = \mathfrak{O}_{O_f(\beta X)}(\langle U_1\rangle) \cup \mathfrak{O}_{O_f(\beta X)}(\langle U_2\rangle).$$

The inclusion $\supset$ straightly follows from the definition of sets of the type $\mathfrak{O}(H)$. That is why it is enough to show the inverse inclusion. Let $\mu' \in O_f(\beta X)$ be an order-preserving functional such that $\mu' \notin \mathfrak{O}_{O_f(\beta X)}(\langle U_1\rangle) \cup \mathfrak{O}_{O_f(\beta X)}(\langle U_2\rangle)$. Then $\mu' \in O_f(\beta X) \setminus \mathfrak{O}_{O_f(\beta X)}(\langle U_i\rangle)$, $i = 1,2$. From [10] (see, p. 234) we have

$$O_f(\beta X) \setminus \mathfrak{O}_{O_f(\beta X)}(\langle U_i\rangle) = [O_f(X) \setminus \langle U_i\rangle]_{O_f(\beta X)}, \qquad i = 1,2.$$

Hence, $\mu' \in [O_\beta(X) \setminus \langle U_i\rangle]_{O(\beta X)}$, $i = 1,2$. Since $\langle U_1\rangle \cap \langle U_2\rangle = \varnothing$ by [3] we have

$$[O_f(X) \setminus \langle U_1\rangle]_{O_f(\beta X)} \cap [O_f(X) \setminus \langle U_2\rangle]_{O_f(\beta X)} = [O_f(X) \setminus (\langle U_1\rangle \cup \langle U_2\rangle)]_{O_f(\beta X)}.$$

Then $\mu' \in [O_f(X) \setminus (\langle U_1\rangle \cup \langle U_2\rangle)]_{O_f(\beta X)}$, or the same $\mu' \in O_f(\beta X) \setminus \mathfrak{O}_{O_f(\beta X)}\langle (U_1\rangle \cup \langle U_2\rangle)$. Consequently, $\mu' \notin \mathfrak{O}_{O_f(\beta X)}(\langle U_1\rangle \cup \langle U_2\rangle)$. Thus, we have just established that the inclusion $\mathfrak{O}_{O_f(\beta X)}(\langle U_1\rangle \cup \langle U_2\rangle) \subset \mathfrak{O}_{O_f(\beta X)}(\langle U_1\rangle) \cup \mathfrak{O}_{O_f(\beta X)}(\langle U_2\rangle)$ is also true. Theorem is proved.

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Rezyume: X *Tixonov fazosi uchun tartibni saqlaydigan* $O_f(X)$ *funksionallar fazosi qaraldi. Berilgan* X *fazoning* γ_X *qoplamasidan foydalanib* $O_f(X)$ *fazoning* γ_0 *ochiq qoplamasi qurildi. Agar* γ_X *ajralgan sistema bo'lsa, u holda* γ_0 *ham ajralgan sistema bo'lishi ko'rsatildi.* X *fazoning Stoun-Chex kompaktli kengaytmasi tartibni saqlaydigan* $O_f(\beta X)$ *funksionallar fazosi* $O_f(X)$ *fazoning mukammal kompaktli kengaytmasigi bo'lishi isbotlandi.*

Резюме: *Для Тихонова пространства* X *рассматривается пространство* $O_f(X)$ *сохраняющих порядок функционалов. Используя покрытия* γ_X *данного пространства* X, *построено открытое покрытие* γ_0 *пространства* $O_f(X)$. *Показано, что если система* γ_X *несовместима, то* γ_0 *также является несовместимой системой. Доказано, что пространства* $O_f(\beta X)$ *сохраняющих порядок функционалов на Стоун-Чеховском компактификации пространства* X *является совершенной компактификацией пространства* $O_f(X)$.

Kalit so'zlar: *tartibni saqlaydigan funkcional, qoplama, mukammal kompaktli kengaytma.*

Ключевые слова: *сохраняющий порядок функционал, покрытия, совершенная компактификация.*

HIBISCUS HYBRID .L. FROM THE SEED REPRODUCTION FEATURES

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Summary: *This article provides information on the botanical description of Hibiscus hybrida, its climatic conditions, its distribution, species, and methods of growing, caring for, and propagating hibiscus*

Key words: *Hibiscus hybrida, tropical, sanitary, mineral substances, seed, hypocotyl.*

Conservation of biological diversity, protection of the plant world and their rational use are global problems. Therefore, special attention is paid to studying the bioecological characteristics of plant species, conducting introduction work, developing protection measures, identifying and preserving rare and declining species. In this regard, species of the genus *Hibiscus* L., which are used as ornamental plants, are of particular importance.

Hibiscus hybrida is a plant belonging to the rose family, and currently there are about 200 varieties of hibiscus. Hibiscus 18th century at the beginning In Europe of countries botany in the gardens grow started. Hibiscus mainly Asia Southeast in part tropical in the regions grows. Hibiscus bush or up to 3 m tall sufficient small It is a tree. It is its own 300 inside close type cover takes. Hibiscus hybrida passed in the 40s-50s of the century famous breeder scientist F.N. Rusanov by mineralized. Many annual scenic plant, hot and to humidity demanding, its flowers large, long time blooms. Very beautiful scenery flowers simple, large, diameter 15-20 cm until enough.

Hibiscus hybrid Malvaceae family this wonderful plants grows mainly in the tropical regions of exotic Southeast Asia. This plant is distinguished by its large, dazzling white flowers. The delicate petals of the flowers are wrapped around its edge with amazing beauty. Such far blooming many annual plant many hot in countries good This variety is not very demanding on soil composition. (1-pic.).



1-pic. Hibiscus hybrid

Hibiscus hybrida of flowers every kind in color to be and size with difference The flowers white , white yellow, rose colorful, red , pink, lilac (siren) colored, purple colored varieties there is. Hibiscus hybrida scenic, fast growth, every kind climate to the conditions flexibility with characteristic Hibiscus hybrid climate regionally far time blooming many annual from plants one is June of the month first from the decade to the cold until it falls blooms.

Hibiscus hybrida of the soil abiotic factors less demanding But good drained in soils good grows. Hibiscus hybrida gas and to smoke resistant city in the territory in landscaping application possible. Hibiscus hybrida seeds 3-4 years during themselves fallibility save remains seeds seeds

sprout output A temperature of 20-24 $^{\circ}C$is required. Prepare the existing soil in the garden by breaking it up to a depth of (30-40 cm) (use a hoe, spade or electric tiller). Add organic matter such as manure, peat moss until the soil is loose and easy to work. Organic ingredients improve drainage, add nutrients and encourage the growth of earthworms and other organisms that help keep the soil healthy. Give the plants a boost by adding a granular starter fertilizer or all-purpose fertilizer that promotes hibiscus growth.

Hibiscus seeds in the spring (March- April) months sprinkled, then sprinkled seeds over butt as in spring 0.5 cm, 1.0 cm in autumn sand sprinkled of sand over wood sawdust, manure with will be closed. Seed above sand and others with when closed thickness 1.5 -4.0 cm from not to exceed need. Then water bottle with light is irrigated. Seeds fertility easy 7-8 days then sprout come out starts in 12-15 days then in the open sprout It comes out. At this point hypocalyptus height 2.5 cm enough and his/her root with combined place will thicken and root feathers appearance it has been. Hibiscus is also easily propagated vegetatively, that is, by cuttings, root cuttings and grafting. In the fall, the stems of hybrid hibiscus are cut off 8-10 cm above the ground and covered with soil, humus or sawdust, and the bottom is opened in the spring. Hibiscus hybrid bushes are divided by dividing the shoots (in spring, as soon as the buds swell)

10 days of sprouts height 2.5 cm to The hypocotyl length 3.5 cm to 15 days in the buds three bud growth begins and then one no lateral roots 20 days true leaf in seedlings is formed, their 4 cm tall to enough. At this time root system much grows.

Uninhabited 1 month since release was of sprouts tall growth accelerated observation possible. 2 months old in sprouts this process further accelerates. Their tall middle 18 cm on account to enough for 3-4 pieces pine tree harvest will be 3 months old in sprouts tall growth accelerates. This time their height 31.5 cm to enough. 4 months sprouts tall intense growing continue At this time seed coat fall goes. 5 months old of sprouts tall growth sharp decreases. From this then of the plant tall growth almost stops.

Hibiscus of the plant good growth Mineral fertilizers are also needed. Basically to the water manure mixed (juice) (be) irrigated It's okay to stay. fertilized is considered. Hibiscus in the spring August of the month halfway per week one times fed, the rest at times one once a month phosphorus and potassium with 1 5 in dose is fed. In the garden planted hibiscus around special one beautiful giving stands. Scenic hibiscus forms China and Indonesia in the regions and gardeners It is also found in greenhouses. Hibiscus some scenic to the nets stopped let's go: (1-pic.).

*Hibiscus syriacus***.** China, India. Leaves hungry green, flowers every kind in color leaf weaver bush. Syria hibiscus slowly grows in 3-4 years flower starts. Up to 100 years life sees. As the years go by, it gets colder endurance increases and to a temperature of -22 °C endure give takes. Syria hibiscus average in the humidity good grows (lime) the soil doesn't like it), copy planting and to cut resistant. Syria hibiscus pencil welding and from the tribe good sprout comes out

Table 1.

Reproduction methods

Reproduction method	Recommendation done time	The method briefly description	Success level d	Advantages	Disadvantages
With seed multiply	Year during (in greenhouses), open spring to the ground end	Soak the seeds for 24 hours warm in the water wet , then 0.5 -1 cm in depth Planting . Substrate : perlite + peat(1:1).Temperature 24-30°C.	70 - 90% (varies) to varieties depending on)	Many in quantity plant to take possible , cheap	New plant mother plant does notretain 100% of its characteristics (especially in F1 hybrids, color andform difference to do possible). More time demand will (6-12 months) untilflowering

Bulb (stem) with apencil) multiply (most) wide widespread and reliable method)	Summer from the beginning until autumn (June September), the most better July - August	Half lignified (half hardened) stem 10–15 cm from the tip long pencil is cut off . Bottom leaves is taken , section place Kornevin or other root harvest doer to the drug Substrate : perlite + peat or sand + peat (1:1). Temperature 22-28°C, high humidity (mini-greenhouse) or package with closed). 3-5 weeks root shoots	85–95%	Mother of the plant all characteristi cs (color, shape , size) are 100% preserved . Fast blooms (3-6 months) inside).	Kalamcha to take for enough in quantity mother plant need .
Air welded	Spring end of summer at the beginning	On the stem ring in the form of bark is taken , wet sphagnum moss or peat with wrapped around , over film with Closed . 4-6 weeks inside root appearance will be , then mother from the plant cut is taken .	80 - 90%	Big the plant fast and reliable multiplicatio n possible , root system strong will be	Technique a little more complicated , more time demand will reach .
Bush become division	Spring at the beginning (plant when he wakes up)	Big bush caution with into pieces is , every one in a piece root and 2-3 buds will be left . Immediately new to the place is planted	90 - 95%	Fast , simple method , immediately big plant is taken	Only big , many annual bushes Suitable for . Mother the plant injury There is a risk

*Hibiscus moscheutos***.** Such wide large of the widespread species flowers there is - width about 12 cm. Each flower is distinguished by unusual carmine spots at the base of the corolla. This variety is used by many gardeners to create large bushes, which are used as hedges. Such an attractive flower needs a lot of light, warmth and a large area for proper growth. Swamp hibiscus can bloom for a long time.

Hibiscus coccineus. This is a perennial green plant Peaceful ocean the most beautiful on the islands, maybe your joint also great for decorating to be possible. This variety is unique for its very large bushes and flowers. The spreading, lush crown with branches makes it especially charming. Red hibiscus reproduces well by cuttings.

To the tree similar type**.** Big bright variety This variety is loved by many modern gardeners for its flowers. It is used as a hedge in front gardens. decoration for is used. The diameter of beautiful flowers does not exceed 10 cm. Complete flowering for good soil and permanent abundant irrigation demand will be done. This plant planting for You should choose sunny places protected from the wind. Hibiscus does not tolerate direct sunlight. the rays preferably sees. Winter during separately Attention is needed. Celsius at temperatures below 10 degrees Celsius all leaves pour sends

Air humidity does not play a special role in hibiscus growth. Spring and in the summer plant nitrogenous substances with nutrition possible. Even elementary Florists can also do this. The best thing about this method is that hibiscus grown from cuttings will delight you with flowering within a

year. The stem length 15 cm and 3 to 5 joint to be Also, the environment to the environment good adapts.

Hibiscus hybrida (Hybrid) hibiscus (plant) sharp continental to the environment flexible that was because in Uzbekistan ecological the situation improvement, major cities beautification, landscaping, for the population comfortable sanitary-hygienic and clean ecological environment in creation wide if applicable to the goal appropriate would be was .

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Rezyume. *Ushbu maqolada Hibiscus hybridaning botanik tavsifi, iqlim sharoiti, uning tarqalishi, turlari, hibiskusning o'stirish, parvarish qilish va ko'paytirish usullari haqida ma'lumot berilgan.*

Резюме. *В статье представлена информация о ботаническом описании гибискуса гибридного, климатических условиях его произрастания, видах, а также способах выращивания, ухода и размножения.*

Kalit so'zlar: *Hibiscus hybrida, tropik, sanitariya, mineral moddalar, urug', gipokotil.*

Ключевые слова: *Гибридный гибискус, тропический, санитарный, минеральный, семенной, гипокотиль.*

OPTIMIZING RNA-BASED GENE ACTIVITY IN CREATING COLD STRESS-TOLERANT POTATO VARIETIES

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Summary: *This article provides detailed information on the cultivation of new potato varieties with enhanced cold-resistant genetic traits, their agronomic requirements from planting to maintenance, and effective agrotechnical methods.*

Key words *: Icarus, santo, romano, assimilation, cardinal, donor, transplant*

Potato (Solanum tuberosum L.) is one of the world's most important food crops, providing a primary source of nutrition for millions of people globally. More than 370 million tons of potatoes are produced worldwide each year, but climate change and cold stress (e.g., low temperatures, freezing) pose serious threats to the crop. Cold stress, particularly frost and post-frost damage, can reduce yields by up to 50%, and even short-term exposure has been shown to result in the loss of entire crops. For example, potato plants stop growing at temperatures below 7°C, suffer from frost damage at -0.8°C, and freeze damage below, costing billions of dollars in global agricultural production. Creating potato varieties resistant to cold stress is one of the pressing issues in agricultural biotechnology, and molecular biological approaches, in particular RNA-based gene activity optimization, play an important role in this process.

Cold stress induces a number of physiological and biochemical changes in plants, including damage to cell membranes, increased osmotic pressure, increased oxidative stress, and impaired photosynthesis. Under such conditions, plant adaptation mechanisms are activated, which is associated with the regulation of gene expression.

Of the President of the Republic of Uzbekistan No. PQ-269 dated September 8, 2025 “On additional measures to increase potato cultivation and further develop seed production in the republic” and the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 462 dated June 6, 2019 “On measures to ensure the supply of seed potatoes to agricultural producers for the 2019 harvest and the guaranteed filling of the domestic consumer market with socially important types of food products”, as well as regulatory and legal documents related to this activity, is one of the pressing issues of today [1,2]

Potatoes are one of the most important food crops in the world, but they are naturally very sensitive to cold: the plant dies at temperatures of −1 - 3 °C, and the tubers are damaged by freezing. Due to climate change and the need to expand potato cultivation in high-altitude areas and northern regions, the creation of varieties resistant to cold (especially spring and autumn frosts) has become a relevant scientific direction in the last 50–60 years.

The greatest progress in the development of cold-resistant potato varieties has been achieved through the use of wild Andean species and molecular marker-assisted selection (MAS). Today, there are commercial varieties that are cold-resistant to −5…−7 °C, mainly intended for the Andean region, China, and Russia. [3,4]

In the 2000s, transgenic potato varieties resistant to −7…−8 °C were obtained by overexpressing the CBF/DREB1 transcription factors (Pino et al., 2007, Plant Cell Reports). However, GMO potatoes are not permitted for commercial cultivation in many countries [5,6]

In Uzbekistan: “Sante”, “Romano”, “Impala” and local varieties “Navruz”, “Zakovat” showed better resistance to cold (data from the Scientific Research Institute of Breeding and Seed Production of the Republic of Uzbekistan, 2015–2023)

RESEARCH METHODOLOGY. In this regard, in order to improve the cold-resistant properties of potatoes, scientific research was conducted in the “In vitro” scientific laboratory of Jizzakh State Pedagogical University and in field conditions during 2024-2025 on the basis of molecular biology to improve the cold-resistant genetic properties of potatoes.

For this, we used Ikar and foreign varieties Sante, Romano and Cardinal, which were created by the method of natural selection adapted to local conditions, and the miracle variety of Jerusalem artichoke plant was used as a donor. Under laboratory conditions, the cold-resistant RNA gene, which has a dominant feature in Jerusalem artichoke cells, transgenic to Ikar, Sante and Romano potato varieties based on the technological scheme.

For this purpose, the genetic RNA gene in the Jerusalem artichoke cell was isolated in the laboratory according to the following method.

120 ml of plain water was taken and poured into a glass beaker, and 5 grams of NaCl and 5 ml of detergent were added to it to expand the cell tissue and enhance the fermentation properties, and the solution was cooled. The Jerusalem artichoke was cleaned of soil and bark and washed in cold water. The cleaned donor node was crushed in a mortar until it became homogeneous and a sample of 2-10 grams (in the required volume) was taken from it. 10 ml of cooled solution was poured over the obtained sample and mixed with a glass rod for 2 minutes. The mixture was placed in a conical tube, mixed in a centrifuge at low speed for 5 minutes, and the mixture was settled. 1-2 drops of isopropyl alcohol were added to the settled mixture to ferment the RNA gene and other compounds contained in it.



Figure 1. Jerusalem artichoke variety "Mo'jiza"

The clear mixture was collected using a pipette and the pure sediment was separated and the nutrient medium was prepared. The 2-3 cm seedlings grown in the nutrient medium of the potato variety were separated from the nodule and grown in the nutrient medium in a petri dish for 2-3 days until they reached 8-10 cm. seeds were grown. By taking a sample of the grown seed material, the types of latent viruses were determined using an electron microscope Mikromed-M and the levels of their damage were determined. The nodules of the healthy variety were kept at room temperature until plasmolysis. In November, the tubers were planted in an open field according to the varieties to a depth of 8-10 cm based on a scheme of 70x20 cm.



Figure 2. Planting stimulated potatoes in the fall

Before planting the nodules, different leaves that fell in the fall were placed in a thickness of 1-2 cm, 100 grams of biohumus fertilizer was added for each nodule, and the nodules were planted on

it. After planting, the ridges were leveled and the soil was broken into capillary tubes. During the autumn and winter, soil and air temperatures were monitored three times using minimum and maximum thermometers. According to observations over the years, in November, December, January and February, the average air temperature was -8-10 ^{0}C; in 2023, due to a prolonged anomalous cold, the air temperature was -25-27 ^{0}C. In this cold, the potato tubers were not damaged at all



Figure 3. Obtaining undamaged potatoes

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Rezyume. *Mazkur maqolada kartoshkaning sovuqqa chidamli gen xususiyatlari kuchaytirilgan yangi navlarini yetishtirish, ularni ekishdan boshlab parvarishlashgacha bo‘lgan agronomik talablari va samarali agrotexnika usullariga oid batafsil ma’lumotlar yoritilgan*

Резюме: *В данной статье представлена подробная информация о выращивании новых сортов картофеля с улучшенными морозоустойчивыми генетическими характеристиками, их агрономических требованиях от посадки до ухода, а также об эффективных агротехнических методах.*

Kalit so‘zlar*: Ikar, santo, romano, assimilyatsiya, kardinal, donor, transplantatsiya*

Ключевые слова: *Икар, санто, романо, ассимиляция, кардинал, донор, трансплантация*

UDK 911

ASSESSMENT OF LANDSCAPE MODIFICATION TRENDS BASED ON KEY CLIMATE CHANGE INDICATORS (A CASE STUDY OF JIZZAKH REGION)

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Summary: *This article assesses the modification trends of landscapes based on key climate change indicators using the Jizzakh Region as a case study.*

Keywords: *climate change, arid regions, main indicators of climate change, natural conditions of Jizzakh region, landscape analysis, modification trends.*

At present, climate change has become one of the most pressing issues among natural geographical processes. This global phenomenon is particularly evident in arid regions, where its impacts are more pronounced. Jizzakh Region can be regarded as one such territory.

Globally, an increase in average temperature of approximately 1.5°C was observed during the second half of the 20th century, and this trend has continued thereafter. The 2015 Paris Agreement indicated that global warming has approached nearly 3°C. In order to reduce global temperatures, countries are striving to rapidly limit the growth of greenhouse gas emissions and subsequently reduce them based on the best available scientific evidence, as well as economic and social measures.

Climate change does not occur uniformly across the globe. In the studied arid region, the impact of climate change on Jizzakh Region over the past 40 years was analyzed using tables and figures. The data sources included the Jizzakh Regional Hydrometeorological Department, Meteoblue.com ERA5, and the fifth-generation atmospheric reanalysis data of the European Centre for Medium-Range Weather Forecasts (ECMWF). These datasets cover the period from 1979 to 2023 with a spatial resolution of 30 km (Table 1; Figures 1, 2, and 3).

Based on the indicators presented in Table 1, the influence of winter–summer temperature and precipitation changes on landscapes within the zone of influence of inland waters of Jizzakh Region from 1979 to 2023 was analyzed. In the graphs, the dotted blue line represents the linear trend of climate change, blue indicates colder conditions, and red represents warmer temperatures. The lower graph shows an increase in the average annual air temperature in Jizzakh Region (Figure 1).

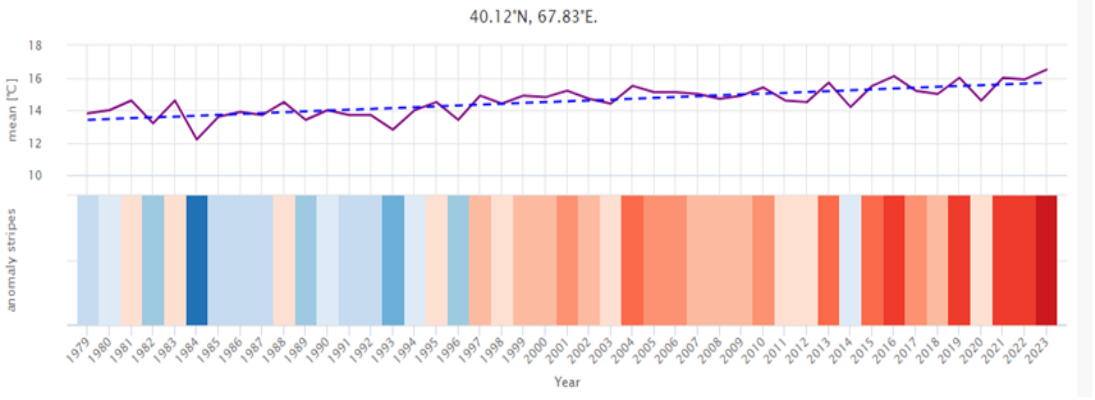


Figure 1. Changes in air temperature in Jizzakh Region (1979–2023)

In addition, precipitation in the region has decreased in line with rising air temperatures. The dotted blue line indicates the linear climate change trend, blue denotes colder conditions, and red denotes warmer conditions (Figure 2).

This graph illustrates the average total precipitation for Jizzakh Region. If the linear trend line of climate change rises from left to right, precipitation trends are positive and humidification increases; if the line is horizontal, no clear trend is observed; and if it slopes downward, aridification intensifies over time. The analysis shows that between 1979 and 2023, air temperature increased while

precipitation decreased, leading to changes in natural water bodies and a decline in landscape productivity.

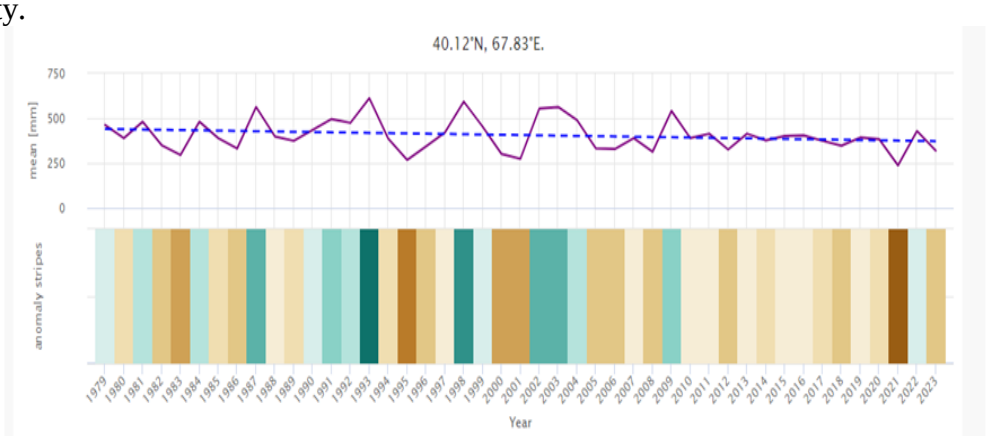


Figure 2. Changes in precipitation in Jizzakh Region (1979–2023)

Monthly temperature anomaly differences from 1979 to the present are presented for Jizzakh Region, showing how much warmer or cooler each month was compared to the 40-year climatic average (1979–2023). The analysis indicates an increase in the number of warm months over the years. The lower graph shows monthly precipitation anomalies, indicating whether precipitation amounts were above or below the 40-year average. Green months represent wetter-than-normal conditions, while brown months indicate drier conditions (Figure 3).

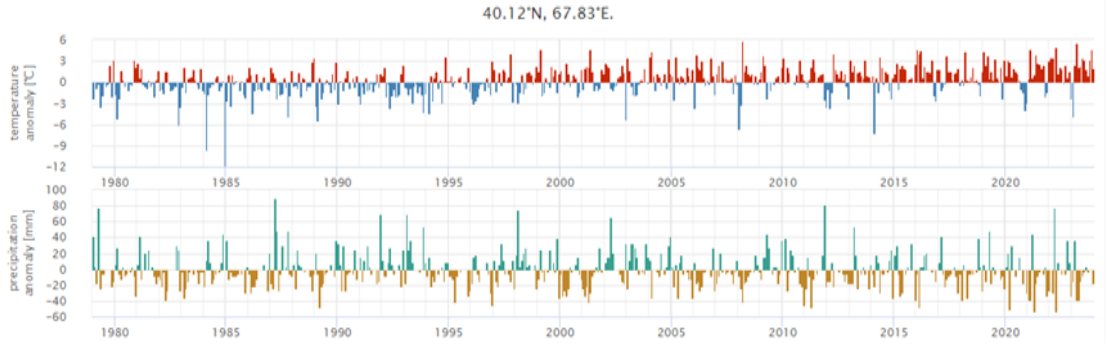


Figure 3. Differences in monthly temperature and precipitation anomalies in Jizzakh Region under climate change conditions.

Based on the analysis, differences in precipitation levels for 1979, 2000, and 2023 were identified. Compared to 1979, precipitation slightly decreased by 2000 and declined further by 2023 (Figure 4).

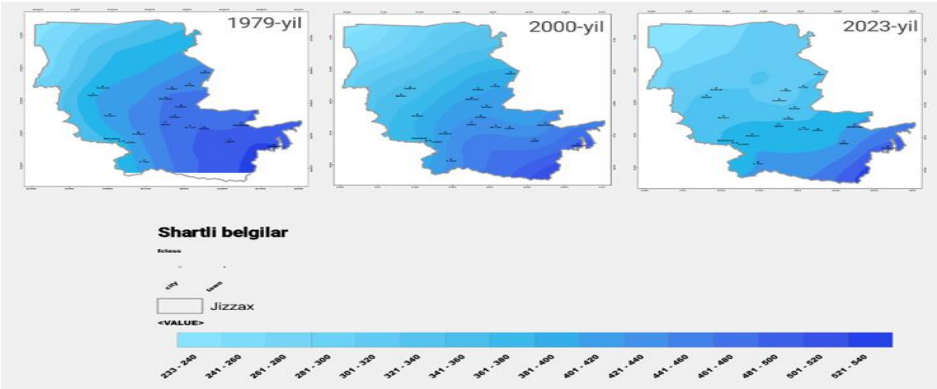


Figure 4. Map-scheme of precipitation anomalies in Jizzakh Region (1979–2023).

The analysis also revealed changes in evaporation rates during 1979–2000–2023. Due to the gradual increase in temperature over the years, evaporation rates increased accordingly (Figure 5).

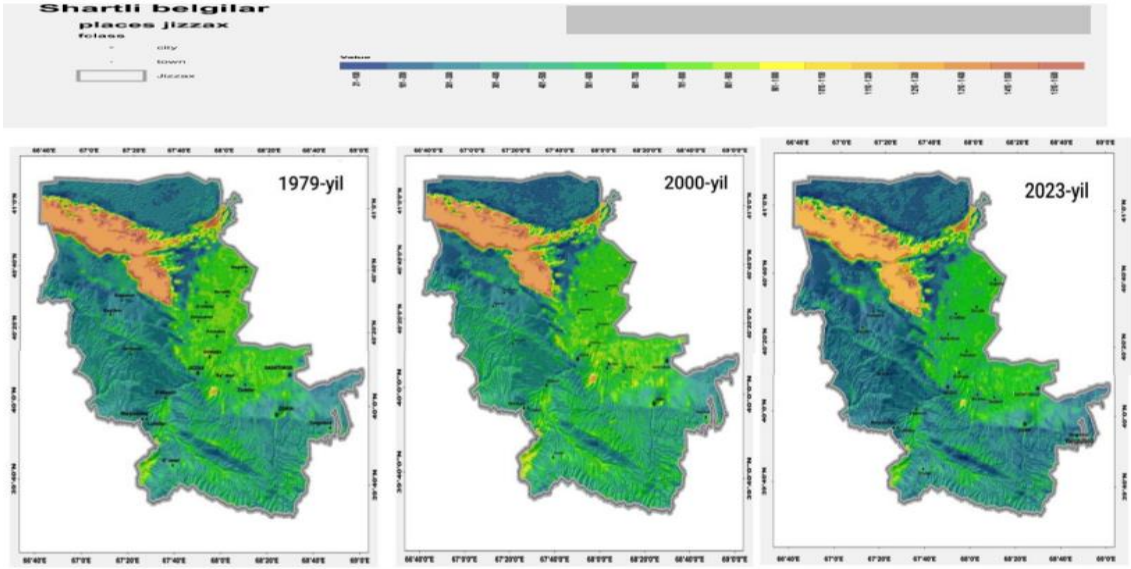


Figure 5. Map-scheme of evaporation differences in Jizzakh Region (1979–2023).

The conducted research demonstrates that global climate change has significantly affected Jizzakh Region. Due to its location in an arid zone, desertification processes are accelerating. This is particularly evident in inland water bodies and associated landscapes, especially within the Aydar–Arnasay Lake System (AALS), where declining water levels and increasing salinity have been observed. As a result, biodiversity in and around the lake has decreased. The number of morphological landscape units during periods of higher water levels differs significantly from current conditions. Between 1985 and 2023, salinity in AALS increased from 5.0 g/L to 8.1 g/L, while surface water temperature rose from 13.4°C to 15.8°C (Figure 6).

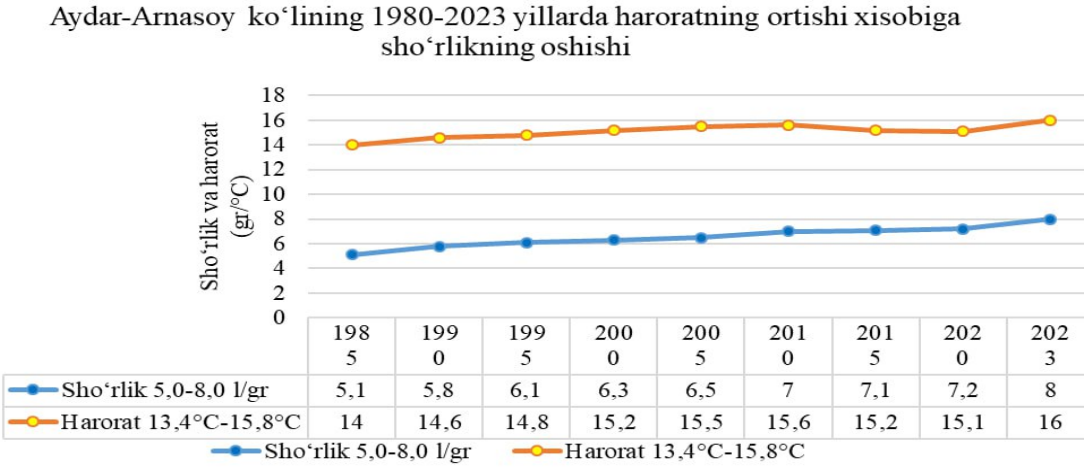


Figure 6. Increase in temperature and salinity in AALS (1980–2023).

Furthermore, the influence of the Kyzylkum Desert in the northern part of the lake has intensified. Saxaul forests are being replaced by shrubs, which in turn are replaced by ephemeral and ephemeroid vegetation. Similar processes are observed in other hydrographic objects of the region. Notably, increased anthropogenic pressure is evident along the middle and lower reaches of the Sangzor River, the lower reaches of the Zominsuv River, the northern parts of Jizzakh and Korovultepa reservoirs, and the lower sections of the Southern Mirzachul Canal. Consequently, a decrease in water discharge in inland waters has been observed, particularly in the Zominsuv River (Figure 7).

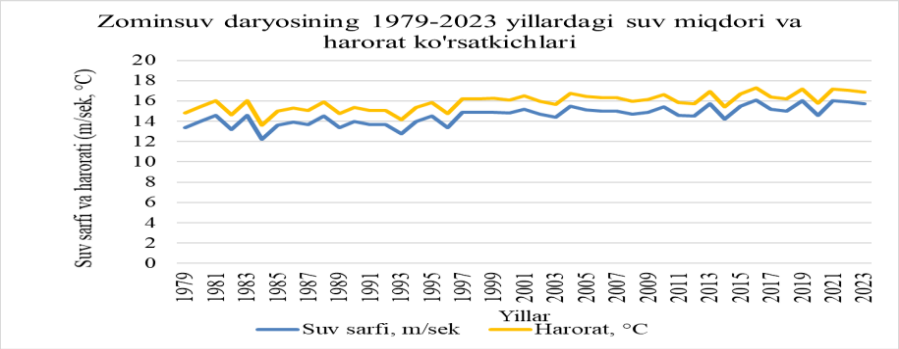


Figure 7. Water discharge and temperature indicators of the Zominsuv River (1979–2023).

The ongoing changes in climatic conditions have led to a reduction in water resources, accelerating desertification and drought processes. Observations over the past forty years show a clear correlation between climate change and declining water levels in both natural and hydraulic water bodies. By comparing trends in air temperature, evaporation, and precipitation—key indicators of global climate change-the dynamics of landscape transformation in Jizzakh Region were identified (Figure 8).

As in other regions of Uzbekistan, a rising trend in global warming has been recorded. The past seven years have been among the warmest on record, with 2016 and 2021 identified as the warmest years. The frequency and intensity of anomalously hot periods in spring and summer have increased. The number of days with air temperatures exceeding 40°C has grown, particularly in desert areas in the north and northwest, where anomalously hot days increased from 22 to 37 days. Prolonged dry periods have intensified atmospheric drought and water scarcity. In recent years, the number of days with atmospheric drought has ranged from 50 to 80 days. Strong winds have contributed to the formation and spread of dust storms. Notably, in November 2021, unprecedented dust and sand storms reduced visibility to 100–200 meters in Syrdarya and Jizzakh regions. Variability in PM2.5 dust concentrations has become a significant issue, exacerbated by industrial emissions, transport, and construction activities, further impacting water-related landscapes.

As a result, between 1979, 2000, and 2023, significant landscape changes were observed in Jizzakh Region (Figure 8). These changes have negatively affected soils, vegetation, and fauna, particularly in the Sangzor River basin and AALS. The northern part of the region is surrounded by hot and arid landscapes of the Kyzylkum and Mirzachul deserts, whose influence has recently expanded into foothill, mountainous, and water-rich landscapes. Increased salinity in AALS waters and declining fish populations illustrate the scale of these transformations.

Based on these results, the dynamics of landscape change in Jizzakh Region from 1985 to 2020 were developed. Special attention was given to changes in hydrographic objects, particularly river terraces, where combined effects of climate change and anthropogenic pressure have accelerated landscape degradation.

From a landscape-ecological assessment perspective, the following evaluation categories were established:

- **Unfavorable level** – Areas unsuitable for geoecological, agricultural, and recreational development, including high and medium-high mountainous, rocky, and eroded watershed zones with limited resources.
- **Less favorable level** – Areas with limited potential for development but suitable for guesthouses, hunting, fishing, water tourism, and health resorts near rivers and reservoirs.
- **Moderately favorable level** – Landscapes moderately suitable for agricultural and recreational activities, mainly in upper parts of small stream valleys.
- **Favorable level** – Landscapes suitable for agriculture and recreation, including forested areas and stream banks.

Highly favorable level – The most suitable landscapes for geoecological, agricultural, and recreational use, including riverbanks, forested slopes, and meadow-rich areas ideal for health and recreation facilities.

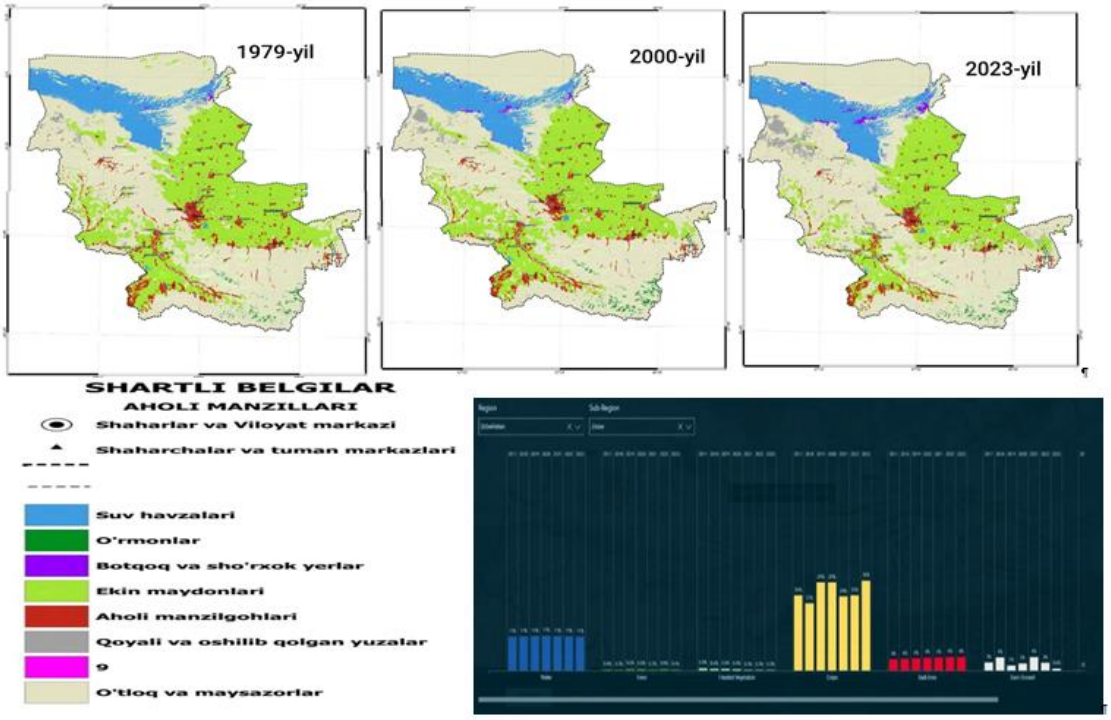


Figure 8. Map-scheme of landscape changes in Jizzakh Region (1979, 2000, and 2023)

Table 1

Meteorological indicators of Jizzakh region in 1979-2023

№	Years	Summer	Winter	Precipitation amount	№	Years	Summer	Winter	Precipitation amount
1.	1979	13,4	-0,5	462.3	24.	2002	14,7	0,4	553.6
2.	1980	14	-0,3	389	25.	2003	14,4	0,1	562.7
3.	1981	14,6	0,3	480.6	26.	2004	15,5	1,2	489.7
4.	1982	13,2	-1,1	349.8	27.	2005	15,1	0,8	331.5
5.	1983	14,6	-	295	28.	2006	15	0,7	328.5
6.	1984	12,2	-2,1	480.6	29.	2007	15	0,7	389.3
7.	1985	13,6	-0,7	389.3	30.	2008	14,7	0,4	313.3
8.	1986	13,9	-0,4	331.5	31.	2009	14,9	0,6	541.4
9.	1987	13,7	-0,6	562.7	32.	2010	15,4	1,1	389.3
10.	1988	14,5	0,2	398.5	33.	2011	14,6	0,3	413.7
11.	1989	13,4	-0,9	374.1	34.	2012	14,5	0,2	325.5
12.	1990	14	-0,3	435	35.	2013	15,7	1,4	413.7
13.	1991	13,7	-0,5	495.8	36.	2014	14,2	-0,1	377.2
14.	1992	13,7	-0,6	474.5	37.	2015	15,5	1,2	401.5
15.	1993	12,8	-1,5	611.4	38.	2016	16,1	1,8	404.5
16.	1994	14	-0,3	386.3	39.	2017	15,2	0,9	374.1
17.	1995	14,5	0,2	267.3	40.	2018	15	0,7	346.7
18.	1996	13,4	-0,9	343.7	41.	2019	16	1,7	392.4
19.	1997	14,9	0,6	419.7	42.	2020	14,6	0,3	383.2
20.	1998	14,9	0,1	593.1	43.	2021	16	1,7	237.3
21.	1999	14,9	0,6	453	44.	2022	15,9	1,6	428.9
22.	2000	14,8	0,5	301.1	45.	2023	15,7	2,2	319.4
23.	2001	15,2	0,9	273.8					

Source: The table was developed by the author based on data from the Jizzakh regional hydrometeorological department [3].

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Rezyume: ***Mazkur maqolada*** *iqlim o'zgarishining asosiy indikatorlari asosida landshaftlarning modifikatsion tendensiyalari Jizzax viloyati misolida baholangan.*

Резюме: *В данной статье на примере Джизакского региона оцениваются тенденции изменения ландшафтов на основе основных показателей изменения климата.*

Kalit so'zlar: *iqlim o'zgarishi, arid hududlar, iqlim o'zgarishining asosiy indikatorlari, Jizzax viloyati tabiiy sharoiti, landshaft tahlili, modifikatsion tendensiyalar.*

Ключевые слова: *изменение климата, засушливые регионы, основные показатели изменения климата, природные условия Джизакского региона, анализ ландшафта, тенденции изменения.*

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STUDY OF THE (*CARYOPHYLLACEAE)* FAMILY INCLUDED IN THE RED BOOK OF THE REPUBLIC OF UZBEKISTAN

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Summary: *The new edition of the Red Book of the Republic of Uzbekistan includes 329 plant species belonging to 48 families. Ten species belonging to the family Caryophyllaceae are included in the Red Book. The species found in the Molguzar, Turkestan and Nurota mountain ranges of the Jizzakh region were analyzed according to literature sources. These include species such as Kachimsimon yetmak (bex) – Allochrusa gypsophiloides, mountain silena – Silene oreina, and glandless silena – Silene paranadena. A table was compiled for species belonging to the Caryophyllaceae family.*

Key words: *Red Book, Caryophyllaceae family, protection, endemic, life forms.*

The conservation of plant diversity has great vital importance for humanity. On December 3, 2004, the laws "On Protected Natural Areas," on September 21, 2016, the law "On the Protection and Use of Plant Resources," and on April 16, 2018, the law "On Forests" were adopted in a new edition. These laws are important documents for preserving all plant species, protecting them, and ensuring their conservation. [3] According to the 2019 edition of the Red Book, 329 plant species of Uzbekistan's flora are considered at risk of extinction. Specialists and scientists of the Republic continuously study their current status. Their observations show that the number and distribution of some species have significantly increased. [5] According to data from 2009, 321 plant species were included in the Red Book [1], while the 2019 edition contains 329 species belonging to 48 families. [3] Among these, ten species belong to the Caryophyllaceae family. A table was compiled for species of the Caryophyllaceae family included in the Red Book. The table provides extensive information such as local and scientific names, rarity status, distribution area, life form, and conservation measures. A description of the family was given. Based on literature, descriptions of some species were provided, and their conservation measures were studied. Caryophyllaceae — a family belonging to the order Caryophyllales. It includes subshrubs, as well as annual, biennial, and perennial herbs. The family comprises about 2000 species belonging to 80 genera. In Uzbekistan, 122 species belonging to 24 genera grow. The leaves are simple, opposite, sessile, with entire margins. The flowers are regular, 4–5-lobed. The calyx may be free or fused. Stamens number 4–10, carpels 1–5, the ovary is superior, and the fruit is a capsule. The family is widespread mainly in the temperate regions of the Northern hemisphere. Species such as Dianthus, Silene, Lychnis, Saponaria and others are ornamental. The roots of species like Gypsophila, Acanthophyllum, Onosma and others are used in the preparation of halva and various beverages. Some species of the Caryophyllaceae family are used in the perfumery industry and medicine. Ten species of Caryophyllaceae are included in the Red Book of the Republic of Uzbekistan. [4]

Table 1. Species of the Caryophyllaceae Family Included in the Red Book of the Republic of Uzbekistan

Uzbek name	Scientific name	Rarity status	Height	Distribution	Life form	Conservation measures
1. Kachimsimon yetmak (bex)	Allochrusa gypsophiloides (Regel) Schischk.	3 – endemic	30–60 cm	Tashkent, Samarkand, Namangan, Jizzakh	Perennial herb	Protected in Surkhan, Kitab, and Chatkal reserves
2.Michelson's silene	Silene michelsonii Preobr.	1 endemic	25–30 cm	Surkhandarya	Perennial herb	Conservation measures not developed

3.Woolly silene	S. tomentella Schischk.	2 – endemic	30–40 cm	Bukhara, Navoi	Perennial herb	Not specially protected
4.Popov's silene	S. popovii Schischk.	2 – endemic	20–25 cm	Samarkand, Kashkadarya, Zarafshan	Perennial herb	Not under special protection
5.Mountain silene	S. oreina Schischk.	1 – endemic	10–15 cm	Samarkand, Kashkadarya, Zarafshan Range	Perennial herb	No special conservation measures
6.Natalia's silene	S. nataliae F.O.Khass.	1 – endemic	3–5 cm	Surkhandarya	Subshrub	Protected in Surkhan Reserve
7.Glandless silene	S. paranadena Bondarenko et Vved.	2 – endemic	30–50 cm	Nurota–Molguzar Ranges (Samarkand, Navoi, Jizzakh)	Perennial herb	Protected in Nurota State Reserve
8.Needle-like white-thorn	Acanthophyllum albidum Schischk.	3 – endemic	30 cm	Fergana, Namangan	Subshrub	Strict protection recommended
9.Awl-leaf white-thorn	A. cyrtostegium Vved.	3 – endemic	20–30 cm	Bukhara, Navoi	Subshrub	Monitoring of populations necessary
10.Uzbekis-tan carnation	Dianthus uzbekistanicus Lincz.	3 – endemic	40 cm	Samarkand, Kashkadarya	Perennial herb	Some populations protected in Kitab State Reserve

Descriptions of Selected Species

1. Kachimsimon yetmak — *Allochrusa gypsophiloides* (Regel) Schischk. A perennial herb, 30–60 cm tall. Stems thin and numerous. Leaves 10–25 mm long, flat, glabrous, and spineless. Flowers pink, arranged in spreading paniculate inflorescences at the top of the stem. Fruit a capsule. Flowering occurs from May to August; fruits ripen in August–September.

2. Mountain silene — *Silene oreina* Schischk. A perennial, many-headed (caudex-forming), densely tufted herb, 10–15 cm tall. Leaf tips elongated and very sharp, covered with dense glandular hairs. Basal leaves are oblanceolate, narrowing toward the base; stem leaves are broader. Flowers white, 1–3 per stem tip. Calyx 2–3 times longer than the corolla, initially cylindrical, later campanulate. Carpophore glabrous. Capsule ovoid. Flowers in May; fruits ripen in May–June.

3. Glandless silene — *Silene paranadena* Bondarenko et Vved. Perennial herb, 30–50 cm tall; stems numerous, woody at the base. Leaves lanceolate, 3–6 cm long, 10–12 mm wide. Flowers solitary at branch tips, large, 30–32 mm long. Petals white to pale pink, deeply bifid. Calyx cylindrical, non-inflated, 22–25 mm long; tube glabrous; teeth with white hairs. Fruit a capsule 10–12 mm long. Flowers April–June; fruits ripen in June. Distribution Notes According to literature sources, the species Allochrusa gypsophiloides, Silene oreina, and Silene paranadena occur in the Molguzar, Nurota, and Turkestan ranges of Jizzakh region. [5, 6]. In the 2009 edition, Allochrusa tadschikistanica Schischk. (Tajik yetmak) was included; however, it is absent from the 2016 and 2019 editions, indicating that the species has likely increased in number or been restored. Dianthus uzbekistanicus Lincz. (Uzbekistan carnation) was not included in the 2009 edition but is present in the 2019 edition, indicating that its population has declined in recent years.

Conclusions 1. In the 2019 edition of the Red Book of the Republic of Uzbekistan, 329 plant species were included. Among them, 10 species belong to the family *(Caryophyllaceae*). 2.

The species *Dianthus uzbekistanicus* (3 – endemic) was included in the 2019 edition. This indicates that the species is currently decreasing in number 3. The species *Allochrusa tadschikistanica*

(3 – endemic) was included in the 2009 edition but omitted from the 2019 edition. This suggests that the species has increased in number or has been successfully propagated. 4.Protecting the species included in the Red Book of the Republic of Uzbekistan, including those belonging to the Caryophyllaceae family, is of great importance for humanity.

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Rezyume: Ushbu maqolada O‘zbekiston Respublikasi Qizil kitobining yangi nashriga kiritilgan Chinniguldoshlar (*Caryophyllaceae)* oilasiga mansub turlar tahlili haqida ma’lumotlar berilgan.

Резюме: В статье приведены данные по анализу видов семейства Гвоздичные (Caryophyllaceae), включенных в новую редакцию Красной книги Республики Узбекистан.

Kalit so‘zlar: Qizil kitob, chinniguldoshlar oilasi, muhofaza qilish, endemik, hayotiy shakllari

Ключевые слова: Красная книга, семейство гвоздичных, охрана, эндемик, жизненные формы.

STRUCTURE OF CESTODES

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Summary: *This article describes the detailed structure of cestodes, including the scolex, neck, proglottids, tegument, and internal organ systems. The morphological features of tapeworms are explained as adaptations to parasitic life in the intestines of vertebrate hosts.*

Key words: *Cestodes, scolex, proglottids, tegument, parasitology.*

INTRODUCTION. Cestodes, commonly known as tapeworms, are obligate parasitic flatworms belonging to the class Cestoda of the phylum Platyhelminthes. They inhabit the intestinal tract of vertebrates, including humans, and cause various parasitic diseases known as cestodiases. The structural organization of cestodes is highly specialized for parasitic life. Their flattened, segmented body and absence of a digestive system represent evolutionary adaptations that allow efficient nutrient absorption from the host's gut. Understanding the morphology and structural features of cestodes is essential for accurate diagnosis, prevention, and treatment of parasitic infections.

MATERIALS AND METHODS. This article is based on comparative morphological analysis of cestodes described in parasitology textbooks, histological samples, and microscopic studies reported in scientific literature. Morphological structures—such as the scolex, neck, proglottids, integument, reproductive system, and excretory system—were examined through published micrographs, anatomical descriptions, and structural diagrams. Literature search was conducted using open-access parasitology journals, WHO publications, and standard diagnostic manuals. All findings were synthesized to obtain a comprehensive description of cestode morphology.

RUSULTS AND DISCUSSION. General Body Structure

Cestodes possess a long, dorsoventrally flattened body that typically consists of three major parts:

1. **Scolex** – the anterior attachment organ;
2. **Neck** – the region generating new segments;
3. **Strobila** – the chain of proglottids forming the segmented body.

Scolex

The scolex enables firm attachment to the intestinal mucosa of the host. Depending on the species, it may contain suckers, rostellar hooks, or both. For example, *Taenia solium* has an armed rostellum, whereas *Taenia saginata* lacks hooks. The scolex does not function as a head but acts primarily as an attachment organ.

Neck Region

Immediately behind the scolex, the neck is a narrow, unsegmented zone responsible for generating new proglottids by asexual budding. This region is metabolically active and contributes to continuous growth of the strobila.

Proglottids and Strobila

The strobila consists of numerous proglottids arranged linearly. Proglottids mature as they move posteriorly:

- **Immature proglottids** near the neck contain developing organs.
- **Mature proglottids** contain fully developed male and female reproductive systems, making cestodes hermaphroditic.
- **Gravid proglottids** at the posterior end are filled with fertilized eggs and are released into the environment.

Tegument

Cestodes lack an alimentary canal and rely entirely on absorption through their tegument. The surface is covered with microtriches — microscopic projections increasing surface area and enhancing absorption. The tegument also protects the worm from digestive enzymes and host immune responses.

Reproductive System

Cestodes are highly prolific organisms. Each mature proglottid contains a complete hermaphroditic system:

- **Male organs** include multiple testes, vas deferens, and cirrus.
- **Female organs** include ovary, oviduct, uterus, vitelline glands, and Mehlis' gland.

Self-fertilization is most common, although cross-fertilization between proglottids also occurs.

Excretory and Nervous System

The excretory system is based on protonephridial flame cells and longitudinal excretory canals.

The nervous system consists of paired longitudinal nerve cords connected by transverse commissures. The scolex contains the main concentration of nerve ganglia.

Adaptations to Parasitic Lifestyle

Cestodes demonstrate pronounced morphological adaptations:

- absence of digestive system,
- highly developed reproductive structures,
- strong attachment organs,
- protective tegument with microtriches,
- ability to produce numerous eggs.

These adaptations ensure successful survival inside the host and transmission to the next host.

CONCLUSIONS. The structural organization of cestodes reflects their complete adaptation to parasitism. Their segmented body, specialized scolex, reproductive efficiency, and absorptive tegument are key features enabling survival in the intestinal environment. Understanding the morphology of cestodes provides a foundation for improved diagnostic techniques, epidemiological studies, and the development of effective control measures for tapeworm infections.

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Rezyume: *Ushbu maqolada tasmasimon chuvalchanglarning tuzilishi — scolex, bo'yin qismi, proglottidlar, tegment va ichki tizimlari batafsil yoritilgan. Ularning morfologik xususiyatlari parazitlik hayot tarziga moslashuv sifatida izohlangan.*

Резюме: *В статье представлено подробное описание строения цестод, включая сколекс, шейку, проглоттиды, тегумент и внутренние органы. Морфологические особенности ленточных червей рассматриваются как адаптации к паразитированию в кишечнике позвоночных хозяев.*

Kalit so'zlar: *Tasmasimon chuvalchanglar, skoles, proglottid, tegment, parazitologiya.*

Ключевые слова: *Цестоды, сколекс, проглоттиды, тегумент, паразитология.*

PROBLEMS OF THE ARAL SEA AND ITS SURROUNDING REGION

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Summary: *This article examines the problems of the Aral Sea and its surrounding region.*
Keywords: *coastal zone, ecological disaster, drinking water, Muynak, Aral Sea region.*

The global community is deeply concerned about the worsening environmental situation in the Aral Sea and the surrounding Aral region. The Aral crisis is one of the largest regional environmental disasters, affecting the lives of more than 35 million people living in the sea basin, including a significant portion of the population of Uzbekistan.

The Aral Sea, which until recently was considered one of the largest lakes in the world, is rapidly drying up. The main cause of the Aral Sea's desiccation has been the sharp reduction in water inflow as a result of diverting the waters of the Amu Darya and Syr Darya rivers for irrigation purposes. The expansion of irrigated land in Central Asia and the inefficient use of water resources predetermined the fate of the Aral Sea.

Over the past 40–45 years, the sea level has fallen by 22 meters (from 53 meters in 1961), while the volume of water has decreased from 1,064 km³ to 115 km³. As a result, salt flats and shifting sands have formed in its former basin. By the end of 2004, the sea level was recorded at an absolute height of 28.5 meters, and approximately 45,000 km² of its surface area had dried up and turned into land.

While the long-term average salinity of seawater had previously been 9–11 g/l, it has now exceeded 72 g/l. Consequently, the Aral Sea has lost its significance as a biologically productive water body. Biological diversity has sharply declined: the number of animal species in the marine region has decreased from 174 to 38.

The drying of the Aral Sea has led to a serious deterioration of the socio-ecological situation in the Aral Sea region. Each year, between 15 and 75 million tons of salt and dust rise from the dried seabed, causing extensive pollution of the air and soils over vast territories. In the Aral Sea region, the pace of both natural and anthropogenic desertification is increasing. The salt content of drinking water ranges from 2 to 4 g/l, while water consumption in some areas does not exceed 5 liters per person per day (compared to the norm of 200–300 liters). Morbidity and mortality rates among the population have reached high levels.

The possibility of restoring the Aral Sea to its original state has already been lost. Under present conditions, it is impossible to maintain the former water level of the Aral Sea. The establishment of artificial forests on the dried seabed is of great importance in combating wind-driven sand and salt transport. Since 1981, trees and shrubs such as white and "black saxaul", "kandym", "cherkes", and other plant species have been planted on the dried areas of the sea, yielding positive results.

At present, forests covering an area of about 25,000 hectares are established annually. However, newly exposed seabed areas are covered with salt, where vegetation may not grow at all. The countries of Central Asia are cooperating in addressing the problems of the Aral Sea and the surrounding region.

The United States, Japan, Germany, France, and other developed countries, as well as the United Nations, the World Bank, and various governmental and non-governmental international organizations, are contributing to positive solutions to this problem of the century [1, pp. 86–88].



Figure 1



Figure 2

Local residents, observing the retreat of the sea, recall that they used to stick poles into the shoreline and then return some time later to see how far the sea had receded. As the volume of water decreased, salt concentrations increased, and the Aral Sea began to turn into a toxic body of water. Today, 90% of the former territory of the Aral Sea is desert—an area comparable in size to Ireland. The death of the sea changed not only people's way of life but also the regional climate.

When physician Yoldoshboy Dosimov arrived to work at the Muynak hospital in the 1980s, the sea had already retreated dozens of kilometers from its former shoreline. He vividly recalls the diseases that became more widespread during those years. "Respiratory and kidney diseases were common, as well as tuberculosis. Until recently, many children died from diarrhea." When the Aral Sea dried up, winds began to carry salts from the vast desert that had formed in its place over hundreds of kilometers.

According to specialists, more than 100–150 million tons of dust and salt are lifted into the atmosphere each year from the desert formed on the former seabed, leading to increased illness among the population of the Aral Sea region. In particular, the incidence of various cancers rose, and diseases of the lungs and heart became more frequent. By the 1990s, infant mortality in Karakalpakstan was higher than in other regions. However, the problems of the Aral Sea, which had been widely and thoroughly discussed in the late 1980s, were once again largely forgotten in the 1990s. More precisely, the issue was addressed only in connection with occasional conferences or events [3].

The territory of the Aral Sea has completely gone out of human control and has been declared an environmentally unfavorable zone. In this region, the ecological and reclamation condition of soils has deteriorated sharply; every year the area of highly saline lands increases, leading to complex economic and social problems. Not only agriculture suffers from this process, but also ancient archaeological monuments. High-voltage power lines and the foundations of transmission towers are severely damaged as well, and their repair requires significant financial and labor resources.

If until recently there were about 50 historical monuments in the Ellikkala district, today only around 30 remain. In the Turtkul district, the ancient settlement of **Koikyrilgan Kala,** built in the 4th century BC and believed to have functioned as an observatory, has completely disappeared [1].

At present, Uzbekistan is well aware of the scale and consequences of the problem. In particular, it has become evident that the Aral Sea can no longer be saved or restored, and the main task for Uzbekistan has become preserving life in the Aral Sea region. A globally unprecedented experience is being implemented: Uzbekistan is transforming the dried bottom of the Aral Sea into a forest. Uzbek scientists appear to have found a solution to the ecological catastrophe.

In the desert, several hundred kilometers from Muynak, people begin work early in the morning. Forty years ago, these areas were the seabed at a depth of 25–30 meters. Today, piercing winds blow, and everything around appears white from small shells and salt. Saxaul trees prevent the wind-driven dispersal of dust and salt from the soil.



Figure 3



Figure 4

As a result, the rise of toxic salts from the bottom of the Aral Sea into the atmosphere will be reduced. At present, one seventh of the Aral Sea bed within Uzbekistan, or about 500,000 hectares, has been transformed into saxaul forest. Alongside these trees, various grasses and other plant species can also be observed.

Saxaul is planted in rows, with a distance of 10 meters left between adjacent rows. This is done because when saxaul grows, its seeds disperse around the area, allowing new shoots to sprout in the spaces between the rows. Within a few years, the previously bare land becomes covered with new trees. However, the extremely arid climate, lack of precipitation, and in some cases excessive concentrations of toxic salts in the soil hinder the survival of saxaul. In certain areas, only 20–25% of the seedlings survive.

Currently, research is also being conducted to improve the resilience and survival rate of the trees. Nevertheless, today about 500,000 hectares of desert on the Uzbek side of the dried Aral Sea have been transformed into forests of saxaul and tamarisk. This is a globally unprecedented experiment that is difficult to believe. However, approximately 3 million hectares of the former seabed still remain open desert.

If afforestation continues at the current pace, it will take another 150 years to convert the remaining area into forest. Transforming the seabed into forest in order to preserve life around the Aral Sea has effectively been chosen as the most cost-effective, practical, and accessible measure. Even so, planting saxaul on 18–20 thousand hectares annually requires about 5–7 million (USD).

The burden of addressing the consequences of this massive ecological catastrophe inherited from the Soviet period lies primarily with Uzbekistan and Kazakhstan. At present, most of the funding is provided by the Government of Uzbekistan. As saxaul forests expand, many residents of Karakalpakstan are once again beginning to look toward the future with hope [2].



Figure 5



Figure 6

In some foreign countries (Germany, Israel, and the United States), hydroponic methods are used in horticulture and in the creation of miniature architectural gardens. Hydroponics is a method of cultivating various vegetables, melon crops, flowers, and gardens without soil, using nutrient solutions instead. Such gardens are the result of combining intelligent agrotechnologies for plant care with modern planting techniques.

A hydroponic garden makes it possible to grow plants and obtain fruits and vegetables even in areas without soil, for example, in open courtyards or enclosed spaces, in suspended garden structures, on vertical walls, and in special containers. Plants grow rapidly, bloom, and bear fruit visibly within a short period of time. Low-growing plant varieties are selected for planting.

Among vegetables, cherry tomatoes are commonly grown; among leafy crops: spinach, iceberg lettuce, coriander, and water spinach; among herbs: basil, coriander leaves, licorice (a leguminous plant), and mint. Among flowering plants: periwinkle, begonia (a decorative plant with small flowers), chrysanthemums, lavender, verbena, petunia, dandelion, saxifrage, and others. Among bulbous plants: daffodils, gladiolus, large-flowered canna, dahlia, tulip, hyacinth, agapanthus, cornflower, saffron, lotus, and others.

The hydroponic method allows plants to be supplied with essential nutrients at the required time and ensures effective plant care. Compared to traditional horticulture and melon cultivation, this method significantly reduces land and water consumption. In addition, fertilizers do not enter natural water bodies and are not wasted, as often occurs in conventional agricultural practices. Today, hydroponics is widely used in Europe as a landscape-forming system [4].

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MESOZOIC DEPOSITS CONDITIONS FOR OIL AND GAS PRESENCE (WESTERN UZBEKISTAN)

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Summary: *The article examines the distinctive characteristics of Mesozoic deposits in Western Uzbekistan and the current state of their distribution zonality. Groundwater plays a crucial role in the formation and preservation of oil and gas accumulations. Under certain conditions, it can contribute to either their accumulation or destruction. Therefore, the purpose of this research is to determine the role of reservoir properties and groundwater in the formation and distribution of hydrocarbons in the Mesozoic deposits of Western Uzbekistan. In this work, a comprehensive approach was applied to address problems involving the scientific synthesis of factual data from the Jurassic and Cretaceous sedimentary layers in the studied area. This approach incorporated materials that characterize various parameters within these geological strata. In conclusion, the oil and gas potential of the study area has been evaluated based on various criteria, and the findings are presented.*

From a general geological perspective, considering the characteristics of oil and gas formation, as well as the dynamics and chemical unity of reservoir fluids, is an important criterion for oil and gas exploration. This factor deserves attention when selecting a rational approach to geological exploration work. Based on the geological analysis of Jurassic and Cretaceous deposits in the studied area, various zones were identified along with their corresponding areas of high potential for oil and gas. Identifying such local areas within the studied territory significantly expands the range of potential exploration targets, which will enable increasing the effectiveness of prospecting and exploration work in the future.

Key words: *geological, deposits, formation water, pressurized water system, mineralization, horizon, fluid, mine, migration, Jurassic, Cretaceous, Mezozoic.*

INTRODUCTION

In the oil and gas industry, studying the chemical composition of formation waters is one of the main issues. Its significance lies in the fact that this composition substantially reflects the underground conditions in general and the influence of hydrocarbon (UV) accumulations in particular. True, the relative importance of some components in the chemical composition of waters is not the same. If in the early stages of hydrogeological development, the study of the ionic-salt composition of formation waters occupied a central place, now much attention is paid to the determination of the dissolved, gaseous, organic, and microcomponent composition of water, as well as the general hydrochemical zonality of fluids, as components associated with the components of UV deposits [2, 5].

Accordingly, the targeted objective of the research is to determine the hydrogeochemical characteristics of groundwater in the Mesozoic deposits of Western Uzbekistan and to identify their role in the formation and distribution of UV accumulations.

From a hydrogeological point of view, the considered territory occupies the northeastern part of the Amu Darya water-pressure system, bounded in the north and south by the South Kyzylkum and Amu Darya faults, and in the east and southeast by the mountain structures of the Hissar and Karatepa systems (Fig. 1). Within the considered territory, three hydrogeological regions are distinguished by structural-пpetectonic, lithological-facies, and hydrogeological conditions: Bukhara, Chardzhou, and Beshkent-Kashkadarya [12].

Degree of study of the problem and research methods. The structure of the Mesozoic aquifer system of Western Uzbekistan has been studied in considerable detail to date. The initial data

about it is based on hydrochemical information indicating a significant difference in the formation waters of Jurassic and Cretaceous deposits between exploration areas and explored hydrocarbon raw material deposits (Korsakov, Dikenstein, Zaydelson).

The study of the lithology of the sedimentary cover, the reservoir properties of rocks, and the hydrogeological conditions of the exploration areas of the studied territory made it possible to substantiate the independence of the Jurassic, Neocomian-Apthian, Cenomanian-9пегAlbian, and Cenon-Paleocene (Nadturonian) aquifer complexes (V.A. Kudryakov, T.N. Avazov, S. Talipov) [7]. These ideas, later reinforced with new factual material, received general recognition (A.A. Karsev et al., Ya.A. Khodzhakuliyev, I.V. Kushnirov [13], G.P. Yakobson et al., A.S. Panchenko, G.A. Arzhevsky, V.N. Pashkovsky, V.A. Kudryakov) [6, 10].

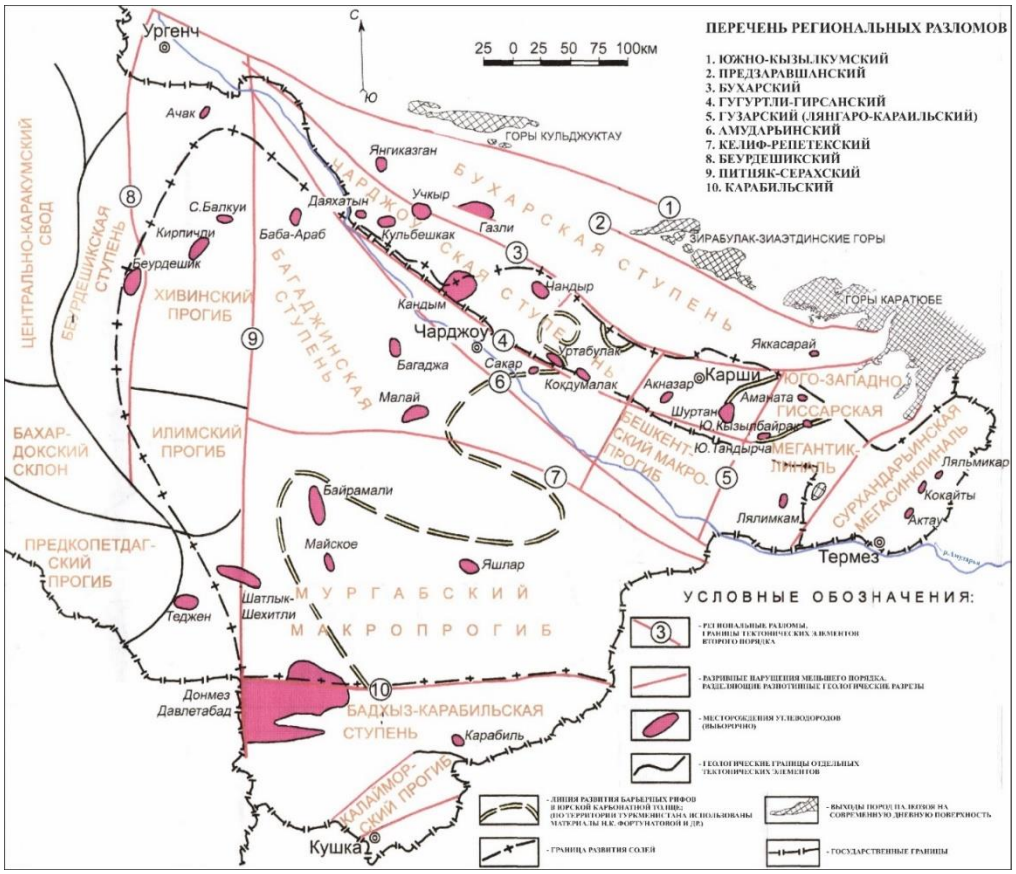


Figure 1. Scheme of hydrogeological zoning of the northeastern part of the Amudarya oil and gas basin

Admittedly, there have been attempts to determine the names of water pressure complexes, which is associated with disagreements regarding the stratigraphic age of individual sections of the section. For example, L.E. Mikhailov and V.V.Pechernikov spoke about the neocomian-apt-lower alb and upper alb-senomanian water-pressure complexes, while G.A. Arzhevsky determined the age of the clays of the acanthoplite suite by the upper apt age, using the name of the upper aptian water barrier instead of the lower albian. V.A. Kudryakov, Ya.A. Khodzhakaliev, and I.V. Kushnirov called the Neocomian-Aptian complex the Lower Cretaceous complex [7, 10].

V.N.Korsenshtein considered the lower albian, middle-upper albian, and Cenomanian aquifers as partially isolated complexes [4]. In areas without Jurassic water pressure, the lower part of the aquifer system was assessed differently as a combination of Jurassic and Lower Cretaceous complexes (T.N. Avazov) and an independent Jurassic-Lower Cretaceous complex (I.V. Kushnirov) [1, 8].

Consequently, over the entire period of research, no significant change in views on the structure of the water pressure system is observed. Previously existing concepts changed only

quantitatively, by attracting newly explored areas and new types of hydrogeological data to the research object. All this allows us to limit ourselves to a brief overview of the most important features of water-pressure complexes and waterproof structures.

Of the numerous studies characterizing the evolution of ideas about the hydrogeochemical zonality of Western Uzbekistan, the generalizing scientific reports and publications of V.V.Kolodiy, L.E.Mikhailov, V.N.Korsenshteyn, V.A.Kudryakov, E.A.Bars, Ya.A.Khodzhakulyov, V.N.Pashkovsky, S.Kholdarov, S.Talipov, T.N.Avazov, S.A.Bakiyev, T.Kh.Shoymurotov, and others deserve special attention.

In the overall set of studies, the main features of the formation of oil and gas deposits as components of natural water pressure systems were identified: the connection of the processes of formation and decomposition of hydrocarbon accumulations with water-saturated rocks, the dependence of the preservation of hydrocarbon deposits on modern and ancient hydrogeological conditions, as well as the significance of various components of the chemical composition of groundwater for oil and gas exploration.

At the same time, a number of important issues of oil and gas hydrogeology remain underdeveloped and controversial. In particular, there is no unified understanding of natural water pressure systems and the classification of identified hydrodynamic anomalies. The problem of hydrochemical zoning of groundwater in the lower horizons of the sedimentary section and their interrelationship has not been sufficiently studied. The determination of vertical and lateral zonality of the Jurassic and Cretaceous aquifer complexes of Western Uzbekistan is episodic and is currently poorly studied [16].

Currently, there is a large amount of data on the composition of formation waters in the studied territory, the analysis of which allows for a largely new understanding of the structure of the hydrogeochemical field and the mechanism of formation and distribution of groundwater. In recent years, qualitative and quantitative changes have occurred in hydrogeological studies of the studied territory, associated with the expansion of the use of probabilistic-statistical methods of system analysis in the study of hydrogeological phenomena and processes. Information-search systems of digital three-dimensional modeling, taking into account modern achievements in the field of hydrogeology and the foundations of traditional methods of processing and analyzing hydrogeological data, are being introduced into the practice of hydrogeological works. It is on this basis that all subsequent studies were carried out for a detailed study of hydrogeological structures using additional approaches and indicators of the studied territory.

In the study, a comprehensive approach was applied to solving problems, including the scientific generalization of factual data in the section of Jurassic and Cretaceous deposits of the studied territory, with the involvement of materials characterizing the flow, reservoir pressure, temperature, and macro- and microcomponent composition of reservoir waters.

Main Part. Thus, the Mesozoic deposits of Western Uzbekistan encompass numerous aquifers, dissected by Jurassic and Cretaceous deposits. The water-resistant basis for them is mainly metamorphic and igneous rocks of the Paleozoic basement, located at depths from 3.0-3.5 km to 5.0-5.5 km. The considered aquifers, due to the presence in the section of neocomian-upper Jurassic, lower Albian, and lower Turan aquifers, are combined into Jurassic and Cretaceous (Neocomian-Aptian, Albian-Cenomanian, Senonian-Paleocene) water-pressure complexes (Fig. 2).

Isolated confined aquifer complexes unite the following aquifer horizons: Jurassic XX-XVII (terrigenous formation) and XVI-XV horizons (carbonate formation), as well as Cretaceous - XIV-XII (Neocomian-Apthian), XI-IX (Alb-Cenomanian), VIII-VII (Cenon-Paleocene) terrigenous pachks. In the extreme northwestern part of the Bukhara Steppe (Gazli, Meshekli, Yangikazgan, and other districts), the Lower Cretaceous aquifer complex combines with the Jurassic aquifer complex, forming a single Jurassic-Lower Cretaceous aquifer complex [12].

The groundwater of the Jurassic deposits of the territory is associated with the sand-alveolar terrigenous collectors of the Lower-Middle Jurassic period and the carbonate collectors of the Callovian-Kimmeridgian period. It is possible that sporadically developed permeable horizons,

discovered in the Farob, Saritash, Pamuk, and other areas of Permian-Triassic age, should also be included here, the thickness of the latter sometimes reaches the first hundred meters.

The sand-silt horizons (XX-XVII) of the Lower-Middle Jurassic terrigenous formation (TF) are very unstable in area and cross-section, as well as in reservoir characteristics, even within local sections. The thickness of the stratum varies from hundreds of meters in the Chardzhou step to a wide range of complete fractures in the northwestern part of the Bukhara step (Pitnyak, Gazli uplifts). Sections corresponding to the Saritash-Shurtepa, Karabair-Andabazar, and other uplifts are bounded by isolines with a thickness of 100 m and 200 m. The porosity (m) of rocks varies from 5% to 12%, and the permeability (k) from 10 to 200 millidarsi (mD).

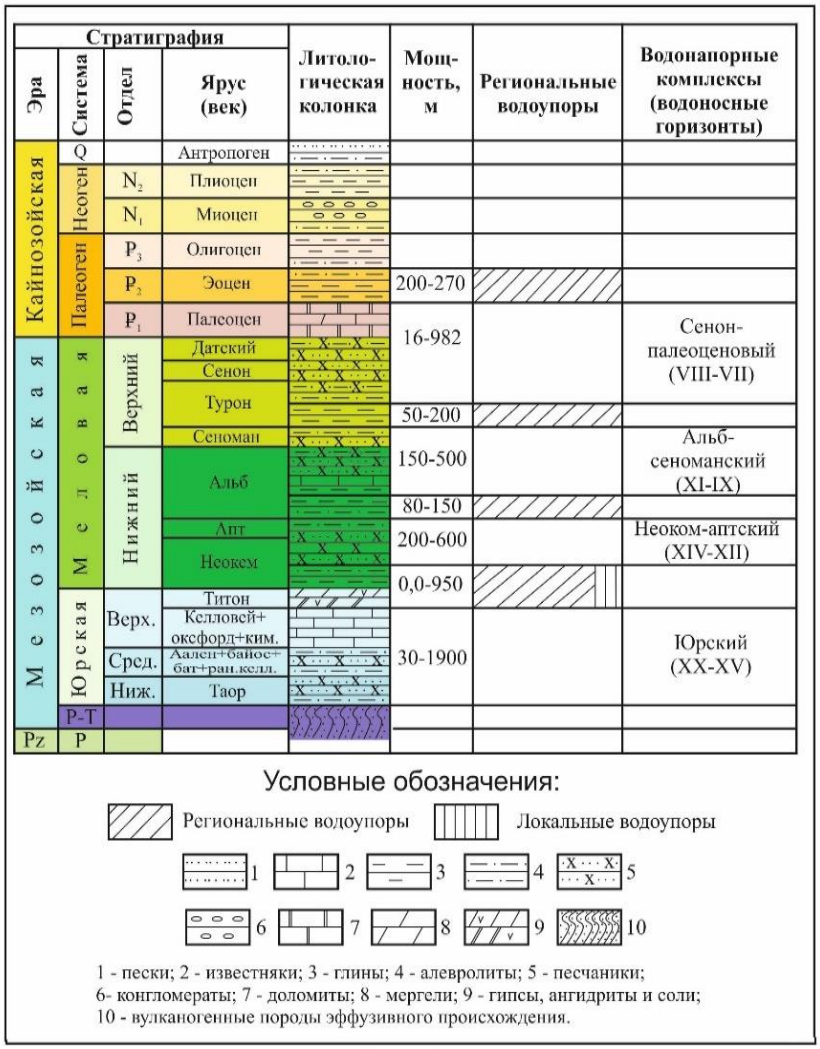


Figure 2. Structural diagram of the Jurassic and Cretaceous aquifer complexes of the Bukhara-Khiva oil and gas region

An increase in thickness is observed in the southwestern direction - from 300 m in the zone of the Bukhara deep fault, up to 1000 m and more in the territory of the Kimerek graben. However, in the southwestern direction, the increase in the thickness of the deposits is not accompanied by an increase in the volume of reservoirs due to the silting of the section. In the Chardzhou Stage, the TF is fully studied at the Khodzhikazgan, Dayahatyn, Hakkul, Urtabulak, Kokdmalak, and other deposits, where the permeable core, consisting of coarse-grained sandstone, accounts for 30.9% of all outflow. The reservoir type in sandstones is granular. The maximum pore size is up to 1 mm. The average porosity values are 12.4%, and the permeability is 62 mD.

The Jurassic Carbonate Formation (KF) is distributed over most of the region, with the exception of the Pitnak uplift and the eastern part of the Gazli uplift (horizons XVI and XV). In the

southwestern and southeastern directions, an increase in the thickness of carbonate deposits to 300-400 m is observed. Characteristic features of this part of the aquifer complex are the presence of dense clay limestones with anhydrite layers of the XVa horizon on the Mubarek uplift and the southern slope of the Kagan uplift (between the XVI and XV horizons), consisting of weakly cemented (loose) limestones, as well as the presence of organogenic limestones on some areas of the Chardzhou step (Kultak, Pamuk uplifts, etc.) above the KF. The proportion of reservoir rocks in the volume of KF is estimated on the order of 40%, while reservoirs of a porous type are practically absent in the lower part of the formation. Average porosity values of rocks are 12-16%, permeability 4-20 mD. Collectors with the highest capacity and permeability correspond to rifogenic structures.

The biohermic structure of the complex consists of fractured-cavernous, porous, medium-strength clastic-algal limestones. Purely porous differences are more widespread than in the deposits of the overlying horizons of the Chardzhou Stage and the Beshkent Macropogib. Below the section (under the XV reef horizon), dense gray fine-grained limestones with varying amounts of organogenic detritus, made of carbonaceous material, are noted. The Upper Jurassic part of the Bukhara-Khiva Mesozoic section is crowned by a thick (southeast), but gradually thinning (to complete fracturing in the west), evaporite formation (EF) of Kimmeridge-Titon, consisting of gypsum, anhydrites, rock, and potassium salts. The total thickness of the Jurassic aquifer does not exceed 400 m on the Bukhara Stage, 1000 m and more on the Chardzhou Stage and the Beshkent Macropogib.

The Upper Jurassic aquifer consists of alternating layers of clays of the Neocomian Karabil Formation and gypsum, anhydrite, rock, and potassium salts of the Gaurdak Formation of the Titonian Stage. Its structure is significantly variable in lithology and thickness. On the Bukhara Stage, this is mainly an anhydrite layer, which decreases and disappears on the southern slopes of the Gazli uplift and the northern slopes of the Kagan uplift. In the southwestern direction, the thickness of the anhydrites increases, and halite packs appear. In the Chardzhou Stage and the Beshkent Macropogib, the impermeable layer consists of halite and anhydrites, which have subordinate significance. The thickness of this regional water barrier varies from 25 m and less in the northeastern part of the Bukhara Stage to 500-700 and 950 m in the Chardzhou Stage and the Beshkent Macropogib, respectively. The increase in waterproof thickness occurs both due to halite and due to the claying of the lower part of the carabile suite.

The Neocomian-Aptian aquifer complex unites the XIV-XII sandy horizons of the Turanian-type red molasse formation. It consists mainly of red sandstones, siltstones, and clays, and is stratified with several unstable horizons along the strike of pebble conglomerates. Approximately in the middle part of this layer, almost everywhere, a suite of sandy-alveolar rocks is located, containing layers of limestones, sometimes shell-shaped rocks, covered with gray and brownish-red clays. This part of the Red Formation is currently identified as the 13th productive horizon. Unlike all other productive horizons of the Cretaceous section, the XIII horizon contains more oil-gas or oil accumulations. Clay rocks, marls and limestones, and sometimes anhydrite layers predominate on the Chardzhou Stage. The reservoir properties of the rocks are very poor in the Chardzhou stage (m = 10-12%, k < 10 mD) and significantly improve during the transition to the Bukhara stage (m up to 24%, k up to 100-500 mD). Sandstones in the Gazli deposit area are particularly characterized by high permeability (up to 1000 mD). Above this layer, across the entire territory of the studied region, gray and greenish-gray glauconite sandstones are observed, which sometimes contain layers of pebbly conglomerates or mixtures of pebbles, in the middle of which there are accumulations of greenish-gray, gray, and almost black clays. This sand mass is distinguished as the XII productive horizon, with the deposits of which the unique Gazli deposit and large industrial gas occurrences in the structures of the Kagan and Mubarek uplifts are associated. This productive horizon is one of the most stable. The thickness of the Neokom-apt aquifer complex is 200-250 m on the Bukhara Stage and reaches 600 m on the Chardzhou Stage [15].

The Lower Albian water-retaining layer consists of a thick homogeneous clay layer of the acanthoplite formation, which is an analogue of the Karakuz Suite in the southwestern branches of the Gissar Range, forming the lower part of the terrigenous-glauconite formation. This layer is quite stable in terms of lithological composition and thickness, the latter being approximately 80 m in the

Bukhara and 150 m in the Chardzhou steppes. It should be noted that in the lower part of the clay layer section, there are small layers (30-50 cm) of brown sandy rocks, which are distinguished as benchmark horizons.

The Albian-Cenoman aquifer complex includes the XI-IX horizons of the middle part of the terrigenous-glauconite formation, consisting of gray, green, and significantly less often red clays, sandstones, and sands, and includes limestone-shell, clay-shell, and less frequently limestone layers almost throughout the section. In the upper part of the Albanian deposits lies a collection of sandstones, containing layers of limestone-shell and gray clay. This is the so-called XI horizon, on which there are also gas fields of industrial importance in many areas. Cenomanian deposits are composed of sandstones and clays, which have undergone repeated changes. In some areas, in addition, individual layers of limestones and shell limestones are also found. Below the Cenomanian, the X horizon is distinguished, and above it, the IX horizon. Both of them are composed mainly of sandstone and sand. In general, aquifers in the Bukhara stage have very good reservoir properties (m up to 30%, k up to 1000 mD and higher). In the direction of the Chardzhou step and the Kyzylkum foothill dome, the reservoir properties of the rocks deteriorate due to the claying of the section in the southwestern direction and the lack of rock sorting in the northeastern direction. The permeability of rocks decreases sharply (up to 10-100 mD), while the porosity content remains significantly higher at the boundary of the Kyzylkum Basin (25%) and decreases at the Chardzhou Stage (up to 15%). The thickness of the complex increases from 150 m on the Bukhara stage to 500 m on the Chardzhou stage.

A characteristic feature of the material composition of Alb-Cenomanian deposits (XI-IX horizons) is the almost constant enrichment of sandy rocks with glauconite, and clays with sulfide compounds of iron and dispersed bitumens. Above the IX horizon lies a clay-sandy patch with layers of sandstone, covering a large part of the Turanian deposits and the Senonian.

The Lower Turan aquifer is composed of well-preserved clay deposits in terms of thickness and lithology. A gradual increase in thickness (from 50-70 m to 200 m) and the replacement of lumpy material with increasingly fine-grained material occurs in the southwestern direction.

The aquifers of the Cenon-Paleocene (VIII-VII) deposits, located between the Lower Turan and Eocene aquifers, are characterized by a variety of lithological compositions of rocks: mainly terrigenous - in the lower part and carbonate - in the upper part. These horizons are drained by numerous wells and structural boreholes, and in a number of regions, they are exposed to the surface. These horizons are closely related to groundwater and are often characterized by the non-pressurized nature of formation waters. In the southwestern (Chardzhou Stage) and southeastern directions (Beshkent Macropogib), the thickness of the complex and the clay content of the section increase.

The waterproof covering of the Mesozoic confined aquifer system of Western Uzbekistan is a regionally preserved clay layer of the Eocene period (Suzak, Alai, and Turkestan layers). In the highest elevations of the Bukhara Stage, these deposits are not found. Their thickness reaches 200-270 m on the Chardzhou Stage and 270 m on the Beshkent Macropogib.

Thus, the features of the structure of the Mesozoic aquifer system of Western Uzbekistan are as follows: an increase in the volume of the aquifer system in the southwestern direction due to the increase in the clay part of the section and the formation of a halite layer; the presence of regional impermeable and aquifers; the reservoir properties of rocks are highest in the central part of the region and have a downward tendency to deteriorate along the section; the reservoir properties of rocks are closely related to lithological-facies zonality. The summary geofiltration scheme of the hydrogeological section of the Mesozoic Formation in the study area is presented in Table 1.

Table 1

Geofiltration scheme of the hydrogeological section of Mesozoic deposits of Western Uzbekistan

Age of sediments	Elements of the hydrogeological section	Capacity, m	Litological composition	Average mineralization, (g/l) and water type

Eocene (P_2)	Unevenly distributed waterproofing	200-270	Bentonite-like clays of gray and dark gray color	
Senon-Paleocene (K_2-P_1)	Senon-Paleocene aquifer complex (VIII-VII)	16 - 982	Sandstones, carbonate rocks, gypsum and anhydrites	0,8-22,0 SN
Lower Turon (K_2 t)	Regional water barrier	50 - 200	Bentonite-like clays of dark gray and greenish-gray color	
Alb-senoman (K_1 alb-K_2 cm)	Albian-Senomanian aquifer complex (XI-IX)	150 - 500	Sandstones, glauconite sands, siltstones, clays with layers of conglomerates and gravels	1,6 – 145,0 GKN, SN, XK
Lower alb (K_1 alb)	Regionally maintained waterproofing	80 - 150	Argillite-like clays of dark gray color with sparse layers of siltstones and sandstones	
Neokom-apt (K_1 ne-apt)	Neokom-apt aquifer complex (XIV-XIII-XII)	200 - 600	Sandstones, siltstones with clay layers	2,0 – 157,0 SN, CM, XK
Gaurdak Suite (J_1 tit) Carabyl Suite (K_1 ne)	Upper Jurassic (Neocomian-Upper Jurassic) water barrier	0,0 - 950	Anhydrites, gypsum, rock and potassium salts	
Jurassic (J)	Jurassic water-pressure complex (XX-XV)	30 - 1900	Sand-aleurolithic rocks with layers of clays, sandstones, and limestones	4,0 -219,0 XK

Note: Water type: SN -sulfate-sodium; GKN-sodium bicarbonate; CM - chloride-magnesium; XK - calcium chloride.

Research results. The compiled hydrochemical maps of the Jurassic and Cretaceous aquifer complexes of Western Uzbekistan indicate that the distribution of groundwater in the western and northwestern directions has a very complex character with a tendency to change their chemical composition. In the southwestern and northwestern directions of the Bukhara-Khiva oil and gas region (in the direction of the Kulbeshkak uplift), groundwater is characterized by great diversity, both in genetic type and composition (mineralization from 1 to 335 g/l, in some cases up to 400 g/l and more). The general trend of growth in groundwater mineralization along the regional subsidence of the layers from the Bukhara Stage to the Chardzhou Stage is clearly expressed in the Neocomian-Aptian and Upper Jurassic deposits [9, 10, 15].

The water content of the Lower-Middle Jurassic (J1-2) deposits of the studied territory is associated with the sand-silt horizons (XX-XVII) of the terrigenous formation (TF), and their hydrochemical properties are characterized by the following features (Fig. 3).

To the north of the Bukhara Steppe, in the areas of Jurassic deposits, a narrow zone with a mineralization of less than 50 g/l is observed, in which saline waters of mixed genetic type (44.0 g/l of the Karnabchul Plain, 16.2 g/l of the Maydazhay Plain) with varying degrees of metamorphism are distributed. A gradual increase in mineralization is observed in the southwestern direction and along the section. Small concentrations of iodine, bromine, and ammonium were noted, respectively - up to 5, 50, 60 mg/l (according to the classification of V.A.Sulin).

The hydrochemical zone of brines with a mineralization of 50-100 g/l extends parallel to the above-described zone, covering almost the entire territory of the Bukhara Steppe, the northern parts of the Gazli, Kagan, Mubarek uplifts and the Rometan, Kashkadarya basins, as well as the central part of the Azlyartepa dislocation zone.

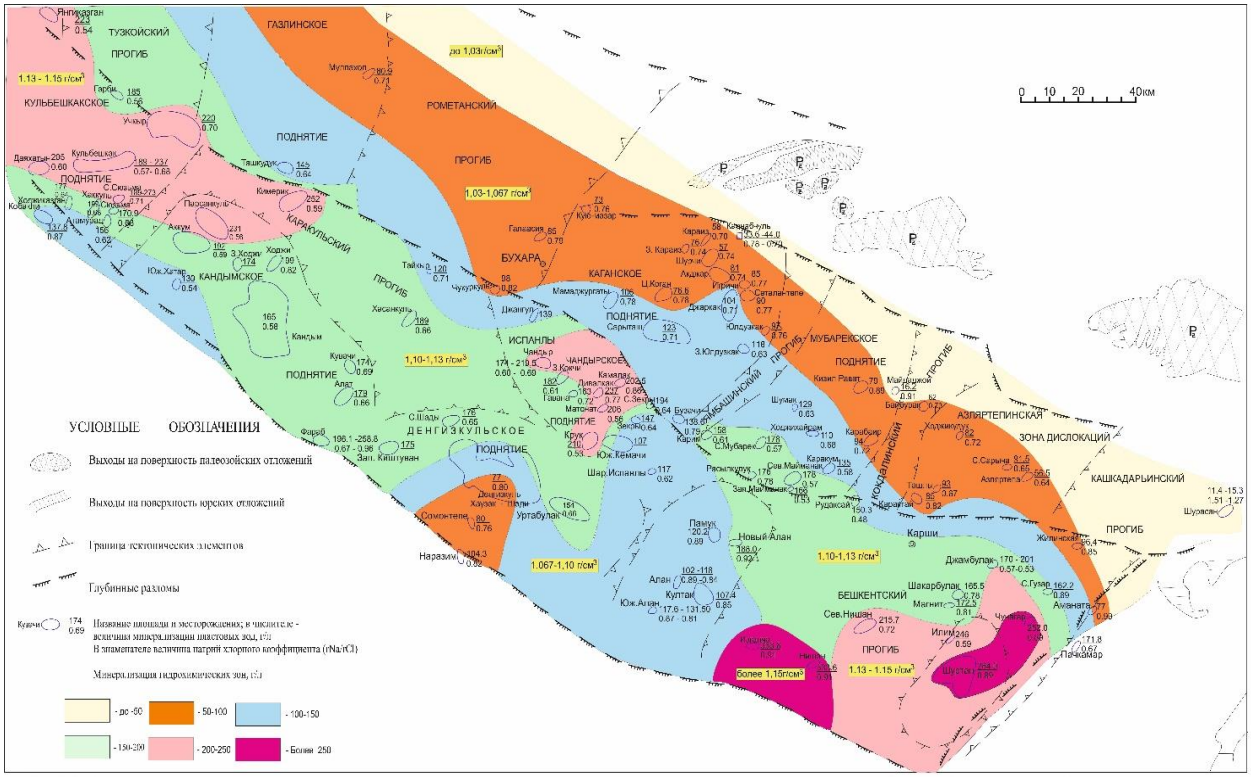


Figure 3. Schematic map of the hydrochemical zoning of groundwater of the Lower-Middle Jurassic deposits of Western Uzbekistan

Formation waters are metamorphosed (0.64-0.85), chloride-calcium type.

The hydrochemical zone with mineralization of 100-150 g/l is distributed in the Mubarek (Karakum area - 135 g/l, Khojaykhairom area - 110 g/l, Shumak area - 129 g/l), Kagan (Saritash area - 123 g/l, Mamazhurgati area - 106 g/l, West Yulduzkak area - 118 g/l) and Gazli (Tashkuduk area - 145 g/l) uplifts of the Bukhara Steppe, as well as in the Kultak uplift area of the Chardzhou Steppe (Kultak area - 107 g/l, Olon area - 118 g/l, South Olon - 131 g/l, Pamyk - 118 g/l). The presence of these zones may be associated with the penetration of bound waters from clay deposits into reservoirs under the influence of high geostatic pressures. These waters are metamorphosed (0.57-0.70) and belong to the chloride-calcium type.

Similarly, the distribution of low-mineralized waters (50-100 g/l) in the hydrochemical zone of 100-150 and more is observed in the Ispanli-Chandyr deposits (Northern Ispanli-117 g/l, Zekri-147 g/l, South. Kemachi-107 g/l), Dengizkul (Dengizkul-77 g/l, Samontepa-80.0 g/l) and Kandym uplifts (Jan. Hazard - 130 g/l). The phenomenon of a slight decrease in the mineralization of formation waters in the transboundary sections of gas condensate reservoirs can be explained by the presence of a mixture of condensation waters.

The distribution of highly mineralized waters mainly occurs in the central Ispanli-Chandyr (Matonat-206 g/l, Kruk-210 g/l, Chandyr-219,5 g/l, Divalkak-237 g/l), Kandym (Farab-258.8 g/l, Haji-199 g/l, Parsankul-231 g/l) and Kulbeshkak (Hakkul-199 g/l, Kulbeshkak-237 g/l, Dayakhatin-205 g/l, Shim. Syzma-273 g/l, Uchkir-220 g/l) and the Karakul Depression (Kimerek-252 g/l). The metamorphism coefficient varies from 0.53 to 0.96, and a very low sulfate content of 0.005-0.00006 is observed. The type of water is chloride-calcium.

In the Lower-Middle Jurassic deposits of the Beshkent macropoligon, there are mainly highly mineralized chloride-calcium groundwater with mineralization of 100-150 g/l, 150-200 g/l and higher. At the same time, in the central part of the fold, mineralized formation waters were recorded in the areas of Alachavan, Bozbichkon, Iymon, and Shimoliy Aknazar, respectively - 104.7 g/l, 113.6 g/l, 121.8 g/l, 121.2 g/l. And in the northern mines. Guzar, Shakarbulak, Shim. In Nishan, Ilim, the distribution of formation waters with mineralization from 162.2 g/l to 246.0 g/l has been established,

which are structurally and tectonically located in the Guzar, Shurtan, Nishan uplifts, Shakarbulak, and Kamashi valleys.

Against the background of the general trend of mineralization and metamorphism of formation waters in the direction of the southern bend, highly mineralized (more than 250 g/l) and metamorphosed waters developed in individual areas. The hydrochemical zone with mineralization above 250 g/l covers the areas of the Shurtan-284.0 g/l, Nishan-330.3 g/l deposits and the Chunagar-252.0, Izgancha-333.5 g/l structures, where strong brines have also accumulated in the uplifted part of the Beshkent macrogib.

The water content of the Upper Jurassic (J3) deposits of the studied territory is associated with the XVI-XV horizons of the carbonate formation (CF), and their hydrochemical properties are characterized by the predominance of chloride-calcium brines of various metamorphic states. Their main characteristic is the general tendency towards increasing mineralization and metamorphism of formation waters in the southwestern direction and as they move away from the fault zones of Jurassic deposits [10, 14].

In the zone of upper Jurassic deposits recovery in the territory of the Bukhara Steppe, a distribution band of waters of mixed genetic type with mineralization less than 50 g/l is observed (Sev. Quyimozor-48 g/l, Karnabchul-42.2 g/l, Chember-28.7 g/l, Azlyartepa-32.7 g/l, Uvada-2.80 g/l), the slightly saline zone is distributed on the northeastern edge of the territory within the Shurasan-13.3 g/l structure (Fig. 4).

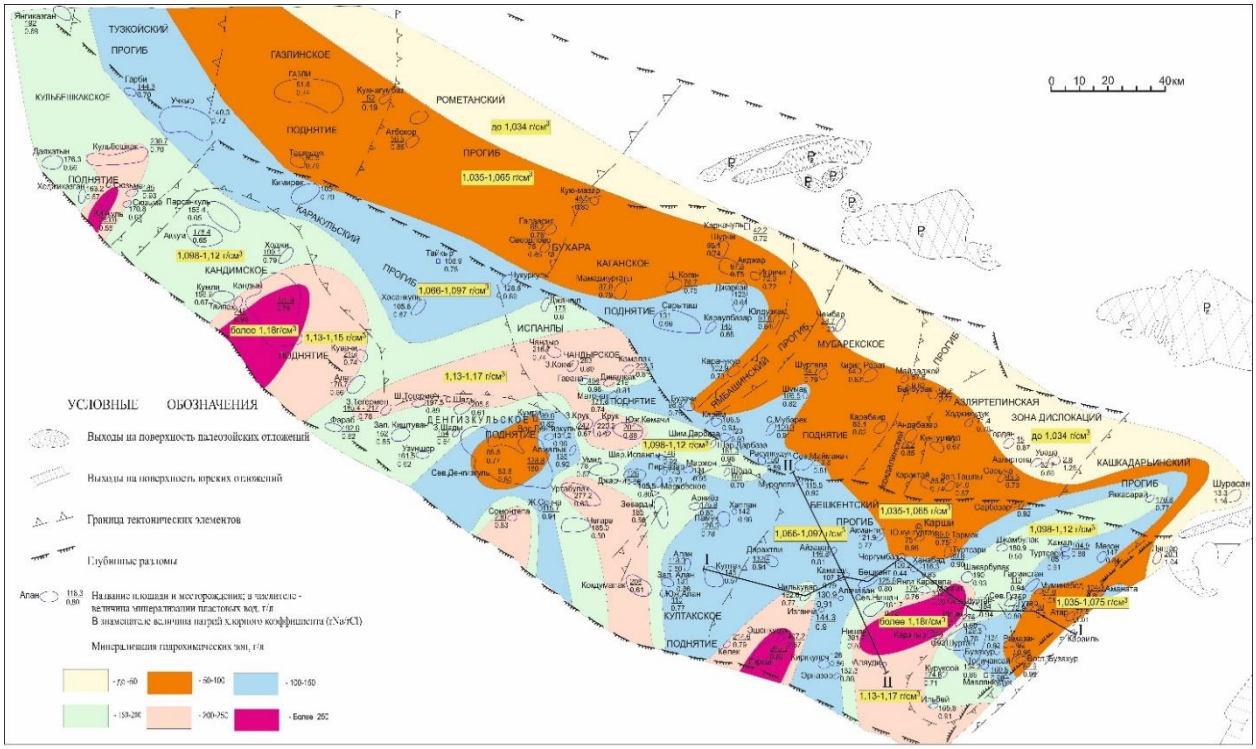


Figure 4. Schematic map of the hydrochemical zoning of groundwater of Upper Jurassic deposits of Western Uzbekistan

Formation waters with a mineralization of 50-100 g/l are widespread in the beach area.

Kuhnagumbas, Gazli, Tashkuduk, Kuyumazar, Mamajurgati, Kyzylravat, Shurtepa, Atbakor, Galaosiyo, Kungirtau, Gharbiy. Stony (from 48.0-56.3 g/l to 87.0-96.6 g/l), high metamorphic coefficient (pNa/pCI) - from 0.67 to 0.83, and sulfate content (pSO_4/pCI) - from 0.09 to 3.0.

Formation waters with a mineralization level of 50-100 g/l are widespread in the areas of Kuhnagumbaz, Gazli, Tashkuduk, Kuimazar, Mamazhurgati, Kizilravot, Shurtepa, Otbakor, Galaosiyo, Kungirtov, and West Tashli, and their mineralization level ranges from 48.0-56.3 g/l to

87.0-96.6 g/l. These waters have a high degree of metamorphism coefficient (pNa/pCI) from 0.67 to 0.83, and the degree of sulfate content (pSO_4/pCI) from 0.09 to 3.0.

However, in the southern regions of the Mubarek uplift, a hydrochemical complication associated with the distribution of mineralized waters has been identified, which exceeds 100 g/l (Karym-106.5 g/l, Rasylkuduk-150 g/l, Shim. Maymanak-113.8 g/l) in the hydrochemical zone 50-100 g/l. The hydrochemical complexity is associated with the penetration of formation waters from the Lower Jurassic deposits by the Ispanli-Chandyr uplift, where the waters are more mineralized and metamorphosed (Sarytash-131 g/l, Djarkak-123 g/l, Karaulbazar-145 g/l, etc.), as well as with the hidden release of Jurassic aquifers along "hydrogeological windows" along the Setalantepa and South Djarkak faults of the Upper Jurassic water barrier.

In the Jurassic KF of the Chardzhou Stage, metamorphosed waters of the chloride-calcium type with mineralization of 100-150 g/l, 150-200 g/l and more are mainly present, which may be associated with greater hydrogeological stability of these areas due to blockage of underground runoff by lithological barriers or tectonic disturbances. The metamorphism coefficient of water in this zone varies from 0.57-0.70 to 0.75-0.85, and an increase in the content of iodine (5-10 mg/l), bromine (100-300 mg/l), and ammonium (100-200 mg/l) is observed.

In the eastern and northwestern parts of the Dengizkul uplift (Urtabulak, North Urtabulak, South Urtabulak, West Tegermen, etc.), the formation waters of the Upper Jurassic deposits consist of strong and very strong saline solutions, the mineralization of which ranges from 201-277.3 g/l (Umid, Urtabulak deposits) to 305.8 g/l (North Tegermen deposit). These waters have a high metamorphic coefficient (0.58-0.63) and a low sulfate content and belong to the chloride-calcium type. Iodine-bromine waters are developed in brines (the content of iodine and bromine exceeds 20 mg/l and 300 mg/l, respectively). The highest concentration of iodine was 37.4 mg/l and bromine - 283 mg/l, which was determined in the area of strong brines in the Dengizkul uplift. In the territory of South Zekra, the bromine content of brines was 987 mg/l, and in Pirnazar and Markovskaya, the iodine content reached 42.4-52.8 mg/l. Similar iodine-bromine waters are characteristic of the Urtabulak-Kokdumalak area of strong brines, where the amount of iodine reaches 57.7-67.9 mg/l, and bromine - 350-652 mg/l.

Highly mineralized brines: Ispanli-Chandyr (Chandyr fields, Ghar. Kokchi, Havana, West Kruk, Jan. Kemachi, Kuvachi, Kandym, Khodzha, Taylak, Hakkul, Kulbeshkak) with mineralization from 215.0-230.0 g/l to 278.0-283.2 g/l, with a metamorphism coefficient from 0.74 to 0.98, and low sulfate content up to 0.0007, a high content of microcomponents was revealed: iodine 13.4-21.6 mg/l, bromine 283-519.7 mg/l, and ammonium 200-300 mg/l.

A hydrochemical zone of groundwater of the chloride-calcium type with a mineralization of 100-150 g/l and 150-200 g/l is observed in most of the territory of the Beshkent macrophage. It should be noted that in the central and southern parts of the Beshkent Depression, as well as with the depth of occurrence of Upper Jurassic deposits, a gradual increase in mineralization is observed. However, this hydrochemical field is completely heterogeneous. Against the background of the general trend of mineralization and metamorphism of formation waters, in the central part of the depression (zone of stable hydrogeological regime of water exchange) and in individual areas, there are areas with the development of highly mineralized waters (Ilim-270.1 g/l). Similar zones are distinguished in the form of hydrochemical anomalies in the area of the Darakhtyli-2 (255.3 g/l), Girsan-6 (265.2 g/l), Chilkuvar-2 (285.5 g/l), Mangit-2 (296.9 g/l) and Eshonkuduk-1 (407.2 g/l) wells. As can be seen, the presence of these anomalies in this zone is associated with the influence of buried intersalt rapes on the formation of ultra-stable brines. In these strong brines, the highest iodine content was 46.6-48.7 mg/l and the highest bromine content was 638.7-835 mg/l [15].

The groundwater of the Cretaceous (K) deposits of Western Uzbekistan is also distinguished by great diversity: all genetic types of water are found, the mineralization in them varies from 1 to 231 g/l. Slightly mineralized and metamorphosed waters, with a pronounced infiltration genesis, are distributed in the alb-cenomanian deposits of the Bukhara Stage.

The hydrochemical zone of saline and very weak brines with a mineralization of 10-50 g/l is present only in some areas of the Chardzhou step, in particular, in the areas of Kyrkynchak, Shimoliy

Kamashi, and Alyauda, the total mineralization of which is 20.7 g/l, 39.0 g/l, and 46.4 g/l, respectively. Very weak brines with a mineralization of 50-100 g/l are also widespread in the Kandym, Dengizkul, Ispanly-Chandyr, Kultak uplifts, and the Karakul depression. Strong salts of the chloride-calcium type (100-150 g/l) are observed in the Kultak uplift (Pomuk, Kultak) and the Kashkadarya Basin (Shurasan, Yakkasaray), the metamorphic coefficient of which is 0.5-0.8. Subsequently, as a result of regional subsidence, the mineralization and metamorphism of formation waters increase further, reaching from 150 g/l to 227.4-230.7 g/l in the Alat and Kulbeshkak areas, with a metamorphism coefficient of 0.7-0.71 (Fig. 5).

The mineralization of formation waters in the lower Cretaceous deposits of the Beshkent macropogib is as follows: Buzakhur-112.8 g/l, Shim. Qamashi-131.7 g/l, Maymanoqtoğ-133.7 g/l, Ayzovat 206.5 g/l, which is associated with the outflow of water from the lower stratigraphic aquifer complexes. The formation waters of the Upper Cretaceous deposits of the territory of Western Uzbekistan, mainly of the Bukhara Stage, are mainly slightly saline and saline waters (< 10 g/l, 10-50 g/l) and are metamorphosed to varying degrees - from 1.05 to 5.2.

Thus, in pressure water complexes of the Cretaceous period, infiltration water exchange processes are significantly more pronounced than in the Jurassic period. This is especially characteristic of the Upper Cretaceous part of the confined aquifer of the Bukhara Stage.

Hydrochemical anomalies observed in the Cretaceous aquifer complexes of the Bukhara Stage are explained by the penetration of chloride-calcium salt solutions from the Jurassic deposits through permeable tectonic disturbances from below. Within the Chardzhou Stage, metamorphosed sedimentary waters have been preserved, the composition of which has likely been repeatedly renewed during the Elysian water exchange process, which dominated throughout the entire history of the hydrogeological development of the Mesozoic confined aquifer system of Western Uzbekistan.

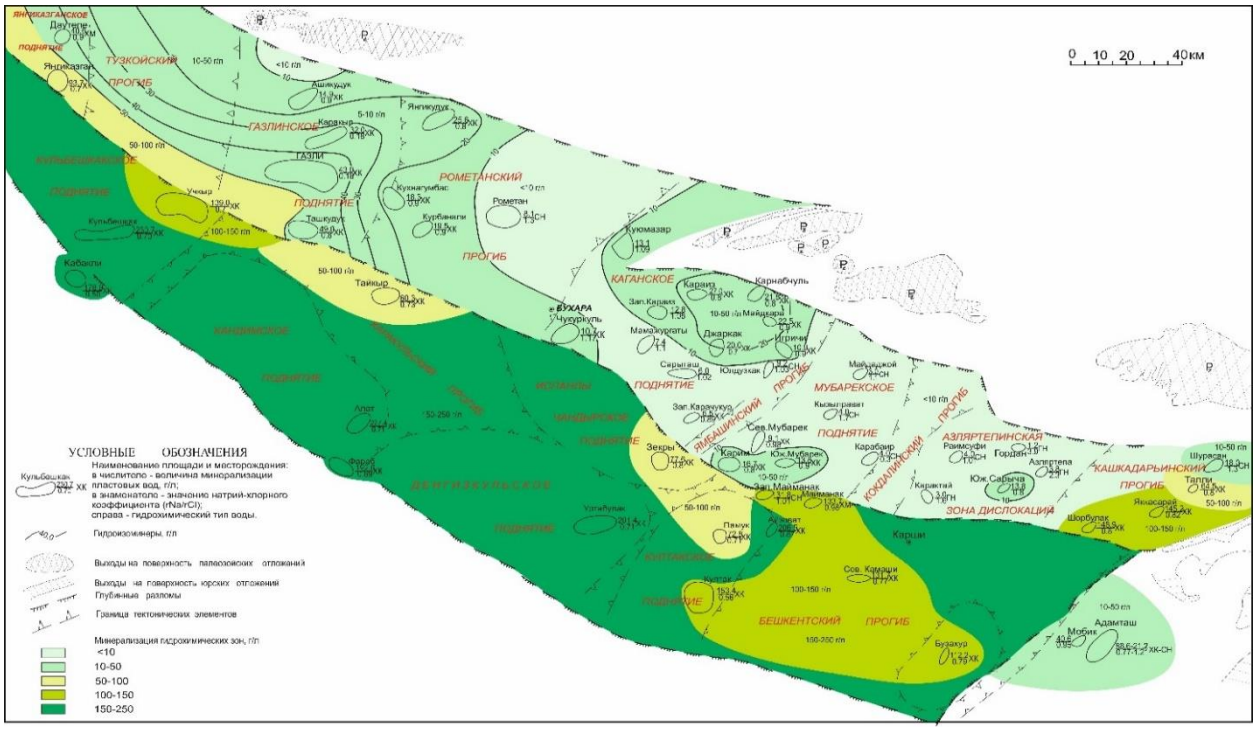


Figure 5. Schematic map of the hydrochemical zoning of groundwater of the Lower Cretaceous deposits of Western Uzbekistan

One of the important directions in the study of the regularities of the distribution of dissolved organic matter (DOR) and dissolved gases in the formation waters of Mesozoic deposits of Western Uzbekistan was the determination of the prospecting significance of aromatic hydrocarbons. Geochemical changes in the "water-rock" system are a direct indicator of the presence of hydrocarbon deposits. The composition and quantitative concentrations of individual groups of SEOM (naphthenic

acids, phenols, benzols, organic carbon, etc.) are successfully used as direct search indicators for determining the presence of hydrocarbons in the earth's crust [3, 7].

Especially widespread VROV (Hydrogen-Related Organic Hydrogens), exceeding the background content, was recorded in the Chardzhou step. The highest values are observed in the Kandym, Dengizkul, Ispanly-Chandyr, Kultak uplifts, and the Beshkent basin, with a sharp increase in the VROV content in a number of deposits (Mangyt, Shakarbulak, Nishan, Tarmak, Western Border, Kokdumalak, etc.). As can be seen, for the Jurassic aquifer complex, the statistical dependence of trap productivity on the VROV value is quite stable, which is confirmed by the discovery of hydrocarbon reserves in new areas: Chegaraqum, Western Sabo, Yumay, Northern Darvoza, Supali, Chilgumbaz, Chilkuvar, Yangi Karatepa, Feruza, Khanabad, Mirmiron, Ilim, Northern Shurtan, Oydin, and others. As can be seen, for the Jurassic aquifer complex, the statistical dependence of trap productivity on the UOB value is quite stable, and in new areas - Chegaraakum, Western Sabo, Yumay, Northern Darbaza, Supali, Chilgumbaz, Chilkuvar, Yangi Karatepa, Feruza, Khanabad, Mirmiron, Ilim.

It is known that iodine in groundwater has a very high migration ability, volatility, and dispersion properties, and is well adsorbed on rocks. Ultimately, its quantity is regulated depending on the conditions of water exchange and the degree of hydrogeological closure of the subsoil [2, 5]. Analysis of the distribution of iodine in the groundwater of Jurassic deposits of the Beshkent macropoygib shows that the increase in iodine content is clearly similar to the general mineralization of waters and is associated with certain gas-oil-condensate deposits (Shurtan, Sev, Shurtan, Ilm, Rubai, Mangit, Sherkent, Yangi Karatepa, Beshkent, Kamashi, S. Nishan). High concentrations of iodine, bromine, and ammonium have also been established in highly mineralized brines of Jurassic deposits of the Chardzhou Stage (Ispansko-Chandyr, Kulbeshkak uplift). When considering the distribution of the latter and comparing the iodine-bromine values with the oil and gas prospects map of the region, it was established that the oil and gas regions correspond to areas with a high and high concentration of iodine and bromine in groundwater.

It should also be noted that among the indirect indicators of oil and gas content, in addition to the total salt content of waters, the sulfate content of groundwater (pSO_4/pCl) is also significant. The collected materials and their analysis show that the most characteristic feature of the hydrochemical composition of oil and gas field waters is the absence or very low content of sulfates (from 0.021 to 0.0005), i.e., very low indicators. Consequently, the low sulfate content and high content of microcomponents can also be recognized as local criteria for formation waters of Jurassic deposits.

CONCLUSION

Summarizing the brief hydrochemical characteristics of Jurassic and Cretaceous deposits of Western Uzbekistan, it should be noted that modern hydrochemical zonality is inherited mainly from the elizion stages of hydrogeological development. Apparently, the decisive role in this was played by the processes of deep metamorphism of sedimentogenic and ancient infiltrogenic groundwater. Infiltration water exchange processes affected only the peripheral parts of the water-pressure systems and individual uplift zones. The chalk part of the water-pressure system of the Bukhara bench is the most eroded, the inner, sunken parts of the bench are the least eroded.

As a result of the conducted research on the hydrogeochemical properties of formation waters of Mesozoic deposits of Western Uzbekistan, it was established that predominantly highly mineralized, metamorphosed, and sedimentogenic waters are widespread. At the same time, the formation waters of Jurassic and Cretaceous deposits are significantly enriched with various gases, organic matter, with a high and low sulfate content of microcomponents (iodine, bromine), which is associated with the hydrogeological closure of the subsoil and the stable hydrogeological regime of waters, contributing to favorable hydrogeochemical conditions for the formation and storage of UV deposits.

A stable correlation with oil and gas indicators has been established, reflecting the general regularity of increasing the reliability of chemical-organic indicators of trap productivity and oil and gas content in the Jurassic aquifer complex. The maximum VROV value was established in Akkum,

Kumli, Khoja, Alat, Uzunshor, Chandir, Havana, Umid, Chegara, Yumay, Alan, Pomuq, Chilquvar, Qamashi, Feruza, Ilim, Mezon, and other areas.

In the areas of Jurassic and Cretaceous water supply complexes, located far from ancient and modern infiltration zones, the metamorphic factor associated with the chemical composition of layered waters of Mesozoic sediments and their modern hydrogeochemical zonality has been confirmed.

Consequently, the study of the hydrogeochemical conditions of natural water supply systems is one of the most important links in the hydrogeological study of oil and gas zones, since they not only determine the hydrogeochemical zoning, but also have a very important influence on the conditions of reservoir accumulation and storage.

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Rezyume: *Maqolada G‘arbiy O‘zbekistondagi mezozoy yotqiziqlarining o‘ziga xos xususiyatlari va ularning tarqalish zonalligining hozirgi holati ko‘rib chiqilgan. Yer osti suvlari neft va gaz uyumlarining hosil bo‘lishi va saqlanishida muhim rol o‘ynaydi. Ma’lum sharoitlarda ularning to‘planishiga yoki yo‘q qilinishiga olib kelishi mumkin. Shuning uchun ushbu tadqiqotning maqsadi G‘arbiy O‘zbekistonning mezozoy yotqiziqlarida uglevodorodlarning shakllanishi va tarqalishida kollektorlik xususiyatlari va yer osti suvlarining rolini aniqlashdan iborat. Ushbu ishda o‘rganilayotgan hududdagi yura va bo‘r davri cho‘kindi qatlamlarining faktik ma’lumotlarini ilmiy*

sintez qilish bilan bog‘liq muammolarni hal qilishda kompleks yondashuv qo‘llanildi. Bunda geologik qatlamlarning turli parametrlarini tavsiflovchi materiallar qo‘llanilgan. Xulosa qilib aytganda, tadqiqot hududining neft-gaz salohiyati turli mezonlar asosida baholangan va natijalar keltirilgan.

Umumiy geologik nuqtayi nazardan neft va gaz hosil bo‘lishining xususiyatlarini, shuningdek, qatlam flyuidlarining dinamikasi va kimyoviy birligini hisobga olish neft va gazni qidirishning muhim mezoni hisoblanadi. Bu omil geologiya-qidiruv ishlariga oqilona yondashuvni tanlashda e’tiborga loyiqdir. O‘rganilayotgan hududda yura va bo‘r yotqiziqlarining geologik tahlili asosida neft va gaz uchun yuqori salohiyatga ega bo‘lgan turli zonalar va ularning tegishli maydonlari aniqlandi. O‘rganilayotgan hududda bunday mahalliy maydonlarni aniqlash potensial qidiruv obyektlari doirasini sezilarli darajada kengaytiradi, bu esa kelajakda qidiruv-razvedka ishlari samaradorligini oshirish imkonini beradi.

Резюме: *В статье рассматриваются особенности мезозойских отложений Западного Узбекистана и современное состояние их зональности распространения. Подземные воды играют важную роль в образовании и сохранении залежей нефти и газа. При определенных условиях это может привести к их накоплению или уничтожению. Поэтому целью настоящего исследования является определение коллекторских свойств и роли подземных вод в формировании и распространении углеводородов в мезозойских отложениях Западного Узбекистана. В данной работе применен комплексный подход к решению задач, связанных с научным синтезом фактических данных о юрских и меловых отложениях исследуемой территории. При этом использовались материалы, характеризующие различные параметры геологических слоев. В заключение можно сказать, что нефтегазовый потенциал исследуемой территории был оценен на основе различных критериев и представлены результаты.*

С общегеологической точки зрения важным критерием поисков нефти и газа является учет особенностей нефтегазообразования, а также динамики и химической единицы пластовых флюидов. Этот фактор заслуживает внимания при выборе рационального подхода к геологоразведочным работам. На основе геологического анализа юрских и меловых отложений на исследуемой территории выявлены различные зоны с высоким потенциалом для нефти и газа и соответствующие их площади. Выявление таких локальных участков на исследуемой территории позволит существенно расширить круг потенциальных поисковых объектов, что в перспективе позволит повысить эффективность поисково-разведочных работ.

Kalit so‘zlar: *geologik, yotqiziqlar, qatlam suvlari, bosimli suv tizimi, ma’danlashuv, gorizont, flyuid, shaxta, migratsiya, yura, bo‘r, mezozoy.*

Ключевые слова: *геологический, отложения, пластовые воды, напорная система воды, оруденение, горизонт, флюид, шахта, миграция, юра, мел, мезозой.*

CHEMICAL ACTIVATION OF JELVAK PHOSPHORITES OF KARAKALPAKSTAN

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Summary: *The article investigates the process of chemical activation of Karakalpak phosphorite flour using ammonium nitrate solutions at a temperature of 70°C and urea melt. A comprehensive analysis was conducted on the influence of these reagents on the structure and properties of phosphate raw materials.*

It is shown that depending on the nature of the activator and the N:P_2O_5 ratio in the activation products, the relative content of assimilable P_2O_5 increases: from 37,78% in the original phosphor original phosphorite flour to 79.87–94.59% when treated with ammonium nitrate solution, and to 66.79–85.31% when using urea melt.

Key words: *Ammonium nitrate solution, urea melt, chemical activation, pebble phosphorite, balanced NP fertilizers, composition and strength of granules*

Introduction: Currently, phosphorous fertilizers are produced at chemical enterprises of JSC "Uzkhimiyosanoat," such as JSC "Ammonphos-Maxam" and the "Kokand Superphosphate Plant." The phosphate raw material for these plants is provided by the Kyzylkum Phosphorite Complex. However, due to the shortage of high-quality phosphate raw materials, these plants produce only 140-150 thousand tons of phosphorous fertilizers based on 100% P_2O_5 content. In the context of the shortage of phosphorous fertilizers, the development of small local deposits of agronomical ores, which are currently not utilized in industrial production, has become a pressing issue.

One of the key reserves for increasing the production of phosphorous fertilizers is the development of local (undeveloped) deposits. Karakalpakstan has dozens of deposits of such low-grade phosphorites (Khudjakulsky, Sultan-Uizdag, Khojaylinsky, Nazarhansky, Chukai-Tukai, and others), with a total reserve of over 70 million tons. These can be developed for agricultural purposes and quickly address the issue of supplying locally needed phosphorous fertilizers. Their advantage lies in the fact that they are located in close proximity to the consumer, require minimal capital investment, can be put into operation in a short time, and the product (raw-milled phosphorites) is significantly cheaper than any other phosphate product.

The highest effect of phosphorite flour is observed when implementing the "phosphorization of soils" technique, which involves a one-time application of at least 1 ton/ha, or 200 kg/ha of P_2O_5, to the soil for a long period (up to 5 years or more) [1].

In agrochemistry, the criterion for the assimilability of phosphorus from its compounds is the share of P_2O_5 extracted into solution by 2% citric acid; the latter's dissolving capacity is similar to that of the humic acids in soil. In pebble phosphorite – the Kyzylkum variety – the relative content of citric acid-soluble P_2O_5 is 25-35%, which is significantly higher compared to, for example, Karatau or, even more so, apatite ores [2].

For example, in the study [3], the properties and effectiveness of natural phosphates from various deposits were examined for their direct use as fertilizers. The most soluble in ammonium citrate solution and 2% citric acid were the phosphorites from Tunisia and Curacao, followed by phosphorites from South Carolina, Florida, Idaho, Tennessee, and apatite from Virginia. Tunisian phosphorite has the highest specific surface area, while Virginia apatite has the lowest. The compactness of particles reduces the effectiveness of the phosphorites.

N.N. Bushuyev [4] used the focusing camera-monochromator Ginie FR-552 to perform high-precision determination of the structural parameters of phosphate materials. In this work, a linear relationship was established between the agrochemical characteristics of known types of phosphate raw materials from various deposits and the values of the "a_0" and "c_0" parameters of the unit cell. Based on the obtained "a_0" values, the phosphorites are arranged in order of increasing these values:

the 1st group includes pebble phosphorites, the 2nd group – granular phosphorites, the 3rd group – shell phosphorites, and the 4th group – apatites. That is, the lowest unit cell parameter values are found in pebble phosphorites, while the highest are found in apatites. It is concluded that the smaller the crystal size, the greater their interaction with soil solutions, and the higher their agrochemical effectiveness. Therefore, pebble phosphorites can be directly used as fertilizers in the form of ground flour without the need for long-term trials.

The use of finely ground phosphorite as a direct fertilizer, without any chemical processing, would provide agriculture with the cheapest phosphorous fertilizer [5].

However, phosphorite flour is successfully used in large quantities on acidic soils [6], while it is ineffective on neutral and alkaline soils in Uzbekistan.

In these cases, methods to increase its effectiveness include the use of organo-phosphorite composts made from local types of organic raw materials (manure, peat, poultry litter, lignin) [7]. For instance, in the study [8], organo-mineral fertilizers were obtained through composting cattle manure (CM) and poultry litter with phosphorite flour from Karakalpakstan, depending on the manure-to-phosphorite ratio and the duration of the composting process. It was found that the optimal manure to phosphorite ratio is 1:0.06–1:0.12, with a composting period of 3 months. In another source [9], composts were prepared based on CM manure and mineralized mass, a by-product of the dry beneficiation process of Kyzylkum phosphorites, depending on the manure-to-phosphorite ratio (10:0.8; 10:1; 10:1.4), the dispersion of the mineralized mass (-0.16; -0.25+0.16; -0.5+0.25; -1+0.5; -3+2; -2+1; -5+3 mm), and the duration of composting (1; 15; 30; 45; 60; 75; 90 days). It was shown that the lower the amount of phosphate raw material in the mixture, the longer the composting time, and the higher its dispersion, the higher the content of assimilable P_2O_5 in relation to total P_2O_5. The degree of transformation of the organic part of the manure into humus substances, including humic acids, fulvic acids, and water-soluble organic substances, also increases.

To expand the range of phosphorite flour applications to neutral soils, it is necessary to increase the content of assimilable forms of phosphorus. This can be achieved through the activation of phosphate raw materials [10].

Activation can be carried out mechanically [11], mechanochemically [12], chemically [13], thermally [14], complexometrically [15], and microbiologically [16].

In the study [17], activation of phosphorites from the Chulaktau, Kokdjon, and Chilisay deposits (Kazakhstan) was carried out using a 10% ammonium nitrate solution, a 30% ammonium sulfate solution, and 50-70% calcium nitrate solutions. The activation conditions were as follows: interaction for 30 minutes at a temperature of 80°C and a solid-to-liquid ratio of 5:1. When the ammonium sulfate and ammonium nitrate solutions interacted with Chulaktau phosphorite, the content of assimilable phosphates in the fertilizer increased by 38-42% by weight, with a decarbonization degree of 24-41%. However, no increase in assimilable P_2O_5 content was observed in Kokdjon phosphorite.

For chemical activation, phosphorite ore from the Khojakul deposit was used, with the following composition (wt.%): P_2O_5 – 19.11; insoluble residue – 1.64; SiO_2 – 28; CaO – 32.83; MgO – 0.30; Fe_2O_3 – 3.50; Al_2O_3 – 1.54; SO_3 – 1.10; CO_2 – 4.03; F – 2.09. This raw material belongs to the pebble type, whose main minerals are kurskite and francolite in nearly equal amounts. Before use, it was ground in a ball mill. Its particle size distribution is characterized as follows: class (-5+3 mm) – 7.65%; (-3+2 mm) – 24.43%; (-2+1 mm) – 18.29%; (-1+0.5 mm) – 3.0%; (-0.5+0.25 mm) – 22.73%; (-0.25+0.16 mm) – 10.07%; (-0.16+0.1 mm) – 4.11%; (-0.1+0.05 mm) – 6.20%; (-0.05 mm) – 3.51%.

Chemical activation of Khojakul pebble phosphorite flour with the above composition was carried out using 70% and 85% ammonium nitrate solutions. The experiments were conducted in a thermostatted cylindrical reactor with a volume of 200 ml, equipped with a paddle stirrer, at a temperature of 90°C for 30 minutes. The quantities of components were calculated so that the N:P_2O_5 ratio in the final fertilizer was 1:0.1, 1:0.3, 1:0.5, and 1:0.7. After the components interacted, the pulps

were dried in a thermostat at 105°C, and the products were analyzed for nitrogen, various forms of phosphorus, and calcium according to established methods [18].

Activation of phosphorite flour with molten urea was carried out as follows. A weighed amount of urea was melted in a porcelain beaker equipped with a stirrer by heating in a thermostatted glycerin bath. The melt temperature was maintained at 140°C. The weighed amount of phosphorite flour was slowly added to the melt, and the mixture was thoroughly stirred. The interaction time of the components was 30 minutes. Afterward, the molten mixture was poured into porcelain dishes and cooled. Once cooled, the product was ground and analyzed. The component ratio $N:P_2O_5$ also varied within the range from 1:0.1 to 1:0.7. The results are presented in Tables 1 and 2.

The data show that the more phosphorite flour is added to the ammonium nitrate solution or urea melt, and the lower the nitrogen content, the higher the phosphorus and calcium content in the product. For example, when using a 70% ammonium nitrate solution, increasing the mass ratio of $N:P_2O_5$ from 1:0.1 to 1:0.7 causes the nitrogen content in the products to decrease from 29.28% to 15.28%, while the total P_2O_5 and CaO contents increase from 3.05% to 10.18% and from 5.21% to 18.88%, respectively. For the 85% solution, these values change from 29.41% to 15.26%, 2.96% to 9.18%, and 5.68% to 19.51%, respectively (Table 1). When activating Karakalpakstan pebble phosphorites with a 70% ammonium nitrate solution, the content of the assimilable form of CaO decreases from 93.47% to 79.98% (Fig. 1). In the 85% solution, the assimilable CaO decreases from 94.37% to 80.98% (Fig. 2).

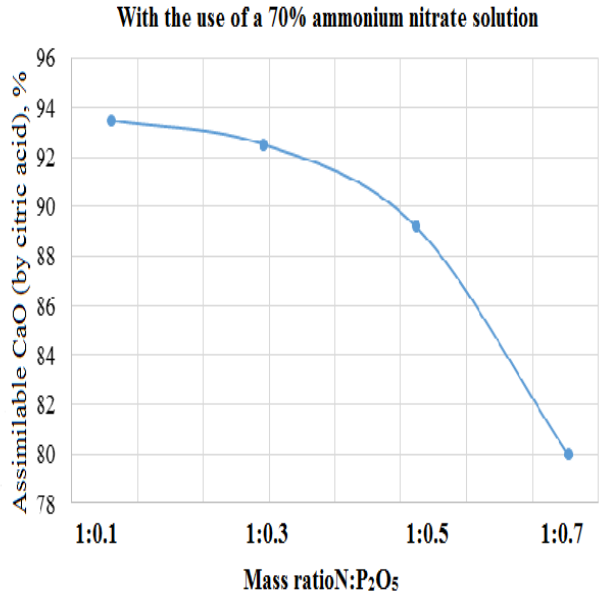


Figure 1

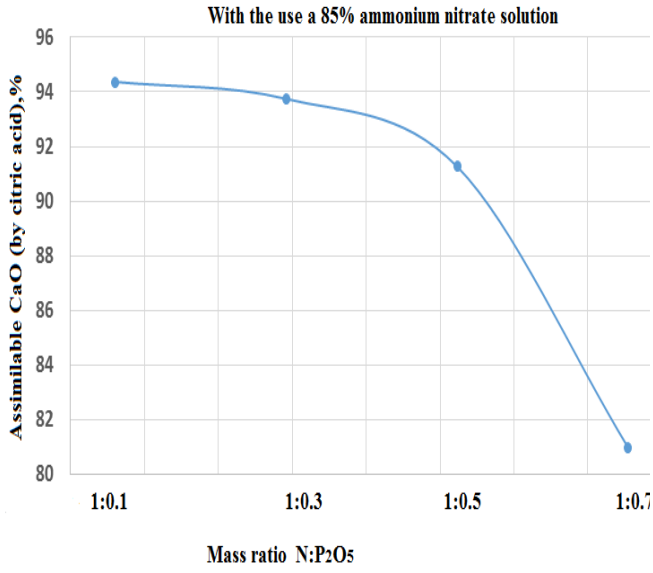


Figure 2

As the data show, treatment of Khojakul phosphorite flour with ammonium nitrate solution sharply increases the content of assimilable phosphorus forms. In the original phosphate raw material, the content of assimilable P_2O_5 determined by EDTA (Trilon B) relative to total P_2O_5 was 32.23%, and by citric acid was 37.78%. In the resulting products, these values range from 61.39% to 90.82% and 79.87% to 93.78% for the 70% ammonium nitrate solution, and from 65.36% to 91.22% and 82.35% to 94.59% for the 85% solution, respectively. Such products are already effective nitrogen-phosphorus fertilizers. Their strength properties meet agricultural requirements, ranging from 3.69 to 6.89 MPa and 3.82 to 7.02 MPa, respectively. The concentration of ammonium nitrate solution has little effect on the change in assimilable phosphorus content. It is also worth noting that water-soluble forms of calcium appear in the interaction products, amounting to 8.69–16.89% and 6.82–16.02%, respectively.

This indicates that due to its acidic nature, ammonium nitrate at relatively high temperatures partially decomposes the calcium carbonate present in the phosphorite flour, resulting in the formation of calcium nitrate and kurskite, along with the formation of monocalcium phosphate.

High contents of assimilable forms of P_2O_5 and CaO in the phosphorite flour activation products (ranging from 66.79% to 85.31%) are also observed when using molten urea at N:P_2O_5 ratios from 1:0.7 to 1:0.1 (Table 2). At the same time, the total contents of N, P_2O_5, and CaO range from 17.29% to 37.19%, 4.22% to 12.32%, and 7.70% to 20.80%, respectively. This method achieves the highest strength of the granulated product, ranging from 3.89 to 10.24 MPa. When activating Karakalpakstan pebble phosphorites with molten urea at 140°C, the content of assimilable CaO decreases from 90.78% to 74.86% (Fig. 3).

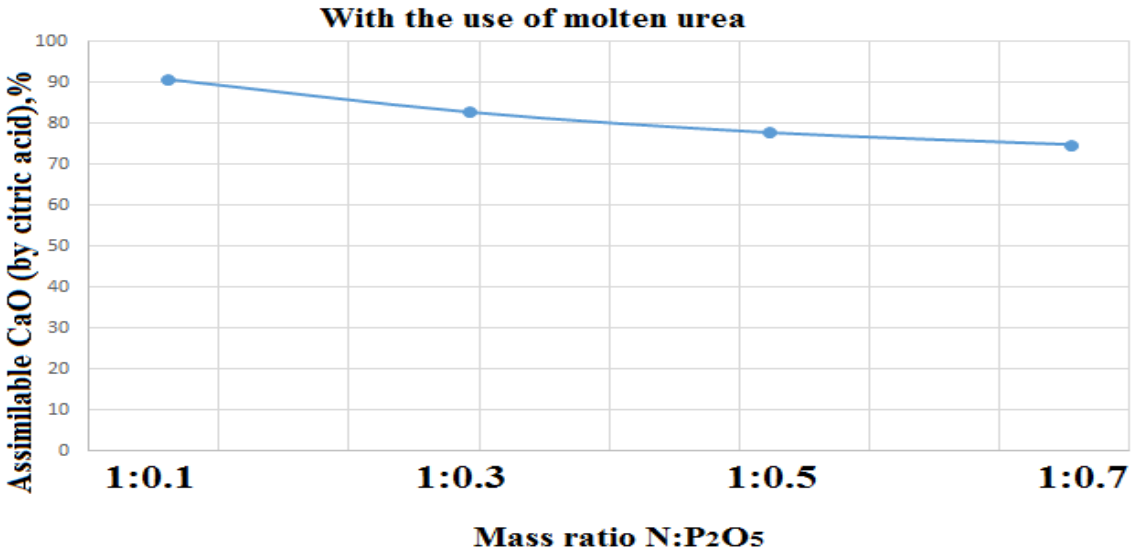


Figure 3

Chemical activation of Khojakul phosphorite flour using concentrated ammonium nitrate solution and molten urea enables the production of nitrogen-phosphorus fertilizers with an optimal ratio of nutrient elements, suitable for use on all soil types and for all agricultural crops. The high availability of pebble phosphorites makes them acceptable for producing fertilizer mixtures using non-acidic methods. Chemical activation of phosphates allows the utilization of substandard phosphate raw materials in the resource base without restricting the content of carbonate, aluminosilicate, and iron-containing minerals, while ensuring a waste-fre a waste-free process.

Table 1

The composition of the products of the interaction of Khojakul phosphorous with ammonium nitrate solutions

Mass ratio N:P_2O_5	N, %	P_2O_5 general., %	Assimilable P_2O_5 (by Trilon B, %	Assimilable P_2O_5 (by citric acid), %	CaO general., %	Assimilable CaO (by citric acid), %	Water-soluble CaO, %	$\frac{P_2O_5\ ass}{P_2O_5\ gen}$ (by Trilon B, %	$\frac{P_2O_5\ ass.}{P_2O_5\ gen.}$ (by citric	$\frac{CaO\ Water\text{-}soluble}{CaO\ gen}$ %	Granule strength, MPa
Using a 70% ammonium nitrate solution at 70°C											
1:0,1	29,28	3,05	2,77	2,86	5,21	4,87	0,84	90,82	93,78	16,12	6,89
1:0,3	22,81	6,61	5,05	5,72	11,61	10,74	1,08	76,4	86,54	9,30	5,31
1:0,5	18,23	9,27	6,84	7,8	15,73	14,03	1,28	73,79	84,14	8,14	4,76
1:0,7	15,28	10,18	6,25	8,13	18,88	15,10	1,10	61,39	79,87	5,83	3,69

Using a 85% ammonium nitrate solution at 70ºC											
1:0,1	29,41	2,96	2,7	2,8	5,68	5,36	1,02	91,22	94,59	17,96	8,02
1:0,3	22,88	6,66	5,26	5,85	11,68	10,95	1,48	78,98	87,84	12,67	7,81
1:0,5	18,35	9,05	6,88	7,8	16,03	14,63	1,55	76,02	86,19	9,67	6,84
1:0,7	15,26	9,18	6,0	7,56	19,51	15.8	1,31	65,36	82,35	6,71	4,23

Table 2

The composition of the products of the interaction of Khojakul phosphorous with carbamide melt

Mass ratio $N:P_2O_5$	N, %	P_2O_5 general., %	Assimilable P_2O_5 (by Trilon B, %	Assimilable P_2O_5 (by citric acid), %	CaO general., %	Assimilable CaO (by citric acid), %	$\frac{P_2O_5 \text{ ass}}{P_2O_5 \text{ gen}}$ (by Trilon B, %	$\frac{P_2O_5 \text{ ass.}}{P_2O_5 \text{ gen.}}$ (by citric acid), %	Granule strength, MPa
1:0,1	37,19	4,22	3,41	3,6	7,70	6,99	80,81	85,31	3,89
1:0,3	26,82	8,89	6,68	7,23	14,0	11,59	75,14	81,33	7,77
1:0,5	20,92	10,65	6,80	7,58	18,09	14,07	63,85	71,17	8,1
1:0,7	17,29	12,32	7,6	8,23	20,80	15,57	61,69	66,79	10,24

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Rezyume: *Мақолада Қорақалпоқ желвакли фосфорит унини аммоний нитрати эритмаларида 70°С ҳароратда ва карбамид суюқланмаси билан кимёвий фаоллаштириш жараёни ўрганилди. Ушбу реагентларнинг фосфат хомашёсининг тузилиши ва хусусиятларига таъсирига комплекс таҳлил ўтказилди.*

Резюме: *В статье исследован процесс химической активации каракалпакской желваковой фосфоритовой муки в растворах нитрата аммония при температуре 70°С и расплаве карбамида. Проведен комплексный анализ влияния данных реагентов на структуру и свойства фосфатного сырья.*

Калит сўзлар: *аммоний нитрати эритмаси, карбамид суюқланмаси, кимёвий фаоллаштириш, желвакли фосфорит, NP-ўғитлари, гранулаларнинг таркиби ва мустахкамлиги*

Ключевые слова: *раствор нитрата аммония, расплав карбамида, химическая активация, желваковый фосфорит, NP-удобрения, состав и прочность гранул.*

SOLUTIONS FOR PROVIDING HIGH-QUALITY DRINKING WATER TO THE POPULATION IN REMOTE SETTLEMENTS OF KARAKALPAKSTAN

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Summary: *The article examines the shortage of drinking water in the Aral Sea region and analyzes Singapore's experience in water management.*

Key words: *Aral Sea region, landscape architecture, water resources, "green" technology, Singapore, "NEWater"*

The shortage of drinking water is one of the major global problems of our time, as water is a fundamental natural resource essential for life. This issue is particularly acute in the northwestern districts of Karakalpakstan, where extreme climatic conditions prevail. The policies of the Soviet regime led to a large-scale ecological disaster in the Aral Sea region.

Water availability in the region is influenced by both the scarcity of water resources and environmental factors. Contaminated drinking water has contributed to the deterioration of the health of many local residents. The water shortage has complicated agricultural work, crop cultivation, tree planting, gardening, as well as landscaping and urban improvement projects in villages, towns, and cities.

The government is carrying out large-scale efforts to alleviate this severe ecological situation in the Aral region. Special measures are being implemented in Uzbekistan to address water scarcity, and foreign experience in this area is being studied.

During the state visit of the President of the Republic of Uzbekistan to Singapore, promising agreements were reached on cooperation in the fields of "green" technologies, urban planning and construction, public services, and municipal management. Singapore's experience in rational water management and the use of water-saving technologies deserves special attention [1].

Priority areas of cooperation include the implementation of advanced "green" technologies and digital solutions, as well as the improvement of urban infrastructure and communication systems. It should be noted that Singapore is one of the most developed centers in Asia and a global leader in the implementation of modern technologies. Despite the almost complete absence of natural water resources, the country's extensive experience in water supply management attracts significant interest in Uzbekistan.

Currently, the country has an efficiently functioning urban water supply system known as the "Four Taps." Water from the "first tap" comes from local water sources, the second tap supplies water imported from Malaysia, the third tap is for the reuse of treated wastewater, and the fourth tap is for desalinated seawater.

Singapore also employs rainwater harvesting in its reservoirs. The reuse of wastewater has long been effectively implemented in the country. A specially established municipal utilities council applies the rare NEWater technology for wastewater treatment. The operation of these treatment facilities, managed by municipal services, provides 30% of the daily water supply (520,000 m^3 per day). Typically, after treatment, the water is supplied to industrial and manufacturing enterprises, while the remainder is directed to one of 17 large water reservoirs.

The water reclamation process occurs in three stages. First, fine particles, residues, and bacteria are removed using membrane filtration. Next, reverse osmosis is applied, and finally, the water is disinfected with ultraviolet light and hydrogen peroxide. As a result of these large-scale reforms in water management, Singapore obtains 30% of its required water through the NEWater program, 20% from seawater desalination, 10% from local water bodies, and only the remaining 40% from Malaysia.



According to studies, water treated using the NEWater technology fully meets WHO standards and is even suitable for cooking and drinking.

According to forecasts by companies responsible for public water supply, by 2060 they plan to double the volume of desalinated water through the launch of two new plants, triple the capacity of the NEWater facilities, and increase the share of water supply to 80% [2].

Thus, one of the main current problems in Karakalpakstan is the shortage of water and the deterioration of drinking water quality. One of the effective solutions for providing high-quality drinking water in the extreme settlements of Karakalpakstan is Singapore's experience, namely:

- the reuse of treated water;
- desalination of groundwater, which, in our opinion, can yield good results.

The reuse of wastewater in Karakalpakstan will help improve the environment by treating sewage from densely populated cities (e.g., Nukus and others), using it for irrigation, and planting various trees on vacant plots around the city. Karakalpakstan is extremely rich in groundwater. Therefore, we believe that this water can be utilized in the national economy through desalination.

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STUDYING THE EFFECTIVENESS OF THE HEKTAŞ FIBON, K.SUS. PREPARATION IN COMBATING SPIDER MITES IN COTTON

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Republican Scientific Research and Production Center for Termite Control of the Academy of Sciences of the Republic of Uzbekistan.

Summary: *In this study, the biological efficacy of the HEKTAŞ FİBON, k.sus. formulation against the spider mite on cotton was evaluated under the conditions of the "Ahmad ali dehqon ota" farm in the Urta Chirchik district of Tashkent Region. The biological efficacy of HEKTAŞ FİBON, k.sus. after treatment reached 65.7%, 79.7%, and 96.2% on the respective assessment days, fully meeting the established evaluation criteria. Based on the obtained results, HEKTAŞ FİBON, k.sus. can be recommended as an effective agent for controlling the spider mite on cotton.*

Keywords: *Spider mite, HEKTAŞ FİBON, cotton, acaricide, formulation, biological efficacy, pest control, field trial, Spiromesifen*

Introduction

Increasing cotton yield—as one of the agricultural crops grown in Uzbekistan, which is also important for export—requires constant attention from both producers and scientists. Significant losses in cotton yield and a decrease in the technological quality of cotton fiber are directly associated with the activity of harmful insects, in particular aphids, thrips, cotton bollworms, spider mites, and whiteflies.

In combating these pests, along with agrotechnical and biological methods, traditional chemical preparations are also widely used. However, certain shortcomings of these insecticides make it necessary to select and introduce into agricultural practice new, highly effective preparations produced by foreign manufacturers that meet modern ecological standards. The expansion of the range of insecticides is also associated with the need to overcome resistance that develops in certain pest populations as a result of prolonged use of a single preparation.

The purpose of this research is to study the results of the research work of HEKTAŞ FİBON, LLC "Qorasuv Agro-kimyo ta'minot" in Uzbekistan. (active substance - Spiromesifen 240 g/l) as a means of combating spider mites on cotton.

To achieve this goal, a large-scale field experiment was conducted on cotton at the "Ahmad Ali Dehqon Ota" farm in the Urtachirchik district of the Tashkent region, where the biological effectiveness of this preparation against this pest was studied.

Literature review Spider mites, cotton bollworms, and insects in cotton fields cause significant damage to cotton crops in Uzbekistan under favorable conditions for their development. Spider mites are one of the most serious pests of cotton in Uzbekistan. In some areas, spider mites can destroy more than half of the harvest, and in ordinary years, crop losses can reach 6-10%, and in some cases up to 14%. Along with crop losses, the spider mite also negatively affects the fiber quality of cotton. In heavily affected areas, the fiber shrinks by 1.0-1.5 cm, the seeds of heavily affected plants lose germination energy, and germination is slow and uneven. The spider mite is also harmful at the imago, nymph, and larval stages. In cotton-growing regions, 12-20 generations of spider mites develop in one season [1.5.6].

effectiveness of the preparation HEKTAŞ FİBON, k.sus. was tested in the cotton fields of the

H
E
K **Pest.** Spider mite. Occurs in the larval, nymph, and imago stages. On average, 25-30 pests T were identified on one leaf. [1.2].
A
Ş

F

Soil. Soils of the experimental plot - typical sierozem soils. Salinization is not observed as a result of irrigation. The depth of groundwater is 1.5-1.9 m.

Agrotechnology. Before the start of testing against the spider mite, two cultivations, two irrigations, chiseling, and inter-row cultivation were carried out. The first irrigation was carried out before cotton flowering, during the formation of vegetative organs of plants, the second - during the mass formation of bolls. [2].

Agroclimatic indicators. The territory of the "Ahmad Ali Dehqon Ota" farm, located in the Urtachirchik district of the Tashkent region, belongs to the Chirchik agroclimatic district. This region is located in the upper part of the Chirchik valley, close to its lower reaches. The border of the district runs along the watershed of the Ugam mountain range in the northwest, along the watershed of the Pskem mountain range in the east and crosses the Angren plateau, and along the watershed of the Chatkal mountain range in the south. The western boundary coincides with the boundary of the Tashkent agroclimatic region, with an elevation of about 600 m and borders the area with the distribution of gray soils. In the Chirchik agroclimatic region, the following agroclimatic zones are distinguished: at an altitude of 600-800 m - hot and dry, in the range of 800-1360 m - warm and humid, above 1360 m - cool and humid. When the sum of effective air temperatures exceeds 10°C, it reaches 4000°C in the lower part of the region and 1000°C at an altitude of 2300 m. In winter, the air temperature is quite variable, with warm weather alternating with sharp frosts. The frost-free period lasts from 191 to 218 days. The summer season is moderately hot. The absolute maximum air temperature is 44°C.

Results and their analysis

Testing of the preparation HEKTAŞ FİBON, k.sus. was carried out on the scale of a field experiment, which included a large experimental plot.

For each experimental variant, the area of the experimental plots was three times repeated, each 1.0 ha.

Experimental diagram.

1. HEKTAŞ FİBON, c.sus. - 0.4 l/ha
2. SELECTIN 1.8% EC. (standard) - 0.4 l/ha
3. Control - unprocessed

During the tests, the consumption rate of the working solution was 300 l/ha.

Duration and conditions for the use of the drug. Treatment of plants with working solutions of preparations was carried out in the second ten days of July in the morning hours, with an air temperature of 25°C, wind speed of 1-2 m/s, relative humidity of 30%, without precipitation.

The preparation was applied to the cotton fields with a working solution by spraying on a tractor sprayer OVX-28.

Conducting calculations. The number of pests in the experimental plots was recorded on days 3, 7, and 14 before and after treatment with working solutions of preparations in accordance with the requirements of the "Methodological Instructions..." and the working program.

Test results and analysis of the preparation. The percentage of pest decline is accepted as a criterion for biological effectiveness. This indicator was assessed by comparing the effectiveness of the direct action of the drug with the control, depending on the type of pest and the approved methodology. For a positive assessment of the drug in the fight against spider mites, the biological effectiveness should be at least 95% or higher (methodological guidelines..., 1986, 2004) [4].

Biological effectiveness was calculated using the Abbott formula, where:

$$C = \frac{Aв - Ba}{Aв} \times 100$$

C - biological effectiveness in the percentage of pest number reduction with correction of control;

A - number of spider mites before treatment in the experiment;

a - live spider mites after treatment in the experiment;

V - the number of live spider mites in the previous count in the control;

v - the number of live spider mites in subsequent counts in the control.

The results of calculating the biological effectiveness of the preparation HEKTAŞ FİBON, k.sus. and the standard are presented in the table. Analysis of the biological effectiveness values of the studied and reference preparations at the applied consumption rates led to the following conclusion:

The biological effectiveness of the drug against spider mites HEKTAŞ FİBON, c.sus. at a rate of 0.4 l/ha from the third to the fourteenth day was 65.7; 79.7 and 96.2% respectively. For the reference preparation, respectively, by days - 66.1; 78.9 and 95.2% biological effectiveness was observed (table).

Table

Biological effectiveness of HEKTAŞ FİBON, K.Sus. in controlling spider mites on cotton fields at the "Ahmad Ali Dehqon Ota" farm, Urtachirchik district, Tashkent region

№	Variant	Application rate, L/ha		Average number of pests per leaf (sample)				Biological effectiveness, by days		
		Preparation	Working solution	Before treatment	After treatment, by days					
					3	7	14	3	7	14
1.	HEKTAŞ FİBON, k.sus.	0,4	300	27,5	9,1	5,1	0,9	65,7	79,7	96,2
2.	СЕЛЕК ТИН 1,8% к.э. эталон	0,4	300	26,9	8,8	5,2	1,1	66,1	78,9	95,2
3.	Control	untreated	-	28,1	27,1	25,7	23,9			

In conclusion, the conducted tests HEKTAŞ FİBON, k.sus. When using the preparation (Spiromesifen 240 g/l) against spider mites at a rate of 0.4 l/ha on cotton, it was found that it meets the criteria for a positive assessment of the preparation on cotton.

In conclusion, this preparation can be used in large field experiments as an effective agent against spider mites. Treatment by the method of mass spraying on a tractor is recommended.

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Резюме: *Ушбу тадқиқотда Тошкент вилояти Уртачирчиқ туманидаги «Ahmad ali dehqon ota» фермер хўжалиги шароитида ғўзада ўргимчакканага қарши HEKTAŞ FİBON, k.sus. препаратининг биологик самарадорлиги ўрганилилган. HEKTAŞ FİBON, k.sus. препаратининг биологик самарадорлиги ишловдан кейин кунлар бўйича мос равишда 65,7; 79,7 ва 96,2% ни ташкил қилди ва қабул қилинган мезонларни тўлиқ қаноатлантиради. Олинган натижалардан келиб чиқиб, HEKTAŞ FİBON, k.sus. препарати ғўзада ўргимчакканага қарши самарали восита сифатида тавсия этилиши мумкин.*

Резюме: *В данном исследовании в условиях фермерского хозяйства «Ahmad ali dehqon ota» Уртачирчикского района Ташкентской области была изучена биологическая эффективность препарата HEKTAŞ FİBON, k.sus. против паутинного клеща на хлопчатнике. Биологическая эффективность препарата HEKTAŞ FİBON, k.sus. после обработки составила соответственно 65,7; 79,7 и 96,2% по дням учёта и полностью соответствовала установленным критериям оценки. Полученные результаты показывают, что препарат HEKTAŞ FİBON, k.sus. может быть рекомендован в качестве эффективного средства против паутинного клеща на хлопчатнике.*

Калит сўзлар: *Ўргимчаккана, HEKTAŞ FİBON,Ғўза Акарицид, препарат, , Биологик самарадорлик, Зараркунандага қарши кураш, Дала тажрибаси, Spiromesifen*

Ключевые слова: *Паутинный клещ HEKTAŞ FİBON, хлопчатник, акарицид, препарат, биологическая эффективность, борьба с вредителями, полевой опыт*, Spiromesifen

SELECTION PRINCIPLES FOR PLANTS IN UNFAVORABLE CLIMATIC ZONES

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Summary: *The aim of this research is to study innovative foreign and local experiences in landscaping areas with unfavorable climatic conditions, and based on these findings, to develop recommendations for selecting plants adapted to the harsh climatic regions of Karakalpakstan.*

Key words: *Climatic conditions, Aral Sea, recommendations, landscape architecture, Japanese quince.*

The aim of this research is to study innovative foreign and local experiences in landscaping in areas of the population that face unfavorable climatic conditions, and based on this, to develop recommendations for selecting plants suited to the climate of Karakalpakstan's unfavorable areas.

The geographic climate conditions of Karakalpakstan present specific ecological issues for plant cultivation in unfavorable regions, such as the movement of desert sands and dust storms, the decreasing biodiversity of plant life, and challenges in creating and planning landscapes, which ultimately worsen social conditions. To address these issues, local and foreign experiences related to this field have been studied, their essence revealed, and recommendations developed for applying these experiences to solve regional problems. Proposals are given for stopping the movement of sand carried by strong winds from deserts over plains and populated areas, reinforcing desert soils, selecting and cultivating plants that can turn deserts into forested areas, and creating vegetable gardens under desert conditions, thus improving the ecology of villages and cities located in these deserts and plains while enhancing their landscapes. Improving ecological conditions, plant cultivation in unfavorable regions, scientific articles and reports, trees, shrubs, climbing plants (vines), flowers, herbaceous plants.

Main Part. Introduction. This article addresses critical issues regarding selecting plants for Karakalpakstan's unfavorable climatic zones and focuses on finding solutions. Decree No. 132, dated February 19, 2019, by the Cabinet of Ministers of the Republic of Uzbekistan on intensifying measures for establishing "green cover" – protective forests in areas where water has dried up at the bottom of the Aral Sea; the Presidential Decree No. PF-5611 dated January 5, 2019, regarding additional measures for rapidly developing tourism in Uzbekistan; speech by the President during a video-selective meeting on social-economic development concerning Karakalpakstan on November 10, 2020; Presidential Decree No. PF-60, dated January 28, 2022, regarding "The Development Strategy of New Uzbekistan for 2022-2026," as well as other relevant regulatory documents, highlight tasks that this research aims to address.

The research method follows a standard format. It includes studying foreign and local experiences related to topics and challenges and their solutions through internet materials and practical observations. It also involves generalizing findings to develop proposals aimed at resolving the aforementioned issues. The Aral Sea region is considered one of the most unfavorable areas in our republic concerning plant cultivation due to its natural climatic conditions and soil characteristics, which pose numerous challenges in shaping plant life. To resolve this issue, studying innovative foreign and local experiences in landscaping within population centers facing adverse climatic conditions holds significant importance.

Landscape architecture predominantly utilizes ornamental plants, which include trees, shrubs, climbing plants (vines), flowers, herbaceous plants, and ground-covering species. Trees consist primarily of woody plants, including both trees and shrubs. Trees comprise three parts: roots, a single trunk that rises from the ground, and the primary part – leafy branches or shoots above it. In shrubs, unlike trees, there is no single trunk; they mainly consist of two parts: the underground roots and numerous slender stems that grow above the ground, along with leafy branches attached to them. Trees grow taller than shrubs, live longer, and are sturdier. However, it is difficult to draw a clear

boundary between trees and shrubs because some tall shrubs, such as the buffaloberry or myrtle, can grow like short trees, while some low trees may have heights similar to those of tall shrubs.

All trees and shrubs are considered perennial plants, and they are divided into evergreen and deciduous groups. Evergreen trees and shrubs can be further classified into coniferous and broadleaf types. Coniferous types always have needle-like leaves and differ from broadleaf trees and shrubs by producing cones instead of flowers during the flowering period. Coniferous trees that grow in Uzbekistan include Eastern biota, thorny juniper, blue juniper, Oriental cypress, swamp cypress, Virginian juniper, Zarafshan juniper, Crimean pine, common pine, Eldar pine, and Austrian black pines. Evergreen broadleaf ornamental trees include magnolias and ginkgos. Evergreen shrubs in Uzbekistan include Turkistan juniper, Japanese barberry, evergreen boxwood, and tree-like western arborvitae. The number of deciduous ornamental trees and shrubs is large and diverse.

The natural biological characteristics of trees and shrubs include their height, external appearance, shape and color, density of branches and foliage, flowering period, flower color, drought resistance, and lifespan. Young trees are classified according to their height into three categories [1]:

1. Trees of the first category have a height of 20 meters or higher. Typically included are thorny junipers, common pines, Crimean pines, white willows, white poplars, sycamores (plane trees), common oaks (English oaks), cultivated mulberries (black mulberries), large-leaved linden (basswood), etc.
2. Trees in the second category range from 10 to 20 meters tall. Examples include Eldar pine, steppe mulberry (Morus), junipers (junipers), false chestnut (Aesculus), western arborvitae (Thuja occidentalis), and American black locusts (Robinia pseudoacacia), among others.
3. Trees in the third category range from 5 to 10 meters tall. Examples include Canadian spruce (Picea glauca), Lenkoran acacia (Albizia julibrissin), ginkgo biloba (Ginkgo biloba), catalpa (Catalpa bignonioides), elm tree species (Ulmus minor), hawthorn species (Crataegus), and Japanese sophora, among others.

Trees shorter than 5 meters can be classified according to their ornamental characteristics as a group of shrubs with heights ranging from 0.5 to 5 meters. Shrubs are further divided into three groups based on height:

- Tall shrubs (2–5 m): common junipers, Bundenezh shinigami shrub species like Syringa vulgaris or lilacs, among others;
- Medium-height shrubs (1–2 m): ornamental peonies like Paeonia lactiflora or Ligustrum, among others;
- Low shrubs (0.5–1 m): Kazakh acacia species like Robinia pseudoacacia or Mahonia aquifolium.

Among trees, some prefer sunlight—meaning they cannot grow well in shaded areas—such as birches (Betula), oaks (Quercus), ash-leaved maples (Acer spp.), or Fraxinus angustifolia; meanwhile, there are also shade-tolerant types, such as horse chestnut (Aesculus hippocastanum) or linden trees (Tilia).

A quick method to achieve the ornamental effect is by planting fast-growing trees and shrubs in the designated area. Fast-growing plants include eucalyptus species like Eucalyptus globulus, black poplar, pyramid-shaped poplars, Canadian poplar, balsam poplar, trembling aspen, Gleditsia triacanthos, elms like Ulmus minor, ash-leaved maple; weeping willows; green ashes like Fraxinus pennsylvanica; common pines such as Pinus sylvestris; white acacias like Robinia pseudoacacia, etc. There are also plants with wide-spreading roots suitable for stabilizing soil on sloped terrain, such as field maples like Acer campestre or Tataria acacias widely distributed across regions; these include narrow-leaved hawthorn types, Crataegus monogyna, among others.

In the conditions of Uzbekistan, it is important to take into account the moisture (water) sensitivity of trees and shrubs. In this respect, they can be divided into three groups [2]:

1. Moisture-demanding plants: swamp cypress, ivalar, lapina, turanga poplar, black alder, and bosh.

2. Plants with moderate humidity requirements: Amur cork tree, downy birch, smooth elm, sycamore, Norway maple, small-leaved linden, magnolia, common ash, prickly spruce, silver spruce, berry yew.

3. Plants with low demand for moisture: Japanese quince, island elm, white acacia, amorpha, common trouser, hawthorn, glidichia, beta, prickly spruce, Virginia juniper, Cossack juniper, Crimean pine, Scots pine.

Trees and shrubs resistant to saline soils include saltwort, ginseng, tamarisk, saksaul, and soapberry, which have the ability to grow in chlorinated saline soils [3].

Ash, linden, laurel, European olive, etc., are demanding trees even on calcareous soil. Aylant (Chinese ash) can also grow in oil-contaminated soil. Therefore, if it is not possible to improve the soil when transplanting plants, the most correct approach is to choose a plant suitable for the existing soil.

Trees and shrubs growing on salty soils include the above-mentioned ash, linden, laurel, European olive, and aylant.

It is known that trees and bushes also protect areas from external environmental influences. At such times [4]:

To protect against noise, use Norway maple, common birch, small-leaved linden, common elm, Siberian larch, Tatar honeysuckle, yellow acacia, Siberian hawthorn.

To protect against gases, use Pennsylvania maple, Leshyna, horse chestnut, Manchurian, honey locust, gray or black poplar, Canadian poplar, white acacia, biota, white mulberry, Virginia juniper, Cossack juniper, oddium privet, felt linden, and others.

For protection from dust, it is recommended to choose elm, weeping white willow, horse chestnut, gray maple, Tatarian maple, field maple, Canadian poplar, Bolle poplar, white mulberry, green and common ash, yellow acacia, oddium privet, narrow-leaved oleaster, and Van-Gutt's spirea.

In order to block the wind and provide shade, it is recommended to choose densely branched trees such as common oak, horse chestnut, Norway and field maple, Odd spruce, English oak, honey locust, magnolia, small-leaved linden, etc.

When choosing plants for planting in groups, it is necessary to pay attention to their architectural-artistic features: height, external shape, color, and leaf characteristics. Especially, the height and appearance of the trees in the group should be in contrast or in nuanced relationships. [3]

- Compatibility of the selected plants with the functional goals of the greened open environment. For example, plants planted along the sidewalk of the main street must, first of all, be resistant to traffic noise, gas, and dust, create cool shade along the sidewalk, and provide an attractive landscape. Therefore, for the sidewalk, it is necessary to choose trees with a wide appearance, closely spaced branches, resistance to gas, dust, and noise, and, at the same time, an appealing aesthetic. On the other hand, for greening the promenade around a monument or memorial, the main green material should be a parterre-type decorative lawn or flower plants, combined with some low shrubs.
- Compatibility of the ecological characteristics of plants with the conditions of the environment where they are planted. It is necessary to consider the compatibility of newly selected plants with pre-existing decorative trees (if they are left) or the mutual biological compatibility of selected trees and shrubs; that is, ensuring that they do not harm each other's growth.

It is also necessary to take into account whether the selected plant (tree or shrub) is suitable for the natural-climatic conditions of the region.

Knowing the flowering time and flowering period of woody plants also greatly helps in choosing and using them appropriately: from early spring to the end of February–March: forsythia, Canadian redbud; in spring (April–May): roses; in summer (June–August): Albizia, Broussonetia splendens, Hibiscus catalpa, Hydrangea, Sophora, etc.; in autumn (September–November): Marchinian rose, lilac spirea, hibiscus [2].

In order to use a particular species in landscaping, it is necessary to know its negative characteristics in addition to its positive qualities. These include plants contaminating the area with

their fruits (poplar, mulberry), contaminating the area with their needles or leaves (plane tree, honey locust, yucca), or having poisonous fruits and leaves (Cossack juniper). It is forbidden to plant these species in kindergartens, schools, and children's parks.

When forming groups, it is necessary to take into account the growth and viability of the plants selected for the group; that is, fast-growing types of trees should not be planted next to slow-growing ones, and sun-loving plants should not be planted under shade trees.

It is important to use trees and shrubs in project work, to choose them for planting and creating green compositions, and to study and know their decorative qualities. One of these features is their natural shape — the wind-resistance and denseness of branches.

In order to fully and effectively use all the potential of planted plants, it is necessary to observe the following basic principles when choosing them [3]:

Landscape trees are generally divided into two groups according to their natural shape and appearance: geometric and non-geometric trees. The first group includes pyramidal, columnar (carrot-shaped), egg-shaped, spherical, and oval trees, while the second group includes branching, umbel-like, umbrella-like, tent-like, double, and scattered trees.

The shapes of trees and shrubs change depending on their age and the seasons. They can also be given various artificial shapes through pruning, i.e., cutting off their branches. In creating green compositions, in addition to the natural forms and height of plants, the density, size, pattern, and color of branches and leaves are also important. Beyond their leaves, it is important to pay attention to the decorative qualities of their flowers when choosing woody plants for landscaping. Among trees, magnolia, false chestnut, and acacia; among shrubs, Japanese quince, roses, lilac (siren), and forsythia have the ability to bloom beautifully and effectively.

Discussion part of the study: The article examines the selection of plants for planting in areas with unfavorable climate and soil. The practical importance of the research results is highlighted by the fact that, in the project organizations of our republic and Karakalpakstan, it is of great importance to green the areas of settlements with extreme climates, to use these results in developing project proposals for urban planning and landscape architecture for settlements in such conditions, and to implement them in practice.

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Rezyume: *Ushbu tadqiqotning maqsadi noqulay iqlim sharoitlariga ega hududlarni ko‘kalamzorlashtirish bo‘yicha innovatsion xorijiy va mahalliy tajribalarni o‘rganish hamda shu asosda Qoraqalpog‘istonning og‘ir iqlimli mintaqalariga moslashgan o‘simliklarni tanlash yuzasidan tavsiyalar ishlab chiqishdan iborat.*

Резюме: *Цель данного исследования – изучение инновационного зарубежного и местного опыта по озеленению территорий с неблагоприятными климатическими условиями и, на основе этого, разработка рекомендаций по подбору растений, приспособленных к климату неблагоприятных районов Каракалпакстана.*

Kalit so‘zlar: *Iqlim sharoitlari, Orol dengizi, takliflar, landshaft arxitekturasi,Yapon bexisi.*

Ключевые слова: *Климатические условия, Аральское море, ландшафтная архитектура, Японская айва.*

BIOECOLOGICAL CHARACTERISTICS OF DOMINANT COLEOPTERA SPECIES IN THE USTYURT PLATEAU (KARAKALPAKSTAN SECTION) AND INTEGRATED CONTROL MEASURES AGAINST THEM

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Summary: In this article, the Ustyurt Plateau (Karakalpakstan section) experiences severe aridification due to the Aral Sea crisis and climate change, leading to degradation of natural vegetation and increased pest pressure from Coleoptera (beetles). This study identifies the taxonomic composition, distribution, trophic links, and bioecological features of dominant Coleoptera species in natural and anthropogenically transformed habitats. Four key dominant pest species were recorded for the first time in the region: *Xylotrechus* (Rusticoclytus) *rusticus* (longhorn beetle on shrubs), *Trachypteris picta* (green buprestid), *Anobium pertinax* (wood-boring anobiid), and *Blaps lethifera* (darkling beetle). Their trophic preferences on herbaceous, semi-shrub, shrub, and tree plants (e.g., *Haloxylon aphyllum*, *Tamarix hispida*, *Sophora japonica*, *Aesculus hippocastanum*) were established. Integrated control trials using the entomopathogenic fungus *Beauveria tenella* (VD-85 strain) and the chemical insecticide Entolucha (20% s.k.) achieved 90.6 % biological efficacy under laboratory and field conditions. Physical-mechanical preventive measures also showed high effectiveness. The results provide a scientific basis for monitoring and ecologically safe pest management in arid ecosystems.

INTRODUCTION

The desiccation of the Aral Sea and progressive aridification of the Ustyurt Plateau have caused dramatic changes in natural ecosystems, including dieback of herbaceous, semi-shrub, and shrub vegetation. These processes have triggered outbreaks of phytophagous insects, particularly Coleoptera, which accelerate degradation of plant cover and threaten forage resources for livestock farming. The problem is exacerbated by anthropogenic transformation of landscapes (overgrazing, afforestation with saxaul, etc.). Despite global and national efforts (e.g., Uzbekistan's "Yashil makon" program and Aral Sea restoration initiatives), there is a lack of detailed data on the faunistic composition, dominance structure, and control strategies for Coleoptera pests in the Karakalpakstan section of Ustyurt. This study aims to investigate the bioecological characteristics of dominant Coleoptera species and develop integrated pest management approaches aligned with national priorities in ecology and sustainable agriculture.

EXPERIMENTAL RESEARCH

Field surveys were conducted in 2021–2025 across natural (desert-steppe, saxaul-dominated) and anthropogenically transformed (pastures, afforested areas) habitats of the Ustyurt Plateau (Karakalpakstan). Entomological collections were made using standard methods: sweeping nets, pitfall traps, light traps, and hand collection from host plants. A total of 52 Coleoptera species belonging to 14 families, 19 subfamilies, and 45 genera were identified. Taxonomic identification followed keys by Plavilshchikov (1994), Nikolaev & Kolov (2005), Izhikevich & Nikitsky (2005), and others. Dominance was assessed using abundance indices and frequency of occurrence. Trophic links were studied by direct observation of feeding and rearing larvae/adults on host plants. Laboratory bioassays evaluated the efficacy of the entomopathogenic fungus *Beauveria tenella* (VD-85 strain) and the insecticide Entolucha (20% s.k.) on dominant species. Field trials were carried out in 2024–2025. Data were statistically analyzed using Biostat 2007 software.[1,2]

RESEARCH RESULTS

A total of 52 Coleoptera species were recorded, with four species identified as dominant pests for the first time in the region:

- *Xylotrechus (Rusticoclytus) rusticus* (Cerambycidae) – feeds on shrubs (*Tamarix*, *Haloxylon*);
- *Trachypteris picta* (Buprestidae) – damages green parts of semi-shrubs;

- *Anobium pertinax* (Anobiidae) – wood-borer of trees and dead wood;
- *Blaps lethifera* (Tenebrionidae) – soil-dwelling, damages roots and seedlings.

These species showed high abundance in degraded pastures and afforested sites. Trophic specialization was confirmed: *X. rusticus* and *T. picta* prefer *Haloxylon aphyllum* and *Tamarix hispida*; *A. pertinax* attacks dead wood of *Aesculus hippocastanum*, *Sophora japonica*, etc.; *B. lethifera* is polyphagous on soil surface. Phenological calendars revealed peak activity in May–July (larval feeding) and August–September (adult emergence).

The fact that most of the insects of the genus Coleoptera (Linnaeus, 1758) of the Karakalpak branch of the Ustyurt Plateau live secretly inside plant stems during larval and adult stages, the formation of improved nests creates some difficulties in carrying out improved preventive control measures against them. From this point of view, during the experiments, taking into account these circumstances, it was deemed expedient to check the biological effectiveness of control in laboratory conditions to ensure the complete extinction of the dominant species of the genus Coleoptera (Linnaeus, 1758) *Xylotrechus* (Rusticoclytus) *rusticus* (Linnaeus, 1758) - shrub beetle, *Trachypteris picta* (Pallas, 1773) - green glossy beetle, *Anobium pertinax* (Linnaeus, 1758) - building wood rodent, *Blaps lethifera* (Mars., 1802) - broad-chested soil beetle.[3,4]

Biological agent - entomopathogenic microorganism strain VD-85 of the fungus *Beauveria tenella* (Patent No IDP 04692 dated 23.03.2001). In the conditions of Uzbekistan, it was isolated from the Asian locust disease by A.A. Nurzhanov and others. This biological agent, the preparation "Biofirin" prepared on the basis of the VD-85 strain of the fungus *Beauveria tenella*, was used in laboratory conditions to control the dominant species of the genus Coleoptera (Linnaeus, 1758) *Xylotrechus* (Rusticoclytus) *rusticus* (Linnaeus, 1758) - bush beetle, *Trachypteris picta* (Pallas, 1773) - green glossy beetle, *Anobium pertinax* (Linnaeus, 1758) - building wood rodent, *Blaps lethifera* (Mars., 1802) - broad-chested soil beetle.

In this case, plant samples initially severely damaged by insect pests were stored in mesh screens at room temperature ($+20^0$C, $+22^0$C) and observation was carried out for 3 months, then adult insects from the plants were placed in desiccators. Also, in early spring, in field conditions, insect collection was carried out by wrapping adhesive films on the surface of plants. Dominant species were isolated from all collected insect samples and used in laboratory experiments.

In conclusion, it was noted that the preparation "Biofirin" prepared on the basis of the VD-85 strain of the entomopathogenic microorganism fungus *Beauveria tenella*, was highly effective against the dominant species of *Xylotrechus* (Rusticoclytus) *rusticus* (Linnaeus, 1758) - bush beetle, *Trachypteris picta* (Pallas, 1773) - green glossy beetle, *Anobium pertinax* (Linnaeus, 1758) - house wood rodent, which amounted to 88%-91%, and the average biological effectiveness was 73.5% compared to *Blaps lethifera* (Mars., 1802) - broad-chested soil beetle.[6,9]

Biological effectiveness of the biological preparation "Biofirin" against dominant species of insect pests of the genus Coleoptera (Linnaeus, 1758) of the Karakalpak branch of the Ustyurt Plateau under laboratory conditions.

№	Insect species	Preparation concentration (%)	Duration of the experiment, number of dead insects (in days)				Biological effectiveness (%)
			3	5	10	15	
1		**2**	**3**	**4**	**5**	**6**	**7**
1	*Xylotrechus rusticus*	0,001%	2,2±0,2	7,2±0,4	12,4±0,5	19,3±0,3	48,2%
		0,003%	3,1±0,2	7,9±0,3	13,7±0,4	25,2±0,9	63,0%
		0,005%	3,8±0,3	8,1±0,5	15,4±0,6	34,6±0,9	86,5%
2	*Trachypteris picta*	0,001%	2,1±0,1	7,5±0,6	13,2±0,6	17,2±0,5	43,0%
		0,003%	2,7±0,1	9,1±0,6	14,2±0,4	28,3±0,9	70,7%
		0,005%	4,1±0,3	9,9±0,8	15,6±0,9	35,2±0,9	88,0%
3	*Anobium pertinax*	0,001%	2,4±0,2	8,2±0,4	14,4±0,5	16,2±0,5	40,5%
		0,003%	2,9±0,2	8,7±0,4	15,6±0,9	30,4±1,0	76,0%
		0,005%	3,1±0,2	9,3±0,3	16,8±0,7	36,7±0,9	91,7%
4	*Blaps lethifera*	0,001%	1,5±0,3	5,4±0,6	10,3±0,6	13,3±0,4	33,2%
		0,003%	1,9±0,3	6,5±0,5	13,4±0,8	26,2±0,8	65,5%
		0,005%	2,2±0,1	8,2±0,6	15,9±0,8	29,4±0,9	73,5%
5	In control, living creatures		40,0±0,1				100%
P			<0,001	<0,01	<0,01	<0,01	<0,001

During the research, laboratory experiments were conducted, and based on a comparative analysis of the results obtained with the "Biofirin" preparation, chemical protection measures were applied against dominant pest insects belonging to the order Coleoptera (Linnaeus, 1758) in herbaceous, semi-shrub, and shrub plants of the flora of Uzbekistan in the Qoraqalpog'iston section of the Ustyurt Plateau.

The target pest species included *Xylotrechus* (Rusticoclytus) *rusticus* (Linnaeus, 1758) – longhorn beetle of shrub plants, *Trachypteris picta* (Pallas, 1773) – green shining beetle, *Anobium pertinax* (Linnaeus, 1758) – common furniture beetle, and *Blaps lethifera* (Mars., 1802) – broad-breasted darkling beetle.

For pest control, chemical preparations "Sermit" (10%) suspension emulsion, "Enjio" (24%) wettable powder, and "Entolucha" (20%) wettable powder were applied at a concentration of 0.005%.

The application of chemical preparations was carried out by dissolving them in water and spraying, which is widely practiced in many regions of the world in field areas and anthropogenically transformed sites to protect forage plants used in livestock farming from pests. The preparations penetrate plant tissues in fine droplets, remain within the plant body for 3–5 weeks, cause severe damage to all parts of the pest's body including chitin-synthesizing tissues, disrupt feeding processes, and strongly damage the lymph nodes and cuticle. Therefore, these preparations are widely used in preventive measures against pest insects of various crop types.

According to the experimental results, working aqueous solutions of the chemical preparations "Sermit" (10% suspension emulsion), "Enjio" (24% wettable powder), and "Entolucha" (20% wettable powder) at a concentration of 0.005% were applied by spraying against dominant pest species of four plant types in the plain. The target pests included *Xylotrechus* (Rusticoclytus) *rusticus* (Linnaeus, 1758) – longhorn beetle of shrub plants, *Trachypteris picta* (Pallas, 1773) – green shining beetle, *Anobium pertinax* (Linnaeus, 1758) – common furniture beetle, and *Blaps lethifera* (Mars., 1802) – broad-breasted darkling beetle. Observations were carried out for 3–15 days.

During the initial 3–10 days, the effectiveness of the preparations against insects was relatively weak; however, by the 15th day, a high mortality rate of pests was recorded.

Throughout the experiment, 40 insect specimens were used for each treatment variant. According to the obtained results, the effectiveness of the preparations was as follows. The highest efficacy was observed with "Entolucha" (20% wettable powder). Within 15 days, mortality rates were recorded as: *Anobium pertinax* (Linnaeus, 1758) – 86.0% (34.4 ± 0.6), *Trachypteris picta* (Pallas, 1773) – 83.0% (33.2 ± 0.6), *Xylotrechus* (Rusticoclytus) *rusticus* (Linnaeus, 1758) – 81.0% (32.4 ± 0.7), and *Blaps lethifera* (Mars., 1802) – 63.5% (25.4 ± 0.5). The overall mean biological efficacy of this preparation was 78.4%.

For the "Enjio" (24% wettable powder) preparation, the 15-day results showed mortality rates of 84.2% (33.6 ± 0.6) for *Anobium pertinax*, 80.7% (32.3 ± 0.5) for *Xylotrechus (Rusticoclytus) rusticus*, 78.5% (31.4 ± 0.5) for *Trachypteris picta*, and 65.5% (26.2 ± 0.4) for *Blaps lethifera*, with an average biological efficacy of 77.2%.

In the 15-day results of "Sermit" (10% suspension emulsion), lower mortality rates were observed: *Trachypteris picta* – 67.5% (27.0 ± 0.5), *Anobium pertinax* – 66.2% (26.5 ± 0.5), *Xylotrechus* (Rusticoclytus) *rusticus* – 63.0% (25.2 ± 0.4), and *Blaps lethifera* – 55.7% (22.3 ± 0.4), resulting in the lowest average efficacy of 63.1%.

Additionally, *Blaps lethifera* (Mars., 1802) consistently showed the lowest mortality rates across all three preparations, ranging from 55.7% to 65.5%.

In the control group (treated with water only), no insect mortality was observed during the 15-day period, with 100% survival (40.0 ± 0.1), which fully confirms that all recorded mortality was solely due to the effects of the applied chemical preparations.[9,10]

Biological effectiveness of chemical preparations against harmful insects of the dominant species of the genus Coleoptera (Linnaeus, 1758) of the Karakalpak branch of the Ustyurt Plateau under laboratory conditions.

№	Name of chemical preparations (0,005%)	Insects name	Duration of the experiment, number of dead insects				Biological effectiveness (%)
			3	5	10	15	
1		2	3	4	5	6	7
1	"Sermit (10%) sus. Emulsion"	*Xylotrechus rusticus*	3,1±0,1	6,3±0,3	11,2±0,4	25,2±0,4	63,0%
		Trachypteris picta	3,6±0,1	6,8±0,2	12,5±0,4	27,0±0,5	67,5%
		Anobium pertinax	3,9±0,2	7,0±0,4	14,2±0,5	26,5±0,5	66,2%
		Blaps lethifera	2,5±0,1	5,5±0,3	9,5±0,4	22,3±0,4	55,7%
2	"Enjio (24%) suspension powder"	-//-	4,2±0,2	7,2±0,4	14,1±0,5	32,3±0,5	80,7%
		-//-	4,8±0,2	8,5±0,4	14,9±0,5	31,4±0,5	78,5%
		-//-	5,2±0,2	8,8±0,4	15,2±0,6	33,6±0,6	84,2%
		-//-	3,5±0,1	5,7±0,3	11,4±0,4	26,2±0,4	65,5%
3	"Entolucha (20%) suspension powder"	-//-	4,8±0,3	8,3±0,4	15,5±0,5	32,4±0,7	81,0%
		-//-	5,2±0,3	8,9±0,5	15,9±0,4	33,2±0,6	83,0%
		-//-	5,6±0,2	9,0±0,4	16,4±0,7	34,4±0,6	86,0%
		-//-	4,4±0,2	5,9±0,3	11,9±0,5	25,4±0,5	63,5%
4	In control, living creatures		40,0±0,1				100%
5	P		<0,001	<0,001	<0,01	<0,01	<0,001

CONCLUSIONS

The Ustyurt Plateau (Karakalpakstan) hosts 56 Coleoptera species, with four newly recorded dominant pests (*X. rusticus, T. picta, A. pertinax, B. lethifera*) causing significant damage to forage and afforested plants. Climate aridification and anthropogenic pressure have increased pest outbreaks and expanded their trophic niches. Integrated control combining *Beauveria tenella* (biological) and Entolucha (chemical) provides 90.6% efficacy and is ecologically safer than broad-spectrum insecticides. Physical-mechanical preventive measures are highly effective and recommended for sustainable management in arid ecosystems. The obtained data support monitoring programs and contribute to national strategies for Aral Sea region restoration and biodiversity conservation.

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Rezyume: *Ustyurt tekisligi Qoraqalpog'iston bo'limida iqlim o'zgarishi va Orol dengizi qurishi natijasida tabiiy ekotizimning degradatsiyasi kuzatilmoqda. Ushbu tadqiqotda Coleoptera turkumining 52 turi aniqlangan bo'lib, ular orasida ilk bor qayd etilgan dominant zararkunandalar (Xylotrechus rusticus, Trachypteris picta, Anobium pertinax, Blaps lethifera) o'rganildi. Ularning oziqaviy birligi, tarqalishi va fenologiyasi tavsiflandi. Entomopatogen zamburug' (Beauveria tenella VD-85) va kimyoviy preparat (Entolucha 20%) yordamida 90.6% biologik samaradorlikka erishildi. Fizik-mexanik profilaktika choralari ham yuqori natija berdi. Natijalar qurg'oqchil hududlarda monitoring va ekologik xavfsiz kurash tizimini ishlab chiqish uchun asos bo'lib xizmat qiladi.*

Резюме: *В Каракалпакском отделе Устюртской равнины наблюдается деградация природных экосистем в результате изменения климата и высыхания Аральского моря. В данном исследовании было выявлено 52 видов отряда Coleoptera, среди которых были изучены впервые зарегистрированные доминантные вредители (Xylotrechus rusticus, Trachypteris picta, Anobium pertinax, Blaps lethifera). Описаны их кормовые единицы, распространение и*

фенология. С помощью энтомопатогенного гриба (Beauveria tenella VD-85) и химического препарата (Entolucha 20%) достигнута биологическая эффективность 90.6%. Физико-механические профилактические мероприятия также дали высокие результаты. Результаты послужат основой для разработки системы мониторинга и экологически безопасной борьбы в засушливых регионах.

Kalit so'zlar: *Ustyurt tekisligi, Coleoptera, dominant zararkunandalar, bioekologik xususiyatlar, integratsiyalashgan kurash, Beauveria tenella, Orolbo'yi, qurg'oqchilik.*

Ключевые слова: *Устюртская равнина, Coleoptera, доминантные вредители, биоэкологические особенности, интегрированная борьба, Beauveria tenella, Приаралье, засуха.*

THE INCIDENCE OF GALLSTONES AND BILIARY TRACT DISEASES AMONG THE POPULATION OF THE REPUBLIC OF KARAKALPAKSTAN AND ITS CORRELATION WITH ENVIRONMENTAL FACTORS

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Summary: *This research examined the patterns of gallstone and biliary tract disease outbreaks in the Republic of Karakalpakstan between 2009 and 2021, as well as how these outbreaks relate to environmental factors, particularly chemical contamination of drinking water. The analysis revealed a correlation between the levels of contamination of open water reservoirs, tap water, and well water and morbidity rates using the Pearson correlation method and Student's t-test. The results showed that as the level of chemical contamination of water increases, the incidence of gallstones and biliary tract diseases also increases. The highest correlation was noted with well water pollution (r = 0.66). No statistically significant correlation was found with air pollution. In the Aral Sea region, especially in the northern, western, and central zones of Karakalpakstan, providing the population with quality drinking water can have a significant positive impact on reducing these diseases.*

Key words: *Aral Sea region, drinking water, chemical pollution, gallstones and biliary tract diseases, correlation.*

INTRODUCTION. The Republic of Karakalpakstan's population's health has been seriously threatened in recent years due to the ecological disaster in the Aral Sea region. As a result of the depletion of water resources and the pollution of air, soil, and water, a trend towards an increase in various chronic diseases is observed. One of them is gallstones and biliary tract diseases. The causes of these diseases are numerous, and one of the main factors is the poor quality and disruption of the chemical composition of drinking water. In Karakalpakstan, water sources in most cases rely on rivers and groundwater flowing through the dried-up areas of the Aral Sea. The salts, metals, and other harmful elements in their composition disrupt metabolic processes in the body, creating conditions for the formation of gallstone.

MATERIALS AND METHODS. In scientific sources, it is noted that the high content of nitrates, sulfates, heavy metals (in particular, iron, manganese, lead) in water negatively affects the function of the liver and biliary tract. Meanwhile, water resources in the Aral Sea region are saline and polluted, which exacerbates the incidence of diseases. Previous studies have shown that the mineralization of drinking water reaches 2-3 g/l, which is 3 times higher than the physiological norm. This increases the risk of gallstone formation in the long term. The research was conducted in the period from 2009 to 2021 in the Western, Northern, Central, and Southern zones of the Republic of Karakalpakstan. The data were taken from the statistical database of the Ministry of Health of the Republic of Karakalpakstan. Based on disease indicators per 100,000 population:

Annual dynamics of gallstones and biliary tract diseases; The correlation of drinking water (open reservoirs, tap water, well water) with the level of chemical pollution was determined and assessed using Pearson's correlation coefficient (r) and Student's t-test.

RESULTS AND DISCUSSION. In the course of the study, the indicators of the overall prevalence of gallstones and biliary tract diseases in Karakalpakstan for the period 2009-2021 were analysed. If in 2009 the morbidity rate per 100,000 population was 0.49, then by 2021 this indicator increased to 0.80. During this period, there was a 1.6-fold increase in the number of diseases, which clearly shows the impact of environmental factors on health in the region.

In order to achieve clarity in illuminating the dynamics of gallstone disease, two five-year periods were separated from the period 2009-2021, consisting of 2011-2015 and 2016-2020, and their average five-year indicators were compared (Table 1).

Table 1

Indicators of gallstones and biliary tract diseases of the population of the Republic of Karakalpakstan by medical-geographical zones (per 100 thousand population)

By medical-geographical zones of cities and districts	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Muynak	0	0	0	0,69	0,17	0	0,03	0,03	3,03	1,7	2,95	0,84	0,83
Kungrad	1,7	0,12	0,49	0,03	0,04	0,11	0,09	0,06	0	0,09	0	0	0,08
Kanlikul	0,8	0,14	0,2	0,37	0,43	0,51	0,69	0,62	0,55	0,52	0,53	0,49	0,33
Shumanay	1,1	0,35	0,44	0,44	0,43	0,47	0,43	0,48	0,49	0,58	0,48	0,46	0,4
Western zone	0,9	0,15	0,28	0,38	0,27	0,27	0,31	0,3	1,02	0,72	0,99	0,45	0,41
Takhtakupir	0,13	0,23	0	0,23	0,23	0,18	0,49	0	0,23	0,2	0,22	0,22	0,22
Karauzek	0,3	0,09	0	0,04	0,04	0,06	0,18	0,12	0,31	0,27	0,3	1,04	0,3
Chimbay	0,3	0,18	0,28	0,26	0,04	0	0,05	0,17	0,12	0,18	0,16	0,1	0,18
Kegeyli	0,1	0,1	0,08	0,25	0,13	0,12	0,12	0,14	0,02	0,02	0,02	0,08	0,11
Northern zone	0,21	0,15	0,09	0,2	0,11	0,09	0,21	0,1	0,17	0,17	0,18	0,36	0,2
Nukus city	0,28	0,12	0,1	0,11	0,21	0,25	0,19	0,31	0,3	0,35	0,29	0,38	2,9
Nukus district	0,1	0,29	0,16	0,25	0,27	0,11	0,04	0,14	1,53	0	1,47	1,5	0,95
Khodjeyli	0,2	0,19	0,33	0,4	0,32	0,24	0,25	0,37	0,6	0,55	0,58	0,57	0,1
Takhiatash	0,13	0	0,04	0	0	0	0	0	0	0,25	0	0	0
Central zone	0,18	0,15	0,16	0,19	0,2	0,15	0,12	0,21	0,61	0,3	0,59	0,61	0,99
Amudarya	6,9	1,25	1,31	1,71	0,79	0,66	0,74	0,86	1,13	1,28	1,09	1,13	1,29
Beruni	0,42	0,14	0,09	0,11	0,1	0,12	0,13	0,11	0,08	0,04	0,07	0,12	0,06
Ellikkala	0,08	0,17	0,19	0,22	0,52	0,58	0,57	0,6	0,27	0,56	0,26	0,27	0,27
Tortkul	0,51	0,13	0,15	0,14	0,05	0,11	0,15	0,29	0,23	0,16	0,22	0,12	0,4
Southern zone	1,98	0,42	0,45	0,56	0,37	0,37	0,4	0,46	0,43	0,51	0,41	0,41	0,51
KR	0,49	0,26	0,3	0,35	0,26	0,26	0,27	0,33	0,41	0,4	0,4	0,39	0,80

Table compiled by the author based on data from the Ministry of Health of the Republic of Karakalpakstan

Note. 1. Bozatau District was abolished in 2004 and re-established in 2019. 2. The city of Takhiatash was a city subordinate to the Republic of Karakalpakstan until 2013. In 2013, the city of Takhiatash was incorporated into the Khodjeyli district. In 2017, part of the territory of the Khodjeyli district was transformed into the Takhiatash district.

Between 2009 and 2021, Pearson's method was used to calculate the correlation between the chemical pollution of drinking water (water from open reservoirs, tap water, and well water) and the markers of gallstones and biliary tract diseases. The reliability of the obtained results was assessed using the Student's t-test. In 2011-2020, a direct average reliable correlation between the indicators of gallstones and biliary tract diseases and the level of chemical contamination of water in open water reservoirs was revealed in the Western zone itself r_{xy}=0.35 (with Student's t-test t=6.95 and p=0.95), while in the period 2009-2021, such a correlation was not found.

2009-2021 yillarda o‘t toshi va o‘t yo‘llari kasalliklari ko‘rsatkichlarining ochiq suv havzalari suvi kimyoviy ifloslanishi darajasi bilan to‘g‘ri kuchli haqqoniy korrelyatsion bog‘lanishi Markaziy zonada r_{xy}=0,77 (Styudent testi t=4,07 va p=0,95 bo‘lganda) aniqlangan bo‘lsa, shu davrda to‘g‘ri o‘rtacha haqqoniy bog‘lanish shu zonaning Nukus shahrida r_{xy}=0,45 (Styudent testi t=4,67 va p=0,95 bo‘lganda) va Nukus tumanida r_{xy}=0,37 (Styudent testi t=1,45 va p=0,8 bo‘lganda) aniqlandi. In 2009-2021, a direct strong reliable correlation between the indicators of gallstones and biliary tract diseases and the level of chemical contamination of water in open water reservoirs was revealed in

the Central zone r_{xy}=0.77 (with Student's t-test =4.07 and p=0.95), while a direct average reliable correlation was revealed in the same zone in the city of Nukus r_{xy}=0.45 (with Student's t-test t=4.67 and p=0.95) and in the Nukus district r_{xy}=0.37 (with Student's t-test t=1.45 and p=0.8). In the city of Nukus, a direct average reliable correlation between these two indicators r_{xy}=0.64 (with Student's t-test t=4.51 and p=0.95) was also found in the period 2011-2021.

In 2009-2021, a direct average correlation of the indicators of gallstones and biliary tract diseases with the level of chemical contamination of water in open water reservoirs was revealed in the Khodjeyli district of the Central zone r_{xy}=0.49 (with Student's t-test t=4.17 and p=0.95). In 2011-2020, a direct average reliable correlation of gallstones and biliary tract disease indicators with the level of chemical contamination of water in open water reservoirs was revealed in the Beruni district of the Southern zone r_{xy}=0.37 (with Student's t-test t=5.12 and p=0.95) (Table 2)

Table 2

Dynamics of gallstones and biliary tract diseases by medical-geographical zones (per 100 thousand population)

Zones	2011-2015	2016-2020	Increase/decrease
Western zone	0,3	0,7	+2.3 times
Northern zone	0,14	0,2	+42 %
Central zone	1,04	1,1	+6%
Southern zone	0,38	0,44	+16 %
Karakalpakstan	0,29	0,39	+34 %

The table was compiled by the author based on data from the Ministry of Health of the Republic of Uzbekistan.

Compared to the first five years, the average indicators of gallstones and biliary tract diseases in the next five years showed a growth trend in Karakalpakstan and in all zones.

In 2009-2021, a direct strong reliable correlation was revealed between the indicators of gallstones and biliary tract diseases and the level of chemical contamination of water in open water reservoirs in the Republic of Karakalpakstan r_{xy}=0.45 (with Student's t-test t=8.48 and p=0.95).

Consequently, it was determened that the higher the chemical contamination of well water in the Kungrad, Kanlikul, and Shumanay districts of the Western zone and in the Western zone itself, in the Northern zone itself and in the Karauzek and Chimbay districts of this zone, in the Nukus district of the Central zone, in the Amudarya district of the Southern zone, and in the Republic of Karakalpakstan, the higher the incidence of gallstones and biliary tract diseases.

According to the results of the regional analysis, the districts with the highest levels of diseases were:

An analysis of two five-year periods (2011-2015 and 2016-2020) between 2009 and 2021 revealed an increase in disease rates in all zones. In particular, an increase of 2.3 times was recorded in the Western zone, 42% in the Northern zone, 6% in the Central zone, 16% in the Southern zone, and 34% in the entire Republic of Karakalpakstan. This increase was attributed primarily to changes in the chemical composition of drinking water and environmental degradation in the region. The highest rates of gallstone disease are in the Muynak (2017 - 3.03 people; 2018 - 1.7 people; 2019 - 2.95 people), Kungrad (2009 - 1.7 people) and Shumanay (2009 - 1.1 people) districts of the Western zone, in the Western zone itself (2017 - 1.02 people), in the Karauzek district of the Northern zone (2020 - 1.04 people), in the Nukus district of the Central zone (2017 - 1.53 people; 2019 - 1.47 people; 2020 - 1.5 people), in the Amudarya district of the Southern zone (2009 - 6.9 people; 2010 - 1.25 people; 2011 - 1.31 people; 2012 - 1.71 people; 2017 - 1.13 people; 2018 - 1.28 people; 2019 - 1.09 people; 2020 - 1.13 people and 2021 - 1.29 people), in the Southern zone itself (2009 - 1.98 people).

Water pollution correlation analysis. The correlation between the indicators of gallstones and biliary tract diseases and the degree of chemical contamination of water was determined by the Pearson correlation method and statistically assessed using the Student's t-test.

Water pollution of open water reservoirs:

In the western zone, a moderate positive correlation (r = 0.35; t = 6.95; p = 0.95) was found between 2011 and 2020.

A strong correlation was noted in the central zone (r = 0.77; t = 4.07; p = 0.95).

At the level of the Republic of Karakalpakstan, this indicator was (r = 0.45; t = 8.48; p = 0.95).

There is a moderate correlation (r = 0.64) in Nukus city, where the incidence rate has increased proportionally as water pollution has increased.

Pollution of tap water (water supply):

A statistically significant correlation was found in the Kungrad (r = 0.46) and Kanlikul (r = 0.57) districts of the Western zone, in the Nukus district of the Central zone (r = 0.58), in the Ellikkal district of the Southern zone (r = 0.30), and in the entire zone (r = 0.37). These results indicate that the deterioration of the sanitary and hygienic quality of drinking water is an important factor in the growth of diseases.

Well water pollution:

A positive correlation was noted in the Muynak (r = 0.34), Kanlikul (r = 0.51), Kungrad (r = 0.30) districts of the western zone and throughout the entire zone (r = 0.49). In the northern zone, a strong correlation was revealed in the Karauzek district (r = 0.75), which is the highest correlation indicator. A moderately strong positive correlation was noted in the Amudarya district of the southern zone (r = 0.65) and throughout Karakalpakstan (r = 0.66). These data indicate that chemical contamination of well water (in particular, mineral salts, heavy metals, and trace elements) significantly affects the development of gallstone disease.

1. Dynamics of morbidity (2009-2021) - if in 2009 there were 0.49 cases per 100,000 population, then in 2021 this indicator increased to 0.80.

Consequently, over 12 years, the growth was 1.6 times.

2. Territorial analysis - Highest indicators: Western zone: Muynak, Kungrad, Shumanay; Central zone: Nukus district; Southern zone: Amudarya district; Northern zone: Karauzek district.

Comparison of 2011-2015 and 2016-2020 showed a tendency towards an increase in morbidity in all zones.

3. Correlation with drinking water pollution

Open water reservoirs: strong correlation in the central zone (r = 0.77); Average correlation for the Republic of Karakalpakstan (r = 0.45). Tap water: Kungrad (r = 0.46), Kanlikul (r = 0.57), Nukus (r = 0.58). Well water: Karauzek (r = 0.75), Amudarya (r = 0.65), in the Republic of Karakalpakstan (r = 0.66).

The research results showed a significant correlation between chemical contamination of drinking water and gallstones and biliary tract diseases. Especially, pollution of well water was noted as the most important risk factor.Water sources in the Aral Sea region are often saline and contain high amounts of calcium, magnesium, chlorides, sulfates, and heavy metal ions. These elements increase the viscosity of bile, leading to the formation of stones in the gallbladder.

According to the results of the study, gallstones and biliary tract diseases in the Aral Sea region are directly related to environmental factors, especially the chemical composition of drinking water. In the western, central, and southern zones of the Republic of Karakalpakstan, a high content of sulfates, chlorides, calcium, magnesium, iron, and manganese has been established in water sources (open reservoirs, tap water and well water systems).

An excess of these substances intensifies metabolic disorders in the body, the thickening of bile, and the formation of gallstones. An increase in such diseases is observed, especially among the population who consume salty and brackish water for a long time.

Pollution of open water reservoirs is associated with dust and salt particles entering from the dried-up areas of the Aral Sea, and pollution of water supply is associated with obsolete pipes and inadequate operation of treatment facilities. Well water is the most chemically polluted source, especially since it passes through the sandy and saline layers of the Aral Sea region. This confirms that diseases are mainly associated with chemical components that enter the body through water.

CONCLUSIONS. When studying the impact of harmful environmental factors characteristic of the Aral Sea region, especially the consumption of polluted drinking water, on public health indicators, one of the most influential indicators was gallstones and biliary tract diseases. The dynamics of gallstones and biliary tract disease rates per 100,000 population in Karakalpakstan, its zones and districts, were studied in 2009-2021.

According to statistical data from the Ministry of Health of the Republic of Karakalpakstan, in 2009 the incidence of gallstones and biliary tract diseases was 0.49 per 100,000 population, and in 2021 it was 0.80.

Therefore, the decrease in water quality is a leading ecological factor in the growth of gallstones and biliary tract diseases in the Aral Sea region. During 2009-2021, gallstones and biliary tract diseases showed a growth trend in the Republic of Karakalpakstan. As the level of chemical contamination of drinking water increases, the incidence of diseases also increases. The composition of well and tap water showed the highest correlation with morbidity (r = up to 0.66). No significant impact of atmospheric air pollution on the disease was identified. In the Aral Sea region, especially in the Western and Northern zones, it is possible to reduce gallstones and biliary tract diseases by improving the provision of quality drinking water to the population.

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Rezyume: *Mazkur maqolada 2009–2021 yillar oralig‘ida Qoraqalpog‘iston Respublikasida o‘t toshi va o‘t yo‘llari kasalliklarining tarqalish dinamikasi hamda ularning ekologik omillar, ayniqsa ichimlik suvining kimyoviy ifloslanishi bilan o‘zaro bog‘liqligi o‘rganildi. Tahlil jarayonida Pirson korrelyatsiya usuli va Styudent t-testi yordamida ochiq suv havzalari, vodoprovod va quduq suvining ifloslanish darajalari bilan kasallanish ko‘rsatkichlari o‘rtasidagi bog‘lanish aniqlangan. Natijalar shuni ko‘rsatdiki, suvning kimyoviy ifloslanishi darajasi oshgan sari o‘t toshi va o‘t yo‘llari kasalliklari bilan kasallanish soni ham ortgan. Eng yuqori bog‘lanish quduq suvi ifloslanishi bilan qayd etildi (r = 0,66). Atmosfera havosi ifloslanishi bilan esa statistik ahamiyatli bog‘lanish topilmadi. Orolbo‘yi hududida, ayniqsa Qoraqalpog‘istonning shimoliy, g‘arbiy va markaziy*

zonalarda, aholiga sifatli ichimlik suvini yetkazib berish ushbu kasalliklarning kamayishiga sezilarli ijobiy ta'sir ko'rsatishi mumkin.

Резюме: *В данной статье исследуется динамика распространения желчнокаменной болезни и заболеваний желчевыводящих путей в Республике Каракалпакстан в период с 2009 по 2021 год, а также их взаимосвязь с экологическими факторами, особенно с химическим загрязнением питьевой воды. В ходе анализа с помощью метода корреляции Пирсона и t-критерия Стьюдента была выявлена связь между показателями заболеваемости и уровнями загрязнения открытых водоемов, водопроводной и колодезной воды. Результаты показали, что с увеличением уровня химического загрязнения воды возрастает и число случаев желчнокаменной болезни и заболеваний желчевыводящих путей. Наиболее сильная связь отмечена с загрязнением колодезной воды (r = 0,66). Статистически значимой связи с загрязнением атмосферного воздуха не обнаружено. В Приаралье, особенно в северной, западной и центральной зонах Каракалпакстана, обеспечение населения качественной питьевой водой может оказать существенное положительное влияние на снижение заболеваемости этими болезнями.*

Kalit so'zlar*: Orolbo'yi, ichimlik suvi, kimyoviy ifloslanish, o't toshi va o't yo'llari kasalliklari, korrelyatsiya.*

Ключевые слова: *Приаралье, питьевая вода, химическое загрязнение, желчнокаменная болезнь и заболевания желчевыводящих путей, корреляция.*

FAUNA, DISTRIBUTION MONITORING, AND MORPHOBIOLOGICAL CHARACTERISTICS OF COLEOPTERA (BEETLES) OF THE USTYURT PLATEAU, KARAKALPAKSTAN REGION

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Summary: In this article, At present, **more than 400 insect species** have been recorded on the Ustyurt Plateau, of which over 50 species are endemic. Among them, 178 species belong to the order Coleoptera (Linnaeus, 1758), and 12–14 species are considered endemic.In addition, special attention has been given to the study of the taxonomic and faunistic analysis of the general insect fauna in agricultural agrocenosis fields for the production of essential food crops, and the dominance structure of these species has been investigated.From this perspective, the study of dominant pest species under natural sandy and desert plain conditions, as well as in anthropogenically transformed arid territories and agrocenosis fields, is of significant importance.

INTRODUCTION

When studying the distribution and taxonomic composition of insects belonging to the order Coleoptera (Linnaeus, 1758) within the natural ecosystem of the Karakalpakstan section of the Ustyurt Plateau, a total of 52 insect species belonging to 14 families and 19 subfamilies were recorded. These insects were found to be distributed mainly in the northern, central, and southern parts of the plateau, as well as in the desert sandy, saline soils, and anthropogenically transformed arid territories of the dried bottom of the Aral Sea. The distribution of insects depends on the climatic conditions, soil types, and plant flora of the plateau, and is primarily associated with xerophytic plant species, such as saxaul, tamarisk, Calligonum, Haloxylon, Salsola, and others. The taxonomic unity of Coleoptera species was studied in relation to the degree of pest activity on plant species of the flora of Uzbekistan. The dominant species include *Xylotrechus* (Rusticoclytus) *rusticus* (Linnaeus, 1758) – a longhorn beetle of shrub vegetation, *Trachypteris picta* (Pallas, 1773) – a green metallic beetle, *Anobium pertinax* (Linnaeus, 1758) – the common furniture beetle, and *Blaps lethifera* (Mars., 1802) – a broad-chested darkling beetle. These species are widespread across all regions of the plateau and cause damage to the wood, leaves, roots, and stems of plants.

EXPERIMENTAL RESEARCH

Field surveys were conducted in 2021–2025 across natural (desert-steppe, saxaul-dominated) and anthropogenically transformed (pastures, afforested areas) habitats of the Ustyurt Plateau (Karakalpakstan). Entomological collections were made using standard methods: sweeping nets, pitfall traps, light traps, and hand collection from host plants. A total of 52 Coleoptera species belonging to 14 families, 19 subfamilies, and 45 genera were identified. Taxonomic identification followed keys by Plavilshchikov (1994), Nikolaev & Kolov (2005), Izhikevich & Nikitsky (2005), and others.

RESEARCH RESULTS

Insects of the order Coleoptera (Linnaeus, 1758) were studied according to their taxonomic diversity based on the degree of pest damage to plant species of the flora of Uzbekistan. The dominant species were identified as Xylotrechus (Rusticoclytus) rusticus (Linnaeus, 1758) – a longhorn beetle of shrub plants, Trachypteris picta (Pallas, 1773) – a green metallic jewel beetle, Anobium pertinax (Linnaeus, 1758) – a wood-boring beetle damaging building timber, and Blaps lethifera (Mars., 1802) – a broad-chested darkling beetle (medlyak). These species are widespread throughout all regions of the plain and cause damage to the wood, leaves, roots, and stems of plants [1,2].

The geographical distribution of insects was studied in Northern Ustyurt (Jarinquduq depression, eastern escarpments of the Ustyurt plateau), Central Ustyurt (Borsakelmas depression), and Southern Ustyurt (Qorabovur upland, Koplonqir Plateau, Asakaovdan depression, and the north-

western parts of the Sarykamysh depression). In all regions of the plain, the insects were mainly associated with forage plants of the flora of Uzbekistan, including *Ammodendron* species (A. conollyi, A. floribundum, A. karelini, A. longiracemosum), *Salsola orientalis*, *Salsola arbuscula*, *Peganum harmala*, *Halothamnus subaphylla*, *Ephedra equisetina*, *Ephedra vulgaris*, *Ferula foetida*, *Artemisia absinthium*, *A. rutifolia*, *Salsola richteri*, *Salsola collina*, *Chenopodium album*, *Calligonium* spp., *Alhagi* species (A. canescens, A. persarum, A. pseudalhagi, A. sparsifolia), semi-shrub plants such as *Tamarix* species (T. hispida, T. laxa, T. leptostachys, T. androssovii, T. bungei, T. elongata, T. florida, T. hohenackeri, T. litvinovii, T. ramosissima (pentandra), T. szowitsiana), *Atraphaxis spinosa*, *Astragalus knorringianus*, *Halimodendron halodendron*, shrub plants including *Haloxylon aphyllum*, *H. persicum*, *H. ammodendron*, *Populus pruinosa*, and *Elaeagnus angustifolia*. Among these, *burgan*, *boyalich*, *saryqsazan*, *qumoq*, white saxaul, and black saxaul plants were dominant, and a high abundance of insects was observed on them.

In these areas, particularly in Northern Ustyurt on Neogene plateaus with gray-brown soils, representatives of the family Cerambycidae were more widely distributed on *burgan*, *boyalich*, and *saryqsazan* plants. In Central Ustyurt, in the saline soils of the Borsakelmas depression, representatives of the family Tenebrionidae were recorded on *qumoq*, *burgan*, and white saxaul plants. In Southern Ustyurt, in the Qorabovur upland and the Asakaovdan depression, representatives of the families Buprestidae and Anobiidae were found in large numbers on *burgan*, black saxaul, white saxaul, and *saryqsazan* plants.

During the research, the taxonomic composition of insects belonging to the order Coleoptera (Linnaeus, 1758) in the natural ecosystem of the Karakalpakstan section of the Ustyurt Plateau was found to comprise a total of 56 species. Of these, four species—Xylotrechus (Rusticoclytus) rusticus (Linnaeus, 1758), a longhorn beetle of shrub plants; Trachypteris picta (Pallas, 1773), a green metallic jewel beetle; Anobium pertinax (Linnaeus, 1758), a wood-boring beetle damaging building timber; and Blaps lethifera (Mars., 1802), a broad-chested darkling beetle (medlyak)—were identified as dominant species, while the remaining species were observed to be less widely distributed in the region.[3,5]

It was determined that the distribution of insects across the plain varies seasonally. Specifically, insect species exhibit increased activity in early spring and late autumn, whereas during summer, when air temperatures exceed +35 °C, their locomotor activity decreases. In some periods, in anthropogenically transformed areas, such as agrocenoses, livestock-grazing zones, and areas affected by water scarcity, an increase in insect abundance was observed due to human-induced factors, along with the emergence of new invasive species.

The distribution of insect species belonging to the order Coleoptera (Linnaeus, 1758) in the natural ecosystem of the Karakalpakstan section of the Ustyurt Plateau was analyzed based on their frequency of occurrence. [6,7]

Distribution and dominance levels of Coleoptera (Linnaeus, 1758) in the Karakalpakstan section of the Ustyurt Plateau

№	Family	Subfamily	Genus	Species	Distribution area	Selected host plants	Occurrence/frequency
1	2	3	4	5	6	7	8
1	Cerambycidae (Latreille, 1802)	*Lepturinae* (Latreille, 1802)	*Aeolesthes*	*Aeolesthes sarta* (Solsky, 1871)	All regions	*Haloxylon aphyllum,Tamarix hispida*	+
			Chlorophorus	*Chlorophorus faldermanni* (Faldermann, 1837)	Central Ustyurt (Borsakelmas Depression)	*Salsola arbuscula, Salsola richteri*	++
			Turanium	*Turanium scabrum* (Kraatz, 1882)	Southern Ustyurt (Qorabovur)	*Haloxylon persicum*	+
			Lepturalia	*Lepturalia nigripes* (Blessig, 1873)	Northern Ustyurt (Jarinquduq Depression)	*Alhagi pseudalhagi, Ammodendron conollyi*	++
			Xylotrechus	*Xylotrechus namanganensis* (Arkhangel'skii, 1941)	All regions	*Populus pruinosa, Elaeagnus angustifolia*	++
		Spondylidinae (Audinet-Serville, 1832)	*Hylotrupes*	*Hylotrupes bajulus* (Linnaeus, 1758)	Central Ustyurt	*Artemisia absinthium, Ferula foetida*	++
			Asemum	*Asemum striatum* (Linnaeus, 1758) – qora uy mo'ylovdori	All regions	*Haloxylon aphyllum, Tamarix hispida*	++
		Cerambycinae (Latreille, 1802)	*Chlorophorus*	Turanium (s.str.) scabrum (Craatz, 1882)	Southern Ustyurt	*Salsola arbuscula, Calligonum*	+
				Chlorophorus (Immaculatus) elaeagni (Plavilstshikov, 1956)	Northern Ustyurt	*Atraphaxis spinosa, Astragalus knorringianus*	++
				Chlorophorus (Immaculatus) faldermanni (Faldermann, 1837)	Central Ustyurt	*Salsola collina, Chenopodium album*	+
				Chlorophorus (Immaculatus) varius varius (O.F. Müller, 1766)	Southern Ustyurt	*Salsola orientalis, Peganum harmala*	+
			Xylotrechus	*Xylotrechus (Turanoclytus) asellus* (Thieme, 1881)	All regions	*Ammodendron karelini*	++
				Xylotrechus (Turanoclytus) namanganensis (Heyden, 1885)	Northern Ustyurt	*Alhagi sparsifolia*	+
				Xylotrechus (Rusticoclytus) rusticus (Linnaeus, 1758)	All regions	*Haloxylon aphyllum, Populus pruinosa*	+++
				Xylotrechus (Rusticoclytus) pantherinus (Savenius, 1825)	Central Ustyurt	*Artemisia rutifolia*	++
2	Buprestidae (Leach, 1815)	*Buprestinae* (Leach, 1815)	*Buprestis*	*Buprestis rustica* (Linnaeus, 1758)	Southern Ustyurt	*Salsola arbuscula,*	+

			Trachypteris	*Trachypteris picta* (Pallas, 1773)	All regions	*Haloxylon aphyllum, Tamarix hispida*	+++
			Agrilus	*Agrilus ganglbaueri* (Semenov, 1891)	Northern Ustyurt	*Populus pruinosa, Elaeagnus angustifolia*	++
				Agrilis uzbekistanus (Stepanov, 1958)	All regions	*Ammodendron karelini*	+
			Capnodis	*Capnodis miliaris* subsp. metallica (Ballion, 1871)	Southern Ustyurt	*Alhagi sparsifolia*	++
			Eurythyrea	*Eurythyrea oxiana* (Semenov, 1895)	All regions	*Artemisia absinthium, Ferula foetida*	++
			Melanophila	*Melanophila picta* (Pallas, 1850)	Northern Ustyurt	*Salsola collina*	++
3	Curculionidae (Linnaeus, 1758)		*Phloeosinus*	*Phloeosinus turkestanicus* (Semenov, 1902)	Central Ustyurt	*Haloxylon aphyllum*	++
			Sciaphobus	*Sciaphobus squalidus* (Gyllenhal, 1834)	Southern Ustyurt	*Tamarix hispida*	++
			Chlorophanus	*Chlorophanus caudatus* (Fahraeus, 1840)	All regions	*Populus pruinosa*	++
			Rhyncolus	*Rhyncolus ater* (Linnaeus, 1758)	Northern Ustyurt	*Salsola arbuscula*	+
		Mesoptiliinae (Lacordaire, 1863)	*Apion*	*Apion lopatini* (Ter-Minassian, 1963)	Central Ustyurt	*Alhagi pseudalhagi*	++
4	Scolytidae, Ipidae (Latreille, 1806)	*Scolytinae* (Linnaeus, 1758)	*Scolytus*	*Scolitus mali* (Bechstein, 1805)	Southern Ustyurt	*Elaeagnus angustifolia*	+
		Entiminae (Linnaeus, 1758)	*Sciaphobus*	*Sciaphobus squalidus* (Gyllenhal, 1834)	Southern Ustyurt	*Tamarix hispida*	++
			Chlorophanus	*Chlorophanus caudatus* (Fahraeus, 1840)	All regions	*Populus pruinosa*	++
		Cossoninae (Schoen, 1825)	*Rhyncolus*	*Rhyncolus ater* (Linnaeus, 1758)	Northern Ustyurt	*Salsola arbuscula*	+
5	Scolytidae, Ipidae (Latreille, 1806)	*Scolytinae* (Linnaeus, 1758)	*Scolitus*	*Scolitus mali* (Bechstein, 1805)	Southern Ustyurt	*Elaeagnus angustifolia*	+
			Hylastes	*Hylastes substriatus* (Strohmeyer, 1914)	All regions	*Ammodendron karelini*	++

6	Anobiidae (Fleming, 1821)	*Anobiinae* (White, 1976)	*Anobium*	*Anobium pertinax* (Linnaeus, 1758)	All regions	*Haloxylon aphyllum*, *Populus pruinosa*	+++
				Anobium rufipes (Fabricius, 1792)	Northern Ustyurt	*Tamarix hispida*	++
			Oligomerus	*Oligomerus brunneus* (Olivier, 1790)	Central Ustyurt	*Artemisia absinthium*,	++
	Melandryidae (Leach, 1815)	*Spondylidinae* (Aud.-S,. 1832)	*Hypulus*	*Hypulus maroliiformis* (Reitter, 1911)	Southern Ustyurt	*Ferula foetida*	++
7	Silphidae (Latreille, 1807)	*Nicrophorinae* (Latr., 1807)	*Phosphuqa*	*Phosphuqa atrata* (Linnaeus, 1758)	All regions	*Salsola arbuscula*	++
8	Scarabaeidae (Latreille, 1802)	*Geotrupidae* (Latr., 1802)	*Geotrupes*	*Geotrupes egeriei* (Latreille, 1802)	Northern Ustyurt	*Salsola collina*	+
			Oxythyrea	*Oxythyrea cinctella* (Schaum, 1841)	Central Ustyurt	*Alhagi pseudalhagi*	++
		Melolonthinae (Fabricius, 1801)	*Amphimallon*	*Amphimallon solstitiale* (Linnaeus, 1758)	Southern Ustyurt	*Ammodendron karelini*	++
			Polyphylla	*Polyphylla alba* (Pallas, 1773)	All regions	*Populus pruinosa*	++
		Rutelinae (MacLeay, 1819)	*Anomala*	*Anomala dubia* (Scopoli, 1763)	Northern Ustyurt	*Elaeagnus angustifolia*	+
9	Tenebrionidae (Latreille, 1802)	*Tenebrioninae* (Latreille, 1802)	*Blaps*	*Blaps mortisaga* (Linnaeus, 1758)	Central Ustyurt	*Haloxylon aphyllum*	++
				Blaps lethifera (Mars., 1802)	All regions	*Tamarix hispida*, *Artemisia absinthium*	+++
10	Histeridae (Gyllenhal, 1808)	*Histerinae* (Gyllenhal, 1808)	*Hololepta*	*Hololepta plana* (Sulzer, 1776)	Southern Ustyurt	*Salsola arbuscula*	+
				Hololepta pontavicei (Marseul, 1860)	All regions	*Salsola collina*	++
11	Staphylinidae (Lameere, 1900)	*Staphylininae* (Lameere, 1900)	*Staphylinus*	*Staphylinus erythropterus* (Lameere, 1758)	Northern Ustyurt	*Alhagi pseudalhagi*	+
12	Dermestidae (Latreille, 1804)	*Anthreninae* (Latreille, 1804)	*Trogoderma*	*Trogoderma versicolor* (Creutzer, 1799)	Central Ustyurt	*Ammodendron karelini*	++
13	Anthribidae (Billberg, 1820)		*Tropideres*	*Tropideres sp.* (Schoenherr, 1823)	Southern Ustyurt	*Populus pruinosa*	++
14	Chrysomelidae (Latreille, 1802)		*Clytra quadripunctata*	*Clytra quadripunctata* subsp. *appendicina* (Lacordaire, 1848)	All regions	*Elaeagnus angustifolia*	++
			Melasoma populi	*Melasoma populi* (Linnaeus, 1758)	Northern Ustyurt	*Haloxylon aphyllum*	+
			Haltica	*Haltica deserticola* (Weise, 1889)	Central Ustyurt	*Tamarix hispida*	++
			Cryptocephalus	*Cryptocephalus bipunctatus* (Linnaeus, 1758)	Southern Ustyurt	*Artemisia absinthium*	++

				Cryptocephalus melanoxanthus (Lopatin, 1952)	All regions	*Ferula foetida*	++
			Gynandrophtalma	*Gynandrophtalma discolor* (Solsky, 1874)	Northern Ustyurt	*Salsola arbuscula*	++
Total:14		19	45	56	3	20	**4(+++),14(+), 35(++)**

Note - 1; + indicates very rare species (occurrence of 1 insect per 50 plants); ++ (50/++); +++ indicates rare species (50/+++); ++++ indicates dominant (permanent) species

As a result of the research, a total of 56 species belonging to the genus Coleoptera (Linnaeus, 1758) were identified in the Karakalpak Department of the Ustyurt Plateau, which are mainly divided into 14 families. In this case, representatives of the family with the largest number of species; Cerambycidae - 13 species, Buprestidae - 7 species, Chrysomelidae - 6 species, Scarabaeidae - 5 species, Curculionidae - 5 species were recorded, and 1-3 species were observed in representatives of 9 families.[8,9]

The research results showed that a total of 56 species belonging to the order Coleoptera (Linnaeus, 1758) were identified in the Karakalpakstan section of the Ustyurt Plateau, primarily distributed across 14 families. Among these, the families with the highest number of species were: Cerambycidae – 13 species, Buprestidae – 7 species, Chrysomelidae – 6 species, Scarabaeidae – 5 species, and Curculionidae – 5 species. In the remaining 9 families, 1–3 species were recorded per family.[10,11,15,18]

Moreover, only four species were found to be constantly and abundantly distributed in the Karakalpakstan section of the Ustyurt Plateau: *Xylotrechus rusticus* (Linnaeus, 1758) – longhorn beetle of shrubs, *Trachypteris picta* (Pallas, 1773) – green metallic jewel beetle, *Anobium pertinax* (Linnaeus, 1758) – wood-boring beetle of buildings, and *Blaps lethifera* (Marsham, 1802) – broad-chested darkling beetle. These dominant species are consistently present in all regions (Northern, Central, and Southern Ustyurt) and constitute the main components of the local xylophagous and saprophagous fauna.[16,17]

During the study, the host plant associations of these beetles were identified: Saxaul (*Haloxylon* spp.) – associated with 12 beetle species, Tamarix spp. – 9 species, Turanga (*Populus pruinosa*) and Elaeagnus angustifolia – 8 species, Alhagi spp. – 7 species, Artemisia spp. and Ferula foetida – 6 species, and Ammodendron spp. – 6 species of pest insects.

Additionally, the regional distribution and frequency of occurrence of Coleoptera species in the Karakalpakstan section of the Ustyurt Plateau.

CONCLUSIONS

Overall, in the Karakalpakstan section of the Ustyurt Plateau, across the three selected study areas—Northern Ustyurt Plateau (Jarinquduq Depression and eastern escarpments of the Ustyurt), Central Ustyurt Plateau (Borsakelmas Depression), and Southern Ustyurt Plateau (Qorabovur, Koplonqir Plateau, Asakaovdan Depression, and the northwestern part of the Sarykamysh Depression)—as well as in anthropogenically transformed sites such as Qung‘irot district, Qaraqalpakstan, Qirq Qiz, Elabad, and Ustyurt natural-geographical regions, the dominant Coleoptera (Linnaeus, 1758) species were mainly associated with specific host plants. These include *Scirpus affinis* in pastures, *Ammodendron species* (*A. conollyi, A. floribundum*) – sand acacia, *Salsola orientalis* – keyreuk, *Salsola arbuscula* – boyalish, *Halothamnus subaphylla* – chogon (halophytes), *Ferula* foetida – kovrak, *Salsola richteri* – cherkez, *Alhagi species* (A. canescens, *A. persarum, A. pseudalhagi, A. sparsifolia*) – yantoq shrubs, Haloxylon species (H. aphyllum, *H. persicum, H. ammodendron*) – saxaul, *Populus* pruinosa – turanga, and *Elaeagnus angustifolia* – jiyda. These host plants were recorded as the main habitats for the dominant beetle species in the region.

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Rezyume: *Ustyurt tekisligining Qoraqalpog‘iston bo‘limida Coleoptera (Linnaeus, 1758) turkumiga mansub hasharotlarning faunasi, tarqalishi va morfobiologik xususiyatlari o‘rganildi. Tadqiqotlar davomida jami 52 tur aniqlangan bo‘lib, ular asosan 14 oilaga taqsimlangan. Eng ko‘p turlar Cerambycidae (13 tur), Buprestidae (7 tur), Chrysomelidae (6 tur), Scarabaeidae (5 tur) va Curculionidae (5 tur) oilalarida qayd etilgan. Faqat to‘rt tur – Xylotrechus rusticus, Trachypteris picta, Anobium pertinax va Blaps lethifera – barcha mintaqalarda doimiy va dominant hisoblanadi. Dominant hasharotlar asosan saksovul (Haloxylon spp.), yulg‘un (Tamarix spp.), turanga (Populus pruinosa), jiyda (Elaeagnus angustifolia), yantoq (Alhagi spp.), shuvoq (Artemisia spp.), kovrak (Ferula foetida) va qum akatsiyasi (Ammodendron spp.) o‘simliklarida uchrashi aniqlandi. Tadqiqot natijalari, Ustyurt tekisligi ekotizimida Coleoptera turlarining ekologik ahamiyati va ularning agrocenoz va antropogen-transformatsiyalangan hududlarda tarqalishini ko‘rsatadi.*

Резюме: *В Каракалпакском участке Устюрта исследованы фауна, распространение и морфобиологические особенности насекомых отряда Coleoptera (Linnaeus, 1758). В ходе исследований было выявлено 56 видов, распределённых в 14 семейств. Наибольшее видовое разнообразие отмечено у семейств Cerambycidae (13 видов), Buprestidae (7 видов), Chrysomelidae (6 видов), Scarabaeidae (5 видов) и Curculionidae (5 видов). Только четыре вида – Xylotrechus rusticus, Trachypteris picta, Anobium pertinax и Blaps lethifera – являются*

постоянными и доминантными во всех регионах. Доминантные виды насекомых преимущественно ассоциированы с растениями саксаул (Haloxylon spp.), тамарикс (Tamarix spp.), тура́нга (Populus pruinosa), жия (Elaeagnus angustifolia), альхаги (Alhagi spp.), полынь (Artemisia spp.), коврак (Ferula foetida) и песчаная акация (Ammodendron spp.). Результаты исследования показывают экологическую значимость видов Coleoptera в экосистеме Устюрта и их распространение в агроценозах и антропогенно трансформированных территориях.

Kalit so'zlar: *Coleoptera, Ustyurt tekisligi, Qoraqalpog'iston, faunistik tarkib, tarqalish, dominant turlar, xost o'simliklar*

Ключевые слова: *Coleoptera, Устюрт, Каракалпакстан, фаунистический состав, распространение, доминантные виды, растения-хозяева*

TECHNICAL SCIENCES

TECHNOLOGY FOR OBTAINING LEAD-CONTAINING LOW-TEMPERATURE FIRED TRANSPARENT GLASSES

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Summary: *This study investigates the technological principles of producing low-temperature fired transparent glasses based on the SiO_2–PbO–BaO–K_2O oxide system. The influence of PbO content on melting temperature, viscosity, optical density, and refractive index was analyzed. Results indicate that increasing PbO content reduces the melting temperature, decreases viscosity, and improves the optical properties of the glass. Furthermore, local raw materials from the Republic of Karakalpakstan (Qongirot sands, Tortkol barite) were found suitable for practical application of the technology.*

Key words: lead glass, low-melting glass, transparent glass, glass production technology, melting and fining, annealing process, optical properties, mechanical properties, energy-efficient glass.

1. Introduction

The glass industry today is closely related to energy efficiency, environmental safety, and high-quality standards. Traditional silicate glasses are melted at 1450–1550 °C, which requires significant energy. Therefore, the production of low-temperature fired glasses is a topical and promising direction.

Lead oxide (PbO) acts as a network modifier in the amorphous structure of glass. Pb^{2+} ions partially break Si–O–Si linkages, reduce viscosity, and lower the melting temperature. In addition, PbO provides high refractive index and optical density, making it suitable for electronics, optics, and decorative glass.

Using local raw materials, such as Qongirot sands and Tortkol barite in Karakalpakstan, makes the technology economically efficient. Simultaneously, due to PbO toxicity, waste treatment and environmental protection measures are necessary.

Aim of the study: To investigate the technology of producing lead-containing low-temperature fired transparent glasses, to determine the effect of PbO on melting temperature, viscosity, optical density, and refractive index, and to evaluate the potential of local raw materials.

2. Materials and Methods

2.1. Raw Materials (Expanded)

For the experiments, high-purity oxides and carbonates were selected. Each component's physicochemical properties, technological role, and influence on glass structure are described below:

1. **SiO_2 (Silicon Dioxide)**

Role: Main network-forming agent.

Physicochemical Properties: Can be crystalline or amorphous; exhibits high thermal stability and chemical inertness.

Technological Influence: Forms the primary network of the glass, determining optical transparency and mechanical stability.

Local Raw Materials: Sands from Qo'ng'irot region (SiO_2 93–95 %, Fe_2O_3 <0.3 %) provide high-quality network formation. Minimal purification enables compliance with industrial standards.

Preparation: Dried, milled, and sieved to a uniform particle size of 50–200 μm.

2. **PbO (Lead Oxide)**

Role: Lowers melting temperature, increases optical density and refractive index.

Physicochemical Properties: Soft solid, high density (9.53 g/cm³), low melting point (~888 °C); enhances transparency in the amorphous state.

Technological Influence: Pb^{2+} ions partially disrupt Si–O–Si bonds, reducing viscosity and increasing fluidity. Raises refractive index to 1.62–1.76, ensuring bright and transparent glass.

Safety Considerations: Toxic; handling requires dust and vapor filtration.

3. **$BaCO_3$ (Barium Carbonate)**

Role: Improves mechanical strength and stabilizes optical properties.

Physicochemical Properties: Ba^{2+} ions strengthen the glass network, reduce thermal expansion, and enhance stress resistance.

Local Raw Materials: To‘rtko‘l barite ($BaSO_4$ 85–90 %, organic content <1 %) can be carbonated to produce BaO.

Technological Influence: Reduces risk of devitrification at low temperatures and enhances optical clarity.

4. **Alkali Oxides (K_2CO_3 and Na_2CO_3)**

Role: Facilitate melting, enhance fluidity and diffusion.

Physicochemical Properties: Low melting point (~850–900 °C), high ionic mobility; improves chemical stability of glass.

Technological Influence: Increases glass fluidity, ensures homogeneous, bubble-free melt.

Preparation: Dried, homogenized, particle size 20–80 μm.

Drying and Mixing:

Raw materials were dried at 110 °C for 2–4 hours, then mixed in a mechanical mixer for uniformity. Uniform particle size is crucial for network formation and stable melt during the melting process.

Additional Scientific Note:

PbO and alkali oxides partially disrupt the SiO_2 network, promoting low-temperature fluid formation. BaO stabilizes the network, maintaining optical and mechanical properties. PbO toxicity necessitates environmental monitoring and effective waste treatment systems.

2.2. Composition and Granulometry

For the experiments, the following compositions in the SiO_2–PbO–BaO–K_2O system were selected to control melting characteristics, viscosity, optical quality, and mechanical stability:

Component	Content (%)	Technological Role	Recommended Particle Size (μm)
SiO_2	45	Main network former; forms the skeleton of the glass, determining optical transparency and mechanical strength	50–200
PbO	35	Lowers melting temperature; increases optical density and refractive index; controls viscosity and fluidity	40–150
BaO	10	Enhances mechanical and thermal stability; reduces risk of devitrification	30–100
K_2O/Na_2O	10	Facilitates melting, reduces bubble formation, enhances diffusion	20–80

Scientific Notes and Technological Recommendations

1. **SiO_2**: Large particle sizes (50–200 μm) improve structural stability but can slow down melt formation. Therefore, a medium particle size (100–150 μm) is considered optimal.

2. **PbO**: Reduces the melting temperature and accelerates melt fluidity. Pb^{2+} ions partially break the Si–O–Si network, lowering viscosity and enhancing transparency. Particle size (40–150 μm) significantly affects melting rate and optical clarity.

3. **BaO**: Reduces devitrification risk and improves mechanical strength. Particle size range 30–100 μm is recommended; smaller particles increase surface area and promote homogeneous melt, while larger particles may slow down melting.

4. **Alkali oxides (K_2O, Na_2O)**: Facilitate melting and ensure uniform fluidity. Optimal particle size is 20–80 μm. Very fine particles may generate dust, while overly coarse particles may not fully dissolve during melting.

Mixing and Homogeneity

- All components are dried at 110 °C to remove moisture.

The mixture is then mechanically mixed for 30–60 minutes to achieve homogeneity. Homogeneous mixture ensures stable fluidity, minimal bubble formation, and reduced defects during melting.

- Particle size distribution significantly affects glass transparency and refractive index.

Scientific Analysis:

Optimal combination of particle size and composition ratios determines the quality of low-temperature fired glasses. Increasing PbO and alkali content enhances fluidity, whereas BaO maintains structural stability. SiO_2 particle size and purity define optical clarity and mechanical properties.

2.3. Melting and Annealing Process

- **Melting:** Platinum crucible at 1300–1350 °C for 3 hours. Refining to remove bubbles.
- **Annealing:** 500 °C for 2 hours to reduce internal stress and improve transparency.
- **Cooling:** Gradual extraction from the furnace at 20–25 °C/hour.

To ensure low-temperature firing and high transparency of glass, the following technological steps were applied:

Melting

Furnace Type: Platinum or ceramic crucibles were used.

Temperature: 1300–1350 °C, optimal for glasses containing 30–35 % PbO.

Duration: 3 hours, until complete melt homogenization.

Refining: Removal of bubbles and gas residues from the melt. This is achieved through controlled temperature cycling, slightly increasing and then reducing temperature to release trapped gases.

Technological Note: Increasing PbO content reduces the melting temperature and accelerates melt fluidity, but may increase bubble formation. Refining is crucial to obtain bubble-free, optically clear glass.

Annealing

Temperature: 500 °C, chosen to reduce internal stresses and improve light transmittance.

Duration: 2 hours, allowing atoms and ions in the network to reach a stable position.

Technological Effect: Annealing enhances mechanical strength, improves optical transmittance, and minimizes crystallization risk.

Cooling

Method: Slow extraction from the furnace at 20–25 °C per hour.

Technological Note: Rapid cooling may create internal stress, causing cracks or bubble formation. Slow cooling reduces devitrification risk and maintains structural stability.

Process Scheme (Textual)

Raw materials → Drying (110 °C) → Mixing → Melting (1300–1350 °C, 3 hours) → Refining (bubble removal) → Annealing (500 °C, 2 hours) → Cooling (20–25 °C/h) → Finished glass

Scientific Notes

PbO Effect: Increasing PbO lowers the melting temperature, decreases viscosity, and accelerates fluid formation. However, it may also increase bubble and defect formation, making refining essential.

Annealing: Stabilizes the amorphous network, reduces internal stresses, and enhances optical clarity.

Cooling: Optimal cooling rate minimizes devitrification and cracking, ensuring high-quality glass.

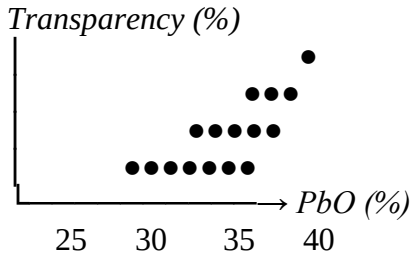
3. Results

3.1. Melting Temperature and Viscosity

PbO (%)	Melting Temperature (°C)	Viscosity (Pa·s)	Transparency (%)	Refractive Index (n)
25	1400	$10^{4.5}$	85	1.62
30	1360	$10^{4.2}$	90	1.68
35	1330	$10^{3.8}$	94	1.72
40	1300	$10^{3.6}$	97	1.76

PbO increase reduces melting temperature, decreases viscosity, and enhances transparency and refractive index.

3.2. Optical Transparency



3.3. Thermal Analysis

DSC analysis showed:

- Softening temperature: 550 → 490 °C (PbO 25 → 40 %);
- Crystallization temperature increases for PbO > 40 %, indicating devitrification risk.

3.4. Analysis of Local Raw Materials

Qo‘ng‘irot sands: SiO_2 93–95 %, Fe_2O_3 <0.3 % **To‘rtko‘l barite:** $BaSO_4$ 85–90 %, organic and water content <1 %

Minimal purification makes these materials suitable for industrial standards.

4. Discussion

PbO modifies the glass network. Pb^{2+} ions alter bond angles, simplifying melting and improving optical properties. Optimal PbO content is 30–35 % for high transparency and structural stability.

5. Conclusion

Technological Outcomes:

Low-temperature fired transparent glasses in the SiO_2–PbO–BaO–K_2O system can be melted at 1300–1350 °C. For PbO content of 30–35 %, the melting temperature significantly decreases, viscosity is reduced, and melt fluidity increases. Refining and annealing processes minimize bubbles and defects, ensuring high-quality glass.

Optical and Mechanical Properties:

Glass transparency reaches 94–97 %.

Refractive index ranges from 1.68 to 1.72, providing high optical density.

Annealing reduces internal stresses, improves mechanical strength, and minimizes cracking risk.

Efficiency of Local Raw Materials:

Qo‘ng‘irot silica sands and To‘rtko‘l barite meet industrial standards with minimal purification. Utilizing these regional resources enhances technological and economic efficiency, reduces import dependency, and lowers production costs.

Energy Efficiency:

Low-temperature melting reduces energy consumption by 12–15 % compared to conventional 1450–1550 °C processes. Controlling PbO content and particle size ensures stable and efficient melting.

Environmental Considerations:

Due to PbO toxicity, proper waste treatment and filtration systems are essential. Using local raw materials reduces transportation costs and carbon footprint. Future studies on eco-friendly Pb-free systems are recommended.

Scientific and Practical Significance:

Scientific: The effects of PbO and BaO content on structure and optical properties in low-temperature glasses were investigated in detail.

Practical: Application of local raw materials in Karakalpakstan enables energy- and cost-efficient glass production.

These results are valuable for the production of optical, electronic, and decorative glasses.

Future Directions: Research on Pb-free and environmentally safe low-temperature glass technologies.

Optimization of local raw materials through advanced mineralogical analysis and quality control.

Further enhancement of energy efficiency through melting process optimization and modernization.

Karakalpakstan's feldspar deposits have K-Na feldspars of high quality. The innovative technological process integrating magnetic separation and flotation resulted in feldspar with 97% purity and minimized Fe_2O_3 to 0.23%. Addition of 20% feldspar to ceramic materials decreased the sintering temperature by 100ºC and increased the mechanical strength. The technology is energy efficient and environmentally sustainable. It is also cost-effective and will facilitate industrial development. Opening a feldspar processing plant in Karakalpakstan would contribute to import substitution, employment growth, and economic development in the region.

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Rezyume: *Tadqiqot Qoraqalpog‘iston Respublikasi, O‘zbekistondagi dala shpati konlarining mineralogik, kimyoviy va texnologik xususiyatlarini o‘rganadi. Mintaqaning katta geologik salohiyatiga qaramay, mahalliy dala shpati resurslari sanoat miqyosida foydalanilmagan. Batafsil laboratoriya tahlili va tajriba miqyosidagi tajribalar orqali dala shpati bo‘lgan tog‘ jinslarini yuqori sifatli sanoat xom ashyosiga aylantirish uchun samarali boyitish va qayta ishlash texnologiyasi ishlab chiqildi.*

Maydalash, magnit ajratish va flotatsiyani birlashtirgan taklif qilingan jarayon 96–97% tozalik darajasiga va Fe_2O_3 miqdori 0,25% dan past bo‘lgan dala shpati konsentratlariga erishdi. Qayta ishlangan dala shpatining 20% ni o‘z ichiga olgan keramik jismlarning sinterlash sinovlari kuydirish haroratini 100–120°C ga pasaytirdi, bu esa taxminan 10–12% energiya tejashga olib keldi. Ushbu texnologiya mintaqaviy shisha va keramika sanoatini qo‘llab-quvvatlash uchun mahalliy resurslardan foydalanish uchun ekologik toza va iqtisodiy jihatdan samarali yechimni taqdim etadi.

Резюме: *В исследовании рассматриваются минералогические, химические и технологические особенности месторождений полевых шпатов в Республике Каракалпакстан, Узбекистан. Несмотря на значительный геологический потенциал региона, местные ресурсы полевых шпатов до сих пор не разрабатывались в промышленных масштабах. На основе детального лабораторного анализа и пилотных экспериментов была разработана эффективная технология обогащения и переработки, позволяющая превратить полевошпатсодержащие породы в высококачественное промышленное сырье.*

Предлагаемый процесс, сочетающий дробление, магнитную сепарацию и флотацию, позволил получить концентраты полевых шпатов чистотой 96–97% и содержанием Fe_2O_3 менее 0,25%. Испытания на спекание керамических масс, содержащих 20% переработанного полевого шпата, позволили снизить температуру обжига на 100–120 °C, что привело к предполагаемой экономии энергии 10–12%. Данная технология представляет собой экологически безопасное и экономически выгодное решение для использования местных ресурсов в поддержку региональной стекольной и керамической промышленности.

Kalit so‘zlar: *dala shpati, Qoraqalpog'iston, alyuminosilikat, boyitish, flotatsiya, magnit ajratish, keramika, shisha, energiya samaradorligi, minerallarni qayta ishlash.*

Ключевые слова: *полевой шпат, Каракалпакстан, алюмосиликат, обогащение, флотация, магнитное разделение, керамика, стекло, энергоэффективность, обогащение полезных ископаемых.*

APPLICATION OF MACHINE LEARNING ALGORITHMS FOR AUTOMATIC ANALYSIS OF THE KARAKALPAK LANGUAGE

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Summary: *This article discusses the development of a grammatical model for the Karakalpak language using artificial intelligence. The model includes morphological and syntactic analyses and serves as a foundation for language technologies. This approach plays a significant role in the development of the language.*

Key words: *Karakalpak language, machine learning, natural language processing, computational linguistics, automatic language analysis.*

In the era of modern technological advancement, language technologies are rapidly developing. Machine learning algorithms hold great significance in the field of language analysis and are widely used for studying various languages. This article discusses the application of machine learning algorithms for automatic analysis of the Karakalpak language.

Machine learning is a branch of artificial intelligence that enables computers to learn from experience without explicit programming. Machine learning (ML) is a discipline of artificial intelligence (AI) that provides machines with the ability to automatically learn from data and past experiences while identifying patterns to make predictions with minimal human intervention. Machine learning methods enable computers to operate autonomously without explicit programming. ML applications are fed with new data, and they can independently learn, grow, develop, and adapt. Machine learning derives insightful information from large volumes of data by leveraging algorithms to identify patterns and learn in an iterative process. ML algorithms use computation methods to learn directly from data instead of relying on any predetermined equation that may serve as a model.

Automatic language analysis refers to the process of investigating various linguistic aspects (morphology, syntax, semantics) using computers. An algorithm is a sequence of operations performed to solve a specific problem.[1]

The primary aim of this research is to develop methods for the automatic analysis of the Karakalpak language using machine learning algorithms and evaluate their effectiveness.

Relevance of the Study:

1. Automatic grammatical analysis of the Karakalpak language.
2. Assisting in the development of a language corpus.
3. Enhancing machine translation systems.
4. Automating the processes of language learning and teaching.
5. Automatically classifying and analyzing texts in the Karakalpak language.

Natural Language Toolkit is a leading platform for building Python programs to work with human language data. It provides easy-to-use interfaces to over 50 corpora and lexical resources such as WordNet, along with a suite of text processing libraries for classification, tokenization, stemming, tagging, parsing, and semantic reasoning, wrappers for industrial-strength NLP libraries, and an active discussion forum.[4] Thanks to a hands-on guide introducing programming fundamentals alongside topics in computational linguistics, plus comprehensive API documentation, NLTK is suitable for linguists, engineers, students, educators, researchers, and industry users alike. NLTK is available for Windows, Mac OS X, and Linux. Best of all, NLTK is a free, open source, community-driven project.

NLTK has been called “a wonderful tool for teaching, and working in, computational linguistics using Python,” and “an amazing library to play with natural language.” Natural Language Processing with Python provides a practical introduction to programming for language processing. Written by the creators of NLTK, it guides the reader through the fundamentals of writing Python

programs, working with corpora, categorizing text, analyzing linguistic structure, and more. The online version of the book has been been updated for Python 3 and NLTK 3.

Python, with its extensive libraries and user-friendly syntax, is widely used in machine learning. For analyzing the Karakalpak language, the following Python libraries and algorithms are utilized:

1. NLTK (Natural Language Toolkit): Provides tools for processing text, including tokenization, morphological analysis, and syntactic analysis.[2][3]

```
import nltk
nltk.download('punkt')
from nltk.tokenize import word_tokenize
text = "Men qaraqalpaq tilin úyrenemen."
tokens = word_tokenize(text)
print(tokens)
```

2. Scikit-learn: Supports classification, regression, and clustering algorithms, which can be used for text classification in the Karakalpak language.

```
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.naive_bayes import MultinomialNB
texts = ["Bul jaqsı kitap", "Hawa rayı jaqsı", "Kitap oqıw paydalı"]
categories = ["kitap", "hawa rayı", "kitap"]
vectorizer = CountVectorizer()
X = vectorizer.fit_transform(texts)
clf = MultinomialNB()
clf.fit(X, categories)
new_text = ["Búgin kún ıssı"]
X_new = vectorizer.transform(new_text)
predicted = clf.predict(X_new)
print(predicted)
```

3. Gensim: Useful for semantic analysis and building word vectors.

```
from gensim.models import Word2Vec
sentences = [["men", "mektepke", "baraman"], ["ol", "kitap", "oqıydı"]]
model = Word2Vec(sentences, min_count=1)
similarity = model.wv.similarity('mektepke', 'kitap')
print(f"'mektepke' and 'kitap' similarity: {similarity}")
```

Key challenges include: Limited resources for the Karakalpak language, including annotated corpora; Morphological complexity due to the agglutinative nature of the language; Lack of standardized linguistic resources.

Proposed Solutions:

1. Developing a comprehensive language corpus.
2. Creating morphological analyzers tailored for Karakalpak.
3. Standardizing linguistic resources, such as dictionaries and grammatical rule sets.
4. Adapting models created for related Turkic languages.
5. Leveraging transfer learning to utilize pre-trained models for the Karakalpak language.

The application of machine learning algorithms for automatic analysis of the Karakalpak language holds significant potential. These methods can play a vital role in researching, preserving, and developing the language. However, much work remains to be done, including creating quality resources, adapting algorithms, and accounting for linguistic nuances. Advancing automatic analysis

technologies will facilitate learning, preserve the Karakalpak language, and promote its global recognition. Innovations in this field will help maintain the language's relevance in the digital age.

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Rezyume: *Ushbu maqola Qoraqalpoq tili uchun sun'iy intellekt yordamida grammatika modelini ishlab chiqishga bag'ishlangan. Model morfologik va sintaktik tahlillarni o'z ichiga oladi hamda til texnologiyalariga asos bo'lib xizmat qiladi. Mazkur yondashuv tilni rivojlantirishda muhim ahamiyatga ega.*

Резюме: *В данной статье рассматривается разработка грамматической модели для каракалпакского языка с использованием искусственного интеллекта. Модель включает морфологический и синтаксический анализ и служит основой для языковых технологий. Этот подход имеет важное значение для развития языка.*

Kalit so'zlar: *Qoraqalpoq tili, mashinali o'qitish, tabiiy tilni qayta ishlash, hisoblash tilshunosligi, tillarni avtomatik tahlil qilish.*

Ключевые слова: *Каракалпакский язык, машинное обучение, обработка естественного языка, компьютерная лингвистика, автоматический анализ языка.*

UDC 621.311

INTEGRATION OF SOLAR ENERGY AND HYDRAULIC STORAGE IN IRRIGATION SYSTEMS FOR SUSTAINABLE AGRICULTURE

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Summary: *The article explores ways to improve the energy efficiency of drip irrigation systems for agricultural crops through the use of solar energy and hydraulic energy storage. The study focuses on the arid climatic conditions of Uzbekistan, where more than 92% of water resources are used for irrigation, and pumping stations consume about 12–13% of the country's total electricity. A photo irrigation system powered by photovoltaic (PV) panels is proposed, in which solar energy drives pumping units that lift water from artesian wells into storage reservoirs. During peak solar hours, the pumps operate to accumulate water, allowing irrigation to be performed in the evening and nighttime, thereby reducing water loss due to evaporation. Calculations for tomato irrigation on a 20-hectare area show that the required pump power is 20.6 kW, with a daily energy demand of 157 kWh. The cost of electricity generated by PV systems is 15–30% lower than that of energy supplied from thermal power plants. Moreover, the use of hydraulic storage instead of lithium-ion batteries reduces energy storage costs more than tenfold. The results of the techno-economic analysis confirm the efficiency and environmental benefits of the proposed system, which provides a sustainable approach to water and energy supply for agricultural applications.*

Key words: *solar energy, drip irrigation, hydraulic energy storage, photovoltaic system, pumping station, energy efficiency, water conservation, sustainable development, agriculture.*

At present, more than one-third of the world's population is engaged in agriculture; for them, it is the main source of income and plays a crucial role in the economic development of many countries by providing food, raw materials, products, and employment opportunities [1]. In this regard, investments in agriculture are increasing year by year, contributing to poverty reduction in developing countries [2], addressing key global issues such as achieving food security and improving nutrition [3], and promoting economic growth and development [4,5].

The Republic of Uzbekistan is an arid country with low precipitation, low humidity, and a high level of evaporation; as a result, more than 92% of its water resources are used for irrigation of agricultural crops sown on an area of 4.28 million hectares [6]. Therefore, considering the annual increase in water demand due to the development of the agricultural sector and population growth, ensuring sufficient water resources is one of the country's main challenges.

The irrigated lands of the country are energy-intensive, since about 51% of them receive water through pumping stations, consuming 12–13% of the total electricity generated in the Republic annually [6]. Almost all pumping stations are electrified, and only a small part of the installations are powered by diesel generators. Energy expenditure constitutes the largest share of the operating costs of pumping stations. Therefore, for farmers of the Republic, issues of water and energy conservation, as well as the use of alternative and cheaper energy sources for powering pumping installations, are extremely important.

At present, one of the rational solutions for saving water resources and reducing energy costs in irrigating small agricultural plots is drip irrigation powered by solar energy [7–10]. The authors of [7] argue that using solar energy for drip irrigation of small areas significantly reduces the cost of production. Recently, this direction has become so promising that the term "photo irrigation" has emerged - meaning irrigation using solar energy [8]. The potential of photo irrigation was studied for irrigating olive trees over an area of 10 hectares in southeastern Spain, and the results showed that 161 m³/day of water was required with a PVS of 6 kW capacity [8].

The authors of [9] presented the results of irrigation studies for various crops in five geographic locations around the world: Spain, Saudi Arabia, Mexico, Lebanon, and Jordan. For this

purpose, different power supply options for pumping systems were considered—diesel generators, the electrical grid, and photovoltaic systems (PVSs). The results demonstrated that, in all geographic locations, the use of PVSs resulted in costs 15–30 times lower than those of diesel generators, and 2.2–2.4 times lower than those associated with grid-connected systems.

It should be noted that most researchers in photo irrigation identify the main stages of such studies as follows [7–10]:

1. Determination of the annual amount of water required, distributed by months and days, for the selected irrigated area.

2. Selection of the pumping unit and determination of its parameters along with the pipeline system.

3. Determination of the parameters of the photovoltaic system that meet the requirements of the pumping unit.

The issue of solar energy storage is considered essential due to its practicality. For this purpose, electrochemical or thermal storage is usually proposed, although it is noted that this significantly increases the system's cost [8, 11, 12]. In [12], it is mentioned that to reduce the cost of energy systems, alternative methods such as hydraulic water storage should be considered.

In the Republic of Uzbekistan, drip irrigation is a rapidly developing and promising area. Currently, its energy supply is mainly provided by the centralized electrical grid or fuel-based generators. Under these conditions, studying the use of hydraulic storage of solar energy to improve its efficiency - based on determining optimal irrigation timing, storage volumes, and pumping unit parameters - is, in our view, both interesting and important, though unfortunately, insufficiently explored.

Let us consider the possibilities of hydraulic water and energy storage in drip irrigation systems, for example, for tomato crops over an area of 20 hectares. Here, solar energy is used to power a pumping unit installed in an artesian well that serves as the water source for the area (Figure 1).

Energy from the PVS is transmitted through an inverter to the pumping system (PS), which pumps water from the source into a storage reservoir. Water from the reservoir is then supplied to the drip irrigation system through filters and a fertilizer dosing unit and further distributed to the drip lines. The entire process - starting and stopping the units, controlling water flow, and managing electrical energy - is automated via a control panel under specialized software (e.g., HOMER).

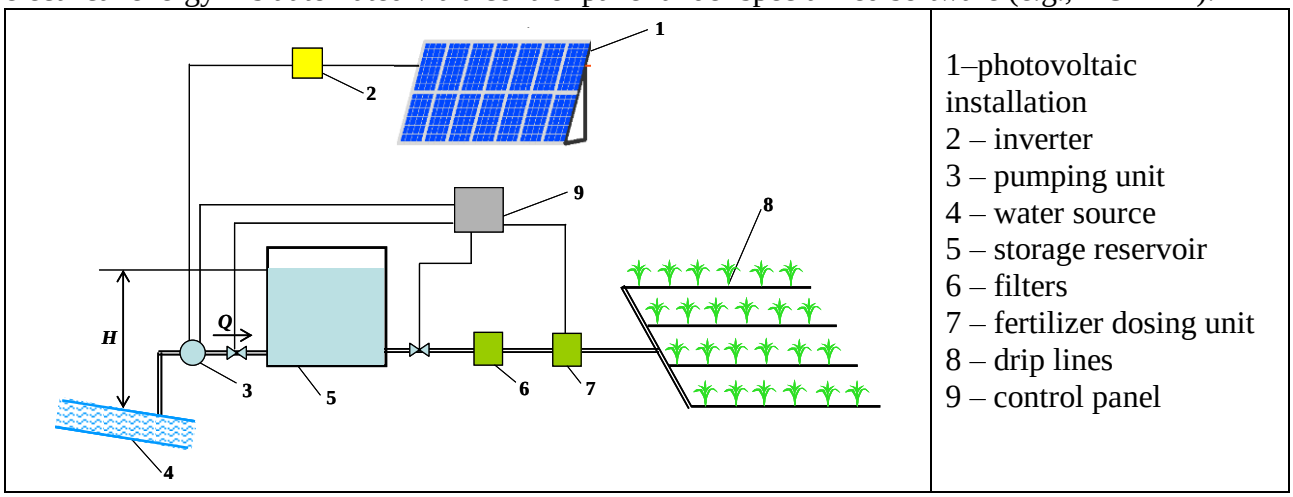


Figure 1. Schematic of a drip irrigation system using solar energy.

Determination of the energy characteristics of this complex is based on solar radiation activity and the irrigation schedule of crops over a 24-hour period, typical for the given area. For many crops in Uzbekistan, irrigation is recommended during evening and nighttime hours to minimize evaporation and transpiration losses (including for tomatoes) [13].

Thus, during peak solar radiation hours, irrigation is not performed; instead, solar energy is used to power the PU, which stores the required water volume in the reservoir.

According to the irrigation scheme providing sequential watering of the designated plots, the water volume required for a single irrigation can be determined as:

$$V_{ir} = m \cdot \omega / n \quad (1)$$

where m – irrigation rate, m³/ha; ω – area size, ha; n – number of plots. The flow rate of water supplied for irrigation is determined as follows:

$$Q_{ir} = V_{ir}/3600 \cdot t_{ir} \quad (2)$$

where t_{ir} is the duration of irrigation (hours).

The capacity of the pumping unit, which must ensure the supply of V_{ir}, can be determined by the following relationship:

$$Q_{PVS} = V_{ir}/3600 \cdot t_{pu} \quad (3)$$

t_{ps} is the duration of the pumping unit's operation during the day (determined based on the number of peak sun-hours during the day and the pump's operating mode).

The daily electrical energy generated by the PVS can be determined by the formula:

$$E_{PVS} = \int_{t_1}^{t_2} N_{PVS}(t)dt \quad (4)$$

The amount of E_{PVS} must be sufficient to supply the water volume V_{ir} from the source to the reservoir, which is determined as follows:

$$E_{PVS} = V_{ir} \cdot H/367 \cdot \eta, kW \cdot h \quad (5)$$

where H and η are the head and efficiency of the pumping unit.

The total energy generated by the PV system, considering losses in the inverter, which are equal to 15 – 20 % of E_{PV}, is calculated by the following relationship [14]:

$$E_{PVS}^{ir} = 1{,}2 \cdot E_{PVS}, kW \cdot h \quad (6)$$

Based on E_{PVS} and t_{ps}, the energy parameters of the PVS are determined, and its main components are selected [219].

To calculate the power of the pumping unit, we use the following expression:

$$N_{ps} = 9{,}81 \cdot K_з \cdot Q_{ps} \cdot H/\eta, kW \quad (7)$$

where $K_з = 1{,}15 \div 1{,}2$ is the power reserve coefficient.

The results of calculating the water flow rate and pumping unit power by irrigation periods throughout the year, calculated using the formulas above, can be presented in the diagram shown in Figure 2. Based on this diagram, the annual values of water flow rate and electricity required for the full water supply of the irrigated area can be determined.

$$V_{year} = \sum_{i=1}^{n} Q_i \cdot t_i; \qquad E_{year} = \sum_{i=1}^{n} N_i \cdot t_i \quad (8)$$

where n is the number of irrigation periods;

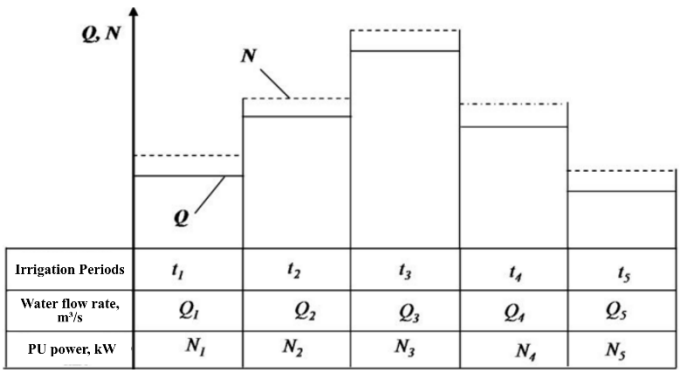


Figure 2. Water Flow Rate in the Irrigation System and Pumping Unit Power by Irrigation Periods throughout the Year

The values of the water flow rate supplied for irrigation, as well as the power of the PVS and PS, can be illustrated using the diagram in Figure 3.

The diagram shows that tomato irrigation is carried out from 17^{00} to 9^{00} for 16 hours, and during the daytime from 9^{00} to 17^{00}, the necessary volume of water will be accumulated in the reservoir by the PS, which is powered by the PVS and will operate at the maximum possible power.

The water flow rate required for irrigation is determined based on the type of agricultural crop, soil properties, climatic, and hydrogeological conditions corresponding to the given irrigated area. For example, for tomatoes in the southern zones of the Republic, the annual irrigation norm averages 5500 m^3/ha with 600 to 700 m^3/ha spent on each irrigation. The number of irrigations is 9, with the irrigation time being from May 1 to October 10 [15]. The duration of irrigation, depending on its scheme, is 10 to 30 hours.

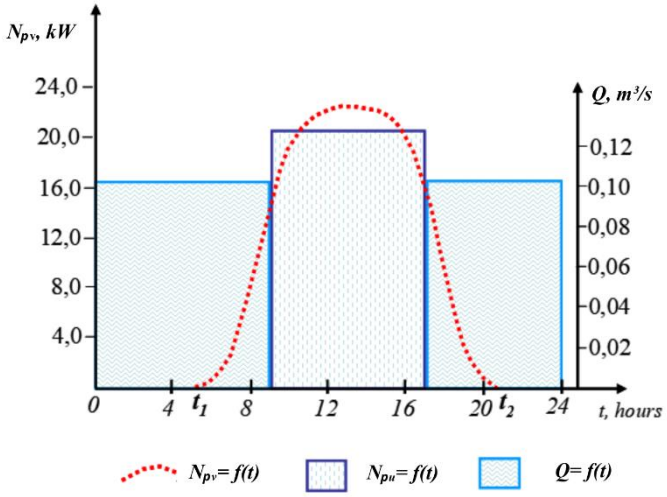


Figure 3. Diagram of Water Flow Rate for Drip System and Unit Power

We present the results of calculating the flow rates and volumes of water, as well as the required amount of electricity for powering the pumping unit, with a head $H = 12$ meters and an efficiency η = 0,7 a number of plots 5, and an irrigation duration 16 hours.

1. Volume of water required for a single irrigation: $V_{ir}=m\cdot\omega/n=700\cdot20/5=2800\ м^3$.
2. Water flow rate supplied for irrigation: $Q_{ir}=V_{ir}/(3600\cdot t_{ir})=2800/3600\cdot16=0{,}0486\ м^3/с$
3. Capacity of the pumping unit, which must ensure the supply of V_{ir}:

$Q_{ps} = V_{ir}/3600\cdot t_{ps} = 2800/(3600\cdot7{,}6) = 0{,}102\ м^3/с$

where $t_{ps} = T_{peak}$ is the number of peak sun-hours during the day, T_{peak} = 7,6 h. [15].

4. Pumping unit power:

$N_{ps}=9{,}81\cdot K_з\cdot Q_{ps}\cdot H/\eta=9{,}81\cdot1{,}2\cdot0{,}102\cdot12{,}0/0{,}7=20{,}58\ kW$

5. Required amount of electricity:

$E_{PVS}=V_{ir}\cdot H/367\cdot\eta=2800\cdot12,0/367\cdot0,7=130,79\ kW\cdot h$

6. Total energy generated by the PVS system: PVS:$E_{PVS}^{ir}=1,2\cdot E_{PV}=1,2\cdot130,79=157\ kW\cdot h$

7. Annual amount of generated electricity:

$$E_{PVS}^{year}=V_{ir}^{year}\cdot \mathrm{H}/367\cdot\eta=110000\cdot12,0/367\cdot0,7=5138,19kW\cdot h$$

where $V_{ir}^{year}=M\cdot\omega=5500\cdot20=110000\ m^3$, M is the irrigation norm, m^3/ha

8. Cost of electricity from the PV system at tariffs of 0,1 \$ (kWh·hour)$^{-1}$ [16]:

$$C=5138,19\cdot0,1=513,82\ \$$$

9. Cost of electricity from thermal power plants at tariffs of 0,13 \$ (kWh·hour)$^{-1}$ [16]:

$$C=5138,19\cdot0,13=668\ \$$$

10. Cost of electricity storage by hydraulic method at specific costs of 0,01 \$ (kWh·hour)$^{-1}$ [17]:

$$A=5138,19\cdot0,012=61,65\ \$$$

11. Cost of electricity storage with lithium-ion batteries at specific costs of 0,187 \$ (kWh·hour)$^{-1}$ [18]:

$$A=5138,19\cdot0,187=960,84\ \$$$

12. Resulting effect:

a) In terms of electricity costs: *154,18 $.*

b) In terms of electricity storage costs*: 899,19 $.*

The main advantages of the proposed scheme and operating mode for the drip irrigation system are as follows:

- Energy supply to the pumping unit using PV energy significantly reduces energy costs compared to the option from thermal power plants (TPP), as the specific cost of PV energy is currently less than 0,1 \$ (kWh·hour)$^{-1}$, and TPP energy is 0,1÷0,17 \$(kWh·hour)$^{-1}$ [16]. According to the Fraunhofer Institute for Solar Energy Systems, the specific cost of energy from combined cycle gas turbine plants is 7,78÷9,96 euro cents (kWh·hour)$^{-1}$, and from gas plants is 11,0÷21,94 euro cent (kWh·hour)$^{-1}$ [18]. Moreover, the cost of solar energy decreases year after year, while the cost of TPP-generated energy increases.

- The use of the PV system only during peak solar activity hours increases the utilization of solar energy and reduces the pumping unit's operating time, thereby lowering its life cycle costs;

- The proposed solar energy use and storage system favorably differs from other storage systems in parameters such as specific power cost, speed of activation, and large storage volumes [17].

The results of the techno-economic calculations showed that using solar energy to power the pumping unit of the tomato drip irrigation system on a 20-hectare area, with PV energy costing 0,1\$ (kWh·hour)$^{-1}$ and energy from thermal power plants costing 0,13 \$(kWh·hour)$^{-1}$ allows for an annual savings of 154.18\$ (excluding the cost of power transmission lines). The effect obtained from implementing the proposed scheme increases several times if it is used in areas without power supply to replace diesel generators.

The specific cost of energy storage in the proposed system is 0,012/0,17 \$ (kWh·hour)$^{-1}$ [17], while in storage units with lithium-ion batteries, this indicator exceeds 0.23\$, and according to Bloomberg New Energy Finance, it is no lower than 0,187 \$ (kWh·hour)$^{-1}$ [19], the resulting effect on storage costs is 899,19 \$, Furthermore, this hydraulic storage system allows for the accumulation of large volumes of energy in conjunction with irrigation pumping stations [17].

All the above indicators convincingly show that in water supply and irrigation systems, the use of solar energy to power pumping units, with a scientifically sound selection of generation and storage volumes, has undeniable advantages.

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Rezyume: *Maqolada qishloq xo‘jaligi ekinlarini sug‘orish tizimlarining energiya samaradorligini oshirish maqsadida quyosh energiyasi va gidravlik akkumulatsiyadan foydalanish masalalari ko‘rib chiqiladi. Tadqiqot O‘zbekistonning qurg‘oqchil sharoitlariga asoslangan bo‘lib, bu yerda suv resurslarining 92 % dan ortig‘i sug‘orishga sarflanadi va nasos stansiyalari mamlakatdagi umumiy elektr energiyasining 12–13 % ini iste’mol qiladi. Quyosh panellari yordamida nasos agregatlarini quvvatlantiruvchi “fotoirrigatsiya” tizimi taklif etilgan. Quyosh faoliyati eng yuqori bo‘lgan paytda nasos suvni rezervuarga to‘playdi, poliv esa kechki va tungi soatlarda amalga oshiriladi, bu esa suvning bug‘lanishini kamaytiradi. 20 ga maydonda pomidor sug‘orish misolida hisob-kitoblar bajarilib, nasos quvvati 20,6 kVt, zarur energiya esa 157 kVt·soat ekanligi aniqlangan. Quyosh elektr energiyasining tannarxi issiqlik elektr stansiyalariga nisbatan 15–30 % arzonroq. Litiy-ion batareyalarga nisbatan gidroakkumulatsiya tizimi energiya saqlash xarajatlarini 10 martadan ko‘proq kamaytiradi. Hisob-kitob natijalari taklif etilgan tizimning iqtisodiy va ekologik samaradorligini tasdiqlaydi.*

Резюме: *В статье рассматриваются вопросы повышения энергоэффективности систем капельного орошения сельскохозяйственных культур путем использования солнечной энергии и гидравлического аккумулирования воды. Исследование выполнено для условий аридного климата Узбекистана, где до 92 % водных ресурсов расходуется на орошение, а насосные станции потребляют около 12–13 % всей электроэнергии страны. Предложена схема фотоэлектрического орошения (photoirrigation), при которой энергия солнечных*

панелей используется для питания насосных установок, подающих воду из артезианских источников в накопительные резервуары. В часы максимальной солнечной активности насосы работают на накопление воды, что позволяет выполнять полив в вечернее и ночное время, снижая потери влаги от испарения. Проведены расчеты для орошения томатов на площади 20 га, показавшие, что мощность насосной установки составляет 20,6 кВт, а требуемая энергия - 157 кВт·ч в сутки. Стоимость электроэнергии от фотоэлектрической установки оказалась ниже на 15–30 % по сравнению с энергией от тепловых электростанций. Применение гидроаккумулирования вместо литий-ионных батарей снижает затраты на накопление энергии более чем в 10 раз. Результаты технико-экономических расчетов подтверждают эффективность и экологическую целесообразность предложенной системы, обеспечивающей устойчивое водо- и энергоснабжение сельского хозяйства.

Kalit so‘zlar: *quyosh energiyasi, tomchilatib sug‘orish, gidroakkumulatsiya, fotoelektr stansiya, nasos stansiyasi, energiya samaradorligi, suv tejash, barqaror rivojlanish, qishloq xo‘jaligi.*

Ключевые слова: *солнечная энергия, капельное орошение, гидроаккумулирование, фотоэлектрическая установка, насосная станция, энергоэффективность, водосбережение, устойчивое развитие, сельское хозяйство.*

DEVELOPMENT OF A LOCAL FELDSPAR PROCESSING TECHNOLOGY IN KARAKALPAKSTAN, UZBEKISTAN

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Summary: *This study focuses on the development of an energy-efficient and water-saving processing technology for local feldspar (K–Na–Al-silicate) raw materials in the Karakalpakstan region of Uzbekistan. The chemical composition, mineralogical characteristics, and beneficiation processes of locally available feldspar ores were investigated. Modern methods such as dry magnetic separation, froth flotation, and acid leaching were optimized to obtain high-grade feldspar concentrates. The results were compared with similar international studies indexed in Scopus and Web of Science. The developed process produced a feldspar concentrate containing 71.0% SiO_2, 19.1% Al_2O_3, and only 0.18% Fe_2O_3, which meets industrial requirements for glass and ceramic production.*

Key words: *feldspar, beneficiation, Karakalpakstan, magnetic separation, flotation, ceramics, energy efficiency*

1. Introduction

Feldspar minerals represent one of the most abundant aluminosilicate groups in the Earth's crust, essential for the production of ceramics, glass, and enamel.[1] They are mainly composed of orthoclase ($KAlSi_3O_8$), albite ($NaAlSi_3O_8$), and anorthite ($CaAl_2Si_2O_8$).

In Uzbekistan, particularly in the **Karakalpakstan** region, granitic and pegmatitic deposits containing Na–K feldspar are widespread but remain underutilized. The lack of local beneficiation plants leads to dependence on imported feldspar from Russia and China. Developing a domestic feldspar processing technology could significantly strengthen Uzbekistan's industrial independence.

Recent global research has focused on optimizing feldspar beneficiation using **magnetic separation, flotation, and acid leaching** to achieve high purity and low Fe_2O_3 content.[2] However, adaptation of these methods to arid regions such as Karakalpakstan—where water resources are limited—requires process modifications.

The aim of this study is to design and validate a **dry, energy-efficient feldspar processing technology** suited to Karakalpakstan's geological and environmental conditions.

2. Materials and Methods

2.1. Raw material sampling

Samples were collected from granitic outcrops in the **Beruniy–Qo'ng'irot geological zone** of Karakalpakstan. Approximately 5 kg of representative feldspar-bearing rock was obtained for laboratory analysis.

2.2. Chemical and mineralogical analysis

X-ray fluorescence (XRF) and X-ray diffraction (XRD) analyses were used to determine the chemical and mineral phase composition.

Component	Content (%)
SiO_2	67.4
Al_2O_3	18.5
K_2O	4.8
Na_2O	4.2
Fe_2O_3	0.6
CaO	1.1

These results are comparable with feldspar compositions reported in similar granitic deposits.[5]

2.3. Beneficiation process

1. **Crushing and grinding:** The ore was crushed in a jaw crusher and ground in a ball mill to below 100 μm.
2. **Magnetic separation:** Dry magnetic separation (0.8 T) was performed to remove Fe-bearing minerals (Baila et al., 2023).
3. **Flotation:** A mixture of oleic acid and dodecylamine reagents was applied to separate feldspar from quartz and mica (Mohanty et al., 2024).
4. **Acid leaching:** To further reduce iron oxide impurities, samples were treated with 5% HCl solution at 60 °C for 30 min.
5. **Drying and sieving:** Final products were dried at 110 °C and screened into specific size fractions.

3. Results

After beneficiation, the feldspar concentrate showed the following chemical composition:

Parameter	Raw ore	Concentrate
SiO_2 (%)	67.4	71.0
Al_2O_3 (%)	18.5	19.1
$K_2O + Na_2O$ (%)	9.0	9.7
Fe_2O_3 (%)	0.6	0.18
Yield (%)	—	83.2

Magnetic separation reduced Fe_2O_3 by approximately 70%, while flotation effectively removed quartz and mica impurities. These results are consistent with findings by[7], who achieved similar purity levels in weathered granitic feldspar.

The final product meets the chemical requirements for use in **glass, porcelain, and ceramic production**, as per international standards.[1]

4. Discussion

The results demonstrate that Karakalpakstan feldspar deposits are mineralogically similar to those in Khiva.[4] Implementing dry magnetic separation significantly reduces water usage, which is crucial for arid environments.

Compared with previous methods[6], the proposed process shows improved energy efficiency and reduced reagent consumption. Acid leaching, as highlighted by, proved to be the most effective step in minimizing Fe_2O_3 to below 0.2%, ensuring suitability for high-quality glass manufacturing.

Thus, this optimized combination of **magnetic–flotation–acid purification** is both technically and environmentally suitable for the Karakalpakstan context.

5. Conclusion

1. Local feldspar deposits in Karakalpakstan contain high-quality Na–K–feldspar suitable for industrial applications.
2. The proposed beneficiation process—combining dry magnetic separation, flotation, and acid leaching—achieved an Fe_2O_3 content below 0.2% with 83% yield.
3. The process is water-efficient and energy-saving, aligning with the environmental constraints of the region.
4. The developed technology can substitute feldspar imports and promote the growth of Uzbekistan’s ceramic and glass industries.

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Rezyume: *Ushbu tadqiqot O'zbekistonning Qoraqalpog'iston mintaqasida mahalliy dala shpati (K–Na–Al-silikat) xom ashyosini energiya tejaydigan va suvni tejaydigan qayta ishlash texnologiyasini ishlab chiqishga qaratilgan. Mahalliy mavjud dala shpati rudalarining kimyoviy tarkibi, mineralogik xususiyatlari va boyitish jarayonlari o'rganildi. Yuqori sifatli dala shpati konsentratlarini olish uchun quruq magnit ajratish, ko'pikli flotatsiya va kislotali eritmalar bilan yuvish kabi zamonaviy usullar optimallashtirildi. Natijalar Scopus va Web of Science jurnallarida indekslangan shunga o'xshash xalqaro tadqiqotlar bilan taqqoslandi. Ishlab chiqilgan jarayon shisha va keramika ishlab chiqarish uchun sanoat talablariga javob beradigan 71,0% SiO_2, 19,1% Al_2O_3 va atigi 0,18% Fe_2O_3 dan iborat dala shpati konsentratini ishlab chiqardi.*

Резюме: *Данное исследование посвящено разработке энергоэффективной и водосберегающей технологии переработки местного полевошпатового (K–Na–Al-силикатного) сырья в Каракалпакстане (Узбекистан). Были изучены химический состав, минералогические характеристики и процессы обогащения местных полевошпатовых руд. Для получения высококачественных полевошпатовых концентратов были оптимизированы современные методы, такие как сухая магнитная сепарация, пенная флотация и кислотное выщелачивание. Результаты были сопоставлены с аналогичными международными исследованиями, индексируемыми в Scopus и Web of Science. Разработанная технология позволила получить полевошпатовый концентрат, содержащий 71,0% SiO_2, 19,1% Al_2O_3 и всего 0,18% Fe_2O_3, что соответствует промышленным требованиям для производства стекла и керамики.*

Kalit so‘zlar: *dala shpati, boyitish, Qoraqalpog'iston, magnit ajratish, flotatsiya, keramika, energiya samaradorligi*

Ключевые слова: *полевой шпат, обогащение, Каракалпакстан, магнитная сепарация, флотация, керамика, энергоэффективность*

QUALITATIVE ANALYSIS METHODS FOR DETERMINISTIC FARM MODELS WITH LIMITED USE OF WATER RESOURCES

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Summary: *In this work, methods for the qualitative analysis of deterministic models of the activities of farms with limited water resources are studied.*

Key words: *Keywords: model, style, resource, direct problem, dual problem, optimal, maximum, minimum, solution.*

Currently, agriculture is one of the most important branches of the national economy of our republic. The intensification of production in this industry, with limited resources allocated for this purpose, is of great importance in the context of the transition to new forms and methods of management. Therefore, the purpose of this work is to develop and analyze deterministic models for farms with limited use of water resources. As well as establishing the relationship between duality and optimality conditions for direct and dual tasks of allocating limited water resources. The study and construction of mathematical models of this class is especially relevant for such an important area of human activity as agricultural production.

So, here is a deterministic version of the problem statement:

$$F = \sum_{j \in A} \sum_{k=1}^{K} P_{kj} x_{kj} a_{kj} \to \max , \tag{1}$$

$$\sum_{j \in A} x_{kj} \le S_k , \quad \left(k = \overline{1, K}\right), \tag{2}$$

(land resources)

$$\sum_{j \in A} \sum_{k=1}^{K} b_{skj} x_{kj} \le b_s , \left(s = \overline{1, m}\right), \tag{3}$$

(material resources)

$$\sum_{j \in A} \sum_{k=1}^{K} a_{\omega jk} x_{kj} \le b_\omega , \quad \left(\omega \in W\right), \tag{4}$$

(mineral resources)

$$\sum_{k=1}^{K} a_{kj} x_{kj} \ge \alpha_j , \quad \left(j \in A\right), \tag{5}$$

(minimum volume of crop production)

$$\sum_{j \in A} \sum_{k=1}^{K} \hat{b}_{kj} x_{kj} \le b . \tag{6}$$

(water resources)

$$x_{kj} \geq 0 \quad \left(j \in A = A_1 \cup A_2, k = \overline{1,K}\right) \tag{7}$$

Here:

A_1 - there are many branches of grain production in agriculture;

A_2 - there are many branches of cotton production in agriculture;

P_{kj} - the profit received from the production of a unit of the *j*-th crop on the *k*-th plot of land in a farm;

x_{kj} - the area of the *k*-th plot for the cultivation of the *j*-th crop on a farm;

S_k - the area of the *k*-th plot of land in a farm;

b_{skj} - the cost rate of the *s*-th type of resource per unit area of the *k*-th plot of land for cultivating the *j*-th crop on a farm;

b_s - the volume of the *s*-th resource in the farm;

S - the number of the type of resource in the farm;

m - the amount of production resources in a farm;

b_ω - volume ω -th mineral resource in the farm;

α_j - volume of mandatory deliveries j - the use of crop production in agriculture;

a_{kj} - yield indicator j -th culture on k -th plot of land on a farm;

b_{kj} - the rate of water consumption per unit area k -th plot of land for cultivation j -the use of crop production in a farm;

b - the volume of water resources of the region in agriculture;

$a_{\omega jk}$ - the rate of application of mineral fertilizers ω -th type on the k -th plot of land per unit area of the crop of the j -th type in the farm;

W - the amount of all types of mineral fertilizers in the farm.

This means that the direct task is to determine the maximum profit that meets the restrictions on the use of land resources, material resources, mineral fertilizers and crop production, as well as on the use of water resources.

Now let's consider a dual problem, to (1)-(7) :

$$\Phi(y_k, z_s, u_\omega, v_j) = \sum_{k=1}^{K}(s_k, y_k) + \sum_{s=1}^{n}(b_s, z_s) + \sum_{\omega \in W}(b_\omega, u_\omega) - \sum_{j \in A}(\alpha_j, v_j) + bl \to \min, \tag{8}$$

under restrictions

$$y_k + \sum_{s=1}^{n} b_{sjk} z_s + \sum_{\omega \in W} a_{\omega jk} u_\omega - v_j a_{kj} + b_{kj} l \geq P_{kj} a_{kj}, \tag{9}$$

$$y_k \geq 0, \quad z_s \geq 0, \quad u_\omega \geq 0, \qquad v_j \geq 0, \qquad l \geq 0. \quad (10)$$

Here y_k - means the assessment of the k - th land resource;

z_s - assessment of the s - th type of material resource;

u_ω - assessment of the ω - th type of mineral resource;

v_j - assessment of the minimum j -th crop production;

l - assessment of a water resource.

The dual task (8)-(10) is to minimize the difference in the summation of estimates of the land resource, estimates of the material resource, estimates of mineral fertilizers, estimates of the water resource, minus the estimate of the minimum volume of crop production in the farm, which satisfy the restrictions on the use of profit of crop production.

It is interesting to compare the models, in particular, to determine the influence of a water resource on the optimal solution. This can be done based on a qualitative analysis of the model using duality relations.

Problems (1)-(7) and (8)-(10) are interrelated linear programming problems, for which the corresponding first and second duality theorems according to [1] are formulated as follows.

Theorem 1. If one of the problems of the dual pair (1)-(7) and (8)-(10) has a solution, then the other problem is also solvable. Moreover, for any optimal solutions $\{x^*_{ijk}\}$ and $\{y^*_k, \quad z^*_s, \quad u^*_\omega, \quad v^*_j, l^*\}$ problems (1)-(7) and (8)-(10) the equality holds:

$$F\{x^*_{ijk}\} = \sum_{j\in A}\sum_{k=1}^{K} P_{kj} x^*{}_{kj} a_{kj} = \Phi\{y^*_k, \quad z^*_s, \quad u^*_\omega, \quad v^*_j, l^*\} =$$

$$= \sum_{k=1}^{K}\left(s_k, y^*_k\right) + \sum_{s=1}^{n}\left(b_s, z^*_s\right) + \sum_{\omega\in W}\left(b_\omega, u^*_\omega\right) - \sum_{j\in A}\left(\alpha_j, v^*_j\right) + bl^*$$

Theorem 2. In order for an acceptable solution to the $\left(x^*{}_{kj}\right)$ problem (1)-(7) t is necessary and sufficient that there exist values such $\left(y^*_k, z^*_s, u^*_\omega, v_j, l^*\right)$, that

$$y^*_k + \sum_{s=1}^{n} b_{sjk} z^*_s + \sum_{\omega\in W} a_{\omega jk} u^*_\omega - v^*_j a_{kj} +$$
$$+ b_{kj} l^* = P_{kj} a_{kj}, \quad (11)$$

if $x^*_{kj} > 0$.

$$\text{If } y^*_k + \sum_{s=1}^{n} b_{sjk} z^*_s + \sum_{\omega\in W} a_{\omega jk} u^*_\omega - v^*_j a_{kj} +$$
$$+ b_{kj} l^* > P_{kj} a_{kj}, \quad (12)$$

that $x_{kj}^{*} = 0$,

Then the task dual (8)-(10) to task (1)-(7) is to select such sets of resources in order to minimize the difference between the total estimates (land, material, mineral, water) resources and the total estimates (minimum volume of crop production) in the farm, which satisfy constraints (11), i.e. profitable constraints of crop production. Now let's analyze equality (11) and inequality (12), i.e. estimates of the water resource. From (11) , (12) we find l^{*} , which has the form:

$$l^{*} = \frac{\left(P_{kj}a_{kj} + a_{kj}v_{j}^{*}\right)}{b_{kj}} - \frac{\left(y_{k}^{*} + \sum_{s=1}^{m} b_{sjk}z_{s}^{*} + \sum_{\omega \in W} a_{\omega kj}u_{\omega}^{*-}\right)}{b_{kj}} \tag{13}$$

If $x_{kj}^{*} > 0$.

It follows from (12) that if

$$l^{*} > \frac{\left(P_{kj}a_{kj} - \sum_{h \in H} u_{h}^{*} + a_{kj}v_{j}^{*+}\right)}{b_{kj}} - \frac{\left(y_{k}^{*} + \sum_{s=1}^{m} b_{sjk}z_{s}^{*} + \sum_{\omega \in W} a_{\omega kj}u_{\omega}^{*-}\right)}{b_{kj}} \tag{14}$$

that $x_{kj}^{*} = 0$.

The ratio (13) has the following economic meaning: the price of water for crop production in the optimal plan consists of the summation of profits, estimates of the minimum volume of crop production minus the summation of estimates of land resources, the cost of material resources, the cost of mineral fertilizers, divided by the rate of water consumption per unit area of k-th plots of land for cultivation of j-th crop production in agriculture.

In conclusion, it can be noted that the method of qualitative analysis of deterministic farm models will make it possible to use water resources more efficiently for agricultural needs, and will also provide an opportunity, to a certain extent, to correct the negative consequences of their use.

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Rezyume: *Ushbu ishda suv resurslari cheklangan sharoitda fermer xo‘jaliklari faoliyatining deterministik modellarini sifatli taxlil kilish uslublari o‘rganilgan.*

Резюме: *В настоящей работе изучаются методы качественного анализа детерминированных моделей деятельности фермерских хозяйств при ограниченных водных ресурсах.*

Kalit so‘zlar: *модель,услуб,ресурс,тўғри масала, иккиламчи масала,оптимал, максимум, минимум,ечим.*

Ключевые слова: *модель, стиль, ресурс, прямая задача, двойственная задача, оптимальный, максимум, минимум, решение.*

UDC 621.311

APPLICATION OF SOLAR POWER PLANTS TO REDUCE ENERGY COSTS IN PUMPING STATIONS

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Summary*: The article analyzes methods to reduce energy consumption in pumping stations (PS) powered by photovoltaic stations (PVS). The economic and environmental feasibility of using solar energy in water supply and irrigation systems is substantiated. It is shown that the operation period of irrigation pumping stations coincides with the period of maximum solar activity, making the use of PVS highly efficient. Three options of energy supply are proposed: a combined supply from PVS and thermal power plant (TPP); a hybrid system with partial energy storage from PVS; and a full supply from solar energy. Based on the developed method, the conditions for minimizing energy costs are determined. As an example, the Jizzakh PS-2 with a constant power of 60 MW and a PVS capacity of 100 MW combined with an energy accumulation system (EAS) is analyzed. The results show that the hybrid scheme provides an economic effect of about 33,400 USD per day compared to traditional TPP supply. The study demonstrates that integrating photovoltaic and energy storage systems significantly improves the energy efficiency of pumping stations, reduces operational costs, and decreases carbon dioxide emissions.*

Key words*: photovoltaic station, pumping station, energy consumption, energy storage, thermal power station, energy efficiency, solar energy, hybrid energy supply, economic efficiency, renewable energy sources.*

The feasibility of using PVS for powering PS is determined by several factors, the main ones being:

- lower electricity tariffs compared to those based on fossil fuels;
- well-known environmental advantages;
- the possibility of constructing solar power plants near pumping stations, which significantly reduces energy transmission losses and the cost of power line construction;
- the operational period of irrigation pumping stations largely coincides with the period of solar activity throughout the year, which allows for maximum utilization of solar energy

(Figure 1).

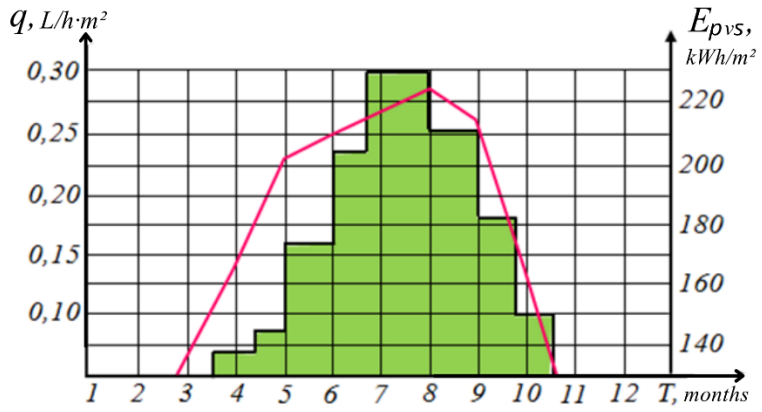
The data presented in the graphs in Figure 1 show that during the vegetation period, the highest levels of solar radiation are observed, providing optimal conditions for the power supply of pumping stations.

When using solar energy for PS power supply, depending on the capacity ratios, the following configurations are possible:

a) combined power supply for the pumping stations based on photovoltaic and thermal power plants;

b) combined power supply based on photovoltaic and thermal power plants with partial storage of solar energy for subsequent use in powering the stations;

c) full coverage of the pumping stations' energy demand using photovoltaic energy.



1 – the amount of solar energy incident on the surface of a photovoltaic panel oriented to the south and installed at an angle of 30° to the horizon, kWh/m² [1].
2 – the amount of water supplied per 1 m² of irrigated land area from March 15 to October 15 in the Kashkadarya region, L/h·m² [2].

Figure 1. Solar radiation energy and water consumption for irrigation of agricultural crops per 1 m² of area under the conditions of the Kashkadarya region.

Possible operation graphs of PS, PVS, and EAS according to the above-mentioned configurations are shown in Figure 2.

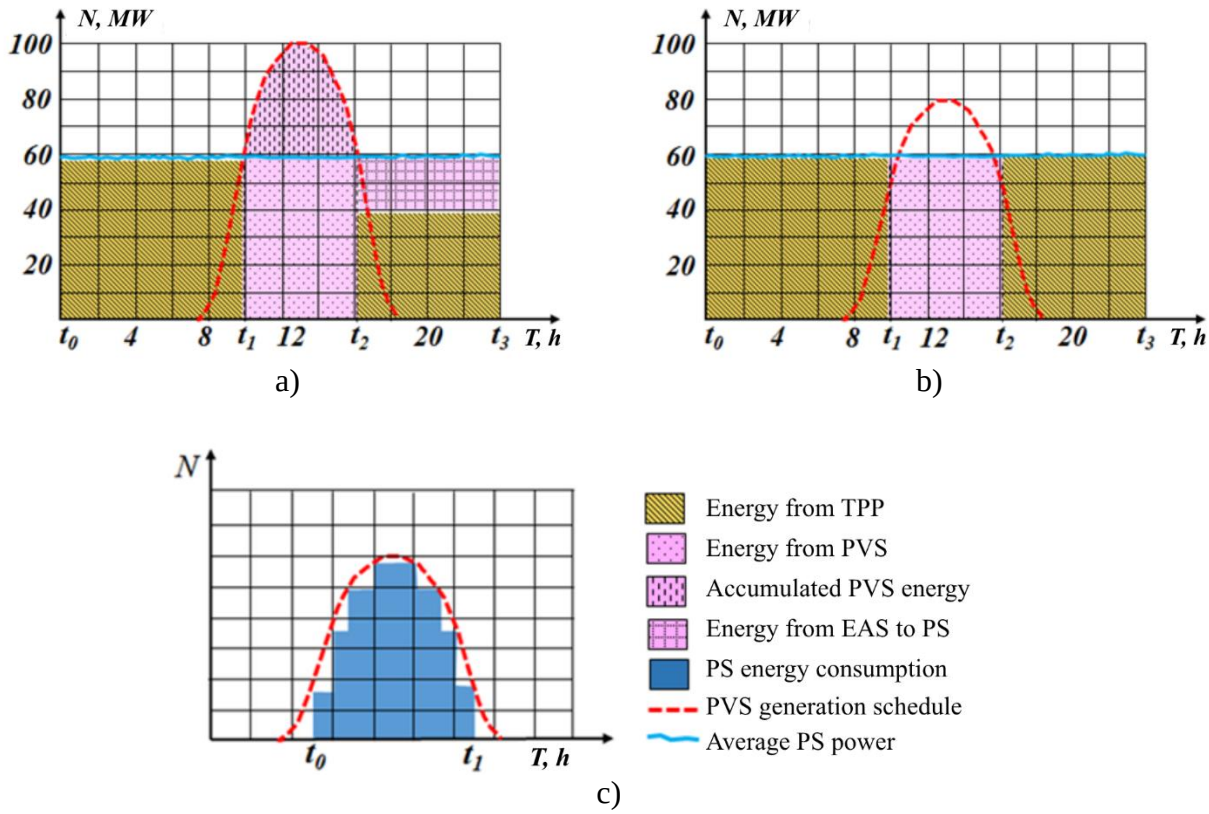


Figure 2. Operating mode graphs of photovoltaic, thermal, and energy storage systems used for powering the pumping stations.

Optimization of the operating modes of the above-mentioned energy complexes is achieved by minimizing energy costs, which is possible under the following conditions:

$$\left.\begin{array}{c} 1.\ Q_{PSmin} \le Q_{PSi} \le Q_{PSmax} \\ 2.\ V_{min} \le \sum_{i=1}^{T} Q_{PSi} t_i \le V_{max} \\ 3.\ 0 \le \gamma_Q \cdot V_{max} \le E_{PS} \end{array}\right\} \quad (1)$$

where, V – the volume of water supplied by the PS to the consumer, γ_Q – the energy consumed by the pumping station to supply 1 m³ of water, kWh/m³.

When the above-mentioned conditions are met, the objective functions for each energy supply option take the following forms:

For the combined power supply of the pumping station based on a PVS and a TPP, with partial accumulation of PVS energy in an EAS:

a) Graphs of the combined use of PVS, TPP, and EAS for supplying a pumping station operating at a constant power throughout the day.

b) Graphs of the combined use of PVS and TPP for supplying a pumping station operating at a constant power throughout the day.

c) Graph of PVS energy generation intended to supply a pumping station operating during daylight hours with variable power.

$$E_{PVS} = \sum_{i=1}^{T_{PVS}} N_{PSi} \cdot t_i \cdot a_{el}^{PVS} + \sum_{i=1}^{T_{TPP}} N_{PSi} \cdot t_i \cdot a_{el}^{TPP} + \sum_{i=1}^{T_{EAS}} N_{PSi} \cdot t_i \cdot a_{el}^{EAS} \rightarrow min \quad (2)$$

where, T_{PVS}, T_{TPP}, T_{EAS} – duration of operation of the PVS, TPP, and EAS during the day, a_{el}^{PVS}, a_{el}^{TPP}, a_{el}^{EAS} – cost of electricity (tariffs) of the PVS, TPP, and EAS for the combined power supply of the PS based on the PVS and TPP;

$$E_{PS} = \sum_{i=1}^{T_{PVS}} N_{PSi} \cdot t_i \cdot a_{el}^{PVS} + \sum_{i=1}^{T_{TPP}} N_{PSi} \cdot t_i \cdot a_{el}^{TPP} \ \rightarrow \ min \quad (3)$$

- for full coverage of the PS energy demand by PVS energy;

$$E_{PS} = \sum_{i=1}^{T_{PVS}} N_{PSi} \cdot t_i \cdot a_{el}^{PVS} \ \rightarrow \ min \quad (4)$$

The determination of daily energy costs using the above methodology can be illustrated by the example of a PS operating according to the schedule shown in Figure 2a.

As an example, the Jizzakh PS-2 with a constant power of 60 MW throughout the day is considered. A PVS with a peak capacity of 100 MW is used to supply power to the pumping station. A portion of the energy generated by the PVS is accumulated and then supplied in the evening to meet the PS demand.

According to the graph of combined use of the PVS, TPP, and EAS, the energy costs can be calculated using the following relationship:

$$E_{PS} = N_{PS}^{TPP}(t_1 - t_0)\, a_{el}^{TPP} + N_{PS}^{PVS}(t_2 - t_1)\, a_{el}^{PVS} + \sum_{i=1}^{t_2 - t_1} N_{PSi}^{EAS1}(t_{2i} - t_{1i\text{-}1})\, a_{el}^{PVS} + N_{PS}^{EAS2}(t_3 - t_2)\, a_{el}^{EAS} + N_{PS}^{TPP}(t_3 - t_2)\, a_{el}^{TPP} \quad (5)$$

where, $\sum_{i=1}^{t_2 - t_1} N_{PSi}^{EAS1}(t_{2i} - t_{1i\text{-}1})$ – the amount of energy used for accumulation,
$N_{PS}^{EAS2}(t_3 - t_2)$ – the amount of energy supplied from the EAS to power the PS;

Distribution of the share of PS power supply among the PVS, TPP, and EAS is as follows: TPP – 920 MWh, PVS – 360 MW·h, accumulated PVS energy – 180 MW·h, energy supplied from accumulation – 160 MW·h.

The consulting company *Lazard* provides data on the LCOE values of TPPs, including the cost of CO_2 emission treatment, as of 2023. For example, the LCOE of TPPs with combined-cycle

gas turbine installations, taking into account CO_2 capture costs, is 0.128 $/kW·h, while for peaking gas turbine plants it ranges from 0.126 to 0.24 $/kWh [3].

According to the *International Renewable Energy Agency (IRENA)*, the average cost of solar energy in 2023 is 0.044 $/kWh [4], while *Total Eren* has proposed a price of

0.04273 $/kWh for the solar power plants being constructed in Uzbekistan [5].

According to data from the *International Hydropower Association* and the *U.S. Department of Energy*, the cost of energy storage is 0.11 $/kWh for pumped hydro storage (PHS) and 0.13 $/kW·h for lithium-ion batteries [6,7,8].

Based on the above data, if we assume that: a_{el}^{PVS} = 0.044 $/kW·h, a_{el}^{TPP} = 0.15 $/kW·h, a_{el}^{EAS} = 0.13 $/kW·h, then the energy costs amount to E_{PS} = 182,560 USD/day.

If the PS is powered entirely by TPP energy, the energy costs amount to E_{PS} = 216,000 USD/day, and comparison with the above results shows that the economic benefit of using the combined power-supply scheme for the PS is at least 33,400 USD/day.

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Rezyume: *Maqolada fotoelektr stansiyalar (FES) yordamida energiya bilan ta'minlanadigan nasos stansiyalarida (NS) energiya sarfini kamaytirish yo'llari tahlil qilingan. Quyosh energiyasidan foydalanishning iqtisodiy va ekologik afzalliklarini asoslab berilgan. Sug'orish nasos stansiyalarining ish davri yilning quyosh faoliyligi eng yuqori davriga to'g'ri kelishi, FESdan samarali foydalanish imkonini beradi. Uchta energiya ta'minoti varianti taklif etilgan: FES va issiqlik elektr stansiyasi (IES) asosidagi kombinatsiyalangan tizim; FES energiyasining bir qismini akkumulyatsiya qilish bilan kombinatsiyalangan tizim; va to'liq FES asosida energiya ta'minoti. Taklif etilgan usul asosida energiya xarajatlarini minimallashtirish shartlari aniqlangan. Misol tariqasida quvvati 60 MVt bo'lgan Jizzax NS-2 uchun FES (100 MVt) va energiya akkumulyatsiya tizimi (EAS) asosida kombinatsiyalangan rejim hisoblab chiqilgan. Natijada, faqat IESdan foydalanishga nisbatan kuniga 33 400 AQSH dollari miqdorida iqtisodiy samara kuzatilgan. Tadqiqot natijalari FES va energiya akkumulyatsiyasi tizimlaridan birgalikda foydalanish NS energiya samaradorligini oshirish, ekspluatatsiya xarajatlarini kamaytirish hamda karbonat angidrid chiqindilarini kamaytirishga xizmat qilishini ko'rsatadi.*

Резюме: *В статье рассматриваются пути снижения энергетических затрат насосных станций (НС), снабжаемых энергией от фотоэлектрических станций (ФЭС). Обосновывается экономическая и экологическая целесообразность использования солнечной энергии в системах водоснабжения и ирригации. Показано, что эксплуатационный период оросительных насосных станций совпадает с периодом максимальной солнечной*

активности, что позволяет эффективно применять ФЭС для их питания. Предлагаются три варианта энергоснабжения: комбинированное питание НС на базе ФЭС и тепловых электростанций (ТЭС); комбинированная схема с аккумулированием части энергии ФЭС; и полное покрытие потребности НС за счёт солнечной энергии. На основе моделирования определены целевые функции и условия минимизации энергетических затрат. Приведен пример расчета для Джиззахской НС-2 мощностью 60 МВт, где при комбинированной схеме с ФЭС (100 МВт) и аккумулирующей системой (ЭАС) достигается экономический эффект порядка 33 400 долларов в сутки по сравнению с традиционным питанием от ТЭС. Доказано, что использование ФЭС в сочетании с системами аккумулирования энергии позволяет существенно повысить энергоэффективность насосных станций и снизить эксплуатационные расходы, а также способствует уменьшению выбросов углекислого газа.

Kalit so‘zlar: *fotoelektr stansiya, nasos stansiya, energiya sarfi, energiya akkumulyatsiyasi, issiqlik elektr stansiyasi, energiya samaradorligi, quyosh energiyasi, kombinatsiyalangan energiya ta’minoti, iqtisodiy samaradorlik, qayta tiklanuvchi energiya manbalari.*

Ключевые слова: *фотоэлектрическая станция, насосная станция, энергетические затраты, аккумулирование энергии, тепловая электростанция, энергоэффективность, солнечная энергия, комбинированное энергоснабжение, экономический эффект, возобновляемые источники энергии.*

UDC: 621.315.592

TECHNOLOGY OF DIFFUSION OF EUROPIUM ENTRY ATOM INTO MONOCRYSTALLINE SILICON IN THE GAS PHASE

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Summary: *A gas-phase diffusion technology for doping monocrystalline silicon with europium impurity atoms has been developed. The proposed method enables the incorporation of europium atoms into the silicon crystal lattice without disturbing its structural integrity. Experimental investigations allowed the determination of the optimal diffusion parameters, ensuring a uniform distribution of the dopant within the near-surface region of silicon. According to the results, the penetration depth of europium atoms into silicon reaches 15–16 μm. Electrical measurements revealed that the concentration of charge carriers formed in the surface layer is 1.8 × 10¹⁸ cm⁻², which confirms the effective electrical activation of europium atoms in the silicon lattice. The developed technology is considered promising for the fabrication of optoelectronic, luminescent, and spintronic devices based on silicon., and spintronic structures, where controlled rare-earth doping is required.*

Key words: *Silicon, europium, diffusion, concentration, diffusion coefficient, temperature.*

Introduction

It has been shown that an intensive molecular bond can form between two impurity atoms of donors in silicon (leading to the formation of nanoclusters). To form such nanoclusters, it is necessary to force the impurity atoms to diffuse through the crystal lattice and ensure that they exist only in inert states. Based on experimental data, the authors determined that the formation of such molecules occurs not during diffusion, but during an additional low-temperature thermal annealing process performed after diffusion in silicon.

The existence of an intensive molecular bond between two donor impurity atoms in silicon (leading to the formation of nanoclusters) has been demonstrated. To form such nanoclusters, it is necessary to induce the diffusion of impurity atoms through the crystal lattice and ensure that they exist only in inert states. Based on experimental data, the authors found that the formation of such molecules occurs not during diffusion, but during an additional low-temperature thermal annealing process carried out in silicon after diffusion [1–3].

Research has shown that the diffusion coefficient of europium impurity atoms in silicon is relatively small [4,5]. By analyzing previous studies, it is possible to determine the diffusion coefficient and its temperature dependence by appropriately selecting the diffusion temperature and duration:

$$D = D_0 \exp(-E_a / kT) \qquad (1)$$

$$D_{Eu} = 2 \cdot 10^{-2} \exp(-2.8 / kT) \qquad (2)$$

here, E_a is the activation energy of diffusion, D_0 is the diffusion coefficient at infinitely high temperature, and k is the Boltzmann constant. According to theoretical calculations, the diffusion coefficient of europium impurity atoms in silicon in the temperature range of T=1100–1350℃ is D_{Eu}= $1.1 \cdot 10^{-12}$–$4.3 \cdot 10^{-11}$ **cm²/s,** respectively (Fig. 1).

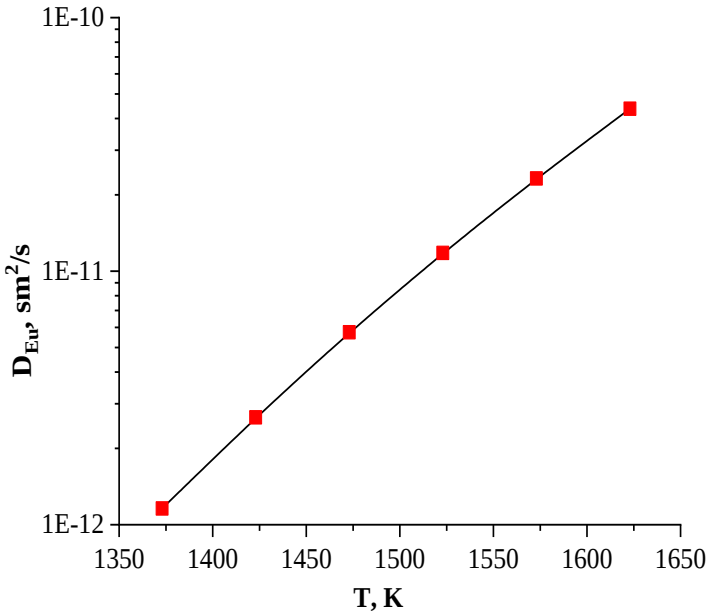


Figure 1. Temperature dependence of the diffusion coefficient for the Si<EuO> sample.

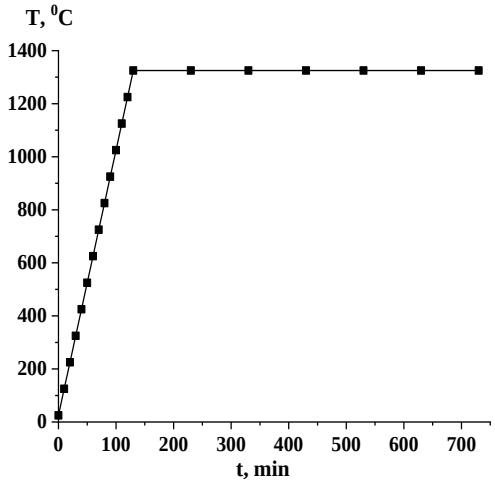


Figure 2. Dependence of temperature variation on diffusion time during the diffusion process of impurity atoms into the silicon sample.

Based on theoretical calculations, impurity atoms were diffused into silicon from the gaseous phase in an MG17–60/300 type vacuum tube electric furnace. The furnace containing the samples was heated from room temperature to **T = 1200–1250 °C** at a rate of **10–15 °C/min** (see Fig. 2). The samples were held at this temperature for **10–15 hours**, after which the quartz ampoules were removed from the furnace and rapidly cooled. To compare the research results with the electrophysical parameters of the initial silicon, the same heat treatment was also applied to the original silicon under identical conditions.

To remove the oxide layer formed on the silicon surface after diffusion, the samples were treated with a hydrofluoric chemical solution and distilled water (HF+H2O2). During this treatment, the surface layer of the samples was etched to a depth of approximately 0.05–0.5 **μm.**

The diffusion of europium impurity atoms in silicon occurs via vacancies, taking place only from one lattice site to another. In this case, the diffusion process proceeds slowly, since the activation energy must be sufficient to break the bonding energy and to create a vacancy.

$$E_a=E_b+E_v \qquad (3)$$

here, E_a is the activation energy, E is the bonding (binding) energy required to break the bond, and E_v is the energy required for vacancy formation.

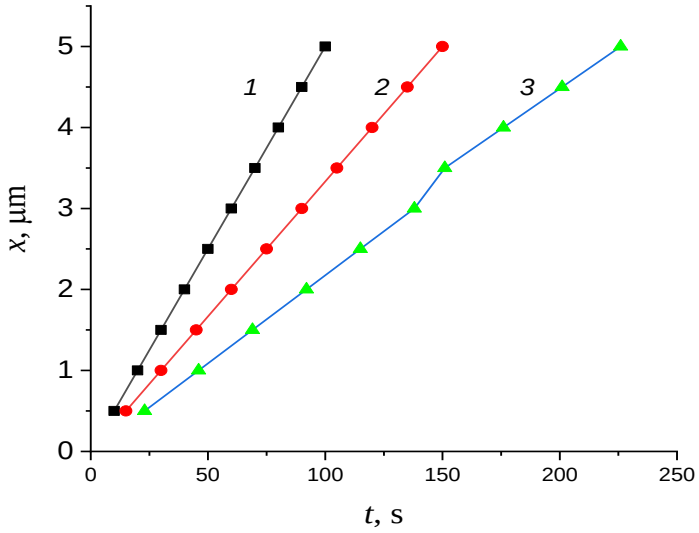


Figure 3. Dependence of the chemical etching of the surface layer of the silicon sample on time.1) 1HF+16HNO₃+8CH₃COOH. 2) 1HF+16HNO₃+16CH₃COOH. 3) 1HF+16HNO₃+24CH₃COOH for chemical solutions.

Experimentally, the impurity atoms in the surface layer of the sample were determined by successive (layer-by-layer) etching in a chemical solution prepared from a mixture of hydrofluoric acid, nitric acid, and acetic acid. In the first stage, to determine the time dependence of the chemical etching of the initial sample (Si<P>–80), chemical solutions with different ratios were prepared:

1) $1HF+16HNO_3+8CH_3COOH$.
2) $1HF+16HNO_3+16CH_3COOH$.
3) $1HF+16HNO_3+24CH_3COOH$.

In this process, acetic acid was used to control the reaction time. The results shown in **Figure 3** were obtained under identical conditions at a temperature of **T =22 °C,** and the experiments were repeated several times. In the first and second mixtures, the chemical etching proceeded linearly, and the etching rates were determined to be. To accurately determine the penetration depth of the impurity atoms, the linear part of the chemical etching reaction was selected based on the data from **Figure 3.**

TECHNOLOGY FOR OBTAINING SAMPLES

To study the ferromagnetic properties of silicon doped with europium impurity atoms, initial monocrystalline silicon samples of grades **KEF-6, KEF-40, and KEF-80** were selected. The diffusion of europium atoms was carried out in evacuated quartz ampoules (vacuum up to **P = 10^{-6} mm Hg)** at temperatures ranging from **T = 1100–1250 °C** for **t = 6÷15 hours** [6–8].

Table 1 shows the electrophysical parameters of the samples measured after diffusion using the **ECOPIA HALL HMS-7000** Van der Pauw measurement system.

Table 1.

Samples	**Type of Conductivity**	Resistivity, ρ, Ω·cm	**Charge Carrier Mobility**, μ, см^2/В·с	Charge Carrier Concentration N, см$^{-3}$
Si<P, Eu>-80	*p*	$1.8\cdot10^{-2}$	191	$1{,}8\cdot10^{18}$
Si<P,Eu>-40	*p*	$1.36\cdot10^{-2}$	204	$2{,}2\cdot10^{18}$
Si<P,Eu>-6	*p*	$1.2\cdot10^{-2}$	309	$1{,}68\cdot10^{17}$

The penetration depth of the impurity atoms into silicon, as well as the distribution of the diffused atoms, was determined both theoretically and experimentally.

$$x = 2\sqrt{Dt}\sqrt{\ln\frac{C_n}{C}} = \sqrt{4Dt\ln\frac{C_n}{C}} \qquad (4)$$

$$C(x,t) = C_0 erfc\left(\frac{x}{2\sqrt{Dt}}\right) \qquad (5)$$

Theoretically, the diffusion penetration depth at **T = 1250 °C** for **t = 10 hours** for the europium impurity atoms was found to be $x_{Si<EuO>}$=15.05 **μm.**

In order to determine the concentration distribution of impurity atoms in monocrystalline silicon doped with europium atoms, a layer-by-layer removal method was employed. Based on the technological processes shown in **Figure 3**, a chemical solution with a ratio of $1HF+16HNO_3+16CH_3COOH$ (1:16:16) was used.

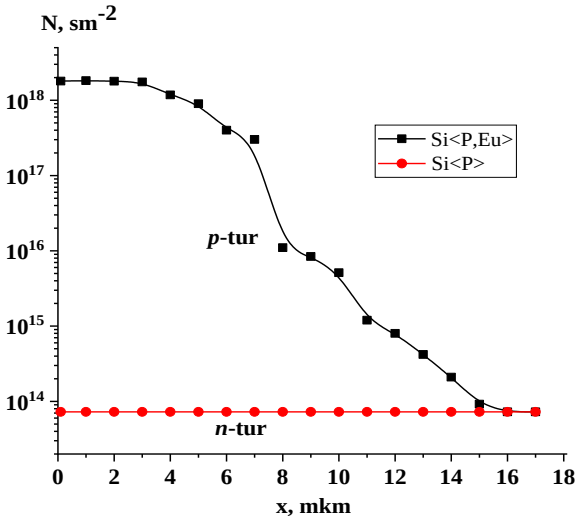


Figure 4. Depth distribution of europium impurity atoms introduced into silicon at a temperature of T = 1250 °C for t = 10 hours.

The rate of chemical etching of the silicon surface depends on temperature. Therefore, special attention was paid to maintaining a constant laboratory room temperature during the chemical etching of the silicon surface and the measurement process. The mixture was divided into **15–20 equal parts,** and each portion of the mixture was used for measuring the corresponding layer thickness.

Using chemical etching, the distributions of **specific resistivity, charge carrier concentration,** and **mobility** as a function of penetration depth were determined by sequentially removing 1 μm layers from the sample surface. In parallel, the **type of conductivity** was also identified (**see Fig. 4**). It was found that in the surface region of the silicon samples, the charge carrier concentration was $N_{Si<EuO>}=1.8\cdot10^{18}$ **cm⁻².** Beyond a depth of **15–16 μm**, the samples exhibited the **electrophysical parameters and conductivity type** corresponding to the initial (undoped) silicon.

CONCLUSION

Based on the experimental results of europium atom diffusion into silicon in the gaseous phase and using modern analytical equipment, the **optimal diffusion technology** for doping silicon with europium atoms was determined. The optimal parameters include **ampoule pressure, impurity atom concentration, diffusion time and temperature,** and other relevant conditions. Experimentally, the **time dependence of the surface layer etching** of the samples was also established using **chemical etching** with a mixture of **hydrofluoric acid, nitric acid, and acetic acid**.

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Rezyume: *Monokristall kremniyga yevropiy kirishma atomlari bilan gaz fazasida diffuziya yo'li orqali legirlash texnologiyasi ishlab chiqildi. Taklif etilgan usul kremniy panjarasiga yevropiy atomlarini panjarasini buzmasdan kiritish imkonini beradi. O'tkazilgan tajribalar natijasida diffuziya jarayonining optimal sharoitlari aniqlanib, legirlashning kremniy sirtiga yaqin qatlamda bir tekis taqsimlanishi ta'minlandi. Tadqiqot natijalariga ko'ra, yevropiy atomlarining kremniyga kirib borish chuqurligi 15–16 mkmni tashkil etadi. Elektr o'lchovlar natijasida kremniy sirt qatlamida hosil bo'lgan zaryad tashuvchilar konsentratsiyasi 1,8 × 10^{18} sm^{-2} ekanligi aniqlandi, bu esa yevropiy atomlarining samarali elektr faolligini ko'rsatadi. Ishlab chiqilgan texnologiya optoelektronika, lyuminestsent va spintronik qurilmalar yaratishda istiqbolli yo'nalish hisoblanadi.*

Резюме: *Разработана технология диффузионного легирования монокристаллического кремния атомами европия (Eu) из газовой фазы. Предложенный метод обеспечивает внедрение атомов европия в кристаллическую решётку кремния без нарушения её структурной целостности. В ходе экспериментов определены оптимальные параметры диффузионного процесса, обеспечивающие равномерное распределение примеси в приповерхностной области кремния. Согласно результатам исследований, глубина проникновения атомов европия в кремний достигает 15–16 мкм. Электрические измерения показали, что концентрация носителей заряда в поверхностном слое составляет 1,8 × 10^{18} $см^{-2}$, что подтверждает высокую электрическую активность атомов европия в кремниевой решётке. Разработанная технология является перспективной для создания оптоэлектронных, люминесцентных и спинтронных устройств на основе кремния.*

Kalit so'zlar: *kremniy, yevropiy, diffuziya, konsentratsiya, diffuziya koeffitsiyentini, harorat.*

Ключевые слова:*Кремний, европий, диффузия, концентрация, коэффициент диффузии, температура.*

TECHNOLOGY FOR DETERMINING SALTS ON THE SURFACE OF PRODUCTS MADE FROM CERAMIC MATERIALS

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Summary: *This article studies the reasons for the formation of salt deposits (efflorescence) on the surface of ceramic products, ways of identification of efflorescence by chemical as well as physical methods, and ways of prevention of efflorescence formation. Chemical composition studies of surface salts of ceramic products involved the use of techniques such as X-ray diffraction (XRD), ion exchange chromatography, pH analysis, and IR spectroscopy.*

Key words: *ceramics, efflorescence, salt deposits, XRD, IR spectroscopy, ion chromatography, moisture*

1. Introduction

Ceramic materials have numerous applications in construction, artwork, electrical engineering, as well as in the chemical field. Nevertheless, one of the main factors that influence the quality of ceramic products is the formation of salt deposits, also known as efflorescence, on the surface of the material. This condition is mostly observed in the presence of water-soluble salts.[1]

Efflorescence not only damages the aesthetic qualities of ceramics but also affects the strength properties and water permeability of the material. Hence, the discovery of the mechanisms of salt formation and technologies of detecting them is a pressing issue.[2]

2. Materials and Methods

This experiment took place at the Laboratory of Inorganic Substances' Technology, Karakalpak State University. In this experiment, the following techniques of analysis are used:

X-ray Diffraction (XRD):Used to analyze crystalline phases of the salt on the surface of the

Ion Exchange Chromatography: For analysis of Na+, K+, Ca^{2+}, Mg^{2+}, Cl-, SO_4^{2-}, and NO

Infrared (IR) Spectroscopy: This is employed in order to identify the characteristic IR bands of SO_4^{2-},

pH Measurement

To measure the Alkalinity of surface solution.

Moisture analysis: To analyze the water content prior to as well as after the process of drying.

3. Results and Discussion

3.1. Composition of Surface Salts

XRD results confirmed the presence of Na_2SO_4, K_2SO_4, $CaCO_3$, and $MgSO_4$. These salts originate from sulfate and carbonate ions present in the clay and additives used in ceramic manufacturing.

Ion concentration results:

Ion Type	Average Concentration (mg/L)	Source
Na^+	45–60	Na_2O in clay
K^+	30–45	Feldspars
Ca^{2+}	25–40	Kaolinite, dolomite
SO_4^{2-}	40–65	Gypsum impurities
CO_3^{2-}	20–35	Carbonate minerals

IR spectra showed strong absorption peaks between 1100–1400 cm^{-1} corresponding to sulfate groups, supporting the XRD findings.

Measured pH values of 8.0–9.5 indicated a weakly alkaline environment, promoting salt migration toward the surface.

3.2. Mechanism of Salt Formation

During drying and firing, water containing dissolved salts moves upward through capillary pores. As the water evaporates, salts crystallize on the surface.

$$\text{Dissolved salts}\frac{\text{capillary diffusion}}{\text{evaporaátion}} > \text{Crystallized salts(surface)}$$

The intensity of this process depends on:

Soluble salt concentration in raw materials,
Drying temperature and rate,
Moisture gradient, and
Pore and crack structure.

4. Prevention of Efflorescence

4.1. Raw Material Purification

Washing and Sedimentation: Washing clay at 40–50°C for 2–3 hours reduced soluble salts by 65–80%.

Chemical Neutralization: Addition of 0.2–0.5% $BaCO_3$ or $Ba(OH)_2$ neutralizes soluble sulfates:

$$Na_2SO_4 + BaCO_3 \rightarrow BaSO_4\downarrow + Na_2CO_3$$

4.2. Additives and Modifiers

Calcium stearate (0.1–0.3%) – forms a hydrophobic layer;
Silane-based hydrophobizers – limit capillary moisture;
Barium carbonate – neutralizes sulfates;
Sodium aluminate – binds chloride and nitrate ions.

4.3. Drying and Firing Optimization

Gradual temperature rise from 60°C to 110°C;
Relative humidity 45–55%;
Duration 10–12 hours.

At 950–1050°C, sodium sulfate transforms into stable silicate phases.

4.4. Structural Densification

Porosity reduction through increased compaction and addition of fluxes such as feldspar or nepheline decreases efflorescence by up to 90% (SEM analysis).

4.5. Surface Coatings

- **Sodium or potassium silicate coatings** form protective SiO_2 films.
- **Acrylic or epoxy resins** make the surface hydrophobic.
- **TiO_2 and SiO_2 nanocoatings** provide UV resistance and block ion migration.

4.6. Storage Conditions

Maintain relative humidity below 60%, avoid damp supports, and ensure proper ventilation and stable temperature.

5. Integrated Industrial Approach

Combining several preventive measures yields the highest efficiency:

1. Washing + $BaCO_3$ neutralization,
2. Controlled drying + hydrophobic surface treatment,
3. Continuous ion chromatography monitoring.

As a result, efflorescence defects decreased from **12–15% to 1–2%** in industrial trials.

Aspect	Method	Main Effect
Raw material	Washing, $BaCO_3$ neutralization	Reduces soluble salts
Additives	Calcium stearate, silanes	Limits capillary movement
Process	Controlled drying/firing	Reduces salt migration
Structure	Densification, fluxes	Decreases porosity

Aspect	Method	Main Effect
Surface	Silicate/nano coatings	Prevents salt crystallization
Storage	Humidity control	Prevents post-production efflorescence

6. Conclusion

Conclusion It is shown that a surface layer of salt deposits that forms on ceramics is composed of sodium and calcium sulfates, which come from soluble components.

A combination of various means—chemical, physical, as well as structural—helps effectively inhibit efflorescence and is also beneficial in terms of aesthetics as well as increased mechanical These techniques, including XRD, ion chromatography, and IR spectroscopy, enabled full analysis of the salts' chemical properties. Anti-Efflorescence technology that has been developed has been proven in practice, having high industrial applicability.

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Rezyume: *Ushbu maqolada keramika mahsulotlari yuzasida tuz konlarining (effloresensiya) paydo bo'lish sabablari, effloresensiyani kimyoviy va fizik usullar bilan aniqlash usullari va effloresensiyaning paydo bo'lishining oldini olish usullari o'rganiladi. Keramika mahsulotlarining sirt tuzlarining kimyoviy tarkibini o'rganish rentgen difraksiya (XRD), ion almashinuvi xromatografiyasi, pH tahlili va IQ spektroskopiyasi kabi usullardan foydalanishni o'z ichiga oldi.*

Резюме: *В статье рассматриваются причины образования солевых отложений (высолов) на поверхности керамических изделий, способы их выявления химическими и физическими методами, а также меры по предупреждению их образования. Исследования химического состава поверхностных солей керамических изделий проводились с использованием таких методов, как рентгенофазовый анализ (РФА), ионообменная хроматография, pH-анализ и ИК-спектроскопия.*

Kalit so‘zlar*: keramika, gullash, tuz konlari, rentgen, infraqizil spektroskopiya, ion xromatografiyasi, namlik*

Ключевые слова: *керамика, высолы, солевые отложения, рентгеноструктурный анализ, ИК-спектроскопия, ионная хроматография, влажность.*

THE DEVELOPMENT AND APPLICATION OF ARTIFICIAL INTELLIGENCE IN EDUCATION

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Summary: *This paper explores the development, types, and applications of artificial intelligence (AI) and machine learning (ML) technologies in education. It highlights the historical evolution of automated assessment systems, the role of AI algorithms in evaluating and identifying gifted students, and their integration into pedagogical processes. The study concludes that AI technologies enhance objectivity, personalization, and efficiency in education.*

Key words: *Artificial Intelligence, Machine Learning, Automated Assessment, Personalized Learning, Gifted Students, Educational Technology.*

History of the development of automated assessment systems in the education system: The development of automated assessment systems in the education system is closely related to the development of technology and changes in pedagogical approaches. This process can be divided into several stages. For example, the initial period falls on the 1950s-1970s. During this period, the first steps in computerization were taken, and test automation and programmed learning were implemented. The first automated assessment systems were used to process tests. For example, optical mark recognition systems (OMR) allowed scanning answer sheets and outputting results. Based on Skinner's concept of "Programmed Learning", simple algorithms were created to test student knowledge. In the 1970s-1990s, computer-based assessment systems were created. CBT (Computer-Based Testing) - the creation and evaluation of test tasks using a computer expanded. During this period, test tasks became closed-ended (multiple answer options), and their automatic evaluation was established. Adaptive testing mechanisms appeared in some advanced systems. This method allowed the student to select subsequent questions based on previous answers. The development of the Internet and online education fell on the 1990s-2000s. During this period, online testing platforms and interactive assessment systems began to be created. As the Internet became more widespread, distance learning and online testing systems appeared. For example, Moodle, Blackboard and other LMS (Learning Management System) systems were introduced. Interactive tasks appeared, which served to increase student activity. Since the 2000s, the era of artificial intelligence and machine learning began and has been developing to this day. During this period, artificial intelligence-based assessment (automatic assessment of written work based on AI, speech analysis), NLP (Natural Language Processing - automatic assessment of essays and answers to open-ended questions through text analysis and understanding), personalized assessment (monitoring the student's unique learning process and personalized assessment directions) and predictive analytics (data analysis to predict student achievements and difficulties in advance) emerged. Today, automated assessment systems are further improved based on artificial intelligence and big data, playing an important role in identifying gifted students and developing individual educational directions.

Main types of artificial intelligence algorithms: The development of artificial intelligence technologies in modern education is especially important in automating the processes of identifying gifted students and assessing them. Below, the main types of artificial intelligence algorithms, their essence and possibilities of application in education are discussed.

Machine Learning (ML) - Machine learning algorithms learn to make independent decisions based on historical data and in new situations. There are supervised learning, unsupervised learning and reinforced types - in supervised learning, input and output data are given, while in unsupervised learning, only input data is given. Reinforcement learning is learned through actions and rewards.

They are used in education to identify gifted students based on analytical indicators and automatically predict assessment results. Neural Networks (NN) - Works on the principle of the human brain. It transmits information through layers and learns complex connections. There are

simple artificial neural networks, convolutional neural networks, recurrent neural networks. These are used in education to deeply analyze test results and identify defects in student responses. Expert Systems (ES) - Make decisions based on the knowledge of human experts by placing them in a database. This algorithm is used in education to use expert assessment systems that determine the level of knowledge in a particular subject and individual counseling systems for students.

Natural Language Processing (NLP) - The understanding and use of human language by a computer system. It is used in education to automatically evaluate written answers and analyze students' text assignments.

Decision Trees - Each node represents a decision point, evaluates data based on "if/then" rules.

Bayesian Classifier - Makes decisions based on statistical probabilities.

Both of these are used in education to classify a student as gifted or average based on answers and to recommend an individual educational path.

Comparative analysis of algorithms:

Algorithm type Adaptability Recommendation system Evaluation Written analysis Statistical basis

Machine Learning High Yes Yes Limited Medium

Neural Networks Very high Yes Yes Medium Low

Expert Systems Medium Great Yes Limited High

NLP Medium Limited Yes Very good Low

Decision Tree/Bayes High Yes Yes Limited High

Various forms of artificial intelligence algorithms play an important role in education, especially in the assessment of gifted students. Each algorithm has its own advantages and limitations. The combined use of these algorithms in an adapted manner allows you to create a comprehensive and effective assessment system for identifying gifted students.

The role of artificial intelligence and machine learning in the education system: One of the approaches that meets the modern needs of the education system in the context of digital transformation is artificial intelligence and its main component, machine learning technologies.

These technologies allow not only assessment, but also personalization of education, increasing efficiency, deepening knowledge, and identifying gifted students.

The main functions of artificial intelligence and machine learning in education

Function Role in education

Automated assessment Automatically analyzes tests, written answers, and interactive tasks.

Personalized education Determines the appropriate educational path for each student.

Developing creativity Develops independent thinking and problem-solving skills.

Cognitive diagnostics Provides a deep analysis of the student's knowledge.

Identifying gifted students Identifies gifted students based on specific indicators.

Reducing subjectivity in assessment Provides assessment free from the subjective opinion of the teacher.

The role of artificial intelligence and machine learning technologies according to the stages of the educational process

Stage Artificial intelligence and machine learning approach

Teaching Individual delivery of knowledge through intelligent recommendation systems

Learning Dynamic resources, tests and flexible tasks

Assessment Deep and automated analysis of learned knowledge

Correction (correction) Identification of shortcomings and development of individual recommendations

Result analysis Final conclusions through Big Data and predictive (human) analysis

Algorithm for identifying gifted students based on artificial intelligence and machine learning (simplified scheme)

1. Input data:

- Academic performance,
- Critical thinking test,

- Social activity,
- Portfolio and competition results,
2. Data cleaning and normalization.
3. Algorithmic model:
- Machine learning: decision tree + neural network,
- Classification: “Gifted”, “Average”, “Needs additional attention”,
4. Personalization of the educational path based on the results.

The integration of artificial intelligence and machine learning technologies into education improves the quality of teaching, ensures objectivity of assessment, and expands the possibilities of identifying gifted students. These technologies serve as a strategic tool for digitizing and optimizing all stages of the pedagogical process.

Opportunities for using artificial intelligence in pedagogical processes: The modern education system is rapidly digitizing, and artificial intelligence technologies are playing an important role in this process. Artificial intelligence creates broad opportunities for personalizing education, automating assessment, adapting educational resources, and identifying gifted students.

The use of Artificial Intelligence in pedagogical processes not only improves the quality of the learning process, but also takes the interaction between the teacher and the student to a new level.

The main pedagogical functions of artificial intelligence tools:

-Adaptive learning: Content is provided that is appropriate for the student's level of knowledge and learning style.

-Automated assessment: The results of tests, written work, and laboratory work are quickly and accurately analyzed using artificial intelligence.

-Assistant role for the teacher: Artificial intelligence helps the teacher monitor student activity, identify knowledge gaps, and improve approaches.

-Recommendation systems: Artificial intelligence provides recommendations to the student when choosing an individual subject, course, or major.

Main areas of integration of SI technologies into the pedagogical process:

Direction Implementation forms Examples

Assessment Intellectualized tests, essay evaluation AI Exam, Gradescope

Personalization of learning Adaptive courses, real-time analysis Smart Sparrow, Knewton

Identification of gifted students Algorithmic sorting, behavioral analysis Neural networks, regression models

Learning resource management Chatbots, virtual teachers Duolingo, Squirrel AI

Assistance services Speech recognition, translation, text analysis GPT, DeepL, Grammarly

Gifted language

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Rezyume: *Ushbu maqolada ta’lim sohasida sun’iy intellekt (SI) va mashinaviy o‘rganish (MO) texnologiyalarining rivojlanishi, turlari va qo‘llanilish yo‘nalishlari tahlil qilinadi. Maqolada avtomatlashtirilgan baholash tizimlarining tarixiy evolyutsiyasi, iqtidorli talabalarni aniqlash va baholashda sun’iy intellekt algoritmlarining o‘rni hamda ularning pedagogik jarayonlarga*

integratsiyasi yoritilgan. Tadqiqot natijalari shuni ko‘rsatadiki, sun’iy intellekt texnologiyalari ta’limda obyektivlik, shaxsiylashtirish va samaradorlikni oshiradi.

***Резюме**: В данной статье рассматриваются развитие, типы и области применения технологий искусственного интеллекта (ИИ) и машинного обучения (МО) в сфере образования. Освещается историческая эволюция автоматизированных систем оценки, роль алгоритмов ИИ в выявлении и оценке одарённых студентов, а также их интеграция в педагогические процессы. Результаты исследования показывают, что технологии искусственного интеллекта повышают объективность, персонализацию и эффективность образовательного процесса.*

***Kalit so‘zlar:** Sun’iy intellekt, Mashinaviy o‘rganish, Avtomatlashtirilgan baholash, Shaxsiylashtirilgan ta’lim, Iqtidorli talabalar, Ta’lim texnologiyalari.*

***Ключевые слова:** Искусственный интеллект, Машинное обучение, Автоматизированная оценка, Персонализированное обучение, Одарённые студенты, Образовательные технологии.*

SUSTAINABLE OPTIMIZATION OF ENERGY BALANCE IN SOLAR PHOTOVOLTAIC SYSTEMS USING PSO, JAYA AND SOCP ALGORITHMS

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Summary: *This article analyzes mathematical models and computational algorithms aimed at sustainable optimization of the energy balance in PV systems. The research is based on advanced approaches proposed for 2020-2024, aimed at minimizing the imbalance between solar energy production, energy storage systems, and load using PSO (Particle Swarm Optimization), JAYA (Optimization Algorithm), and SOCP (Second Order Cone Programming) algorithms. At the same time, production and load profiles were adapted, stress stability was ensured, and technical losses were reduced. The results showed that the system efficiency increased to 93%, and the imbalance decreased from 42.5 kWh to 25.1 kWh. Hybrid algorithms are proposed as an effective solution to ensure the economic and technical stability of solar energy systems in the conditions of Uzbekistan.*

Key words: *solar energy, energy balance, mathematical model, PSO, JAYA, SOCP, optimization, voltage stability, energy systems.*

Introduction

In the last decade, renewable energy sources, in particular solar energy, have become one of the strategic directions of the global energy sector. As a result of the decrease in the cost, technological improvement, and increased efficiency of solar photovoltaic systems (PS), PV systems have become an integral part of the energy system in many countries. According to the International Energy Agency (IEA), solar energy accounted for more than 60% of the world's new generation capacity in 2022. However, the natural variability of solar radiation causes an imbalance between the energy produced and the load. As a result:

- voltage fluctuations occur in the networks,
- increase in technical losses,
- stability decreases,
- economic efficiency decreases.

The Republic of Uzbekistan, in particular the Republic of Karakalpakstan, is one of the leading regions in Central Asia in terms of solar radiation - there are more than 300 sunny days a year. However, existing networks are not ready for full integration with PV systems. Therefore, it is necessary to introduce methods of mathematical modeling and optimization.

Recent research in the field of solar photovoltaic (PV) energy systems has primarily focused on addressing the issues of stability, efficiency, and optimization under variable environmental and operational conditions. According to [1], one of the key challenges in solar energy systems is the instability caused by fluctuations in solar radiation and the limited efficiency of storage systems. The study examined several optimization approaches that combine linear, dynamic, and heuristic methods, resulting in an 8-12% improvement in overall system efficiency. The authors highlighted that hybrid optimization models can effectively balance energy generation and storage processes, although the absence of real-time operational data remains a practical limitation.

In the article presented in [2], the integration of PV systems into existing power grids was analyzed with particular attention to dispatch and load management problems. The authors proposed control methods based on the Particle Swarm Optimization (PSO) algorithm and evolutionary techniques, which enabled a 15–20% reduction in dispatch costs. However, the study also noted that such algorithms require further enhancement to improve real-time adaptability. This research confirmed the effectiveness of PSO as a mathematical foundation for network-level optimization in solar energy systems.

Further advancements in predictive modeling were made in [3], where ensemble machine learning algorithms-combining Random Forest, XGBoost, and artificial neural networks-were used to forecast PV power generation. The ensemble approach improved prediction accuracy by approximately 25% compared to single models, which significantly enhanced the reliability of energy production planning and load distribution management.

The application of the JAYA optimization algorithm in [4] focused on determining the optimal placement and capacity of photovoltaic and battery energy storage (BES) systems. The model considered technical, economic, and reliability constraints, resulting in reduced operational costs and faster convergence to optimal solutions. The findings demonstrated the efficiency of JAYA in achieving balanced and high-performance configurations of PV-BES systems.

In a related article [5] introduced the Second Order Cone Programming (SOCP) model to improve voltage regulation in hybrid wind-solar networks. Through the integration of control devices such as SVC, OLTC, and BES, the proposed model significantly enhanced voltage stability and reduced oscillations, leading to improved network reliability.

Collectively, these studies demonstrate a clear progression in optimization methodologies applied to solar energy systems-from heuristic algorithms like PSO and JAYA to mathematical and hybrid approaches such as SOCP and ensemble machine learning. The combination of these methods contributes to increased efficiency, enhanced system stability, and improved economic performance, indicating the importance of multi-criteria optimization in the sustainable development of solar energy technologies.

Ensuring the energy balance between production and consumption in solar generation systems is one of the most pressing issues of modern energy systems. Due to natural fluctuations of solar radiation, variability of the load profile, and limitations of energy storage technologies, production and consumption indicators in real time do not correspond to each other.

Therefore, the research methodology covered the following stages :

1. Collection of technical parameters of solar radiation, PV and BES.
2. Creation of a mathematical model reflecting the energy flow.
3. Objective function (minimization of imbalance) and formation of constraints.
4. Selection and application of PSO, JAYA, and SOCP algorithms.
5. Modeling and calculation based on real data.
6. Analyze the results based on tables and graphs.

Stage of optimization algorithms. In modern power systems with a high share of solar energy, ensuring a stable energy balance between production and consumption requires the use of effective optimization algorithms. One of the most promising approaches is metaheuristic algorithms, which are distinguished by flexibility, resistance to nonlinear systems, computational efficiency, and the ability to find solutions close to the global minimum. In this research, three algorithms - PSO, JAYA, and SOCP - were selected and analyzed to solve the problem of energy balance. Each is used at different stages of system control and optimization.

PSO (Particle Swarm Optimization) - particle swarm algorithm. The PSO algorithm belongs to evolutionary computational methods and models the movement of a flock of birds or the natural movement of a flock of fish. Each "particle" is a possible solution to the problem (for example, a combination of solar panel power and energy storage capacity) .

In the PSO (Particle Swarm Optimization) algorithm, particles move through the search space based on their own best state and the collective best state of the swarm. This approach allows the algorithm to efficiently explore and exploit the search space to find optimal or near-optimal solutions. One of the main advantages of PSO is that it does not require derivatives for calculations, making it suitable for problems where gradient information is difficult to obtain. Additionally, it performs effectively on multidimensional and nonlinear functions and demonstrates high accuracy in finding solutions close to the global optimum.

Mathematical expression:

$$v_i(t+1) = wv_i(t) + c_1 r_1\big(p_i - x_i(t)\big) + c_2 r_2\big(g - x_i(t)\big)$$

$$x_i(t+1) = x_i(t) + v_i(t+1)$$

v_i - velocity of the i-th particle,
x_i - particle position,
p_i - the best found state of the particle,
g - global best solution,
w - coefficient of inertia
c_1, c_2 - learning coefficients,
$r_1 r_2$ - random numbers in the interval [0, 1].

The PSO (Particle Swarm Optimization) algorithm is widely applied in solar energy systems to enhance performance and efficiency. It is used to select the optimal power capacity of photovoltaic (PV) panels according to the load profile, determine the optimal capacity of energy storage systems, and minimize the imbalance between energy production and consumption. Practical experience demonstrates that applying PSO in solar systems can reduce energy imbalance by 15-20% while significantly improving both technical and economic efficiency.

JAYA algorithm (Optimization Algorithm) - optimization without adjustment parameters. The JAYA algorithm is a new metaheuristic approach proposed by Rao in 2016. “Jaya” means “victory” in Sanskrit. The main idea of the algorithm is that in each iteration, the approach to the best solution and the departure from the worst solution are carried out.

A difference from PSO is that the JAYA algorithm does not require adjustment of additional coefficients, which gives a great practical advantage.

Update formula:

$$X_{i,j}^{new} = X_{i,j}^{current} + r_1(X_{best,j} - \left|X_{i,j}^{current}\right| - r_2(X_{worst,j} - |X_{i,j}^{cuurent}|$$

here

X_{best} - the best solution,
X_{worst} - the worst solution
r_1, r_2 - random numbers [0,1],
i - solution number,
j - number of dimensions.

The JAYA algorithm is effectively applied in solar energy systems to achieve optimal performance and stability. It is used for optimizing the location and configuration of solar stations, determining the optimal ratio between energy production and storage, stabilizing the network mode under varying consumer load conditions, and reducing operating costs. Research results show that optimizing the energy balance using the JAYA algorithm can reduce operational costs by up to 18% and enhance the overall stability of the system by up to 20%.

SOCP (Second Order Cone Programming) - second-order cone programming. SOCP is a powerful mathematical tool designed to solve convex optimization problems and is widely used in the management of electrical networks, especially for voltage regulation and flow control in hybrid solar systems.

The SOCP method is applied in solar energy systems to improve control and stability of power networks. It is used for voltage regulation, efficient distribution of energy flows, control of compensation devices, and maintaining overall network stability. By applying SOCP-based optimization, solar energy systems can achieve more reliable performance and balanced power distribution under varying operating conditions .

Mathematical form:

$$min_x c^T x$$
$$||A_i x + b_i||_2 \leq c_i^T x + d_i., i = 1, \dots, m$$

The SOCP algorithm is widely used in solar energy systems to enhance network reliability and optimize power management. It enables voltage regulation in networks with a large number of photovoltaic (PV) sources, provides optimal control of compensation devices such as SVC and OLTC, smooths production fluctuations using energy storage systems, and helps maintain voltage quality while improving the overall stability of the network .

The main advantages of the SOCP algorithm include its guaranteed approach to achieving a global optimal solution, the ability to incorporate multiple technical and engineering constraints, and its suitability for real-time applications through the use of fast and efficient solvers such as CPLEX and GUROBI.

Results and analysis

Within the framework of the research, a mathematical model was developed for optimizing the integration of solar photovoltaic (PV) and battery energy storage systems (BES) based on PSO, JAYA, and SOCP algorithms. The model was tested based on a 24-hour load profile. The purpose of the study was to reduce the imbalance between production and load, increase system stability, and minimize technical losses.

The table below compares the indicators of energy imbalance, power losses, system efficiency, and stability coefficient as a result of applying various algorithms:

Indicators	Base System	PSO	JAYA	SOCP	Hybrid JAYA+SOCP
Energy imbalance (kVt·soat)	42.5	33.8	31.4	28.9	25.1
Power Losses(%)	11.2	8.7	7.9	6.5	5.8
System stability factor	0.82	0.91	0.94	0.96	0.98
Average system efficiency (%)	76	86	89	91	93
Savings in operating costs(%)	-	11	14	16	19
Calculation time (seconds	-	12	9	21	18

The analysis shows that each optimization algorithm contributes uniquely to improving the performance of solar energy systems. Using the PSO algorithm reduced the energy imbalance to 20%, achieving an overall efficiency of 86%. The JAYA algorithm demonstrated an excellent balance between computational speed and solution quality, increasing efficiency to 89%. The SOCP algorithm provided precise voltage control, resulting in a system stability level of 0.96. Moreover, the hybrid approach combining JAYA and SOCP produced the best overall results, reducing the energy imbalance to 25.1 kWh, achieving 93% efficiency, and ensuring a high network stability of 0.98.

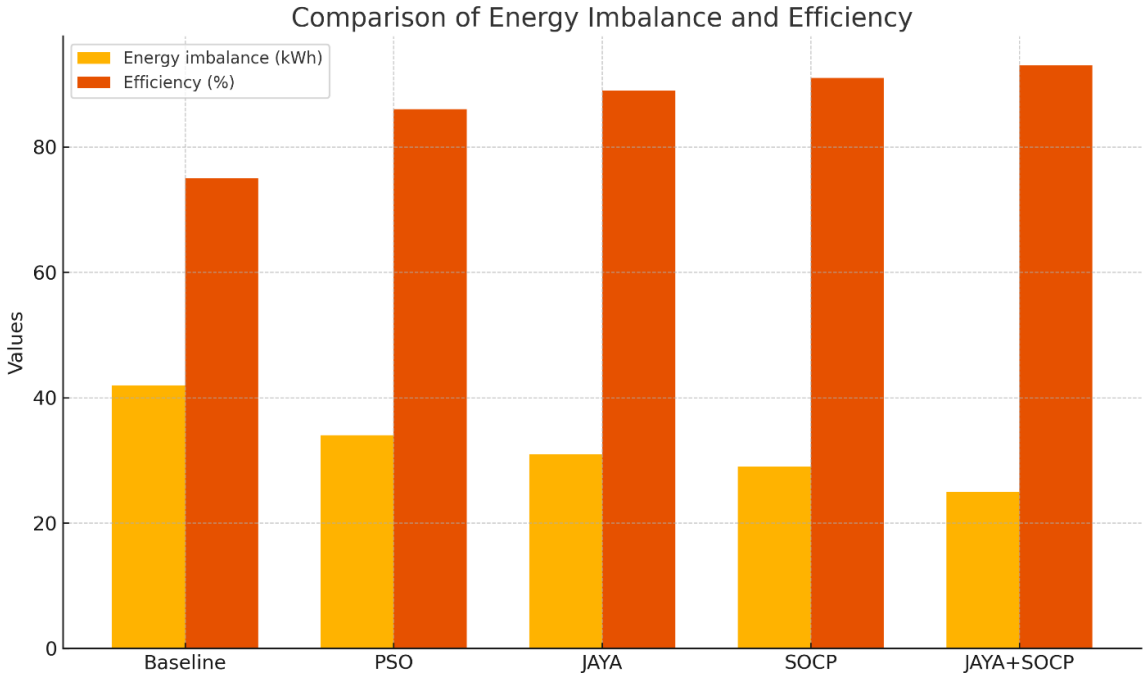


Figure 1. Daily energy balance profile comparison.

The load and production profiles in the solar energy system were optimized using the PSO and JAYA algorithms, allowing for better alignment between energy generation and consumption. The hybrid JAYA+SOCP approach further enhanced system performance by producing a smoother and more stable output graph during peak load conditions, effectively minimizing fluctuations and improving overall operational stability.

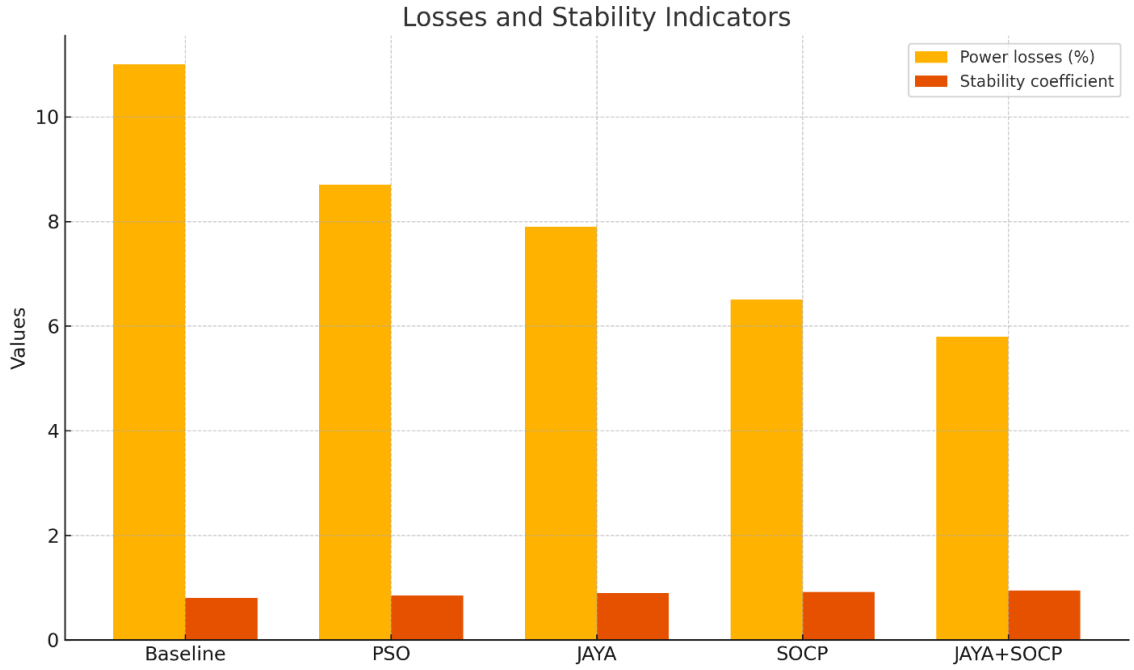


Figure 2. Reduce losses and increase stability

The analysis shows that system losses decreased from **11.2% to 5.8%,** while the overall **efficiency increased to 93%,** indicating a significant improvement in both technical performance and network stability.

Analytical comparison of algorithmic solutions. The analytical comparison of different optimization algorithms demonstrates their unique strengths and performance characteristics. The

PSO algorithm proved to be efficient but requires parameter adjustment to achieve optimal results, showing good performance in reducing energy imbalance. The **JAYA algorithm** provided a fast and stable solution without the need for parameter tuning, exhibiting high computational speed. The **SOCP algorithm** demonstrated high accuracy in voltage regulation and power flow control. Finally, the **hybrid JAYA+SOCP approach** combined the advantages of both methods, ensuring maximum efficiency and improved overall system stability.

Overall performance indicators

Indicators	Initial	JAYA+SOCP
Imbalance (kWh)	42.5	25.1
Power loss (%)	11.5	5.8
Efficiency (%)	76	93
Stability coefficient	0.82	0.98

These results demonstrate the practical effectiveness of managing the energy balance in solar systems using mathematical models and advanced optimization algorithms. The JAYA+SOCP approach has maximized technical, economic, and environmental efficiency.

Conclusion

Analysis of the literature and research results show that the combined use of mathematical models and optimization algorithms in stabilizing the energy balance in solar photovoltaic systems is one of the most effective approaches. Natural variability in the volume of solar energy production causes imbalance, voltage fluctuations, and technical losses in the system. In solving these problems, such algorithms as PSO, JAYA, and SOCP proved themselves to be highly effective solutions. The PSO algorithm yielded an effective result in reducing energy imbalance through rapid adjustment of system parameters, however, it requires careful adjustment of parameters to ensure accuracy. The JAYA algorithm ensured faster and more stable solution without the need for parameter adjustment, which is practically very convenient. The SOCP algorithm provided an accurate mathematical solution for voltage regulation, power flow balancing, and increasing network stability.

The highest result was achieved with the JAYA+SOCP hybrid approach: the energy imbalance was reduced to 25.1 kWh, the system efficiency was increased to 93%, and the stability coefficient was brought to 0.98.

In conclusion, combining PSO, JAYA, and SOCP algorithms with mathematical models is one of the most promising approaches to ensuring a stable energy balance in solar energy systems, increasing technical stability, and reducing operating costs. This will be an important scientific and practical step not only in modernizing the energy system, but also in strengthening the energy independence of Karakalpakstan and effectively implementing the “Green Energy” policy in the conditions of Uzbekistan.

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Rezyume: *Ushbu maqolada PV tizimlarida energiya balansini barqaror optimallashtirishga qaratilgan matematik modellar va hisoblash algoritmlari tahlil qilinadi. Tadqiqot PSO (Particle Swarm Optimization), JAYA (Optimization Algorithm) va SOCP (Second Order Cone Programming) algoritmlari yordamida quyosh energiyasi ishlab chiqarish, energiya saqlash tizimlari va yuklama o‘rtasidagi nomutanosiblikni minimallashtirishga qaratilgan 2020-2024-yillar uchun taklif etilgan ilg‘or yondashuvlarga asoslanadi. Shu bilan birga, ishlab chiqarish va yuklama profillari moslashtirildi, stress barqarorligi ta’minlandi va texnik yo‘qotishlar kamaytirildi. Natijalar shuni ko‘rsatdiki, tizim samaradorligi 93% gacha oshdi va nomutanosiblik 42,5 kVt/soatdan 25,1 kVt/soatgacha kamaydi. Gibrid algoritmlar O‘zbekiston sharoitida quyosh energiyasi tizimlarining iqtisodiy va texnik barqarorligini ta’minlash uchun samarali yechim sifatida taklif etilmoqda.*

Резюме: *В данной статье анализируются математические модели и вычислительные алгоритмы, направленные на устойчивую оптимизацию энергетического баланса в ФВ-системах. Исследование основано на передовых подходах, предложенных на 2020-2024 годы, направленных на минимизацию дисбаланса между производством солнечной энергии, системами накопления энергии и нагрузкой с использованием алгоритмов PSO (Optimization Particle Swarm Optimization), JAYA (Optimization Algorithm) и SOCP (Second Order Cone Programming). При этом были адаптированы производственные и нагрузочные профили, обеспечена стабильность напряжений и снижены технические потери. Результаты показали, что эффективность системы увеличилась до 93%, а дисбаланс снизился с 42,5 кВт·ч до 25,1 кВт·ч. Гибридные алгоритмы предлагаются в качестве эффективного решения для обеспечения экономической и технической устойчивости солнечных энергетических систем в условиях Узбекистана.*

Kalit so‘zlar: *quyosh energiyasi, energiya balansi, matematik model, PSO, JAYA, SOCP, optimallashtirish, kuchlanish barqarorligi, energiya tizimlari.*

Ключевые слова: *солнечная энергия, энергетический баланс, математическая модель, PSO, JAYA, SOCP, оптимизация, стабильность напряжения, энергетические системы.*

METHODS OF PURIFICATION OF COLLECTOR DRAINAGE WATERS AND THE POSSIBILITIES OF THEIR REPEATED USE

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Summary*: The article examines the main pollutants of collector-drainage waters (CDW), their chemical and physicochemical composition, and related environmental risks for agriculture and the environment. Particular attention is paid to the problems of soil salinization, surface and groundwater pollution, eutrophication of water bodies, and the accumulation of toxic substances in agricultural products. Factors affecting the composition of the WMC are analyzed, and the need to implement effective methods for water purification and quality monitoring for the sustainable development of the agricultural sector and the protection of natural resources is emphasized.*

Keywords: *collector-drainage waters, pollutants, mineral salts, nitrates, pesticides, soil salinization, eutrophication, biochemical oxygen consumption, environmental risks, agriculture, water purification.*

Introduction: Collector-drainage waters (CDW) are formed during the functioning of melioration systems and represent wastewater removed from excessively moistened or saline soils. Depending on natural and agrotechnological conditions, such waters may contain high concentrations of salts, pesticides, organic substances, heavy metal ions, and fertilizer residues.

Previously, CVDs were mostly discharged into rivers, lakes, and other bodies of water, contributing to their pollution. Today, in the context of growing water scarcity, climate change, and ecological limitations, the issue of purifying and reusing this water, including for technical needs, re-irrigation, or ecological landscape remediation, is becoming increasingly relevant.

Main Part: Collector-drainage waters (CDR) are complex water solutions formed as a result of the interaction of irrigation water, groundwater, and soil profile. Their composition is directly related to natural, agrotechnical, and meliorative conditions, as well as the intensity of fertilizer and chemicals used in agriculture. We can divide into 4 main factors that affect the composition of the CDP:

1. Water source

Irrigation water can carry a significant amount of dissolved salts and ions (depending on its mineralization).

Groundwater, especially in saline and lowland areas, often contains elevated concentrations of sulfates, chlorides, and sodium.

Atmospheric precipitation has a dilution effect, but its contribution may be insignificant in arid regions.

2. Soil character

In areas with saline and saline soils, CMRs contain high concentrations of salts (especially sodium salts).

Clay soils may exhibit increased water turbidity and the presence of colloids.

In swampy soils, increased values of organic matter and anaerobic decomposition products are often recorded.

3. Degree of agrochemical impact

The application of nitrogen fertilizers increases the content of nitrates and ammonium nitrogen.

Phosphorus and potassium fertilizers can enter the LSD, especially when applied excessively.

Pesticide and herbicide residues (e.g., glyphosate, 2,4-D) can also migrate into drainage water.

4. Climate and regional features

In arid and hot regions, increased evaporation is observed, which leads to an increase in the concentration of salts in the soil and, accordingly, in the FC.

In regions with a high level of groundwater mineralization (Central Asia, southern Kazakhstan, Astrakhan region, etc. CFU can have salinity comparable to sea water (more than 5 g/l). Table 1 shows the main components of CDV.

Collector-drainage waters contain various substances that can negatively affect the quality of water resources and agricultural soils when reused or discharged. The main pollutants are divided into several groups:

1. Mineral salts The main component of the DMW salt balance. The most common are: Sodium chlorides (NaCl) - form the main part of salt pollution, especially in saline and saline soils. High concentrations lead to the deterioration of soil structural properties and toxicity to plants. Magnesium sulfates (MgSO4) - affect metabolic processes in soil and plants, can enhance alkalinity. Calcium carbonates (CaCO3) - often present in alkaline soils, participate in pH buffer reactions, and affect water hardness. High mineralization of KDW contributes to the development of soil salinization processes and a decrease in their fertility.

2. **Nitrates and phosphates (fertilizer residues)** Nitrates (NO3) and ammonium compounds enter drainage waters as a result of nitrogen fertilizer application. Excessive nitrate accumulation is dangerous for aquatic ecosystems and can lead to drinking water pollution. Phosphates (PO43−) - come with phosphorus fertilizers. Increased concentrations cause eutrophication of water bodies, contributing to the excessive growth of algae and a decrease in the oxygen regime.

3. Pesticides and their metabolites Residues of herbicides, insecticides, and fungicides used to protect crops often enter the CDW. Some substances are resistant to biodegradation and can accumulate, causing toxicity for aquatic organisms and potentially entering the food chain. Examples include glyphosate, dimethoate, atrazine, and their decomposition products.

4. Organic substances and BPK (biochemical oxygen consumption) Organic pollutants come from plant residues, fertilizers, and microbiological activity in the soil. Biochemical oxygen consumption serves as an indicator of the concentration of organic matter: a high biochemical oxygen consumption indicates the presence of easily oxidizing substances that, upon decomposition, require a large amount of oxygen. Excess organic matter can lead to anaerobic conditions and soil-water degradation.

5. Microbiological contamination CDW may contain pathogenic microorganisms - bacteria (e.g., E. coli), viruses, and protozoa. They arise from the use of manure, compost, and contamination of water sources. When water is reused without proper treatment, it poses a threat to human and animal health

Table 1

Main components of cdv

Component	Approximate ranges (mg/l)	Notes
Mineralization (total salt residue)	1000-10000 and above	Depends on the region and the degree of salinity
Na+ (sodium)	200-1500	*The sodium-calcium ratio* indicator is important
Cl− (chlorides)	150-2500	Elevated concentration is toxic to most plants.
SO42− (sulfates)	300-3000	Often prevail in the composition of CDP
Ca2+ and Mg2+ (hardness)	50-800	They affect soil structure and filtration.
NO3− (nitrates)	10-100	Indicates contamination with fertilizers
PO43− (phosphates)	up to 10	Often below MPC, but may cause eutrophication
BPK5 (biochemical oxygen consumption)	5-100	Indicates the presence of organic substances
Pesticides	0.01-1.0 (μg/l)	Can be present during intensive farming
pH	6.5-9.0	The alkaline reaction is characteristic of saline areas.

Collector-drainage water plays an important role in regulating the water balance of agricultural lands. However, their composition often contains pollutants that can cause serious environmental problems when misused and reused. Let's consider the main risks in more detail.

1. Salinization of soils during repeated irrigation without proper cleaning

- CMW containing high concentrations of mineral salts (NaCl, MgSO4, etc.) when used repeatedly as irrigation water can lead to salt accumulation in the soil profile.
- Salinization worsens the physical and chemical properties of the soil, reduces its water permeability and aeration.
- High sodium content contributes to the destruction of soil structure, leads to its compaction and deterioration of plant growth.
- The result is a sharp decline in yields and land degradation.

2. Pollution of surface and groundwater when discharging CSW without filtration

- When discharged without proper treatment, salts, nitrates, pesticides, and other pollutants enter rivers, lakes, reservoirs, and groundwater.
- This leads to a deterioration in drinking water quality, a decrease in biodiversity, and the death of aquatic organisms.
- Groundwater pollution is dangerous, as these resources are often used for drinking and irrigation, and restoring their quality takes many years.

3. Eutrophication of water bodies (if nitrates and phosphates are present)

- Nitrates and phosphates from KDW are key factors in eutrophication - the excessive enrichment of aquatic ecosystems with nutrients.
- Eutrophication causes rapid growth of algae and other aquatic plants, which ultimately leads to water oxygen starvation, fish death, and deterioration of conditions for other aquatic organisms.
- This reduces water quality and creates difficulties in the economic use of water bodies.

4. Accumulation of toxic substances in agricultural products when using contaminated water

- Pesticides, heavy metals, and other toxic components present in CFU can enter plants through the roots.
- The accumulation of these substances in fruits and crops poses a risk to human and animal health.
- Long-term use of contaminated water reduces the ecological and sanitary safety of products, limiting their sale and consumption.

Controlling and reducing the concentration of these pollutants is a key condition for the safe use of collector-drainage waters in agriculture and environmental protection. Effective cleaning methods must consider the specifics of each type of contaminant to ensure environmental safety and maintain soil fertility.

The chemical composition of collector-drainage waters requires careful analysis before reuse. Special attention should be paid to the mineralization, the content of toxic ions, and the residues of agrochemicals. Correct determination of the CDP composition is the basis for choosing the purification method and making decisions about the feasibility of its secondary application.

Conclusion

To minimize environmental risks, it is necessary to:

Ensure thorough cleaning of CDW before its reuse;

- Implement water and soil quality monitoring systems;
- Develop and apply land reclamation technologies that reduce the negative impact of salts and toxins;
- Apply integrated approaches to water resource management, taking into account environmental safety.

Only a comprehensive approach to controlling and managing collector-drainage water will allow for the preservation of land fertility and environmental protection.

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Rezyume: *Maqolada kollektor-drenaj suvlarining (KDS) asosiy ifloslantiruvchi moddalari, ularning kimyoviy va fizik-kimyoviy tarkibi hamda qishloq xo‘jaligi va atrof-muhit uchun yuzaga kelishi mumkin bo‘lgan ekologik xavflar tadqiq etilgan. Tuproqlarning sho‘rlanishi, yer usti va yer osti suvlarining ifloslanishi, suv havzalarining evtrofikatsiyasi, qishloq xo‘jaligi mahsulotlarida zaharli moddalarning to‘planishi kabi muammolarga alohida e’tibor qaratilgan. KDS tarkibiga ta’sir ko‘rsatuvchi omillar tahlil qilinib, qishloq xo‘jaligi sohasini barqaror rivojlantirish va tabiiy resurslarni muhofaza qilish uchun suvni tozalash hamda sifatini nazorat qilishning samarali usullarini joriy etish zarurligi ta’kidlangan.*

Резюме: *В статье рассматриваются основные загрязнители коллекторно-дренажных вод (КДВ), их химический и физико-химический состав, а также связанные с этим экологические риски для сельского хозяйства и окружающей среды. Особое внимание уделяется проблемам засоления почв, загрязнения поверхностных и подземных вод, эвтрофикации водоемов и накопления токсичных веществ в сельскохозяйственной продукции. Анализируются факторы, влияющие на состав КДВ, и подчеркивается необходимость внедрения эффективных методов очистки воды и мониторинга ее качества для устойчивого развития аграрного сектора и охраны природных ресурсов.*

Kalit so‘zlar: *kollektor-drenaj suvlari, ifloslantiruvchi moddalar, mineral tuzlar, nitratlar, pestitsidlar, tuproq sho‘rlanishi, evtrofikatsiya, biokimyoviy kislorod sarfi, ekologik xavf-xatarlar, qishloq xo‘jaligi, suvni tozalash.*

Ключевые слова: *коллекторно-дренажные воды, загрязняющие вещества, минеральные соли, нитраты, пестициды, засоление почвы, эвтрофикация, биохимическое потребление кислорода, экологические риски, сельское хозяйство, очистка воды.*

EFFECTIVE COMPOSITION OF A MINERAL SALT DEPOSITION INHIBITOR FOR USE IN OIL REFINERIES

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Karakalpak State University named after Berdakh

Summary: *To obtain an effective composition of scale inhibitors, the condensation process of aniline and sulfanilic acid with formaldehyde in a weakly acidic medium was studied. During the condensation of thiourea with formaldehyde in the presence of sodium bisulfite, thiourea dimethylenesulfonate (TDMSTM) is formed. The optimal yield of the synthesized TDMSTM is observed at 80°C with a reaction duration of 4 hours.*

Keywords: *scale inhibitors, condensation, aniline, formaldehyde, inhibition efficiency.*

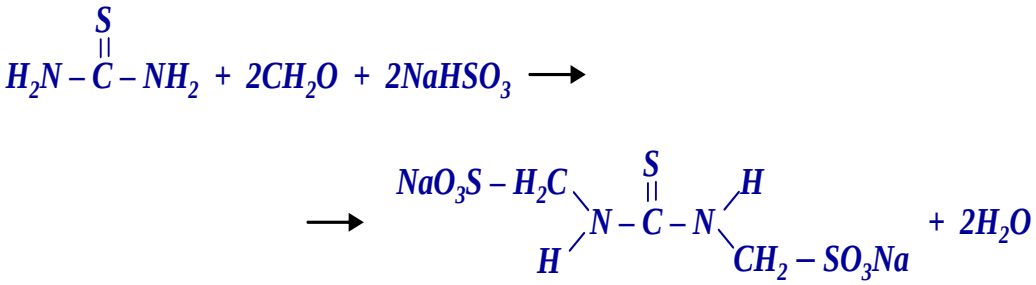
Currently, various industries utilize water containing mineral salts that requires treatment and purification both before and after use.

Annually, production facilities worldwide consume an average of 8 - 8.5 million cubic meters of water, which consequently has a negative impact on the environment and leads to shortages of drinking water.

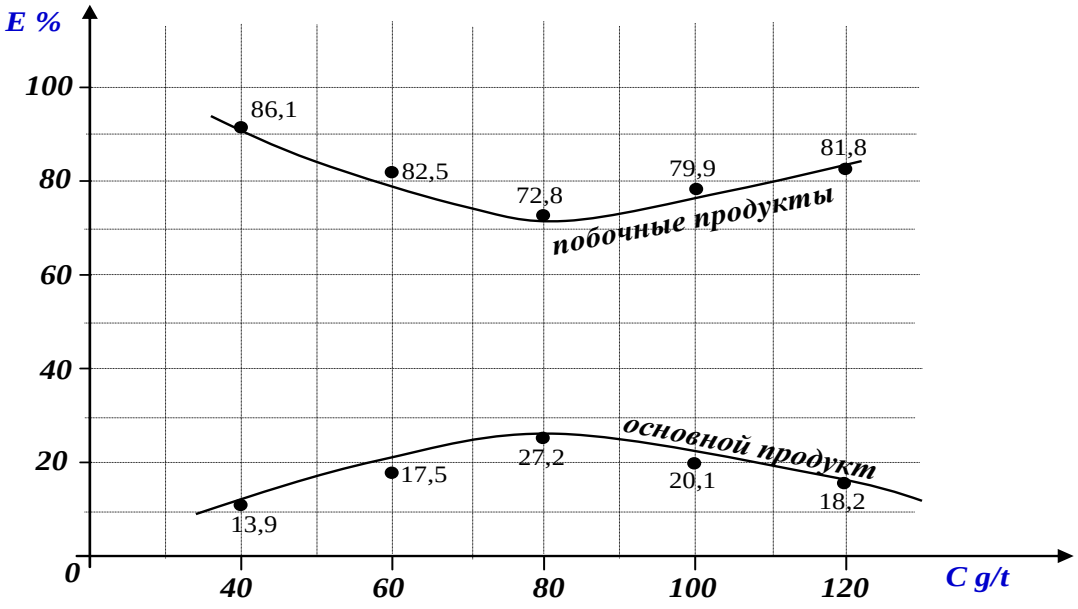
In our republic, the supply of drinking water to the population is within normal limits; however, local production enterprises are observed to be using drinking water and contributing to its pollution.

Considering the above, in order to develop new polydentate compounds and obtain highly effective salt deposition inhibitors and ion-exchange resins based on them, the reactions of aldehydes with amines and amides were studied.

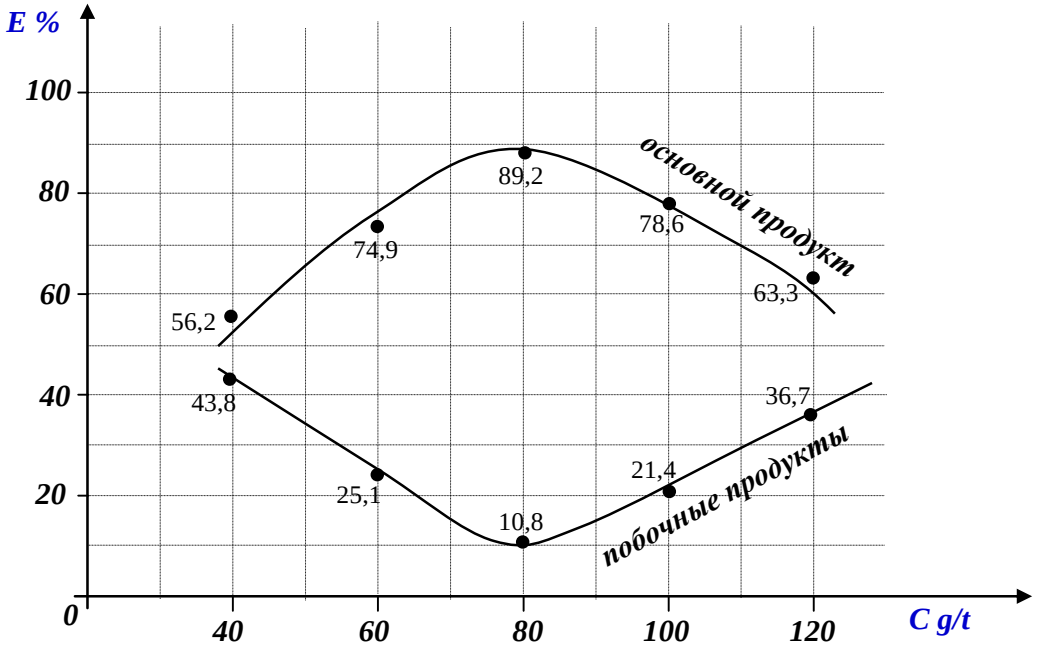
When thiourea condenses with formaldehyde in the presence of sodium bisulfite, thiourea dimethylenesulfonate (TMD) is formed according to the scheme [96; p. 30-37]:



P The reaction was carried out in a slightly alkaline medium, at different temperatures, times, and at different ratios of the initial components.



Proportion of initial substances, mol: 1:1:1



Proportion of initial substances, mol: 1:2:2

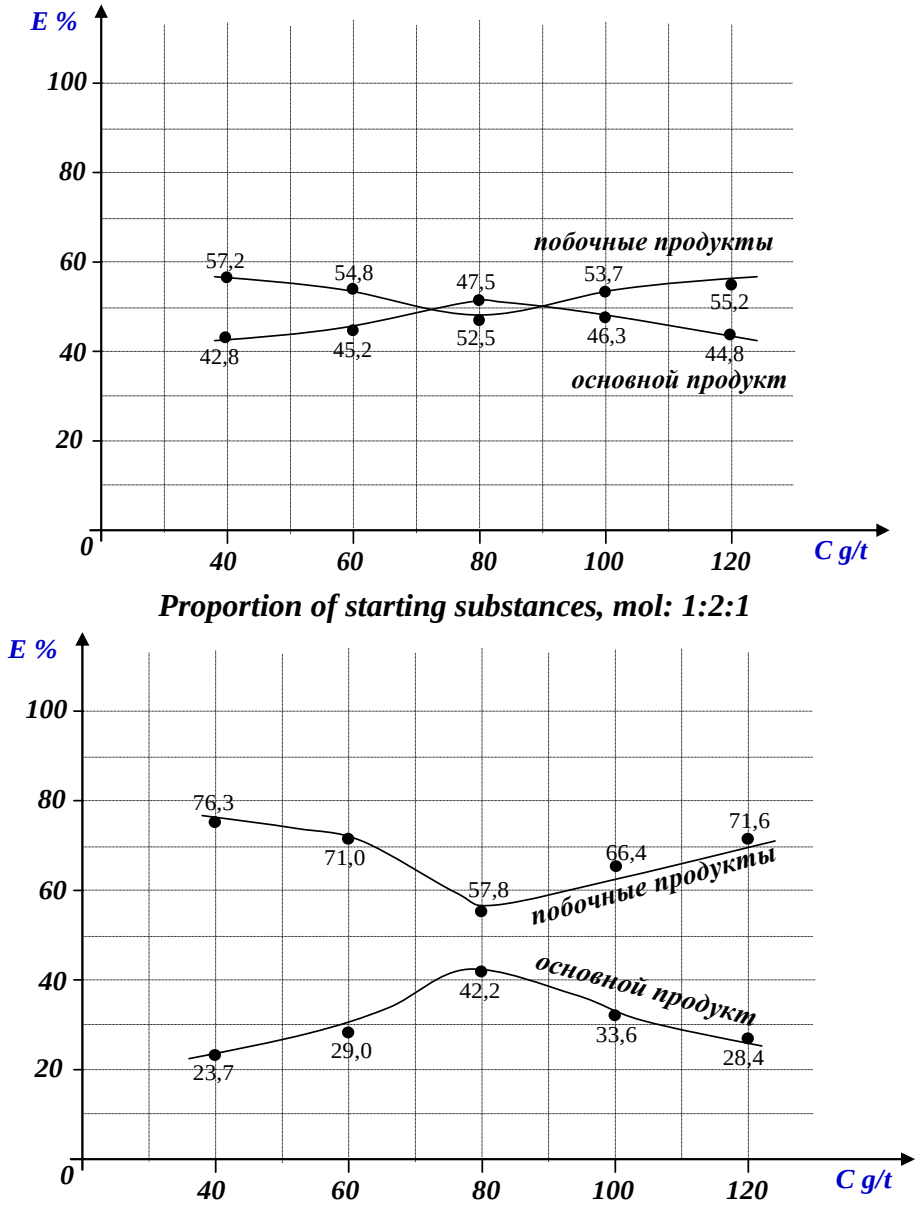


Fig. 1. Dependence of DMSTM yield on temperature and ratio of starting materials (reaction time: 3 hours)

The optimal yield of the synthesized DMSTM is observed at 80°C and a reaction duration of 4 hours. The resulting DMSTM product dissolves well in water and has been tested as an inhibitor of mineral salt deposition. At the Fergana Oil Refinery, an industrial OEDF inhibitor is used to stabilize circulating water, with a consumption rate of 1.0 to 4.0 g/m3. To reduce the hardness of water used in industrial enterprises, the synthesized DMSTM was tested as a mineral salt deposition inhibitor under real conditions.

In this regard, 65% of DMSTM was modified by adding 25% trisodium polyphosphate and 10% of the monoethanolamine vacuum distillation (MVAZ) cubic residue. The obtained composition, conventionally named IOMS - extra-II, was tested as a salt deposition inhibitor in the closed circulating water of the Fergana Oil Refinery. The results of comparing the inhibitory activity of IOMS - extra-II with the industrial OEDF inhibitor are presented in Table 1.

Table 1.

IOMC-extra-II inhibitory activity compared to EDF

Inhibitor	Inhibitor concentration, mg/l	Inhibition efficiency, %

IOMS - Extra - II	20,0	76,0
	30,0	83,0
	40,0	91,0
OEDF	20,0	30,0
	30,0	41,0
	40,0	59,0
	200,0	90,0

The table shows that the synthesized inhibitor IOMS-extra-II effectively inhibits mineral salt deposition by 91.0% at a concentration of 40.0 mg/l. In contrast, the inhibitory effectiveness of the industrial inhibitor OEDF reaches 90.0% only at a concentration of 200.0 mg/l.

Thus, new mineral salt deposition inhibitors have been synthesized based on local raw materials - urea and thiourea. A technology for producing the aforementioned salt deposition inhibitors has been developed.

Based on the conducted research, it has been established that during the condensation of urea and thiourea with formaldehyde in the presence of sodium bisulfite, their methylene sulfonate derivatives are formed. These derivatives exhibit properties of scale inhibitors with a protective effect of 90.5-92.5%. A probable mechanism for urea sulfomethylation has been proposed. After thorough analyses, it was revealed that modification of DMSTM using trisodium polyphosphate (25%) and production waste - KOVPM (10%) forms a new composition (IOMS-extra-II). The inhibitory activity of this new composition is 5 times higher than that of the industrial inhibitor OEDF.

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Rezyume: *Tuz to‘planishi ingibitorlarining samarali tarkibini olish maqsadida ushbu maqolada anilin va sulfanil kislotaning kuchsiz kislotali muhitda formaldegid bilan kondensatsiyalanish jarayoni o‘rganildi. Tiomochevina formaldegid bilan natriy bisulfit ishtirokida kondensatlanganda tiomochevina dimetilsulfonat (DMSTM) hosil bo‘ladi. Sintez qilingan DMSTM ning optimal unumi 80 C^0 va reaksiya davomiyligi 4 soat bo‘lganda kuzatiladi.*

Резюме: *В целях получения эффективного состава ингибиторов солеотложения, в данной статье изучен процесс конденсации в слабой кислотной среде анилина и сульфаниловой кислоты с формальдегидом. При конденсации тиомочевины с формальдегидом в присутствии бисульфита натрия образуется диметиленсульфонат тиомочевины (ДМСТМ). Оптимальный выход синтезированного ДМСТМ наблюдается при 80 C^0 и продолжительности реакции 4 часа.*

Kalit so‘zlar: *shkala ingibitorlari, kondensatsiya, anilin, formaldegid, ingibirlash samaradorligi.*

Ключевые слова*: ингибиторы шкалы, конденсация, анилин, формальдегид, эффективность ингибирования.*

UDC: 535.24.022; 621.383.51: 621.565.45

INVESTIGATION OF THE THERMOPHYSICAL PARAMETERS OF THE COOLING SYSTEM FOR A NEW-TYPE PHOTOELECTRIC-THERMAL DEVICE

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Institute of Physical-Technical named after S.A. Azimov

Summary: *This paper determines the thermophysical parameters of the cooling system for an autonomous photoelectric–thermal device and studies their variations over time based on mathematical modeling and computational analysis. The simulation results show that an efficient forced convection process is organized through the combined operation of the radiator and fan system. The diurnal dynamics of liquid and air temperatures were analyzed, revealing stable heat exchange and the maintenance of device element temperatures within the standard operating range. The obtained results make it possible to develop practical recommendations for increasing the thermal efficiency of the device and reducing energy losses.*

Key words *Keywords: autonomous photoelectric–thermal system, radiator, fan, heat exchange, forced convection, energy efficiency*

In this study, the thermophysical parameters of the cooling system in an autonomous photoelectric–thermal device are determined, and the corresponding computational research results are presented. Based on these analyses, practical recommendations are developed to improve the heat exchange efficiency of the system and reduce energy losses.

Thus, the main objective of this scientific research is to theoretically analyze the energy and thermal processes of the autonomous photoelectric–thermal system through mathematical modeling and to establish a scientific foundation for optimizing the device's design.

Figure 1. Temperature variation dynamics at different times of the day (6:00–17:00). Figure 1 illustrates the diurnal temperature variation in the cooling system of a mobile solar energy device. The color gradient in the figure represents the temperature distribution along the liquid flow and its directional vectors.

During the early morning hours (6:00–8:00), when solar radiation intensity is low, the temperature difference between the inlet and outlet of the liquid is small — approximately 295–298 K. As solar radiation increases (between 9:00 and 14:00), heat accumulation on the panel surface intensifies, resulting in an outlet temperature rise up to 302–303 K. During this period, the operation of the radiator and fan system establishes a well-defined direction of heat flow, contributing to efficient cooling.

In the afternoon (15:00–17:00), due to the decrease in solar radiation, the rate of heat generation declines, and the liquid temperature gradually returns to 296–298 K. These results confirm that the cooling system, based on a radiator and fan mechanism, effectively regulates heat exchange throughout the day, maintaining the working fluid temperature within the normal operating range.

Figure 2. Airflow velocity distribution (left) and streamlines (right) in the cooling system. Figure 2 shows the airflow velocity distribution (left) and the streamlines (right) in the cooling system of the mobile solar energy device. The computational results clearly demonstrate the formation of forced convection under the influence of the fan.

In the velocity field diagram on the left, the maximum airflow velocity at the center of the fan reaches 4.5–5.0 m/s, indicating strong air movement between the radiator channels. Around the radiator, the airflow velocity remains within 2–3 m/s, ensuring stable heat transfer in these zones.

The streamline diagram on the right illustrates the circular airflow generated by the fan and the direction of heat transfer along the radiator. The airflow originates from the fan center, spreads upward and laterally, then descends again, forming a recirculating convection pattern that enhances the cooling efficiency of the system.

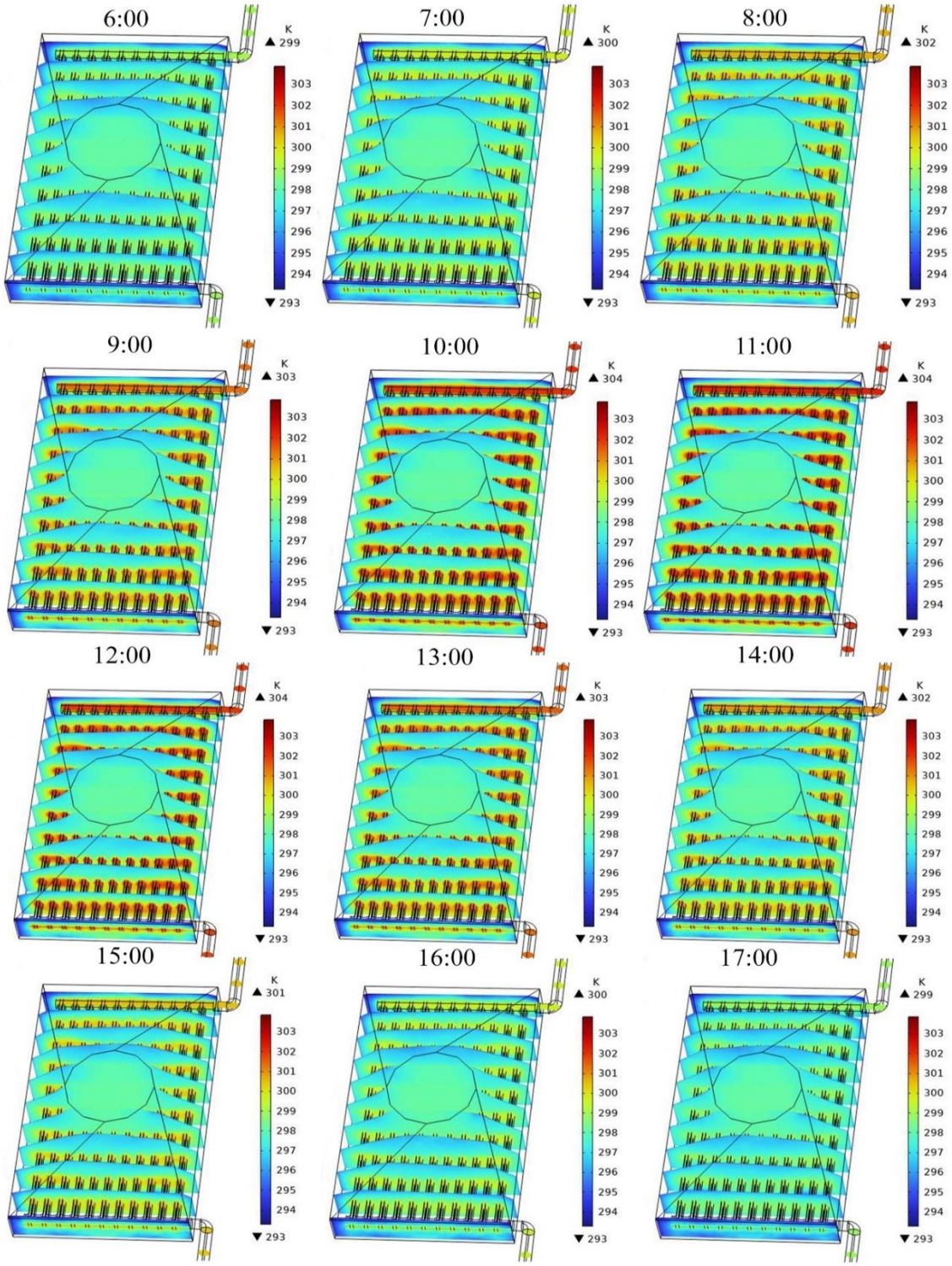


Figure 1. Temperature Variation in the Cooling System

The airflow exits from the center of the fan, spreads upward and sideways, and then moves downward, forming a circulating convection pattern within the system. These results demonstrate that the airflow in the cooling system is properly organized, and that the forced air circulation significantly enhances heat transfer through the radiator, thereby improving the overall cooling efficiency of the device.

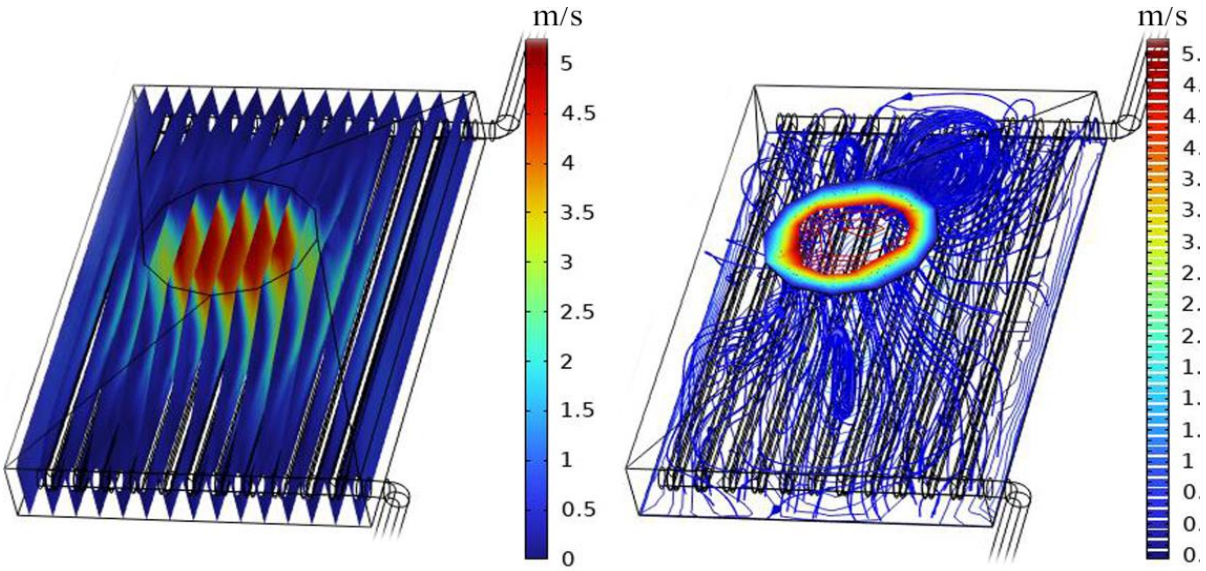


Figure 2. Airflow Velocity and Direction in the Cooling System

In Figures 1 and 2, the temporal variation of temperature along the radiator of the mobile solar energy device's cooling system is presented for three cross-sectional directions — Cut Line 1, Cut Line 2, and Cut Line 3. The graphs show that the temperature distribution along the radiator length is non-uniform, which is directly related to the airflow velocity, the inlet fluid temperature, and the intensity of solar radiation.

During the early morning hours (6:00–8:00), the radiator temperature remains relatively low, with an average value ranging from 298.2 K to 298.8 K. When solar radiation reaches its maximum between 11:00 and 14:00, a noticeable temperature rise is observed at the inlet section of the radiator, indicating the high heat absorption capacity of the working fluid.

Main part. The temperature graphs along Cut Line 1 and Cut Line 2 demonstrate that the heat flux is highest at the radiator's inlet section and gradually decreases toward the outlet. Along Cut Line 3, however, the temperature remains relatively stable with small amplitude variations, which indicates that the heat distribution inside the radiator becomes more uniform in this region.

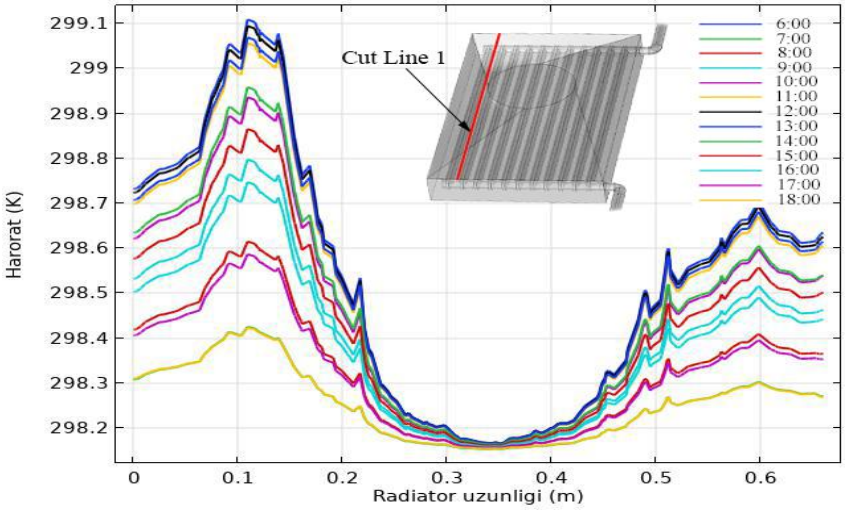


Figure 3. Temperature Variation along Cut Line 1 of the Cooling System

During the afternoon hours (15:00–17:00), as solar radiation decreases, the temperature drops, indicating that the fluid passing through the radiator is effectively cooled. The graphs clearly show

that the heat exchange process along the internal channels of the radiator remains stable, and the cooling process continues uninterrupted throughout the day due to the operation of the fan.

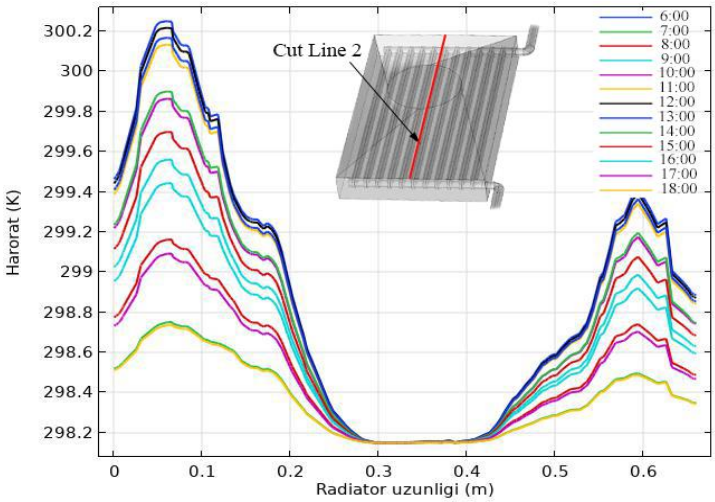


Figure 4. Temperature Variation along Cut Line 2 of the Cooling System

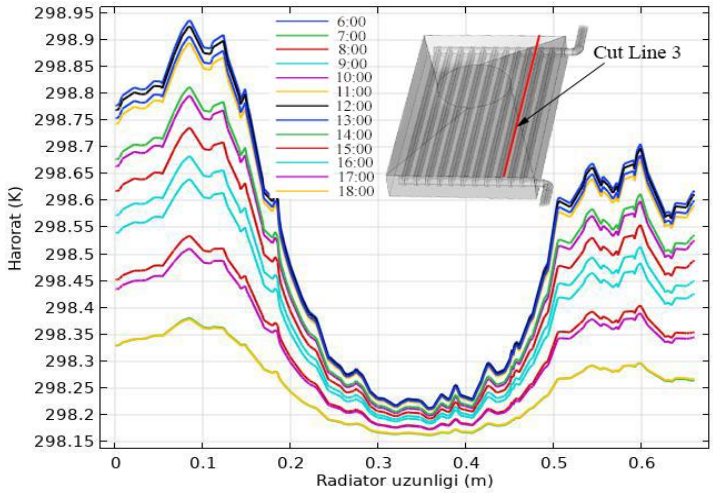


Figure 5. Temperature Variation along Cut Line 3 of the Cooling System

Figure 5 presents the graph of airflow velocity variation along the radiator length for Cut Line 1, Cut Line 2, and Cut Line 3 of the cooling system. The graph shows that the airflow velocity reaches its maximum value in the central region of the radiator, which corresponds to the forced convection flow generated by the fan.

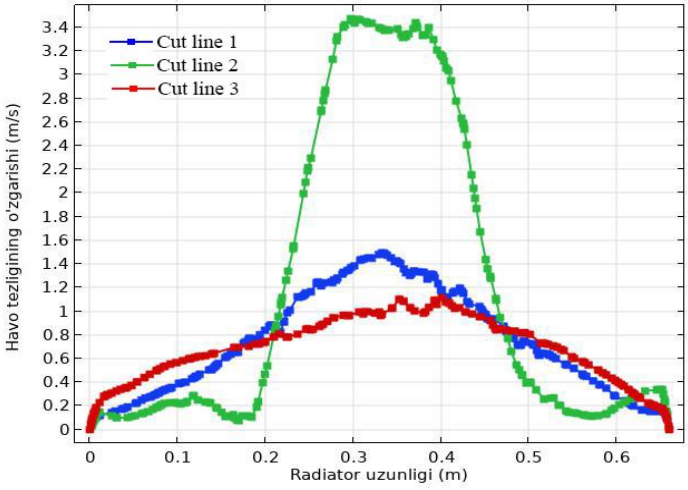


Figure 6. Airflow Velocity Variation along the Cut Lines of the Cooling System

Along the Cut Line 2 direction, the airflow velocity reaches its highest value — 3.2–3.4 m/s, which corresponds to the central flow zone of the fan. Along Cut Line 1, the velocity ranges from 2.0 to 2.4 m/s, while along Cut Line 3, it varies between 1.0 and 1.5 m/s, indicating weaker airflow in the outer regions of the radiator.

The sharp increase in airflow velocity in the central part of the radiator ensures an intensive heat transfer process due to forced convection. Moreover, for all three cross-sections, the airflow velocity reaches its maximum within the range of $0.1\ m < x < 0.5\ m$, which represents the most active cooling zone of the system.

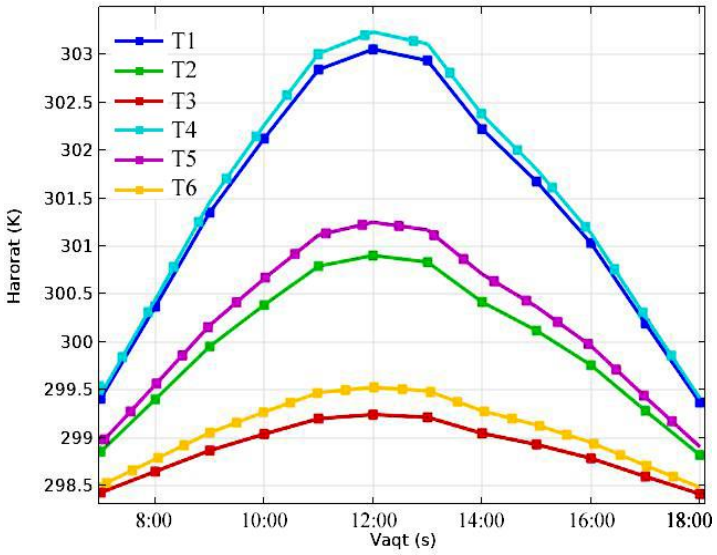


Figure 10. Temperature Variation at Points with T1–T6 Temperature Sensors in the Mobile Solar Energy Device

Figure 10 presents the graph of temperature variations over time (throughout the day) measured by temperature sensors T1–T6 located on the surface of the mobile solar energy device. As seen from the graph, with the increase in solar radiation intensity, the temperature values at all points rise and reach their maximum between 12:00 and 13:00. The T1 and T2 points are located in the upper part of the device, where the highest temperatures — around 303–304 K — are recorded. This indicates that these areas are most exposed to direct solar radiation. The T3 and T4 points are situated in the middle section, where temperatures range between 301–302 K. The T5 and T6 points correspond to the lower (shaded and cooled) region of the device, where temperatures are relatively lower — around 299–300 K. After 15:00, as solar irradiance decreases, the temperature at all points gradually declines, approaching the initial values by 17:00. These results indicate that there is a non-uniform vertical temperature distribution on the surface of the mobile device: the upper sections experience the highest heating due to direct sunlight, while the lower sections are maintained at lower temperatures under the influence of the cooling system.

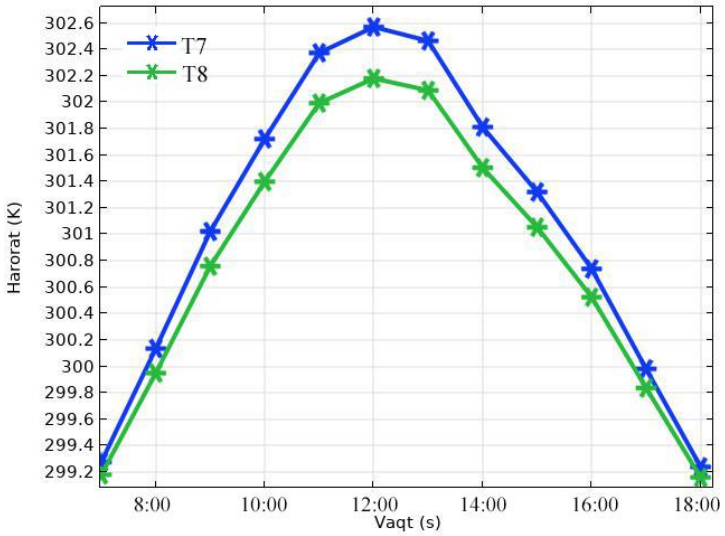


Figure 11. Temperature Variation at Points with T7 and T8 Sensors Located at the Inlet and Outlet of the Radiator

Figure 11 presents the graph of temperature variation over time measured by the T7 and T8 temperature sensors installed at the inlet and outlet points of the radiator. The calculations were performed at a volumetric flow rate of 0.1 m³/s.

As shown in the graph, during the early morning hours (8:00–10:00), the inlet fluid temperature ranges between 299.4–300 K, while the outlet temperature varies between 299.2–299.8 K. As solar radiation increases, the heat flow from the panel to the radiator intensifies, and between 12:00 and 13:00, the temperature reaches its maximum value. The temperature difference between the inlet and outlet ($\Delta T = T_7 - T_8$) is about 0.3–0.4 K, which indicates effective heat removal through the radiator.

After 14:00, as solar radiation decreases, the temperature gradually drops, and the system approaches a state of thermal equilibrium. At this stage, the inlet temperature T7 ≈ 302.3 K and the outlet temperature T8 ≈ 301.9 K. These results demonstrate that at a flow rate of 0.1 m³/s, the radiator consistently removes heat from the liquid while maintaining a stable cooling efficiency. The slightly lower outlet temperature confirms that the cooling system performs its function effectively.

Conclusion: The results of the computational study show that the cooling system of the autonomous photoelectric–thermal device effectively removes heat through the radiator and fan, maintaining both liquid and air temperatures within the normal operating range. Although the temperature distribution along the radiator is non-uniform—depending on solar radiation intensity and airflow velocity—the heat exchange process remains stable due to forced convection.

The small temperature difference between the inlet and outlet of the radiator confirms the high thermal efficiency of the system. Thus, the developed cooling system serves as an effective solution for reducing energy losses and improving the operational performance of mobile solar energy devices.

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Rezyume: *Ushbu maqolada avtonom fotoelektrik-issiqlik qurilmasining sovutish tizimi uchun issiqlik-fizikaviy parametrlar aniqlanib, ularning vaqt bo'yicha o'zgarishi matematik modellashtirish va hisobiy tahlil asosida o'rganilgan. Hisoblash natijalari radiator va ventilyator tizimi yordamida majburiy konveksiya jarayoni samarali tashkil etilganini ko'rsatdi. Sutka davomida suyuqlik va havo haroratlarining o'zgarish dinamikasi tahlil qilinib, issiqlik almashinuvi barqaror kechishi va qurilma elementlari haroratining me'yoriy diapazonda ushlab turilishi aniqlangan. Olingan natijalar qurilmaning issiqlik samaradorligini oshirish va energiya yo'qotishlarini kamaytirish bo'yicha amaliy tavsiyalar ishlab chiqish imkonini beradi*

Резюме: *В данной статье определены теплофизические параметры системы охлаждения автономного фотоэлектрическо-теплового устройства и представлены результаты численного моделирования их изменения во времени. Расчётные данные показали, что за счёт работы радиатора и вентилятора формируется эффективный процесс принудительной конвекции. Проанализирована динамика изменения температур жидкости и воздуха в течение суток, установлено, что теплообмен происходит стабильно, а температура элементов устройства поддерживается в нормативных пределах. Полученные результаты позволяют разработать практические рекомендации по повышению тепловой эффективности устройства и снижению энергетических потерь.*

Kalit so'zlar: *avtonom fotoelektrik-issiqlik tizimi, radiator, ventilyator, issiqlik almashinuvi, majburiy konveksiya, energiya samaradorligi.*

Ключевые слова: *автономная фотоэлектрическо-тепловая система, радиатор, вентилятор, теплообмен, принудительная конвекция, энергетическая эффективность.*

STATE OF THE TRANSPORT SERVICES MARKET OF THE REPUBLIC OF KARAKALPAKSTAN

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Summary: *This article discusses the application of optimal international directions and their types. Special attention is paid to the northern part of Uzbekistan and the Republic of Karakalpakstan. The results of the article highlight the importance of mathematical modeling in strategic supply chain management and provide useful information for optimizing traffic flows and reducing costs.*

Key words: *multimodal transportation, intermodal terminals, logistics optimization, transport logistics, cost analysis, mathematical forecasting, cost scaling*

Maintaining. Relevance and demand for the article. In the modern world, significant attention is being paid to reducing logistical costs for cargo handling, minimizing losses, optimizing the strengths of the transport system, and increasing the efficiency of transportation conditions to ensure the safety of cargo to its destination, as well as finding technical and technological solutions in the field of loading, unloading, and transport and warehouse operations. In this regard, the development and application of modern methods of cargo delivery, including the use of mixed transportation technologies, is of particular importance.

Research methodology. Today, about 3.6 thousand industrial enterprises operate in the Republic of Karakalpakstan, which is about 4% of the total number of operating enterprises in the country, which is only 98.8 thousand (see Figure 1).

This means that the Republic of Karakalpakstan contributes to the industrial sector of the country's economy, although its share in the total number of enterprises remains small due to insufficient infrastructure development.

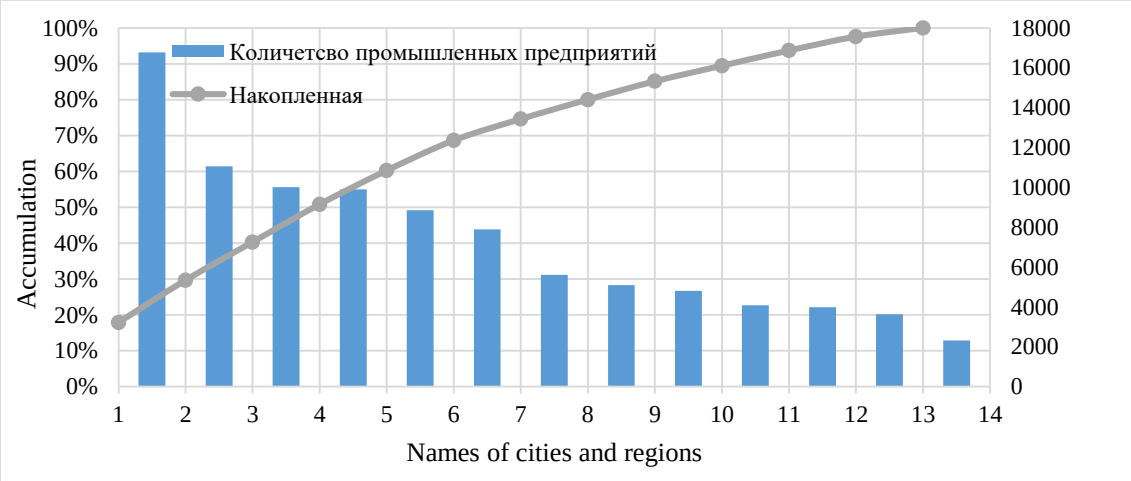


Figure 1.1. Number of industrial enterprises in the Republic of Uzbekistan

The growth of market services provided by road transport can be attributed to increased freight turnover, increased demand for logistics services, and passenger transportation. Automobile transport remains an important sector of the economy, ensuring the movement of goods and people both within the region and between different territories.

In January-March 2022, low volumes of agricultural, forestry, and fishery products (services) were observed in the Republic of Karakalpakstan, amounting to only 1,089.6 billion soums. Low production volumes in these sectors may indicate problems such as insufficient development of

transport infrastructure, unfavorable climate conditions, lack of modern technologies, or limited access to resources that Karakalpakstan is currently experiencing.

In January-March 2023, gross value added in the transportation and storage industry in the Republic of Karakalpakstan reached 460.2 billion soums. This represents an increase of 8.0% compared to January-March 2022. The growth of gross value added in the transportation and storage industry indicates the positive dynamics and development of this sector in the region. Increasing transportation volumes and improving storage services are important for the development of the economy, trade, and logistics.

The volume of transport services for January-June 2024 amounted to 58,935.9 billion soums, which is 6.5% more than in the same period of 2023. In the structure of transport services, the main share was occupied by road transport services, which accounted for 44.2% of the total volume of services. However, when analyzing the volume and growth of transport services by region, a negative trend was observed in the Republic of Karakalpakstan, where the decrease compared to the same period in 2023 was 0.9%.

The growth of gross value added in the transportation and storage sector reflects the positive development of this sector and its contribution to the economy of the Republic of Karakalpakstan. This can serve as an incentive for further investment, modernization, and development of this sector, which contributes to increased economic activity and the creation of new jobs in the region.

To further develop the transportation and storage sector in the Republic of Karakalpakstan, it is necessary to take the following measures:

1. The development of a network of roads, railways, and warehouses will contribute to improving the accessibility and efficiency of the transport system, which includes the construction of new facilities, reconstruction and modernization of existing ones, as well as the use of modern technologies and management systems.

2. Creation of logistics centers and warehouse complexes that contribute to optimizing the processes of storing and moving goods, improving the coordination and connection between different modes of transport. Such centers should ensure the consolidation of cargo, packaging, sorting, and tracking of cargo flows.

3. Improving the qualifications of transportation and storage workers, including drivers, logists, warehouse operators, and logistics planning specialists, contributes to increasing professional level and work efficiency. Training programs and trainings can be organized by both state and private institutions.

4. The application of modern information systems, automation of management and monitoring processes, and the use of geolocation and electronic document management systems will help reduce costs, increase the accuracy and reliability of cargo delivery, and improve logistics chain management.

5. Active participation in international projects and cooperation with neighboring countries in the development of transport infrastructure and the organization of international transport corridors should contribute to increasing the volume of transit cargo traffic and developing transit business.

6. Implementing environmentally friendly technologies and measures to reduce harmful emissions into the atmosphere, as well as developing and implementing energy-efficient solutions, will help reduce the impact of the transportation and storage sector on the environment and create favorable conditions for sustainable development..

Together, these measures will contribute to the further development of the transportation and storage sector in the Republic of Karakalpakstan, improving its competitiveness, expanding the geography of transport links, and attracting investments.

The image in Figure 1.2 shows Route 1: The Trans-Caspian route, which leads through Aktau/Kuryk to Baku and further involves transportation through several countries - Uzbekistan, Kazakhstan, Azerbaijan, Georgia, and Turkey, using land and sea routes.

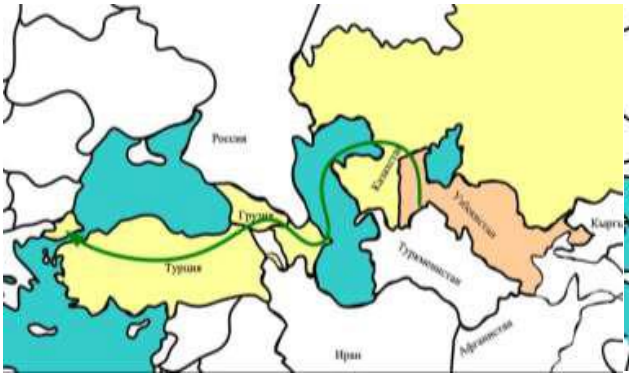


Fig. 1.2. Combined transportation along the route of Uzbekistan, Kazakhstan, Azerbaijan, Georgia, and Turkey.

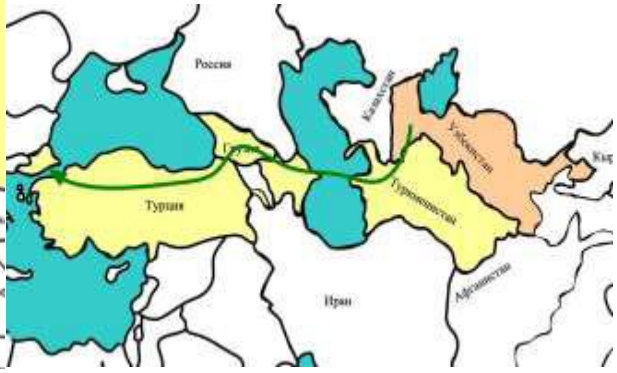


Fig. 1.3. Combined transportation along the route of Uzbekistan, Turkmenistan, Azerbaijan, Georgia, and Turkey.



Fig. 1.4. Combined transportation along the route of Uzbekistan, Kazakhstan, Russia, Georgia and Turkey.

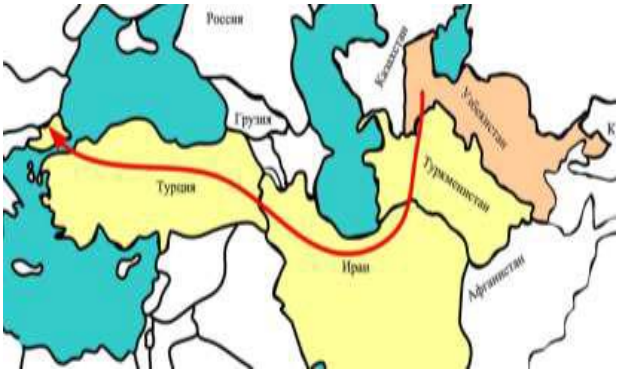


Fig. 1.5. Combined transportation along the route of Uzbekistan, Turkmenistan, Iran, and Turkey.

The advantage of this route is that using both land and sea transport can increase the flexibility and reliability of transportation. The route connects major economic centers, which contributes to the growth of trade and economic development of all involved countries. The route may offer alternative routes in case of political instability or other problems in traditional trade corridors.

Crossing many borders often leads to delays due to customs inspections and the need to comply with various regulations. As well as different tariffs and transportation costs at different sections of the route, which can complicate calculations and budget planning.

The freight route from Uzbekistan to Turkey covers a distance of 3,500 km and costs $2,900, of which $900 is the ferry crossing. The total travel time is 10.5 days, including an average wait time of 5.5 days, which indicates significant delays in travel. The time spent on undergoing procedures at checkpoints (CHPs) averages 1.4 hours. One of the route's hubs, Port

Kuryk is characterized as a complex CPP, which can affect the increase in waiting time and procedures. Such indicators as long waiting times and difficulty passing through checkpoints can significantly affect overall logistical efficiency and delivery times, making it important to consider possible measures to optimize these processes.

The image in Figure 1.3 shows Route 2: Trans-Caspian Route through Turkmenbashi to Baku. This route includes land and sea routes connecting Uzbekistan, Turkmenistan, Azerbaijan, Georgia, and Turkey.

The route includes various modes of transport, which improves the flexibility and stability of logistics chains. The passage through Turkmenistan optimizes cargo transportation from central and southern Uzbekistan, providing the shortest route to Azerbaijan. The route will also contribute to strengthening economic cooperation between the countries of the region.

The shortcomings include the route being subject to political and economic risks, especially in relations between Uzbekistan and Turkmenistan. The need to undergo multiple customs checks can cause delays and increase transportation costs.

The presented Figure 1.4 shows Route 3: a land route that passes through Uzbekistan, Kazakhstan, Russia, Georgia, and Turkey.

Land routes are often more predictable, as they are not susceptible to delays due to maritime weather conditions. Goods are transported from sender to receiver without overloading, which can potentially reduce delivery time and the risk of cargo damage. This route is integrated with rail and road systems, providing flexibility in choosing the transportation method.

However, this route carries unique political and economic risks that could affect the smooth operation of transport through Russia and Iran.

Karakalpakstan plays an important role as a transit zone between Uzbekistan and Kazakhstan. Considering its proximity to the Caspian Sea, Karakalpakstan uses it to organize cargo transportation to Kazakhstan's ports of Aktau and Kuryk, as well as to receive cargo arriving along this route from other countries. Karakalpakstan can also serve as a logistics and industrial hub, opening up opportunities to offer warehousing and transportation services, which are important for the effectiveness of the entire route.

Karakalpakstan plays a key role as a transit zone between Uzbekistan and Kazakhstan. Taking into account its proximity to the Caspian Sea, Karakalpakstan uses it to organize cargo transportation directed to Kazakhstan's ports of Aktau and Kuryk, as well as to receive cargo coming from other countries along this route. Also, Karakalpakstan can act as a logistics and industrial hub, offering warehousing and transportation services, which is important for the effectiveness of the entire route.

Karakalpakstan plays an important role in the transport corridor between Uzbekistan and Turkmenistan due to its strategic geographical location. It serves as a transit point for cargo coming from the eastern and central parts of Uzbekistan, and also serves to develop the transport and logistics infrastructure of the region, thereby improving the overall efficiency of the route. Considering its proximity to Turkmenistan, Karakalpakstan could facilitate access to the Turkmenbashi port for further maritime transportation to Azerbaijan.

Currently, combined transportation in Uzbekistan is mainly carried out using automobile and rail transport. However, these transportations are mainly carried out using wagon shipments, which is not a reliable scheme for delivering goods by rail. Figures 1.2 and 1.3 show the schemes of combined transportation, which include the following stages: first, the cargo is delivered by road transport to intermodal terminals, where overloading of the cargo occurs on rail transport. Then, freight data at railway stations and using sorting, section, and freight indicators are delivered to the next intermodal terminal.

However, despite the active use of combined transport in Uzbekistan, their current delivery scheme from automobile to rail transport may prove ineffective. Wagon-to-wagon communication has its limitations and does not always contribute to optimal cargo transportation. Possible problems with cargo transshipment, additional transportation costs, and extended delivery times.

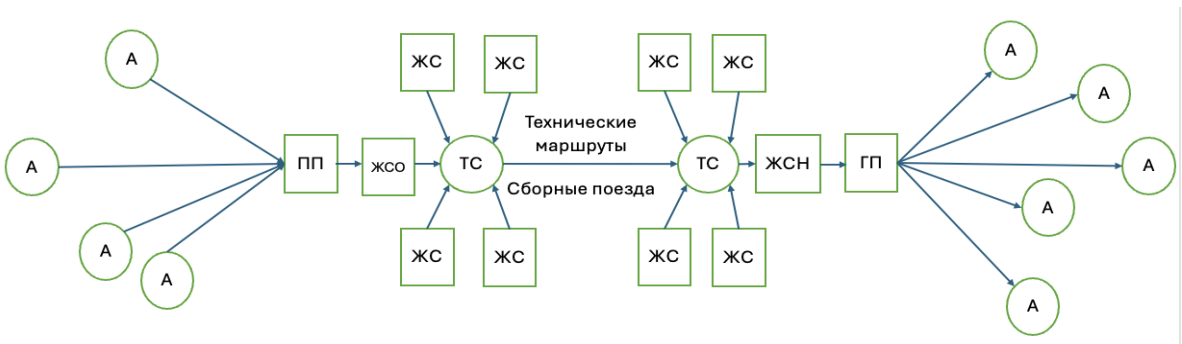


Figure 1.6. Existing logistics chain for cargo delivery from the Republic of Karakalpakstan

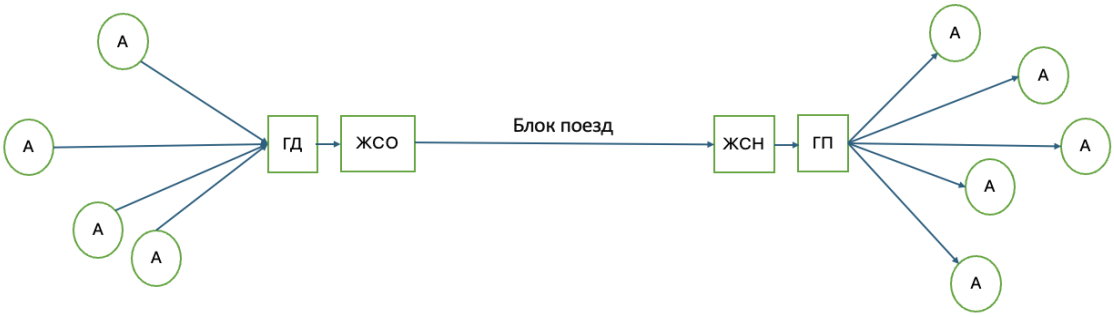


Figure 1.7. Proposed logistics chain for cargo delivery from the Republic of Karakalpakstan

Designations in Figure 1: A - delivery or distribution by motor transport, ACCS RD - access road, FY - freight yard or freight terminal; RSD - railway station of departure, RSD - railway station of destination; TS - technical station, RS - railway station.

As mentioned earlier, rail transport can be used for route shipments of cargo after transshipment from road transport. This technology relies on the principles of routing without disbandment and involves cooperation with profitable owner-operators as shown in Figure 1.7. However, this delivery method is primarily used for mass cargo, and the role of automobile transport is limited within large industrial systems.

Analyzing Figure 1.8, it can be observed that when delivering goods directly from manufacturers to consumers, it is necessary to develop 24 different delivery routes. However, when using an intermodal terminal, the number of these routes is reduced to 10. At first glance, it may seem that the introduction of an additional element in the supply chain, such as an intermodal terminal, will lead to an increase in the cost of delivering goods using combined transportation. However, this notion does not correspond to reality.

Intermodal terminals have the ability not only to transform the parameters of the cargo flow, but also to consolidate cargo, form it, and subsequently send it to other cargo terminals using rail or road transport depending on the volume of the transport batch. This allows for the effective optimization of cargo delivery and minimizes logistics costs. As a result of the use of intermodal terminals, significant simplification and reduction of delivery routes occur. This reduces cargo travel time and increases delivery speed. Additionally, intermodal terminals contribute to more efficient resource utilization and reduced environmental burden, as combining cargo allows for a reduction in the number of required vehicles and, consequently, a reduction in pollutant emissions.

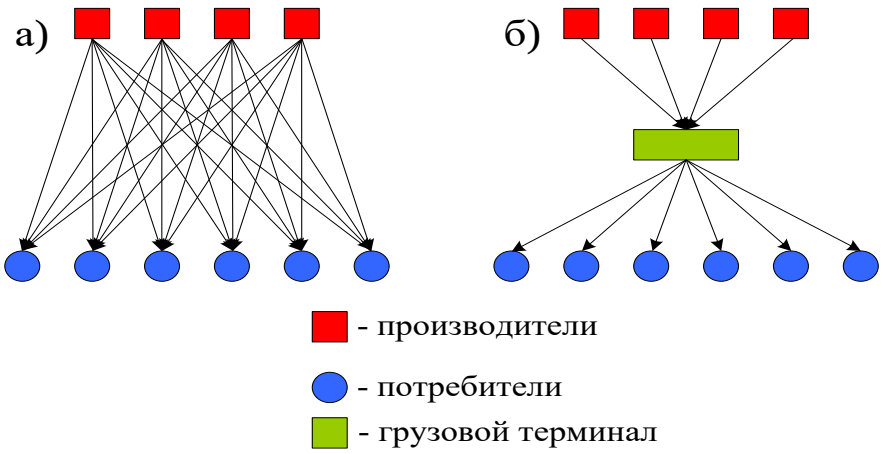


Fig. 1.8. Supply chain element: a - without terminal (24 routes), b - with intermodal terminal (10 routes)

Figure 1.8 further illustrates the operation of intermodal terminals, where the cargo flow is consolidated, formed, and sent to other cargo terminals using various modes of transport depending on the cargo volume. This confirms the possibility of optimization and flexibility provided by intermodal terminals within supply chains.

Thus, the presence of intermodal terminals leads to a significant reduction in the number of cargo delivery routes, improves the efficiency of logistics processes, and reduces costs. Intermodal terminals are an important component in optimizing and developing modern supply chains, allowing for more efficient and sustainable logistics.

In the context of combined transportation, the cargo delivery network can be organized in two different models, depending on the technology used. Let's examine them in more detail, referring to Figure 1.9.

a) Regional supply network. In this model, the supply network covers a specific regional area. Figure 1.9 (a) illustrates this concept. The cargo is collected from manufacturers in various locations of the region and delivered to intermodal terminals, where consolidation and the formation of cargo batches take place. These cargo shipments are then sent to other freight terminals using various modes of transport, such as rail or road transport. Upon arrival at the final cargo terminal, the cargo is distributed and delivered to the final consumers. Such a network organization allows for the optimization of cargo delivery within the region, reducing the number of direct routes and increasing the efficiency of logistics operations.

b) Main supply network: In the main supply network model shown in Figure 1.9 (b), cargo is collected from manufacturers in various territories and sent to intermodal terminals that play the role of central nodes in the network. Here, cargo batches are consolidated and formed, which are then sent to other intermodal terminals at longer distances using various modes of transport, such as rail or sea. After arriving at the final intermodal terminal, the cargo is distributed and delivered to the final consumers. The main supply network allows for the efficient organization of long-distance cargo delivery, reducing the required number of direct routes and optimizing the use of various modes of transport.

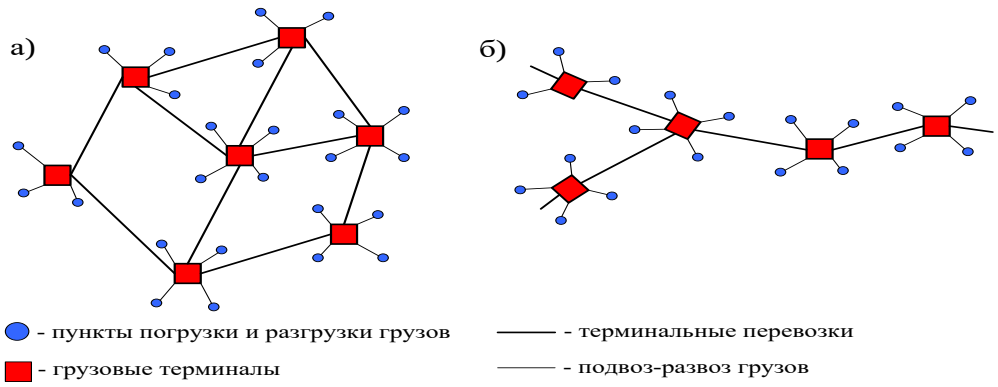


Fig. 1.9. Organization of cargo transportation in combined transport:
a - regional, b - main line

Both of these approaches to organizing the cargo delivery network using combined transportation have their advantages and are applied depending on regional characteristics and the requirements of logistics processes. They contribute to more efficient and sustainable logistics, minimizing costs and reducing negative environmental impacts.

However, despite the fact that combined transportation is an important element of modern logistics, there is potential for improving this system in Uzbekistan. For example, instead of using wagon shipments, we could develop more efficient methods for transporting goods by rail, such as container transportation or using specialized platforms for cargo transportation.

In addition, it is worth paying attention to the development of intermodal terminals and improving their infrastructure. Improvement of terminals will allow for more efficient transshipment

of goods from road transport to rail transport and vice versa, as well as faster and more reliable delivery of goods.

Thus, the presence of intermodal terminals is of great importance for modern supply chains. They allow for shortening delivery routes, reducing logistics costs, and increasing the efficiency of various types of cargo transportation. Intermodal terminals are a key element in the pursuit of optimizing and improving logistics systems in the modern world..

To optimize combined transportation, it is also necessary to pay attention to the coordination of the work of various structural units, such as railway stations, sorting and sectional stations, and freight stations. Only the interaction and coordinated work of these units will allow achieving an optimal cargo delivery scheme.

The development of combined transport in Uzbekistan requires the introduction of new methods and technologies, improvement of infrastructure, and enhancement of the coordination of various structural units. This will allow for more efficient and reliable cargo delivery, contributing to the development of the country's logistics system..

Conclusion: The scientific foundations of joint transport corridor schemes have been developed, in which the Republic of Karakalpakstan plays an important role as a transport hub for the concentration and distribution of cargo passing through the Trans-Caspian corridor. The developed schemes combine innovative approaches aimed at solving the problem of high costs and delivery times from Uzbekistan to Europe. As a result, opportunities are being created to increase the efficiency of logistics and economic integration between regions, and the foundations for sustainable trade and economic cooperation are being laid.

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Rezyume: *Ushbu maqolada maqbul xalqaro yo‘nalishlarni qo‘llash, ularning turlari ko‘rib chiqiladi. O‘zbekistonning shimoliy qismi Qoraqalpog‘iston Respublikasiga alohida e’tibor qaratilmoqda. Maqola natijalari ta’minot zanjirlarini strategik boshqarishda matematik modellashtirishning ahamiyatini ta’kidlaydi va transport oqimlarini optimallashtirish hamda xarajatlarni kamaytirish uchun foydali ma’lumotlarni taqdim etadi.*

Резюме: *В данной статье рассматривается применение оптимальные международные направления, их виды. Особое внимание уделяется северный части Узбекистана именна Республики Каракалпакстана. Результаты статьи подчёркивают важность математического моделирования в стратегическом управлении цепочками*

поставок и предоставляют полезные сведения для оптимизации транспортных потоков и снижения затрат.

Kalit so‘zlar: *multimodal tashishlar, intermodal terminallar, logistikani optimallashtirish, transport logistikasi, xarajatlar tahlili, matematik prognozlash, qiymatni masshtablash*

Ключевые слова: *мультимодальные перевозки, интермодальные терминалы, оптимизация логистики, транспортная логистика, анализ затрат, математическое прогнозирование, масштабирование стоимости*

UDC 620.92; 539.232; 538.9; 535.215.6

S-SHAPED CURRENT-VOLTAGE CHARACTERISTICS IN *n*-TYPE SILICON HETEROJUNCTION SOLAR CELLS

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Summary. *Silicon heterojunction solar cells represent one of the most promising photovoltaic technologies for both terrestrial and space applications. In space, the photovoltaic performance of these devices is influenced not only by charged-particle irradiation but also by extreme temperature fluctuations. In this study, the temperature dependence and occurrence of S-shaped current–voltage characteristics were investigated in n-type heterojunction solar cells under AM0 illumination within the temperature range of 173–373 K. The experimental results revealed that at temperatures below 233 K, the current–voltage characteristics exhibited a pronounced S-shaped distortion near the open-circuit voltage, leading to significant reductions in both the fill factor and conversion efficiency. This anomaly was attributed to the valence band offset at the a-Si:H/c-Si heterointerface, which introduces a parasitic energy barrier for hole transport. As the temperature increases, thermally activated carriers are able to overcome this barrier, thereby reducing the S-shaped distortion and restoring near-ideal diode behavior above 233 K.*

Keywords: *heterojunction, AM0 spectrum, S-shaped current-voltage characteristics, low temperature, energy barrier.*

Introduction

In recent decades, solar energy has emerged as a highly promising, sustainable, and environmentally friendly sources for clean power generation [1]. Currently, various types of solar cells (SCs) - including polycrystalline and monocrystalline silicon (Si), cadmium telluride (CdTe), amorphous silicon (*a*-Si), copper indium gallium diselenide (CIGS) and copper zinc tin sulfide/selenide (CZTS) [2, 3], as well as perovskite and organic SCs [4, 5], are undergoing rapid development and achieving large-scale commercialization. To address the growing demand for lightweight and flexible electronic designs, so-called third-generation SCs, such as perovskite and organic devices, have attracted significant attention and are being extensively investigated in both industrial and laboratory environments [6].

In terms of conversion efficiency, these new-generation SCs typically achieve around 20-25% for a short period, which still lag behind the performance of Si-based SCs (25.6-27.8%), primarily due to challenges related to material quality and device architecture, which significantly limit their performance [7]. Furthermore, in terms of operational stability and device lifetime, perovskite and organic technologies perform considerably worse than their Si-based counterparts [8]. This aspect is particularly critical for applications where stability and long-term reliability are essential when SCs are deployed under diverse climatic conditions or extraterrestrial environments.

In recent years, among Si-based photovoltaic (PV) technologies, Si heterojunction (HJT) SCs, consisting of c-Si wafers passivated with intrinsic and doped hydrogenated amorphous silicon (*a*-Si:H) layers, have attracted considerable attention due to their outstanding surface passivation and high open-circuit voltages (up to 752 mV), with record conversion efficiencies (η) of 27.8% [7]. Moreover, HJT SCs exhibit a higher bifacial coefficient compared with other Si-based PV technologies. These advantages make HJT SCs highly suitable not only for terrestrial applications but also for demanding extraterrestrial environments, such as Low Earth Orbit (LEO, at an altitude of approximately 1500 – 2000 km above Earth's surface) [9].

The current-voltage characteristics (J-V curves) is one of the fundamental diagnostic tools for assessing the PV performance and elucidating the operational mechanisms of SCs [8]. Since J-V curves directly reflect the electrical behavior of SCs. Usually, ideal light J-V curves of SCs exhibit a rectangular shape, defined by high values of short-circuit current density (J_{sc}), open-circuit voltage (V_{oc}) and fill factor (FF), which together determine the overall η. However, under real operating conditions, SCs often exhibit non-ideal behaviors manifested as distortions in the J-V curve, which serve as critical indicators of performance-limiting loss mechanisms. Among these anomalies, the so-called S-shaped J-V curve is particularly detrimental, as it leads to a significant reduction in the FF and, consequently, the overall η [10]. The deviation of S-shaped J-V curves from ideal behavior is commonly associated with charge transport barriers at contact interfaces, mismatches in energy levels (band alignment) between the absorber layer and contact or interfacial defects, all of which create potential barriers that hinder efficient charge extraction, enhance non-radiative recombination, and suppressed photocurrent [10].

S-shaped J-V curves are frequently observed in various emerging PV technologies, including organic [11], perovskite [12], and thin-film SCs such as CdTe, *a*-Si and CIGS [10]. In the CdTe and CIGS SCs, S-shaped J-V curve associated with interface barriers at contacts, leading to "roll-over" effects in the J-V curves, while in organic and hybrid SCs, they are often attributed to charge transport barriers and energy level misalignments at interfaces [10]. In particular, in [13] reported the roll-over phenomenon in the J-V curves of thin film CdTe SCs, which originates from an energy barrier at the front contact. In these devices, at the interface between the CdS window layer and the fluorine-doped tin oxide (FTO) front electrode, two types of oxides, Al_2O_3 and SnO_2 were deposited as high-resistance transparent layers to improve electron transport and optimize band alignment. SnO_2 provides nearly barrier-free electron flow, thereby enhancing cell efficiency, whereas Al_2O_3 introduces a high energy barrier that negatively affects performance. Furthermore, with increasing Al_2O_3 layer thickness, the roll-over phenomenon in the J-V curves was observed to appear at progressively lower forward voltage values. Similar behavior can also occur in HJT SCs due to the complex electronic properties of their *a*-Si:H/c-Si and *a*-Si:H/transparent conductive oxide (TCO) interfaces [14].

Based on the above-mentioned, in this study, we investigate the temperature dependence and occurrence of S-shaped light J-V curves of HJT SCs fabricated on n-type Si wafers under AM0 spectrum in the temperature range of 173–373 K.

Material preparation and methods

Sample preparation

To perform study, HJT SCs (Fig. 1) were created on phosphorus-doped n-type Czochralski (Cz) grown c-Si wafers, with a donor concentration of $N_d \geq 10^{15}$ cm^{-3}, thickness of ~125 μm, crystallographic orientation (100) and initial bulk minority carrier lifetime of $\tau_{bulk} \geq 1$ ms.

Before deposition intrinsic and doped hydrogenated amorphous silicon (*a*-Si:H) layers on the n-type c-Si wafers to form heterojunctions, the wafers underwent a wet chemical cleaning procedure. After, to minimize incident light reflection from the wafer surfaces, and enhance photocurrent, the c-Si wafers were subjected to pyramidal surface texturing. Next, thin intrinsic *a*-Si:H layers (~5 nm thick) were deposited on both front and rear surfaces of the textured wafers using Very High Frequency Plasma-Enhanced Chemical Vapor Deposition (VHF PECVD) method. The primary function of the intrinsic *a*-Si:H thin layer **is to passivate dangling bonds on the c-Si wafer surfaces** through Si-H bond formation, thereby reducing interface defect states and improving carrier lifetime [15]. **Using the same method** to form $p-n$-junction, p-type *a*-Si:H layers (~10-15 nm thick) were deposited on the front side of the *i*-*a*-Si:H coated n-type c-Si wafers, and to create the back-surface field (BSF), n-type *a*-Si:H layers were deposited on the rear sides of *i*-*a*-Si:H deposited n-type c-Si wafers. **To obtain** p**- and** n**-type** *a*-Si:H **layers respectively, the monosilane (SiH_4) gas was diluted with (high-purity, 99.999%) diborane (**B_2H_6**) and phosphine (**PH_3**) gases. All** deposition processes **were performed at 180–185°C and a very high frequency of 40.68 MHz. Further, transparent conductive oxide (TCO) thin layers composed of indium tin oxide (ITO – 90 wt.% In_2O_3 and 10**

wt.% SnO_2) were deposited on the front and rear surfaces of the photosensitive heterostructures using Radio-Frequency (RF) magnetron sputtering. The deposited ITO thin layers facilitate efficient charge carrier transport and collection at the both electrodes. Furthermore, minimizing the thickness of the intrinsic and doped hydrogenated amorphous silicon (*a*-Si:H) layers, as well as TCO, is essential for reducing parasitic absorption losses within these layers [16].

To collect photogenerated charge carriers from the heterostructure surfaces, silver busbar-type contacts were screen-printed onto the both front and rear sides of the photosensitive heterostructures at low temperature (~50 ºC), followed by curing in air at ~200 ºC. The busbar contacts had a height of 25 µm, a width of 45 µm, and were patterned with a pitch of 1.36 mm. These parameters were measured using a KLA/Tencor Alpha-Step D-120 profilometer. A schematic view of the *n*-type HJT SCs is shown in Fig. 1.

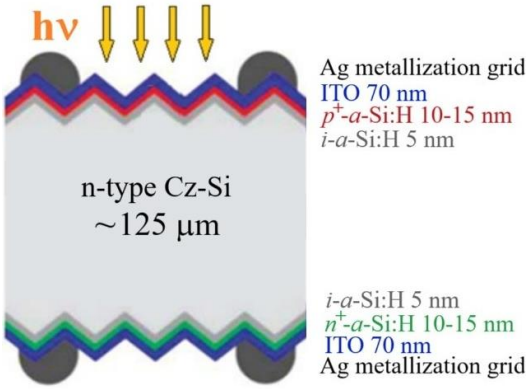


Fig. 1. A cross-sectional view of the finished *n*-type HJT SCs.

To perform experiment, *n*-type c-Si samples with an area of 1 × 1 cm^2 were cut from high-efficiency *n*-type HJT SCs with full-area dimensions of 15.6 × 15.6 cm^2. No additional passivation was applied to the lateral surfaces, and edge isolation was not performed. The cutting process was carried out using a solid-state "MiniMaker2" diode laser with a wavelength of 1064 nm. **During laser scribing, the laser parameters were set as follows: a scribing speed of 200 mm/s, a pulse repetition rate of 20 kHz, and a pulse duration of 10 ns. The scribing process was carried out on the rear side of the *p-n*-junction.**

Characterization and measurement of performances

To investigate the temperature dependence and the occurrence of S-shaped light J-V curves in *n*-type HJT SCs, light **J-V curves** were measured using a liquid nitrogen cryostat (Janis VPF-100) over the temperature range of 173–373 K, in 20 K increments. **During the measurements, the samples were illuminated with** a **class AAA pulsed solar simulator (SS-80AA simulator) under AM0 spectrum (136.7 mW/cm^2). The J_{SC} and V_{OC} were recorded** using a **Keithley SM2460 Source Meter. Temperature stabilization was achieved** with a liquid nitrogen cryostat equipped with **a Lake Shore Model 335 temperature controller**. **Each light J-V curve was measured only** after the target temperature had been reached and **maintained for 4-5 minutes** under AM0 spectrum (136.7 mW/cm^2).

For this study, about 20 *n*-type HJT SCs samples were fabricated, all exhibiting similar parameters within a margin of error below 2%. From these, three representative samples with an active area of 1x1 cm^2 were selected for temperature-dependence measurements, and their results are presented in this study.

Results and discussion

To investigate the temperature dependence and observation of *S*-shaped light J-V curves **in HJT SCs fabricated on *n*-type c-Si wafers, light J-V curves were measured under AM0 spectrum (136.7 mW/cm²) in the temperature range of 173–373 K (Fig. 2). As shown in Fig. 2, the ambient temperature has a strong influence on the shape of the light J-V curves of *n*-type HJT SCs. Specially, the J_{SC} increases slightly with rising temperature, whereas the V_{OC} exhibits**

a clear decreasing trend. The experimental results demonstrate that at low temperatures, particularly below 233 K the illuminated J-V curves of n-type HJT SCs deviate significantly from their conventional diode-like behavior, exhibiting a pronounced S-shaped distortion near V_{OC}, as illustrated in Fig. 2. With increasing temperature, this S-shaped behavior in the illuminated J-V curves gradually disappears in the vicinity **of V_{OC}. Similar behavior has also been reported in studies: in [17], experimental investigations of the temperature dependence of J-V curves revealed the emergence of S-shaped behavior at temperatures well below room temperature, while in [18], the disappearance of S-shaped behavior with increasing temperature was also observed. It is well established that the appearance of S-shaped behavior in light J-V curves at low temperatures leads to a significant reduction in both the FF and η of HJT SCs. This effect is primarily** attributed to charge transport barrier at the heterointerfaces, which, in turn, increase the series resistance (R_s) of SCs [10].

In [10], influence of series (R_s) and short (R_{sh}) resistances on the light J-V curves of SCs was investigated. However, the study emphasizes that simple model with constant R_s and R_{sh} cannot explain the occurrence of S-shaped J-V curves. Instead, more advanced approaches are required that incorporate interfacial energy barriers and Fermi-level misalignment [10, 19]. A high R_s mainly tilts the J-V curve at position of the V_{oc}, while a low R_{sh} reduces the flatness of the curve at the position of J_{sc}. Both high R_s and low R_{sh} lead to a reduction in the FF, and consequently, a decrease in the η of SCs. The R_s arises from high-resistivity absorber materials connected in series (vertical resistivity) and resistive losses in the grid contacts (lateral resistivity). Conversely, the R_{sh} characterizes current leakage pathways, including those through pin holes, surface recombination currents, bulk defect-assisted tunneling, and peripheral leakage at device edges [10].

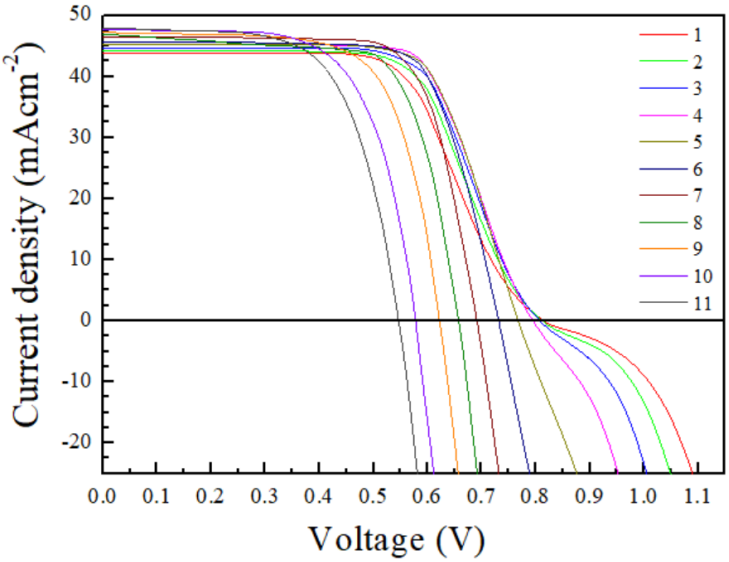


Fig. 2. Light J-V curves of HJT SCs based on n-type c-Si wafers under AM0 spectrum (136.7 mW/cm^2) in the temperature range of 173–373 K. T, K: 1 – 173, 2 – 193, 3 – 213, 4 – 233, 5 – 253, 6 – 273, 7 – 293, 8 – 313, 9 – 333, 10 – 353, 11 – 373.

To investigate the origin of the S-shaped behavior observed in the light J-V curves of the n-type HJT SCs at low temperatures (T<233 K), an energy band diagram was constructed (Fig. 3). In the **n-type** HJT SCs, the main potential barrier responsible for the separation of photogenerated charge carriers in the base and emitter regions under the electromagnetic illumination is formed at the **(p^+)*a*-Si:H/(n)c-Si-**heterojunction. Therefore, this part of the heterostructure is illustrated in the corresponding energy band diagram **(Fig. 3)**. **The energy band diagram was constructed based on the Anderson model under thermal equilibrium conditions at room temperature. The conduction band (ΔE_c) and valence band (ΔE_V) offsets at the *a*-Si:H/c-Si heterointerface were**

calculated using the Anderson model. These values were found to be approximately 0.15 eV and 0.45 eV, respectively. The calculations were performed using electron affinity values of 4.05 eV for c-Si and 3.9 eV for *a*-Si:H [20]. The ΔE_V was calculated using the following equation,

$$\Delta E_V = (E_{g1} - E_{g2}) - \Delta E_c, \quad (1)$$

where, E_{g1} =1.72 eV **and** E_{g2} =1.12 eV represent **the bandgaps of *a*-Si:H and c-Si, respectively, at room temperature** [20]. Also, the band gap of thin ***a*-Si:H layers was determined using Tauc's method, derived from the spectral dependence of** $(\alpha h\nu)^{1/2}$ on $h\nu$**.**

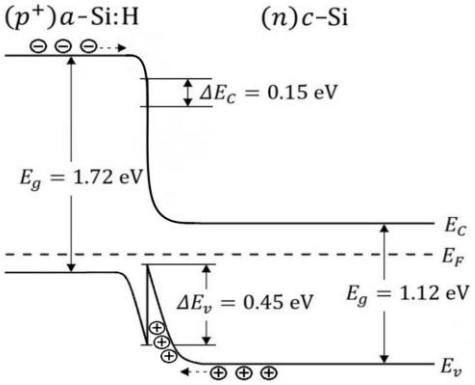


Fig. 3. Energy band diagrams of HJT SCs based on *n*-type c-Si wafers, illustrated at room temperature. In the band diagram, holes are denoted by a circled plus symbol (⊕), while electrons are indicated by a circled minus symbol (⊖) for clarity.

As described by equation (1), the ΔE_V is determined by the bandgap difference between the two contacting semiconductors and the ΔE_c. In our case, E_{g1} for ***a*-Si:H and** E_{g2} for c-Si, respectively. Since the bandgaps of both semiconductors exhibit temperature dependence, the ΔE_V consequently varies with temperature. For the investigated heterostructure, ΔE_V=0.45 eV at room temperature, but this value increases at lower temperatures due to the enhanced bandgap difference $(E_{g1} - E_{g2})$ [21]. According to [22], for achieving the highest values of V_{OC} and FF**,** the optimal ΔE_V should be 0.45 eV at room temperature, as this band offset minimizes carrier recombination at the ***a*-Si:H/c-Si** heterointerface.

First, let us consider the fundamental physical processes occurring in HJT SCs fabricated on n**-type c-Si wafers through analysis of their energy band diagram (Fig. 3)**. **It is well known that under illumination, electron-hole pairs generated in the** n**-base of the HJT SCs are separated by the built-in electric field of the** p^+-n**-heterojunction. Photogenerated holes (minority charge carriers in** n**-type c-Si wafer, which denoted by** a circled plus symbol - ⊕**) inject into the** p^+**-region (emitter) under built-in electric field (Fig. 3). In this case, as illustrated in Fig. 3, holes experience a spike that acts as an energy barrier to hole transport [14]. To contribute to charge transport, holes must overcome the barrier of** ΔE_V=0.45 eV, which arises at the p^+-n**-heterojunction due to the mismatch in valence band alignment between the two types of semiconductors (*a*-Si:H and** c-Si**) brought into contact. As temperature decreases, the** ΔE_V increases, **the spike - barrier impedes hole transport, reducing the fraction of holes that overcome the potential barrier. Consequently, holes accumulate near the front (**p^+**) *a*-Si:H/(**n**) c-Si-heterojunction, inducing the** S**-shaped behavior in the light J-V curves at cryogenic temperatures (Fig. 3)** [19, 21]. Thus, at low temperatures, the R_s increases, leading to a reduction in the FF due to the temperature-dependent shift in the energy barrier (ΔE_V). This effect causes a pronounced displacement of the maximum power point toward lower voltages, characteristic of S-shaped light J-V curves [18].

Our experimental results demonstrate that the S-shaped behavior in the J-V curves of n-type HJT SCs predominantly appears at significantly low temperatures (T<233), whereas, at room temperature and above, the S-shaped anomaly is no longer observed, indicating that the underlying transport limitations are effectively suppressed. In n-type HJT SCs, with increasing temperature, the additional thermal energy facilitates charge carrier transport across interfacial barriers, thereby mitigating the severity of the S-shape. As a result, the J-V curves progressively resemble the ideal diode behavior, exhibiting smoother characteristics and higher FF. This phenomenon has also been confirmed in [13], where it was shown that the occurrence of S-shaped distortions in the J-V curves strongly depends on the thickness of the passivating layer. Specifically, as the layer thickness increases, the likelihood of S-shaped behavior becomes more pronounced. Conversely, employing an ultrathin, high-quality, and highly conductive intrinsic *a*-Si:H layer not only maximizes surface passivation of the c-Si wafer, thereby improving V_{oc} and J_{sc}, but also enhances charge transport properties, resulting in higher FF values.

In [14], however, S-shaped J-V curves of Interdigitated Back Contact Silicon Heterojunction (IBC-SHJ) SCs were observed even at room temperature. According to that study the origin of the S-shaped behavior was attributed to carrier recombination induced by interface defects, the formation of a strong inversion layer at the surface, and pronounced valence band offsets that introduce energy barriers for minority carriers at the heterointerface.

According to the results reported in [23], the disappearance of the S-shaped behavior in the light J-V curves near V_{OC} is attributed to a reduction in the potential barrier due to increased doping levels in the base or emitter layer. As a result, in addition to thermionic emission, carriers can drift through a spike barrier by tunneling (trap-assisted tunneling). With higher doping concentrations, the space charge region (SCR) becomes narrower, leading to an increase in the tunneling current [23].

Capacitance-voltage (C-V) measurements conducted at 100 kHz and 300 K using a Semetrol LLC instrument reveal the width of the SCR of ~0.422 μm in the n-type HJT SCs. At reduced temperatures, this configuration prevents hole tunneling between the n-base and p^+-emitter regions. Consequently, the observed S-shaped behavior in the light J-V curves at lower temperatures is attributed to a parasitic potential barrier caused by the ΔE_{V}.

To investigate the influence of the S-shaped behavior on the FF and conversion efficiency (η) of n-type HJT SCs, the temperature-dependent variation of these parameters was extracted from the illuminated J-V curves. Fig. 4 presents experimental results of the temperature dependence of the FF (*a*) and R_s (*b*) of HJT SCs based on n-type c-Si wafers under AM0 spectrum (136.7 mW/cm^2). The FF is defined by the following expression [23]:

$$FF = \frac{J_m V_m}{J_{sc} V_{oc}}, \tag{2}$$

where, J_m and V_m – current density and voltage at maximum power point.

As shown in Fig. 4 *a*), the FF of the HJT SCs based on n-type c-Si increases linearly from 65% to a peak value of about 75% as the temperature rises from 173 K to 273 K. However, beyond 273 K, the FF decreases linearly, reaching 65.53% at 373 K. The initial increase in FF with rising temperature is attributed decreasing of parasitic potential barrier caused by the ΔE_V (Fig. 3), R_s and enhanced charge carrier transport in the SCs (Fig. 4 *b*).

The decrease in R_s is particularly pronounced in the low-temperature region, where its value decreases from ~13.8 Ω·cm² at 173 K to ~2.5 Ω·cm² at 273 K with rising temperature (Fig. 4 *b*). Within this temperature interval, R_s decreases at a relatively high rate of -0.817%/K, indicating enhanced carrier transport due to reduced resistive losses. This value is in good agreement with the data reported in [24]. In the higher temperature range of 273–373 K, R_s exhibits a slight decrease (-0.41%/K) from ~2.5 Ω·cm² at 273 K to ~1.3 Ω·cm² at 373 K. In the temperature range of 173–273 K, the shunt resistance (R_{sh}) exhibits only minor variations.

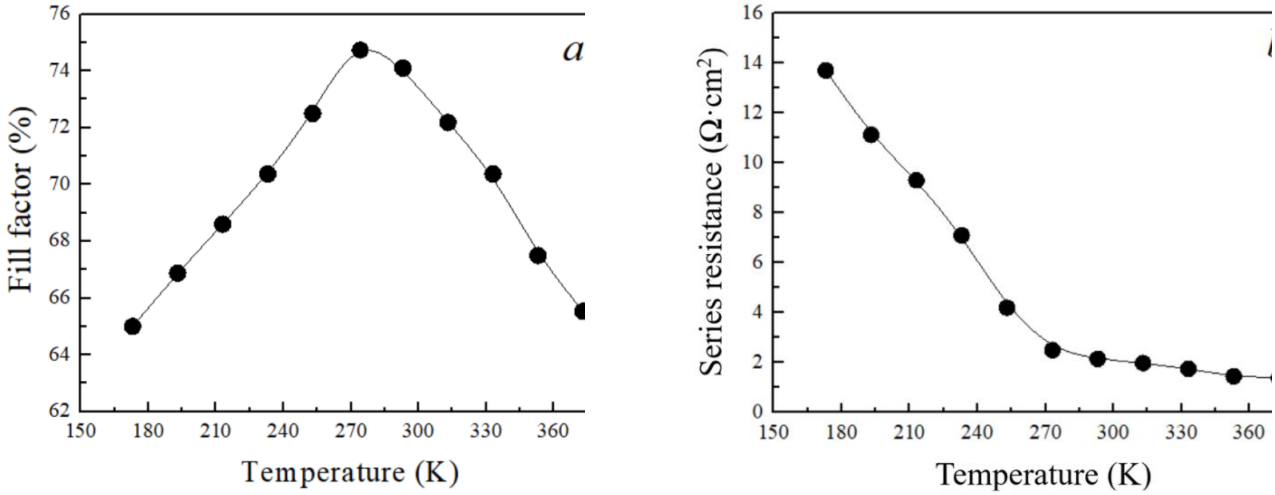


Fig. 4. Temperature dependence of the fill factor (*a*) and series resistance (*b*) of HJT SCs based on n-type c-Si wafers under AM0 spectrum (136.7 mW/cm^2).

The decline in FF of n-type c-Si HJT SCs at higher temperatures is most likely attributed to a decrease in R_{sh}, which is connected in parallel with the $p-n$-junction and consists of parasitic leakage paths that lead to increased current losses and reduced the maximum output power of the PV device.

Furthermore, as described by Eq. (2), FF is influenced by the V_{OC}, which usually exhibits a linear decrease with rising temperature. The temperature coefficient of the fill factor ($TCFF$), determined from the slope of the linear decline in FF, was determined to be -0.14%/K for n-type c-Si HJT SCs in the temperature range of 273–373 K.

Fig. 5 shows the temperature dependence of the conversion efficiency $\eta(T)$ of the HJT SCs based on n-type c-Si wafers under 136.7 mW/cm^2. η of the HJT SCs is defined as the ratio of the P_{max} to the incident light power (P_{rad}), which is expressed by the following equation [23]:

$$\eta = \frac{P_{max}}{P_{rad}} \cdot 100\% = \frac{J_{sc}V_{oc}FF}{P_{rad}} \cdot 100\%, \quad (3)$$

where, P_{rad}=136.7 mW/cm^2.

As shown in Fig. 5, the η of n-type c-Si HJT SCs decreases linearly from ~18.4% to ~12.7% as the temperature increases from 273 K to 373 K. When cooling from 273 K to 173 K, η initially exhibits a slight increase, reaching a peak of ~18.55% at 233 K, followed by a linear decline to ~17.1%. This behavior is primarily governed by the temperature dependence of the semiconductor's intrinsic properties and the key PV parameters of SCs, namely V_{OC}, FF, R_{sh} and R_s, which collectively exert the significant influence on the $\eta(T)$ characteristics. In the 173–273 K range, J_{sc} shows only a minor decrease, while V_{oc} increases slightly with decreasing temperature (see Fig. 2). At temperatures above 273 K, the linear degradation of η is primarily driven by significant reductions in both V_{oc} and FF, which are adversely affected by thermally activated carrier recombination and resistive effects.

The temperature coefficients of the η ($TC\eta$) for n-type c-Si HJT SCs were determined to be -0.31%/K in the 273–373 K range and -0.15%/K in the 173–233 K range. The relatively low $TC\eta$ of HJT SCs, compared with other Si-based PV technologies can be attributed to the presence of *i*-*a*-Si:H passivation layers on both surfaces of the c-Si wafer. This structure reduces TCV_{OC}, which accounts for more than 60% of the overall variation in the power temperature coefficient, thereby playing a dominant role compared to other PV parameters such as J_{sc} and FF [24].

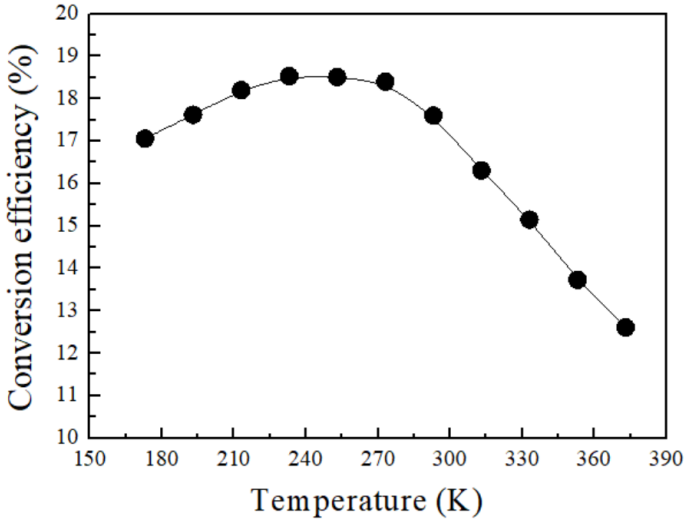


Fig. 5. Temperature dependence of the conversion efficiency of HJT SCs based on n-type c-Si wafers under AM0 spectrum (136.7 mW/cm^2).

It should be noted that the η of SCs under AM0 conditions is lower than under AM1.5G. This is primarily because AM0 lacks atmospheric absorption, leading to a higher contribution of ultraviolet (UV) and infrared (IR) radiation, which are less effectively converted into electricity [25]. The η of n-type HJT SCs at room temperature was determined to be 17.5% under AM0 spectrum and 19.25% under AM 1.5G spectrum, respectively, after laser cutting.

Conclusion

In this study, the temperature dependence of the PV performance and the occurrence of S-shaped J-V curves in n-type Si-based HJT SCs were systematically investigated under AM0 spectrum in the temperature range of 173–373 K. The experimental results revealed that at temperatures below 233 K, the J-V curves exhibit a pronounced S-shaped distortion, leading to substantial reductions in FF and η. This anomalous behavior is attributed to the valence band offset at the a-Si:H/c-Si heterointerface, which introduces a parasitic energy barrier for hole transport. With increasing temperature, thermal activation enables charge carriers to overcome this barrier, restoring near-ideal diode behavior above 233 K. An increase in the series resistance at low temperatures was also clearly identified from the light J–V curves. This behavior indicates that the efficiency of the solar cells decreases significantly under low-temperature conditions.

Acknowledgements

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Declarations of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Rezyume: *Kremniy asosidagi geterotuzulmali quyosh elementlari Yer sirti hamda kosmosda qo‘llaniladigan eng istiqbolli fotovoltaik texnologiyalardan biri hisoblanadi. Kosmik sharoitlarda ushbu qurilmalarning fotoelektrik xususiyatlariga nafaqat zaryadlangan zarrachalarning nurlanishi, balki haroratning keng diapozonida o’zgarishlari ham ta’sir ko‘rsatadi. Ushbu tadqiqotda, 173–373 K harorat oralig'ida, AM0 yoritilish spekrtida n-tipdagi kremniy asosidagi geteroo’tishli quyosh elementlarining haroratga bog'liqlik va S-shaklidagi volt-amper tasniflarining paydo bo'lishi o'rganildi. Tajriba natijalari shuni ko'rsatdiki, 233 K dan past haroratlarda salt-yurish kuchlanishi sohasida volt-amper tasnifning S-shaklli xususiyati namoyon bo’ladi, bu esa quyosh elementining to‘ldirish koeffitsienti va samaradorligining sezilarli darajada pasayishiga olib keladi. Ushbu anomaliya a-Si:H/c-Si geterochegarasida valent sohaning siljishi bilan bog'liq bo'lib, bu kovaklar transporti uchun energetik to'siq hosil qiladi. Harorat ortishi bilan issiqlik faollashuvi hisobiga*

zaryad tashuvchilar ushbu to‘siqni yenga oladi, natijada volt-amper tasnifdagi S-shaklli xususiyat susayadi va 233 K dan yuqori haroratlarda quyosh elementining xususiyati ideal diodning volt-amper tasnifiga yaqinlashadi.

Резюме: *Кремниевые гетеропереходные солнечные элементы являются одной из наиболее перспективных фотовольтаических технологий как для наземных, так и для космических применений. В космических условиях на фотоэлектрические характеристики этих устройств влияет не только облучение заряженными частицами, но и экстремальные колебания температуры. В данной работе исследованы температурная зависимость и возникновение S-образных вольт–амперных характеристик (ВАХ) гетеропереходных солнечных элементов на основе n-типа кремния при освещении спектром AM0 в диапазоне температур 173–373 K. Экспериментальные результаты показали, что при температурах ниже 233 K ВАХ проявляют выраженное S-образное поведение в области напряжения холостого хода, что приводит к значительному снижению как коэффициента заполнения, так и КПД преобразования. Эта аномалия обусловлена смещением валентной зоны на гетерогранице a-Si:H/c-Si, вызывающим появление паразитного энергетического барьера для транспорта дырок. С повышением температуры за счёт тепловой активации носители заряда способны преодолевать данный барьер, что приводит к ослаблению S-образной деформации ВАХ и восстановлению близкого к идеальному диодному поведению при температурах выше 233 K.*

Kalit so‘zlar: *geteroo’tish, AM0 spektr, S-shaklli volt-amper tasniflar, past harorat, energetik to‘siq.*

Ключевые слова: *гетеропереход, спектр AM0, S-образные вольт–амперные характеристики, низкая температура, энергетический барьер.*

FEATURES OF THE CONSTRUCTION OF WIND GENERATOR STATIONS

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Summary: *The work examines wind turbines with vertical and horizontal rotation axes, their operating principle, features, advantages, and disadvantages. Also, considering a synchronous generator with permanent magnets as an electrical machine is of particular importance.*

Key words: *unit, asynchronous motor vertical axis, wind turbines, generator, horizontal axis, power, motor, inverter, short circuit, magnet, rotor, synchronous generator, rotational speed, braking system, weather vane.*

Every year, with the increase in the number of industrial and residential areas, the need for electricity is increasing. And this issue is especially acute in hard-to-reach regions, as well as in regions with an unstable political situation. The construction of thermal power plants or hydroelectric power stations in such areas will lead to capital expenditures, which will be irrational for a number of reasons: the absence of rivers, the lack of developed infrastructure for fuel supply routes, and the low population density of the region.

A simple solution to this problem is the installation of a wind power plant (WPS). This is especially true in regions with stable wind flow throughout the year. [1]

Recently, there has been an intensive increase in wind energy. Wind generators are divided into generators with vertical and horizontal rotation axes.

Wind turbines with a horizontal axis of rotation consist of three blades, a hub, rotating bearings, and drive mechanisms that change the blade angle. The aerodynamic brake is created by the blades themselves, which can rotate perpendicular to the turbine's rotation plane. The blades are equipped with a lightning protection system consisting of a metal receiver that transmits lightning energy to the hub. The driving mechanical circuit consists of the rotor shaft, a transmission connected to the generator via a movable clutch, and a flexible crank. The transmission can be made in the form of a two-stage planetary transmission, a viscous coupling, or another reducer.

Cooling is carried out along two cooling circuits. Bearings are constantly lubricated by spraying. The temperature of the bearings and oil is constantly monitored. An asynchronous or synchronous machine is used as a generator. The optimal temperature of the generator is maintained by the water-glycol cooling circuit. The role of the aerodynamic brake is performed by the blades, control is carried out independently for each blade. [2]

In case of failure of the wind turbine, the blades are installed in a position perpendicular to the rotation plane of the wind turbine. In addition, the system is equipped with a mechanical brake that creates force. The mechanical brake works in conjunction with the blades and fixes the wind turbine in the braking position. The mechanical brake also fixes the rotor during the wind turbine installation process and during maintenance. A mechanical brake has a braking torque limiting system, i.e., the braking torque changes according to an inclined characteristic that ensures a reduction in the load on the driving mechanical circuit. The wind direction is constantly monitored by two fans located on the head of the wind turbine. When the wind direction changes, the wind turbine head rotates with the help of two transmission motors moving along the rotating ring. After stopping the turn, the head 94 is fixed by the rotary brakes. Rotary braking systems are arranged around a circle in rotation.

Benefits:

- High rotation speed, which increases efficiency;
- Simplicity of manufacturing;
- A wide variety of models.

Disadvantages:

- High levels of noise and ultrasound pollution. This can be dangerous for people's health. Therefore, generating industrial capacities are located in uninhabited areas;
- The need to use stabilizers and wind direction devices;

- Rotation speed is inversely proportional to the number of blades, therefore industrial models rarely use more than three blades. [3]

Vertical wind turbines have some advantages over horizontal wind turbines. They do not have nodes for wind orientation, which simplifies the design and reduces gyroscopic loads. A large number of various wind turbines with a vertical axis of rotation have been developed, in which resistance forces and the lifting force of the working blades are used to create the rotational moment. These are devices with plate, cup, or turbine elements, as well as Savonius rotors with S-shaped blades. Wind turbines of this type have a large starting torque, but a lower speed and power compared to the French Darrieus rotor.

The Darrieus design rotor refers to a vertical rotation axis wind turbine that utilizes lifting force generated on curved blades with a wing profile in the cross-section. Its disadvantage is the small initial moment, its advantage is high speed and, due to this, relatively high specific power, attributed to its mass. To eliminate the main disadvantage and to increase the initial torque, the Darrieus rotor is combined with various types of starters, for example, a wind turbine with a Savonius rotor. [4]

Benefits:

- Independence of energy generation from wind strength and inclination. The installation can operate at minimal air flow velocity. In areas with strong winds, they are indispensable.
- Less susceptibility to mechanical damage due to the design features that provide for a small number of movable parts.
- Self-regulation of a vertical-axis wind turbine allows you to avoid purchasing additional components.
- Silence. Due to this property, wind turbines can be installed near residential complexes. Noise pollution does not harm the environment.
- A small height makes it easier to replace and care for parts. Installation of a wind turbine with a vertical axis is advisable in places where tall structures are undesirable.

Disadvantages:

- Significantly lower efficiency (almost two times) compared to wind turbines with a horizontal axis of rotation.
- High cost compared to horizontal installations.
- The weak point of this type of wind turbine is the supporting bearings.

Several variants of wind turbine operating schemes are possible. Possible scheme operation: wind unwinds the wind turbine blades. The wind turbine rotates the wind turbine rotor. An EMF arises in the stator terminals, which is rectified through the controller and charges the batteries. An inverter is connected to the batteries through the same controller, converting DC electrical energy into a voltage of fixed (industrial) frequency and amplitude.

There are also schemes for connecting the wind turbine to work in parallel with the network. Such circuits allow switching to network power in the absence of wind. The city network acts as an additional-reserve power source. Connecting the wind turbine to the network in parallel - without 96 batteries. Inverters are quite complex and expensive in wind turbine schemes. Cascade multi-level frequency converters, which allow obtaining output voltage of industrial frequency from a large number of independent energy sources with a low level of constant voltage (batteries are used here), satisfying all modern requirements, are very often used as inverters. The controller in each wind turbine connection circuit performs various functions and is built based on microprocessor technology. Batteries are the shortest-lived devices in circuits. Unfortunately, electricity has one very serious drawback: it is difficult to accumulate and store for a long time. [5]

From the above, it can be concluded that for scientific research, it is rational to use a wind turbine system with a vertical axis of rotation. When reviewing the typical electrical circuits of wind farm plants, it can be observed that when working with high-voltage wind generators, power matching devices, as well as inverters designed for higher capacities, are necessary. This significantly increases the cost of the entire installation. To solve this problem, a multi-level two-link low-voltage converter connected through a transformer is used, which allows for the stabilization of output power, as well

as obtaining the necessary parameters of the general industrial network (voltage, frequency) at the output.

A synchronous generator with permanent magnets is chosen as the electrical machine. A synchronous motor has smaller mass-dimensional indicators than an asynchronous motor, with equal power of electrical machines.

Due to their design features, synchronous generators are lighter and easily withstand short-term overloads (including starting), provide higher current quality and proper voltage sinusoid, and possess sufficiently high voltage stability. They are excellent for powering inductive loads with high starting current and are more preferred for household consumption.

Today, synchronous generators with brush and brushless current excitation systems are being manufactured. The second option is more preferred. In brush systems, it is quite possible that brushes partially "burn out" after passing large currents, which leads to overheating of the unit. Therefore, for such models, regular maintenance is recommended to monitor the brush unit's condition, and if necessary, cleaning or replacing the brushes.

Disadvantages include poor protection of units from external influences (water, dust). Due to the fact that cooling occurs through air, there is a high probability that everything that is in the air enters inside. It is also worth noting that synchronous generators do not allow for connecting to individual phases of consumers with much higher power. Otherwise, it is practically inevitable that low-power devices will be damaged when connected. [6]

Asynchronous generators are resistant to short circuits, and automatic voltage regulation devices smooth out voltage fluctuations. Therefore, they are especially in demand for active workloads. The design of such units is simpler, and they themselves are more reliable and durable.

The rotors of asynchronous generators produce insignificant heat generation, which does not require cooling, which allows the internal cavity of the unit to be sealed. Thanks to this, the scope of use of aggregates that can be operated in conditions of increased dust and high humidity is significantly expanding. Such sealing also contributes to the longer service life of power plants. When operating asynchronous generators, it is permissible to connect consumers of different capacities to different phases (the permissible value of uneven power supply for inductive loads with a high starting current and more preferable for household consumption).

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In Uzbekistan, the prospects for developing the total generating capacity of wind energy to 5000 MW by 2030 are being studied.



Figure 1: View of a wind power plant

In recent years, Uzbekistan has been paying close attention to the construction of wind power plants among renewable energy sources. This sector is currently the fastest-growing in the global energy sector.

For Central Asia, further acceleration of the use of alternative energy is especially important given the reduction of water resources in the region.

Here are some figures on wind energy. If in 1997 the total installed capacity of wind power plants in the world was 7,500 MW, then by 2020 this figure reached 750,000 MW. Regarding specific countries, in 2020 alone, the People's Republic of China commissioned 52,000 MW of new wind power plants, and the United States commissioned 16,205 MW.

In addition, there is a trend towards a decrease in the cost of electricity generated by wind power plants (WPS). Thus, between 2010 and 2020, the average cost of electricity generated by ground-based wind power plants decreased by 56 percent - from 8.9 US cents to 3.9 US cents per kWh.

In the Republic of Uzbekistan, technical and economic justifications for the widespread use of wind energy have been developed in cooperation with international financial institutions. The "Concept for Electricity Supply of the Republic of Uzbekistan for 2020-2030" has been developed, one of the main goals of which is to increase wind energy capacity to 3000 MW by 2030.

It should be noted that the wind potential indicators in the territories designated for the construction of wind power plants in Uzbekistan are higher than the average for existing wind farms in the world. In other words, when comparing the capacity utilization coefficients, it was established that our country's indicators are 1.5 times higher than the global average. For example, out of a total volume of 8,760 hours per year, wind power plants in Uzbekistan can operate at full capacity for approximately 3,900 hours.

To date, several projects for the construction of wind power plants have been launched in Uzbekistan. Including:

- Construction of a 500-megawatt wind power plant in the Tamdyn district of Navoi region, an agreement on which has been signed with the Masdar company of the UAE. The project cost is $600 million, and once the power plant reaches full capacity, it will generate $1.8 billion annually. kWh of electricity, saving 546 million cubic meters of natural gas per year.

- An agreement on the construction of two wind farms has been signed with the Saudi Arabian company ACWA Power. The company will build a total of 1000 megawatts of wind power plants in the Gijduvan and Peshku districts of the Bukhara region, costing $1.3 billion, which will save 1.1 billion cubic meters of natural gas per year.

- A tender was held with the European Bank for Reconstruction and Development for the construction of a 100 MW wind power plant in Beruniy and Karauzak districts of the Republic of Karakalpakstan. The "ACWA Power" company (Saudi Arabia) was declared the winner of the international tender with a tariff offer of 2.57 US cents per 1 kWh of generated electricity. When commissioned in 2023, the station will generate 350 million kWh of electricity annually and save 106 million cubic meters of natural gas per year.

As the analysis of project implementation shows, the plans outlined in the Concept for the Development of Wind Energy are being implemented ahead of schedule by the Ministry of Energy. This will allow increasing the forecast for the development of wind energy capacity and bringing it to 5,000 MW by 2030. Most of the wind power plants are planned to be built in the Republic of Karakalpakstan.

When implementing wind power plant projects, measures are being taken to ensure their safe integration into a single energy system.

It is also important to note that renewable energy technologies are rapidly developing. In particular, the price of lithium-ion batteries, which are considered the most effective among energy storage devices, has decreased to an internationally acceptable value. International research centers predict that the cost of this type of battery will decrease by an average of 30 percent over the next 5 years.

As a result, Uzbekistan will be able to manage and store energy from renewable energy sources and ensure the stability of the unified energy system.

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Rezyume: *Maqolada vertikal va gorizontal aylanish o‘qiga ega shamol generatorlari, ishlash printsipi, xususiyatlari, afzalliklari va kamchiliklari ko‘rib chiqilgan. Shuningdek, doimiy magnitli sinxron generatorni elektr mashinasi sifatida qarash alohida ahamiyat kasb etadi.*

Резюме: *В статье рассматриваются ветрогенераторы с вертикальной и горизонтальной осью вращения, принцип работы, характеристики, преимущества и недостатки. Также особое значение имеет рассмотрение синхронного генератора с постоянным магнитом как электрической машины.*

Kalit so‘zlar: *Agregat, asinxron motor, vertikal o‘q, shamol generatorlari, generator, gorizontal o‘q, quvvat, motor, invertor, qisqa tutashuv, magnit, rotor, sinxron generator, aylanish tezligi, tormoz tizimi, flyuger*

Ключевые слова: *Агрегат, асинхронный двигатель вертикальная ось, ветрогенераторы, генератор, горизонтальная ось, мощность, двигатель, инвертор, короткое замыкание, магнит, ротор, синхронный генератор, скорость вращения, тормозная система, флюгер.*

MACHINE LEARNING – THE SCIENTIFIC BASIS OF ARTIFICIAL INTELLIGENCE

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Summary: *The article covers the basic principles of machine learning, its role and advantages in network infrastructure. It also analyzes the application of this technology in industry, medicine, education, and cities, based on statistical data.*

Keywords: *Modern computer networks, monitoring tools, machine learning, artificial intelligence, supervised learning, unsupervised learning, reinforcement learning, transfer learning.*

XXI century technologies period is, its the most large from discoveries one this is artificial is artificial intelligence (AI). Intellect is computer or to the program human to the mind typical was thinking, analysis to do, to learn and decision acceptance to do such as functions to perform opportunity giver technologies Today's SI different per day in the fields of medicine, education, industry, transport, agriculture farm, even art and also broad in creativity is being used.

Modern computer networks expanding As they go, they effective management and continuous performance provide for network monitoring tools increasingly important importance profession Monitoring tools to administrators online problems early to determine, to work fertility assessment and security threats against measures see opportunity gives [1].

Machine learning - artificial of intellect study field is, it is statistical algorithms generalization ability improves and tasks person's reveal without instructions This will do. definition many to students incomprehensible to be That's the point. for this science main method to the types briefly stop, then to the point Let's go. This of species the most important ones: supervised and unsupervised learning.

Machine-made learning (MO) – computer systems clear without programming, available information based on independent accordingly to learn and decision acceptance to do opportunity giver algorithms This is a complex. direction artificial of intellect the most active developing field is, its basis statistic modeling, mathematics optimization and neuroinformatics relies on [2]

Machine-made of teaching - supervised, unsupervised and reinforcing teaching types there is.

1. Supervised learning (Supervised Learning)

Supervised study model in construction, data any right answer or label with

together presented the model is learning. at the time, entry information and their relevant answers using parameters optimizes.

Issues: Classification and regression.

Classification: Information designated to classes separation (e.g. , electronic) whether the mail is spam or not determination).

Regression: Constant values prophecy to do (for example, house price or stocks price prophecy to do).

Examples: Image familiar: Again to work related images and their category (for example, "cat " or "dog"). Electronic mail filtering.

2. Uncontrolled learning (Unsupervised Learning)

Uncontrolled in learning, data without labels presented is given, and the model

of information structure tries to learn. In this way purpose - informational uncertainties or groups is to determine.

Issues: Clustering and dimensions reduce

Clustering: Data mutual similarities looking at grouping (e.g.,customers similar purchase to do habits based on grouping).

Dimensions reduce: Big data set further simplify (for example, to simplify the image) squeeze or main features detection). K-means clustering algorithm using customers segmentation using Principal Component Analysis (PCA) information dimensions reduce.

3. Strong Learning (Reinforcement Learning): Strong to study is agent's own movements with the environment to study based study The agent is the target. achieve for awards to take and from punishments tries to escape.

Topics: Games, robotics, cars control (automatic driving). AlphaGo (playing the game of Go play) and other games (e.g. chess). Automatic management systems and robotics.

4. Transference learning (Transfer Learning)

Transference study the model one information from the collection teach him / her other information to the collection to apply This method is especially useful for new information in collections resources saving and time reduction for useful. One the image familiar model teach him / her other one kind of the image familiar in the system application.

5. Deep learning (Deep Learning)

Deep to study is neuron networks deep architecture based on working the car of learning one This method is a type of big in quantity information and strong computing capabilities using further complicated problems solution in doing is used.

Issues: Image familiar, speech familiar, natural the language again performance. Using Convolutional Neural Networks (CNN) the image familiar.Using Recurrent Neural Networks (RNN) the speech familiar

6. Ensemble methods .

Ensemble methods one how many the model together use through general the result to improve goal does. In this one how many small model results will be combined and last decision acceptance will be done. Random Forests. Gradient Boosting.

Companies SI and with car from teaching how uses?

Any in the field to success achieve for almost every one organization own information practical to decisions turn to receive need. SI and the car teaching to organizations information again work and decision acceptance to do such as different various manual processes automation opportunity gives.

Artificial intellect and the car teaching again what What does it give? Systems and strategic to plans current to grow through leaders to the information based conclusions further fast, efficient understands. To them based decisions acceptance does. [3,4]

The car training in banking

The banking sector information privacy and safety very important. Financial services leaders SI and the car teaching using customers information protection with together efficiency increase one how many methods use possible:

- The car to teach fraud and cybersecurity attacks determination and their prevent in receiving application
- User person faster confirmation, documents again work for biometric and computer vision systems current to do
- Chatbots and voiced such as voice assistants smart technologies current to grow through to customers service to show automation.[5,6,7]

Artificial from the intellect health storage in the field use

Health storage in the field big in size from data used. SI is accurate and effective service show for computer science and to analysis increasingly more relies on SI tools. Patients the results to improve, time to save and even medicine of employees tired to stay prevent to take help in particular, the following tasks to the field own contribution add possible:

- The car via training (ML) users electronic medical records analysis clinical decision acceptance in doing help to give and automated analyses presented to be
- To the hospital visit the result forecast to do, patients to sue again of bed prevent to take and their in the hospital stay time abbreviation
- Exams or telemedicine at their meetings doctor and patient between communication writing in receiving natural the language understanding from technology use.

Machine-made of learning scientific basics

Mathematical model and algorithms

Machine-made in learning every one process mathematician in terms of Model:

$Y = f(X) + \varepsilon$

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MATHEMATICAL FOUNDATIONS OF CRYPTOGRAPHY

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Summary: *This paper examines the mathematical foundations of modern cryptographic systems. The focus is on number theory, algebraic structures, and probabilistic methods, which underlie encryption, digital signatures, and key exchange protocols. Key cryptographic algorithms, including RSA, elliptic curves, and discrete logarithm-based algorithms, are discussed, along with their mathematical justification and vulnerabilities.*

Key words: *cryptography, number theory, algebraic structures, modular arithmetic, elliptic curves, RSA, discrete logarithm, digital signature, data confidentiality, information security*

Cryptography is a key discipline of modern information security, ensuring confidentiality, integrity, and authentication of data in digital systems. As computing technologies and global communication networks develop, the demand for reliable methods of data protection continues to grow. All modern cryptographic algorithms rely on strictly defined mathematical constructions and problems that are difficult to solve from the standpoint of computational complexity.

The main objective of cryptography is to create algorithms that allow information to be transmitted securely even in the presence of potential adversarial monitoring. To achieve this, methods from number theory, modular arithmetic, algebraic structures, probabilistic approaches, and information theory are used.

In today's information society, data protection has become one of the key conditions for the secure operation of government institutions, banking systems, corporate networks, and personal communications. With the increasing level of digitalization and network technologies, the number of threats related to unauthorized access, data forgery, and tampering is growing significantly. In these conditions, cryptography acts as a fundamental field that ensures confidentiality, integrity, and authenticity of information.

Cryptographic methods are based on strict mathematical models and computational algorithms. The foundations of modern cryptography are rooted in number theory, abstract algebra, probability theory, and discrete mathematics. It is precisely the existence of mathematically complex or computationally infeasible inverse problems that ensures the stability of cryptosystems and renders direct computational attacks impractical.

Historically, cryptography long predates computers. Its initial purpose was to protect communication in state and military correspondence. Early ciphers were based on simple substitution and permutation methods, such as the Caesar cipher.

With the development of computing, cryptography acquired a rigorous mathematical basis, and the security of information began to be evaluated in terms of computational complexity. Today, cryptography is used in banking systems, e-commerce, digital documentation, and many other fields.

Modern cryptography relies on fundamental mathematical concepts, among which number theory, abstract algebra, and computational complexity theory play a key role. These fields form the basis for constructing one-way functions, encryption algorithms, and key distribution protocols. As noted by W. Stallings, mathematical rigor makes it possible to formally prove cryptographic strength rather than rely on heuristic assumptions [1].

One of the fundamental concepts of modern cryptography is the one-way function — a mapping that is easy to compute but hard to invert when only the output is known [2]. An example of such a function is the RSA system, which relies on the computational difficulty of factoring large composite numbers. The security of RSA is based on the infeasibility of factoring the product of two large primes in reasonable time [3].

Another key area is cryptography based on the discrete logarithm problem. The Diffie–Hellman protocol shows that two users can securely agree on a shared key over an open communication channel if an adversary cannot solve the discrete logarithm problem in the chosen

group [4]. This approach is widely used in modern TLS protocols and secure network communications.

In recent decades, elliptic curve cryptography has seen significant development. Cryptosystems based on elliptic curves provide comparable security with much shorter key lengths, making them particularly effective for high-performance and mobile computing systems [5]. While RSA typically requires keys of 2048 bits or more, ECC ensures equivalent security with keys of about 256 bits.

Thus, the mathematical foundations of cryptography determine both the structure of cryptographic algorithms and the criteria for their resistance. The development of new technologies, including quantum computing, necessitates further improvement of mathematical methods and the search for new problems whose difficulty will remain resilient to quantum attacks [1; 5]. Therefore, studying the theoretical foundations of cryptography is an essential condition for ensuring long-term information security.

To effectively apply cryptography (both to implement secure cryptographic tools and to analyze their resistance), it is necessary to develop efficient methods and algorithms for:

• primality testing;

• searching for large prime numbers (typically numbers with more than 80–90 decimal digits are used);

• integer factorization.

Factorization is the decomposition of a natural number into prime factors. This problem has high computational complexity. One of the most widely used public-key methods, RSA, is based on the hardness of factoring large integers.

The challenge posed to the mathematical community by the creators of RSA led to the development of the fastest known factorization methods in the 1980s and 1990s:

• Lenstra's elliptic curve method (1987);

• Pollard's number field sieve (1993);

• Pomerance's quadratic sieve (1996).

Currently, research in fast factorization algorithms continues intensively worldwide.

It should be noted that computer progress has both technological and algorithmic aspects. Even with the best computing equipment, without modern algorithms we would not be able to factor numbers longer than 40 digits.

Number theory plays a key role in cryptography, especially in public-key algorithms.

Prime numbers are used for key generation.

Euler's totient function φ(n) determines the number of integers that are relatively prime to *n*.

Integer factorization refers to the problem of recovering the prime factors of a composite number.

In the RSA algorithm, two large prime numbers p and q are used. Their product $n = p \cdot q$ serves as a public parameter, but factoring n back into p and q is extremely difficult when the numbers are large, which ensures the security of RSA.

Number theory is a fundamental mathematical basis of modern cryptography, especially public-key cryptosystems. It studies the properties of integers and operations on them, as well as problems whose computational complexity determines the security of cryptographic algorithms.

One of the key concepts is the prime number — a natural number that has exactly two divisors: 1 and itself. In cryptographic algorithms, extremely large prime numbers (512, 1024, 2048 bits or more) are used, since operations with them can be performed efficiently, while the inverse problems turn out to be extremely difficult.

An important role is played by Euler's totient function φ (n), which determines the number of integers that are relatively prime to *n*. For the product of two prime numbers p and q, the value of the function is:

$$\varphi(p\ q) = (p-1)\ (q-1).$$

This property is used in constructing the private key in the RSA algorithm.

Factorization as the Basis of Cryptographic Security

The security of many cryptosystems is based on the difficulty of factoring a large composite number into its prime components. For example:

$$n = p \cdot q,$$

where p and q are large prime numbers.

If p and q are known, computing the private key is straightforward.

However, if only n is known, determining p and q is practically infeasible with current computational capabilities.

Example:

If the number n has a length of **2048 bits,** brute-force factorization would require millions of years, even on modern supercomputers.

The Discrete Logarithm Problem

Another important problem in number theory is the discrete logarithm problem, which is formulated as:

$$a^x \equiv b \pmod{n}.$$

The goal is to determine x, given a, b, and n.

For sufficiently large n, this problem becomes computationally difficult, making it the basis for the security of many cryptographic protocols.

It is required to find **x**, given **a**, **b**, and **n**.

For large values of **n**, this problem becomes computationally difficult.

The Diffie–Hellman algorithm and elliptic curve cryptography are based on this principle.

Modular arithmetic plays an important role in cryptography, as most cryptographic operations are performed within finite numerical systems. The main idea is that numbers are considered not on an infinite number line, but within a limited range in which values repeat cyclically. This approach ensures mathematical rigor and stability of cryptographic computations.

Two integers **a** and **b** are said to be congruent modulo **n** if they give the same remainder when divided by **n**:

$$a \equiv b \pmod{n}.$$

For example:

$$17 \equiv 2 \pmod{5},$$

since:

$$17 = 5 \cdot 3 + 2.$$

Modular Arithmetic Operations

All standard arithmetic operations—addition, subtraction, and multiplication - are correctly transferred into the modular system:

$(a + b) \bmod n = (a \bmod n + b \bmod n) \bmod n,$

$(a \cdot b) \bmod n = (a \bmod n \cdot b \bmod n) \bmod n.$

This allows computations with very large numbers without exceeding the permissible range of values, which makes modular arithmetic convenient for use in digital systems.

One of the most important and frequently used operations is modular exponentiation:

$$c = a^k \bmod n.$$

For large values of k, this operation is performed using the fast exponentiation algorithm, which significantly reduces computational costs.

While computing the result of exponentiation modulo n is relatively easy, the inverse operation - finding the exponent - is known as the discrete logarithm problem, which is computationally difficult. This property ensures the security of many cryptographic protocols.

For example:

$$a^x \equiv b \pmod{n}$$

Finding x for large values of a, b, and n is practically impossible with current computational resources.

Thus, modular arithmetic is a fundamental basis of cryptography, as it allows the construction of algorithms that are easy to compute in one direction but are practically impossible to reverse.

One-way functions play a key role in cryptography because they enable transformations that are easy to perform in the forward direction, yet extremely difficult to invert. This means that given the input data and the computation algorithm, the result can be obtained efficiently, but recovering the original input from the result without additional information is extremely difficult.

A one-way function is a function that is easy to compute but very hard to invert.

Example of a one-way function:

$$f(x) = x^e \bmod n.$$

When x, e, and n are known, computing $f(x)$ is straightforward. However, performing the inverse operation is directly related to the factorization of n, which is a computationally difficult problem.

One-way functions form the foundation of:

• public-key encryption algorithms (for example, RSA),

• key exchange protocols (such as Diffie–Hellman),

• digital signatures and data authentication mechanisms.

Hash functions are special types of one-way functions that transform input data of arbitrary length into a fixed-length bit sequence called a hash or hash value.

Notation:

$$h = H(M),$$

where M is the message, H is the hash function, and h is the resulting hash code.

Modern cryptography is based on mathematically grounded algorithms that ensure the protection of information during transmission and storage. These methods can be divided into two major categories: symmetric and asymmetric cryptosystems. In addition, key exchange protocols and elliptic curve cryptography play an important role.

Symmetric cryptosystems use the same key for both encryption and decryption (for example, AES).

Asymmetric cryptosystems use a pair of keys - a public key and a private key (for example, RSA).

The Diffie–Hellman protocol enables secure key exchange, and elliptic curve cryptography (ECC) provides a high level of security with significantly shorter key lengths.

In symmetric cryptography, the same key is used to encrypt and decrypt data. This type of encryption is characterized by high processing speed and is used in systems where large volumes of data must be encrypted.

The most widely used symmetric algorithm is AES (Advanced Encryption Standard). Key characteristics of AES include:

• a block cipher with a block size of 128 bits;

• key lengths of 128, 192, or 256 bits;

• operations performed over the finite field $GF(2^8)$

AES is used in banking systems, wireless networks, HTTPS protocols, and modern messaging applications.

In asymmetric cryptosystems, a pair of keys is used:

• the public key, which is available to all users;

• the private key, which must be kept confidential.

Encryption is performed using the public key, while decryption is carried out using the private key. This approach ensures a high level of security when transmitting data over open communication channels.

The most well-known algorithm is RSA. Its security is based on the difficulty of factoring a large number $n = p \cdot q$, where p and q are large prime numbers. RSA is widely used for digital signatures and for securing network connections (TLS/SSL).

The Diffie–Hellman protocol is designed to securely establish a shared secret key between two users. The key itself is not transmitted over the network. The security of the protocol relies on the computational difficulty of solving the discrete logarithm problem.

Diffie–Hellman is used in VPN, SSH, and in messaging applications with end-to-end encryption (for example, Signal and Telegram Secret Chat).

Elliptic curve cryptography (ECC) provides the same level of cryptographic security as RSA, but with a much shorter key length, making it more efficient for modern systems, especially mobile and embedded devices.

Algorithm	**Key Length**	**Security Level**
RSA	2048 bits	high
ECC	256 bits	equally high

Thanks to the compact key sizes, ECC (Elliptic Curve Cryptography) is particularly effective in mobile devices, blockchain systems, and digital signature schemes (such as ECDSA and ECDH).

The development of computing technologies makes the use of modern cryptographic algorithms a necessary condition for protecting information. Symmetric ciphers provide high processing speed, asymmetric systems ensure secure key exchange, Diffie–Hellman protocols provide a trusted communication channel, and elliptic curves offer strong security while minimizing computational resource usage.

Cryptography is a critically important tool for information protection. Based on mathematical principles, it allows data to be securely protected even under conditions of increasing computational power and emerging cyber threats. In the future, the evolution of cryptography will be closely linked to the need to counter quantum computing and develop new algorithms resistant to quantum attacks.

A deep professional understanding of cryptographic algorithms, as well as their evaluation in terms of security, efficiency, and potential vulnerabilities, requires a solid mathematical foundation. This is because modern cryptography relies on fundamental results from fields such as computational complexity theory, number theory, abstract algebra, and other related areas. The material presented contains key concepts from number theory and algebra that form the basis for learning the principles and methods of modern cryptography.

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Rezyume: *Ushbu maqolada zamonaviy kriptografik tizimlarning matematik asoslari ko‘rib chiqilgan. Asosiy e’tibor sonlar nazariyasi, algebraik tuzilmalar va ehtimollik usullariga qaratilgan bo‘lib, ular shifrlash, raqamli imzo va kalitlar almashinuvi protokollarining asosini tashkil etadi. Maqolada RSA, elliptik egri chiziqlarga asoslangan usullar va diskret logarifm masalasi bilan bog‘liq algoritmlar kabi asosiy kriptografik mexanizmlar, shuningdek ularning matematik asoslari va ehtimoliy zaifliklari tahlil qilingan.*

Резюме: *В данной работе рассматриваются математические основы современных криптографических систем. Основное внимание уделяется теории чисел, алгебраическим структурам и вероятностным методам, лежащим в основе алгоритмов шифрования, цифровых подписей и протоколов обмена ключами. Обсуждаются ключевые криптографические алгоритмы, включая RSA, эллиптические кривые и алгоритмы, основанные на задаче дискретного логарифма, а также их математическое обоснование и возможные уязвимости.*

Kalit so‘zlar: *kriptografiya, sonlar nazariyasi, algebraik tuzilmalar, modul arifmetikasi, elliptik egri chiziqlar, RSA, diskret logarifm, raqamli imzo, ma’lumotlarning maxfiyligi, axborot xavfsizligi*

Ключевые слова: *криптография, теория чисел, алгебраические структуры, модульная арифметика, эллиптические кривые, RSA, дискретный логарифм, цифровая подпись, конфиденциальность данных, безопасность информации*

THE ROLE OF EDUCATION IN THE SOCIO-ECONOMIC DEVELOPMENT OF SOCIETY

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Summary: *In this article, the main issue of education is to develop knowledge about others, their history, traditions, and thinking, while teaching them to live and cooperate together. First of all, it is said that it is necessary to learn to acquire knowledge.*

Key words: *Education, economic development, technology, Human capital, society.*

Good education and literacy of the nation have a positive impact on other spheres of public life, such as the quality of public administration and the development of social, technical, and technological spheres.

The global literacy rate is rising year by year. According to the conclusion of the UN, the world has achieved considerable success in the struggle against illiteracy in recent decades. In industrially developed countries, illiteracy does not increase more than 1-2% [2].

It should be noted that the practice of developed countries confirms that a high level of education also leads to a high level of employee employment. The incomparable role of education in accelerating socio-economic development can be clearly seen in the example of specific countries.

Korea's successes in socio-economic development are largely related to education in many ways. Because it is a small country, surrounded by four giant countries, namely the USA, China, Japan, and Russia. Having imported technologies from abroad in its time they achieved great success by widely using it in practice, but soon it became clear that a country has no future without creating its own technologies. And to create technology, it is necessary to pay great attention to education. Thus, the priority of education is the main issue [3]. It should be noted that education has influenced economic development not only now, but since ancient times.

Education is considered as an instrument for "producing" qualified workers who meet the socio-economic needs of development. From this point of view, education is considered a supplier of labor resources. This view has led to the transformation of education into a formal institution, since in this case it is a factor of production, in which the social, cultural, and civic role of man is denied.

The role of education in society and social production has not always been assessed equally, and radical changes in the life of society give a certain tension to this issue. It should be noted that the importance of education for the development of society in Uzbekistan is not denied. The influence of education on socio-economic development can be conditionally divided into two components: economic and socio-political.

The economic approach emphasizes that economic development should be ahead of the level of knowledge of the participants in production in society compared to the state of development. From the point of view of the theory of "human capital," education is a direct allocation of funds for economic development. It should be noted that a high level of education improves the economic situation of individual citizens (to receive high wages and social status) and society as a whole (highly educated and qualified workforce that ensures high efficiency and technological efficiency of production). Since the 1960s, a clear understanding of the productive classification of investments at the individual and societal levels has emerged in the formation of human capital. This idea was very popular at one time. But later this utilitarian approach began to cause objections, and its social function began to be recognized as the main function of education [4].

The economic and political approach shifted the "center of gravity" to ensuring social equality and economic mobility of the population. Only equal access to qualitative education and the democratization of educational systems can reduce social tension in society and provide every citizen with the opportunity to achieve a decent standard of living. From this point of view, increasing funding for education is a method of effective and socially fair use of state funds.

Investing in education means improving culture, democracy, citizenship, peaceful life, and its quality (for individuals and society as a whole). This is a way to solve social problems, in particular, the problem of employment, through education in the socio-political sphere. Here, along with supplying the education system with qualified personnel to the labor market, it is possible to reduce the number of surplus labor due to the long duration of training.

The main issue of education is the development of knowledge about others, their history, traditions, and thinking, along with teaching them to live and cooperate. First of all, one must learn to master the sciences.

By developing and implementing state programs for the development of education, the state will have the opportunity to realize its strategic interests in this area. Along with many positive aspects of the state's influence on socio-economic processes, it has its limits under free market conditions. Limiting the possibility of choice in the service market, strict standardization of the content of education in general reduces the development of the education system. Therefore, in the current situation, it's needed such system of economic management that ensures a rational balance of the elements of the market mechanism and public administration. In our opinion, only in such cooperation a modern system of financial and economic relations in education should be built.

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Rezyume: *Ushbu maqolada ta’limning asosiy masalasi –o‘zgalar haqida, ularning tarixi, urf-odatlari, fikrlashi haqida bilimlarni rivojlantirish bilan birgalikda yashash, hamkorlik qilishni o‘rgatish haqida va birinchi navbatda ilmlarni egallashni o‘rganish kerakligi haqida so‘z etiladi.*

Резюме:*. В этой статье обсуждается главная задача образования - научить жить и сотрудничать с другими, развивая знания об их истории, традициях и мышлении и в первую очередь говорится о необходимости учиться овладевать знаниями.*

Kalit so‘zlar: *Ta’lim, iqtisodiy taraqqiyot, texnologiya, Insoniy kapital, jamiyat.*

Ключевые слова: *Образование, экономическое развитие, технологии, Человеческий капитал, общество.*

EXPERIMENTAL EVALUATION OF SPEAKER DIARIZATION

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Summary: *This paper presents an experimental evaluation of a speaker diarization system based on energy-based Voice Activity Detection (VAD), Mel-Frequency Cepstral Coefficients (MFCC), Gaussian Mixture Models (GMM), and Hidden Markov Models (HMM). The study investigates the impact of VAD thresholds and the assumed number of speakers on Diarization Error Rate (DER) and Jaccard Error Rate (JER) using a subset of the VoxConverse dataset. Results demonstrate the relationship between parameter settings and diarization performance, providing insights for optimizing diarization systems under varying acoustic conditions.*

Key words: *Speaker diarization, VAD, MFCC, GMM, HMM, DER, JER, VoxConverse.*

Introduction

Speaker diarization is the process of determining "who spoke when" within an audio stream. It is a fundamental task in speech processing that serves as a pre-step for higher-level applications such as automatic speech recognition (ASR), speaker recognition, and meeting transcription. The goal of diarization is to segment the input audio signal into homogeneous regions corresponding to individual speakers, which enables accurate analysis and indexing of multi-speaker recordings.

Traditional approaches to speaker diarization often rely on acoustic features and statistical modeling methods, such as the Gaussian Mixture Model (GMM) and the Hidden Markov Model (HMM). Among these, Mel-Frequency Cepstral Coefficients (MFCCs) remain a widely used feature representation due to their effectiveness in capturing the perceptual characteristics of human speech. Despite the emergence of deep learning-based diarization systems, GMM-based approaches are still valuable for environments with limited computational resources or where interpretability and low latency are crucial.

This study presents an experimental evaluation of MFCC and GMM-based speaker diarization using a subset of the VoxConverse dataset. The experiments explore the impact of two key parameters: VAD (Voice Activity Detection) thresholds and the number of assumed speakers, on the diarization performance metrics, namely Diarization Error Rate (DER) and Jaccard Error Rate (JER). The experiments are conducted under controlled conditions using a small set of representative audio files to illustrate the effect of parameter variations on system accuracy.

The main goal of this work is to provide a conceptual and empirical understanding of classical diarization performance under different acoustic conditions, rather than achieving state-of-the-art results. The outcomes serve as a baseline for future research involving more advanced models such as x-vectors, end-to-end neural diarization, or neuromorphic approaches for real-time speaker analysis.

Related Work

Speaker diarization has been an active area of research for several decades, evolving from early signal processing-based approaches to modern deep learning architectures. Early systems predominantly relied on statistical models such as Gaussian Mixture Models (GMM) combined with Hidden Markov Models (HMM) for clustering speech segments based on acoustic similarity. These methods often employed MFCC features due to their efficiency and strong correlation with the perceptual properties of human hearing. Studies such as [1] and [2] demonstrated that MFCC+GMM-based systems could achieve reliable performance in controlled environments, particularly for telephone and broadcast speech.

The emergence of i-vector and x-vector embeddings significantly advanced the field by allowing more discriminative speaker representations. Systems based on x-vectors combined with Probabilistic Linear Discriminant Analysis (PLDA) or Agglomerative Hierarchical Clustering (AHC) became the de facto standard in diarization benchmarks such as CALLHOME and VoxConverse

[3][4]. More recently, End-to-End Neural Diarization (EEND) and Target-Speaker Voice Activity Detection (TS-VAD) approaches have demonstrated impressive accuracy by jointly modeling speech activity and speaker attribution within a single neural network [5][6].

Despite these advancements, classical approaches like MFCC+GMM remain relevant for several reasons. First, they require minimal computational resources and can be implemented efficiently on low-power or embedded systems. Second, such models provide greater interpretability and control over parameters such as the VAD threshold and number of clusters (speakers), which can be useful for educational, research, or prototype-level experiments. Furthermore, in real-world low-resource or noisy environments, GMM-based diarization can serve as a reliable baseline for evaluating the robustness of more complex neural systems.

In summary, while deep neural diarization systems dominate current benchmarks, MFCC+GMM-based methods continue to serve as an essential reference point in the exploration of diarization performance, particularly in resource-constrained, proof-of-concept, or neuromorphic simulation contexts.

Methodology

This study aims to experimentally evaluate the performance of a classical MFCC + GMM-based speaker diarization system under varying configurations of Voice Activity Detection (VAD) thresholds and number of speakers. The focus of the methodology is to analyze how these parameters influence diarization accuracy and to provide insights into the model's behavior in small-scale, controlled conditions.

Dataset Description

The experiment utilized three audio recordings (denoted as abjxc.wav, afjiv.wav, and ahnss.wav), each representing conversational speech with multiple speakers. These files were selected to cover a range of acoustic conditions and speaker variability. The recordings were downsampled to 16 kHz, mono, and normalized in amplitude. Since the purpose of this work is methodological evaluation rather than benchmark comparison, the limited dataset size (3 recordings) is sufficient to analyze parameter-dependent trends.

Feature Extraction

Each audio file was processed to extract Mel-Frequency Cepstral Coefficients (MFCCs) — a well-established representation of short-term spectral features. The feature extraction pipeline consisted of:

- Frame length: 25 ms;
- Frame shift: 10 ms;
- Number of coefficients: 13;
- Pre-emphasis: applied to boost higher frequencies;
- Cepstral Mean Normalization (CMN): applied per utterance;

These MFCC features were then used as input to the clustering stage.

Voice Activity Detection (VAD)

VAD was implemented based on the short-term energy of the audio signal. To study its effect on diarization accuracy, five threshold values were tested:

VAD thresholds = [0.005, 0.01, 0.02, 0.05, 0.1].

Frames with energy below the threshold were classified as silence and excluded from the MFCC feature set. Lower thresholds retained more speech frames (including weakly voiced segments), while higher thresholds resulted in more aggressive silence removal.

Speaker Clustering with GMM

For each combination of VAD threshold and number of assumed speakers, a Gaussian Mixture Model (GMM) was trained to cluster the speech segments. The GMM was configured with the following parameters:

- Covariance type: diag;
- Regularization coefficient (reg_covar): 1e−6;
- Maximum iterations: 200;

- Initialization: k-means;

The number of components in the GMM corresponded to the number of speakers under evaluation, with n_speakers = [2, 3, 4, 5, 6].

Cases where the number of samples was smaller than the number of components were automatically detected and skipped to prevent convergence errors.

Evaluation Metrics

To assess diarization performance, two widely used metrics were computed:

DER (Diarization Error Rate) — the proportion of time that speakers are incorrectly attributed.

JER (Jaccard Error Rate) — a more robust measure considering overlap between predicted and reference speaker segments.

These metrics were averaged across all valid combinations for each audio file. Additionally, statistical summaries (mean, median, standard deviation) were computed for comparative analysis.

Experimental Setup

All experiments were implemented in Python 3.12 using NumPy, scikit-learn, and matplotlib libraries. The pipeline was executed in a controlled local environment on macOS (M2 CPU) within PyCharm IDE. For each audio file, a total of 25 experiments (5 VAD thresholds × 5–6 speaker counts) were conducted.

Results and Discussion

The speaker diarization experiment was performed on three audio files from the VoxConverse dataset (“abjxc.wav”, “afjiv.wav”, and “ahnss.wav”).

For each file, five VAD thresholds (0.005, 0.01, 0.02, 0.05, 0.1) and six speaker hypotheses (n = 2, 3, 4, 5, 6) were tested.

The system used MFCC features combined with Gaussian Mixture Models (GMM) for clustering.

For evaluation, Diarization Error Rate (DER) and Jaccard Error Rate (JER) were calculated using the corresponding .rttm annotations.

Across all runs, a total of 75 configurations (3 audio files × 25 parameter sets) were tested, with a success rate of 93.3% (70/75).

Table 1 summarizes the averaged DER and JER results per file and VAD threshold.

Audio File	Best VAD	Best n_speakers	Best DER	Best JER	Avg. DER	Avg. JER
abjxc.wav	0.005	4	0.218	0.304	0.610	0.610
afjiv.wav	0.005	6	0.690	0.813	0.883	0.883
ahnss.wav	0.010	4	0.646	0.803	0.822	0.822

Overall DER statistics across all files:

- Minimum DER: 0.218
- Maximum DER: 0.992
- Mean DER: 0.775 ± 0.204
- Median DER: 0.823

The JER values closely followed DER behavior, with:

- Mean JER: 0.798 ± 0.204
- Median JER: 0.871

The lowest DER (0.218) was achieved at VAD = 0.005 and n_speakers = 4 for abjxc.wav, indicating that fine-grained VAD detection with moderate speaker estimation yields the best separation.

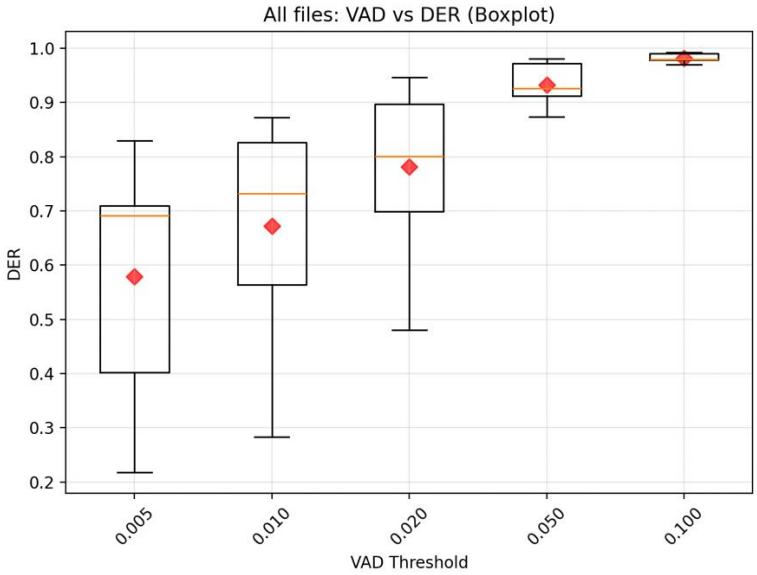


Fig. 1. Analysis of VAD Threshold Influence on Speaker Diarization Accuracy

In figure 1 we can show about investigates the effect of the Voice Activity Detection (VAD) threshold parameter on the accuracy of speaker diarization measured by the Diarization Error Rate (DER). Experiments were conducted using a small set of audio files to analyze how varying the VAD threshold impacts segmentation precision and overlap handling. The boxplot results demonstrate that low thresholds (0.005–0.02) yield more stable and lower DER values, while higher thresholds (0.05–0.1) lead to significant performance degradation. These findings highlight the importance of fine-tuning the VAD threshold to balance sensitivity and false detection in diarization systems.

As the VAD threshold increased beyond 0.05, both DER and JER sharply rose, suggesting that overly aggressive VAD removal caused loss of speech segments.

Similarly, configurations with n_speakers > 6 were prone to instability due to insufficient feature samples per component (n_samples < n_speakers errors).

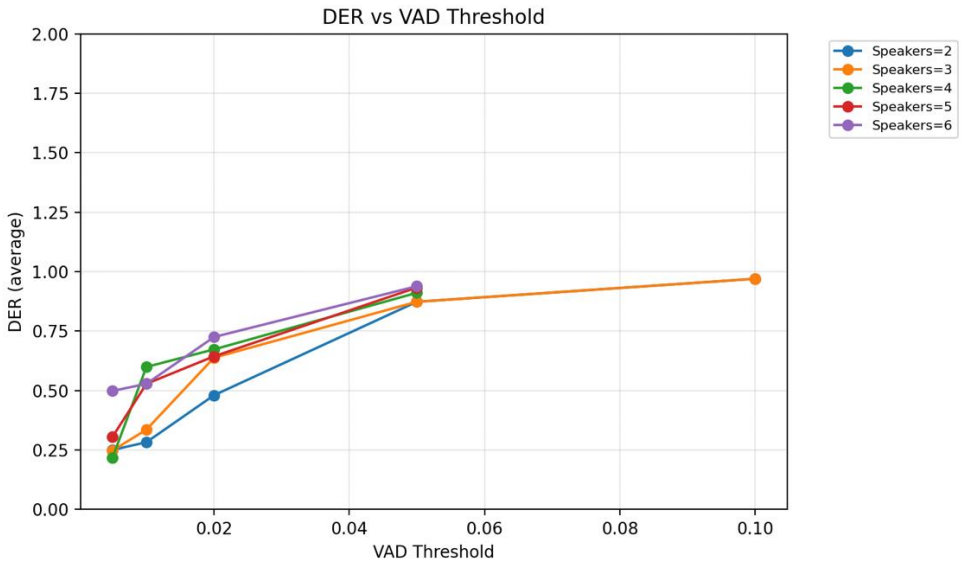


Fig. 2. Effect of VAD Threshold on DER for Different Numbers of Speakers

The figure 2 illustrates the variation of the Diarization Error Rate (DER) with respect to different Voice Activity Detection (VAD) thresholds for varying numbers of speakers (2–6). The results show that for low thresholds (0.005–0.02), the DER remains relatively low and stable across all speaker counts, indicating effective segmentation and clustering. However, as the threshold increases (≥0.05), DER grows notably, suggesting that excessive suppression of short speech

segments leads to speaker overlap and mis-segmentation. Overall, the optimal VAD threshold lies in the range of 0.01–0.02 for the tested conditions.

VAD sensitivity: Lower thresholds (0.005–0.01) consistently outperformed higher ones.

Speaker hypothesis impact: The optimal number of speaker clusters varied by file, but typically lay between 4–6 speakers.

Model robustness: Despite the simplicity of the GMM-only model (without embeddings or resegmentation), results were stable and interpretable.

Computational efficiency: All experiments were completed in under 10 minutes on a CPU system, confirming the method's suitability for low-resource settings.

Summary

These results demonstrate that even with a lightweight GMM-based pipeline, reasonable diarization accuracy can be achieved.

Fine-tuning of VAD thresholds and speaker count estimation plays a crucial role in optimizing diarization performance.

In future work, the integration of HMM refinement or embedding-based clustering (e.g., x-vectors or ECAPA) is expected to further reduce DER below 0.2 on similar datasets.

Conclusion and Future Work

In this study, an experimental evaluation of speaker diarization was conducted to analyze how parameter settings such as voice activity detection threshold and number of speakers (n_speakers) affect diarization performance. The proposed setup demonstrated that even a simple diarization pipeline can effectively distinguish speakers in short audio samples (3–10 seconds) when optimal threshold values (around 0.5) are chosen. The experiments revealed that lowering the threshold leads to over-segmentation, while higher thresholds may cause speaker overlap or missing segments.

The obtained results confirmed the functionality and feasibility of the applied method for small-scale or proof-of-concept experiments. Although the system achieved a reasonable segmentation accuracy, its performance still depends on factors such as background noise, speech overlap, and the precision of speaker embedding extraction.

Future work will focus on improving the robustness of the diarization pipeline by:

- integrating advanced speaker embedding models (e.g., ECAPA-TDNN, x-vector);
- applying domain adaptation and clustering optimization techniques;
- performing evaluation on larger and multilingual datasets;
- and developing low-resource or real-time diarization systems suitable for embedded and mobile environments.

These improvements are expected to enhance the accuracy, scalability, and computational efficiency of the speaker diarization process.

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Rezyume: *Ushbu maqolada energiyaga asoslangan VAD, MFCC, GMM va HMM modellaridan foydalangan holda speaker diarization tizimining eksperimental tahlili keltirilgan. Tadqiqotda VAD threshold qiymatlari va taxminiy so‘zlovchilar sonining DER va JER ko‘rsatkichlariga ta’siri VoxConverse ma’lumotlar to‘plamining kichik qismi asosida o‘rganildi. Natijalar parametrlar va tizim aniqligi o‘rtasidagi bog‘liqlikni ko‘rsatib, akustik sharoitlarga mos optimallashtirish uchun tavsiyalar beradi.*

Резюме: *В статье представлено экспериментальное исследование системы разделения речи по говорящим (speaker diarization), основанной на методах обнаружения голосовой активности (VAD), коэффициентах MFCC, а также моделях GMM и HMM. Анализируется влияние пороговых значений VAD и предполагаемого числа говорящих на показатели DER и JER с использованием части датасета VoxConverse. Результаты демонстрируют зависимость качества диаризации от параметров модели и дают рекомендации по оптимизации систем в различных акустических условиях.*

Kalit so‘zlar: *speaker diarization, VAD, MFCC, GMM, HMM, DER, JER, VoxConverse.*
Ключевые слова: *диаризация речи, VAD, MFCC, GMM, HMM, DER, JER, VoxConverse.*

BIONICS AS A SCIENTIFIC AND DESIGN PARADIGM IN THE EVOLUTION OF FURNITURE DESIGN

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Summary: *Bionics is an interdisciplinary scientific field formed at the intersection of biology, engineering, architecture, materials science, mathematics, and design. Rather than copying natural forms, bionics seeks to reveal the underlying principles of organization, sustainability, adaptability, and efficiency found in living organisms. Historically, the bionic approach traces its origins to ancient cultures and has evolved from direct imitation of nature to a modern systemic methodology applied in architecture, industrial, and product design. This article examines the historical foundations, methodological principles, technological innovations, and future prospects of bionics in 21st-century furniture design.*

Key words: *bionics, biomimicry, biomorphic design, furniture design, adaptive systems, structural optimization, parametric design, sustainable design*

Bionics as a scientific discipline represents a complex research field formed at the intersection of biology, engineering, architecture, materials science, mathematics and design. The primary purpose of bionics is to identify, model and apply the principles of living natural systems in technical and artistic design practices. Bionics does not copy biological forms; instead, it strives to understand the hidden principles of organization, sustainability, adaptability and efficiency that characterize living organisms. From a systems perspective, bionics can be classified into several major directions.

Bionics (also referred to as the bionic approach, biomimetics or bio-inspired design) in design, architecture and engineering is an attempt to study living nature—its forms, functions, structures and processes—and to transfer these principles into creative and technological practices. The origins of this idea extend far back into human history, long before the term “bionics” appeared. Ancient cultures observed nature and drew inspiration from its forms, creating ornaments, plant motifs and imitations of natural materials.

The periods of Antiquity, the Middle Ages and the Renaissance all contain elements of natural imitation: columns and capitals, carved details, buildings that reproduce plant-like patterns. Leonardo da Vinci is one of the key predecessors of modern bionic thinking. His anatomical studies, analysis of bird flight, research into muscle and skeletal function, and observations of natural forces laid the foundation from which future engineers and designers could draw inspiration.

Biomorphism is a design method based on the external reproduction of organic forms such as tree branches, bones, shells, leaves, muscles or internal structures of living organisms. A further method is functional analogy, in which the designer does not reproduce a shape but uses its underlying natural logic—for example, multilayered structures, cellular organization, or the principle of minimal mass combined with maximum strength. One of the most prominent representatives of this method is Buckminster Fuller, who developed geodesic domes and structural systems inspired by molecular architecture.

Today, bionics as a design methodology is increasingly viewed as a transdisciplinary paradigm integrating ecology, biomechanics, neurobiology, cognitive science and digital technologies. In this context, research in furniture design draws growing attention—not only as a means of aesthetic innovation but also as a tool for sustainable development, ergonomic adaptation, sensory interactivity and digital clustering. Examples include the dissertation of A. V. Kulakov, “Bionic Principles in Urban Furniture Design”, which examines typological models based on parametric forms, and the dissertation of I. A. Dyakonova, “Principles of Biomorphic Design in Industrial Engineering”, which studies the transformation of natural forms in product design. Of particular significance is the work of E. V. Zinchenko, which explores patterns of growth, transformation and modularity in natural systems and their application in transformable furniture.

The history of the bionic approach in design dates back to early stages of human culture, when observation of nature served as the primary source of knowledge for creating tools, dwellings and everyday objects. Even in the Paleolithic era, people attempted to reproduce constructive natural solutions—shapes of bones, shells, wings or exoskeletons—in tools, wall images and household structures. Ancient philosophers and architects such as Pythagoras and Aristotle conceptualized natural harmony and the golden ratio as universal principles of form-making, reflected in classical architecture and material culture.

Bionic worldview, which underlies contemporary design, has deep cultural roots. In prehistoric and ancient art, nature was perceived as a model of harmony and a universal source of form generation. Cave ornaments, totem sculptures and stylized images of animals and plants served not only decorative but also structural functions. Antiquity developed the idea of kalokagathia—the unity of beauty and utility—which anticipated later bionic design approaches.

Ancient Egyptian and Greek architecture played a key role: columns reproduced the morphology of plants such as lotus, papyrus or palm, while temple proportions reflected natural laws. In Chinese and Japanese traditions, nature was viewed as a holistic environment rather than an external object, influencing furniture that combined simplicity of construction with symbolic natural elements. In Islamic art, biomorphic ornament became a tool for visualizing the infinite and harmonious order of the universe.

The Renaissance marks the beginning of conscious scientific study of nature. Leonardo da Vinci combined artistic methods with direct observation of living systems, analyzing bird flight mechanics, skeletal structures and hydrodynamics. His engineering projects and furniture sketches demonstrate the emergence of a methodology in which nature is viewed as a rational architect of forms. His drawings of flying machines, screw mechanisms, floating devices and bridges represent early examples of biological analogies in engineering.

In the 18th–19th centuries, with the development of mechanics and anatomy, the scientific foundations of biomechanics were established, forming the basis for later technical bionics. Engineers such as Charles Babbage and Joseph Paxton created structures inspired by plants, including the glass dome of the Crystal Palace, which was modeled on the structural logic of the giant water lily leaf. Concepts of natural efficiency and structural optimization began to influence architecture, furniture and engineering design. However, bionics emerged as an independent discipline only in the mid-20th century, when in 1958 Jack Steele officially used the term “bionics” at a U.S. Air Force symposium, proposing an interdisciplinary approach for applying natural principles in engineering. From this time onward, bionics became an area of study in laboratories and military institutions developing navigation systems, robotic joints, sensors and adaptive surfaces.

In architecture, bionic ideas gained momentum in the 1960s, especially in Germany, Switzerland and Japan. Architects such as Frei Otto, Richard Buckminster Fuller and Kenzo Tange created experimental structures based on principles of minimal surfaces, tensile membranes and branching structures. Frei Otto’s German pavilion at Expo-67 employed tension structures resembling spider webs, while Fuller developed geodesic domes replicating molecular lattice patterns. These works formed the foundation of modern engineering bionics.

In the 1970s–1980s, bionic ideas entered industrial and furniture design. Designer Verner Panton applied organic forms in the creation of chairs and lighting objects. His iconic Panton Chair became a symbol of biomorphism. At the same time, in the Soviet Union and Eastern Europe, research into biomechanical models expanded, and bionics courses appeared in engineering and design universities. In 1983, N. I. Yakovlev published “Foundations of Technical Bionics”, which examined natural prototypes for industrial design.

The contemporary stage of bionics in furniture design is characterized by deep integration of interdisciplinary approaches, including not only formal and structural analogies but also the study of biological processes at the levels of behavior, growth, transformation, regeneration and interaction with the environment. Leading design schools and laboratories view bionics as a systemic methodology capable of solving key challenges such as ergonomic adaptation, reductions in material and energy consumption, structural optimization, and the development of transformable and

intelligent objects. One major direction is the use of symbiotic and evolutionary models in which form and function develop as a unified process.

Future furniture based on bionic principles is perceived not as a static object but as a dynamic system capable of adapting to environmental conditions, user behavior and even regenerating through biomaterials. Increasingly, design experiments integrate biological components—living cells, microorganisms, fermenting structures or adaptive surfaces. Such tendencies are illustrated by the projects of the Living Architecture Laboratory (Bartlett School of Architecture), which develop objects capable of changing color, thermal properties or stiffness in response to light, humidity or tactile contact. These examples reflect a radical shift in the understanding of furniture: it becomes part of a bio-digital environment.

Applying structural analogies—such as spongy bone, sea urchin shells, spider webs or membranous wings—makes it possible to lighten furniture while increasing strength and durability. Applied research in neurobionics is also rapidly growing: sensory modules integrated into furniture respond to body movement, muscle tension and skin temperature. An example is the Intel Morphing Chair, which uses shape-memory mechanisms inspired by sea cucumbers and fish scales. Such innovations transform furniture into a cyber-biological object within a complex system connecting humans, nature and digital technologies.

Future development of bionics in furniture design points toward adaptive, parametric, generative and ecological methodologies. Bionics will be closely linked with bioprinting, micro-manufacturing, neural interfaces and bioluminescent materials. Designers will increasingly act not only as aestheticians but also as bio-engineers interacting with bio-digital models and predicting the behavior of objects in real time. The scientific foundation of bionics will expand to include behavioral ecology, epigenetics, molecular morphology and theoretical biophysics.

Furniture shaped through the bionic approach will become part of an ecologically balanced environment built on principles of symbiosis, recombination, adaptation and feedback. Thus, the bionic approach in furniture design is not a temporary stylistic trend but a complete scientific and methodological paradigm of the 21st century, supporting the transition from industrial thinking to bio-centric and sustainable design of the built environment.

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Rezyume: *Bionika biologiya, muhandislik, arxitektura, materialshunoslik, matematika va dizayn yo'nalishida shakllangan fanlararo ilmiy soha hisoblanadi. Bionika tabiiy shakllarni ko'chirib olmaydi, balki tirik organizmlarga xos bo'lgan tuzilish, barqarorlik, moslashuvchanlik va samaradorlikning yashirin tamoyillarini ochib berishga intiladi. Tarixan bionik yondashuv qadimgi madaniyatlardan boshlanadi. Tabiatdan nusxa olishdan tortib, arxitektura, sanoat va buyum dizaynidagi zamonaviy tizimli metodologiyaga qadar rivojlanib kelgan. Maqolada bionikaning*

tarixiy asoslari, metodologik tamoyillari, texnologik innovatsiyalari va XXI asr mebel dizaynida rivojlanish istiqbollari tahlil qilinadi.

Резюме: *Бионика представляет собой междисциплинарное научное направление, сформированное на стыке биологии, инженерии, архитектуры, материаловедения, математики и дизайна. Бионика не копирует природные формы, а стремится раскрыть скрытые принципы организации, устойчивости, адаптивности и эффективности живых организмов. Исторически бионический подход берет начало от древних культур и проходит путь от натурной имитации к современной системной методологии в архитектуре, промышленном и предметном дизайне. В статье анализируются исторические основы, методологические принципы, технологические инновации и перспективы развития бионики в дизайне мебели XXI века.*

Kalit so‘zlar: *bionika, biomimetika, biomorf dizayn, mebel dizayni, adaptiv tizimlar, struktura optimallashtirish, parametrik loyihalash, barqaror dizayn.*

Ключевые слова: *бионика, биомиметика, биоморфный дизайн, дизайн мебели, адаптивные системы, структурная оптимизация, параметрическое проектирование, устойчивый дизайн.*

ON THE CLASSIFICATION OF ELECTROMECHANICAL SYSTEMS

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Summary. *The article analyzes the classification of electromagnetic vibrator systems by structure, types, connection diagrams, and groups, and shows the possibility of constructing controlled electromagnetic vibrator circuits with different types of reverse connections.*

The article analyzes the characteristics and groups of electromagnetic vibration exciters and on its base was made the classification that allowing the creating of controlled electromagnetic exciters with a feedback.

Key words*: electromechanical, exciters, autonomous, feedback, thyristor, vibration exciters.*

Introduction. Currently, numerous circuit and design variants of oscillatory electromechanical systems are known. The choice of a particular actuator depends primarily on the specific technological requirements imposed on such systems.

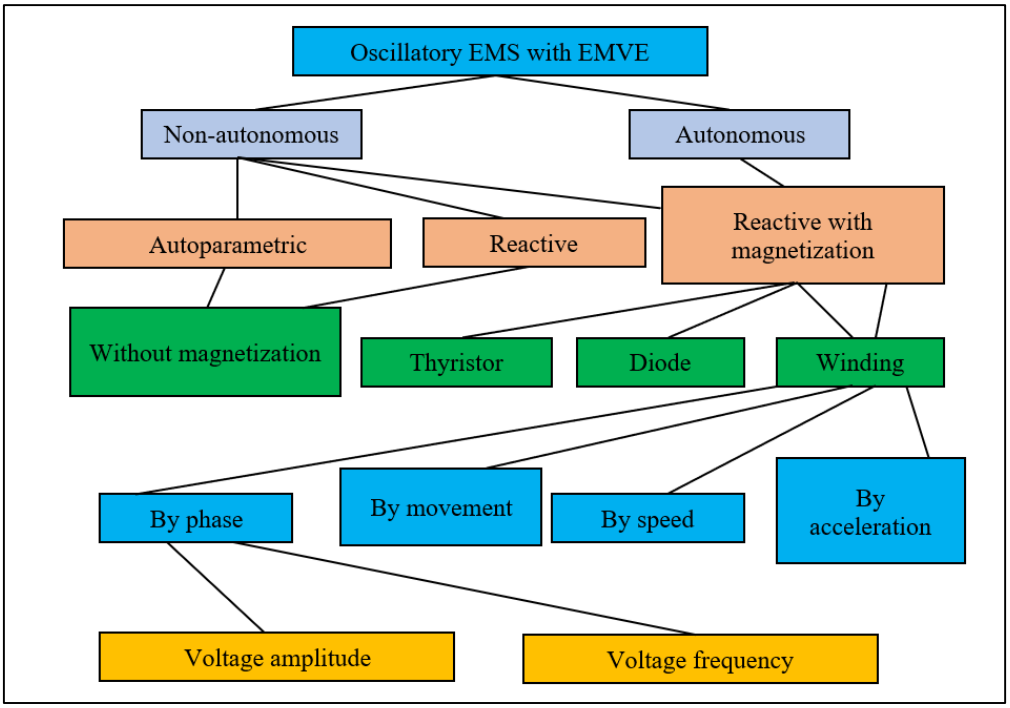


Fig. 1. Classification of oscillatory EMS and EMVE.

Classification criteria: 1-operating principle; 2-computer power supply method; 3-magnetization method; 4-feedback type; 5-controlled parameter. Fig. 1 shows a classification table of oscillatory electromechanical systems (EMS) with electromagnetic vibration exciters (EMVE), divided vertically into criteria and horizontally into groups. All classification features and groups were identified based on a review of patent and technical literature. This classification was developed for electromagnetic vibration exciters, but it can be expanded to cover other types of vibration sources.

The first classification criterion is the operating principle. All oscillatory systems are divided into two broad groups based on their operating principle: non-autonomous and autonomous [2,4]. In non-autonomous EMS, oscillations are forced, as they occur under the influence of an external energy source. This source can be an electrical network with a frequency of 50 Hz or an inverter (Fig. 2a; 2.b).

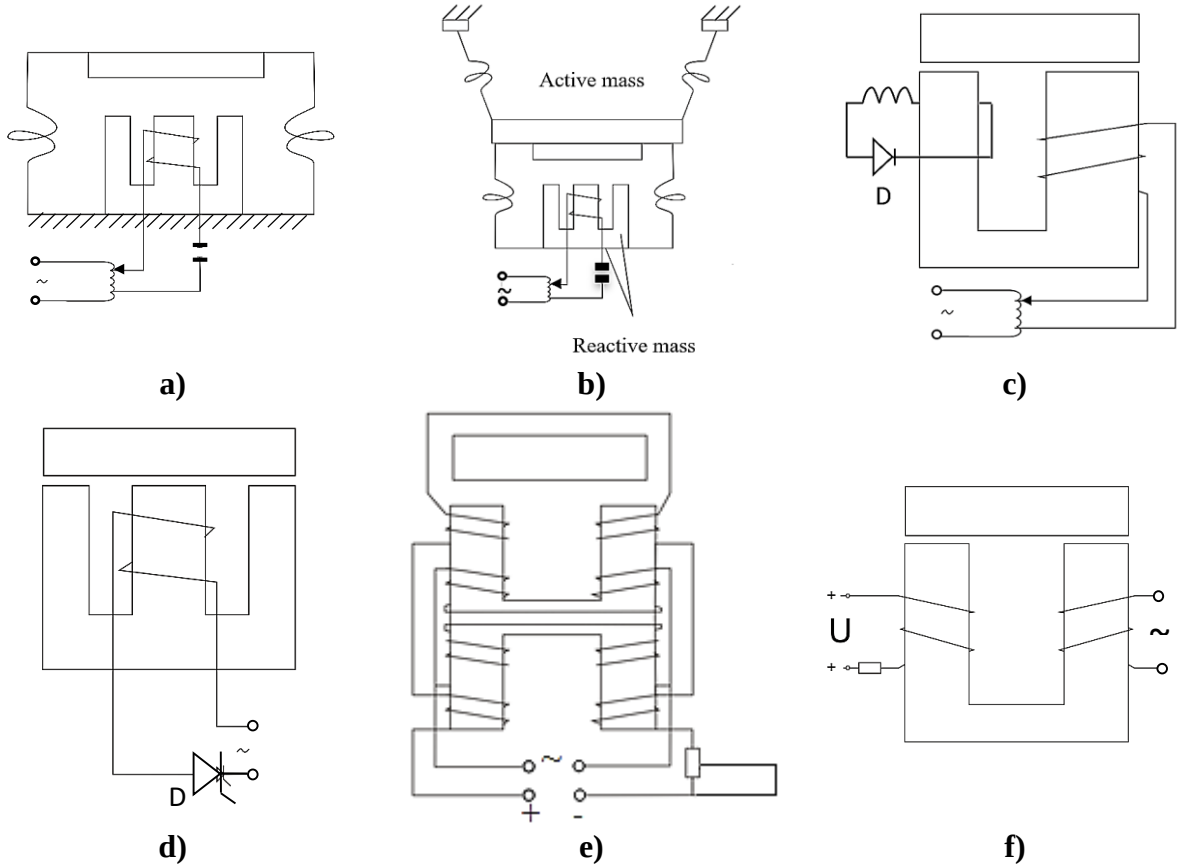


Fig. 2. Designs of the EMVE

Oscillations of autonomous EMS, or "self-oscillations," as they are called, arise and are maintained by a non-oscillatory energy source, and this source is included in the system (Fig. 3).

The energy supply from the source is regulated by the EMS itself via feedback devices (FB). The energy source in such a system is a constant EMF applied to the amplifier (A) (Fig. 3, c).

The second classification criterion is the power supply method. Non-autonomous electromagnetic vibration generators are divided into three groups based on their power supply method: autoparametric, reactive, and reactive with magnetization. The first group includes electromagnetic vibration generators with a series-connected capacitor and those powered by the grid (Fig. 2, a); the oscillation frequency of its armature is lower than the grid frequency. The second group consists of non-autonomous EMS with reactive EVVE. A reactive vibration exciter has a single winding to which an alternating voltage is applied (Fig. 2b). The third group is the most numerous: non-autonomous EMS with EVVE with magnetization. The magnetic core of such a vibration exciter is magnetized using a special circuit. Autonomous EMS can only have reactive EMVE with magnetization (Fig. 2, d, e, f). Their connection circuits are described in detail in [2].

The third classification criterion is the method of magnetic circuit biasing. Autoparametric and reactive magnetic circuits do not require biasing. For reactive magnetic circuits with biasing, many methods for generating direct current have been developed. The most common method is to use a winding for biasing. One possible connection diagram for this winding is shown in Fig. 2e. This diagram is used for both autonomous and non-autonomous EMS. For non-autonomous EMS without feedback, biasing with a diode (Fig. 2c) and a thyristor (Fig. 2d) is also used.

The fourth classification criterion is the type of feedback system. The feedback system is named based on the oscillation parameter of the mechanical working part of the electronic electronic system, the value of which is fed to the system input. Such a parameter may be phase magnitude, displacement, velocity, or oscillation acceleration. The vast majority of oscillatory EMS with EMVs used in industry do not have feedback.

The power supplies of some of them only have inputs for remote regulation of the AC voltage. Currently, EMS with EMVE, covered by feedback, are in the theoretical development stage and are not commercially available. Several circuit designs for non-autonomous EMS with feedback are known; all of them feature phase feedback.

According to the fifth classification criterion, EMC are divided depending on the parameter being regulated. This parameter can be the amplitude or frequency of the alternating supply voltage. Other parameters may include the thyristor's turn-on phase, natural frequency, bias voltage, and gap size. However, such regulation is only applicable to EMC without feedback.

Other features not included in the classification include the design of the EMVE (Fig. 2a-f): only the working part oscillates, while the magnetic circuit is rigidly attached to the foundation. The electromagnet of a push-pull vibration exciter consists of an H-shaped core, two anchors, and coils connected in a specific pattern (Fig. 2e).

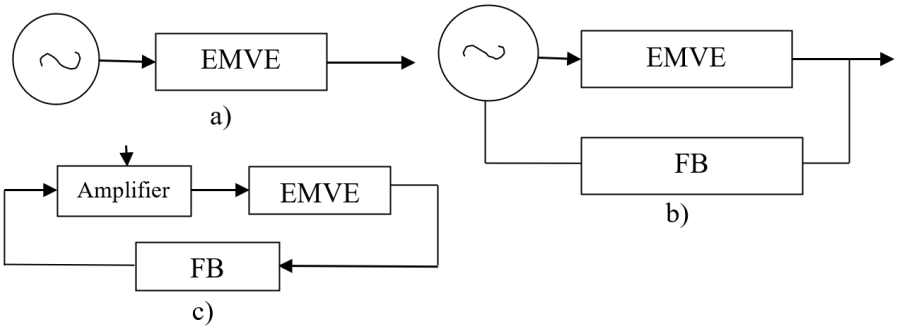


Fig. 3. Structural connections of EMS: a - non-autonomous EMS; b - non-autonomous EMS with feedback; c - Autonomous EMS.

The connections between individual features are shown in Fig. 1 by lines.

Conclusions

The proposed classification describes those features and relationships that make it possible to create practically useful feedback in oscillatory EMS.

The classification of oscillatory systems with electromagnetic vibration exciters brings clarity and order to the vast number of existing circuits and designs. It enables meaningful understanding and subsequent theoretical analysis.

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Rezyume: *Maqolada elektromagnitli titratgichlar tizimlari tuzilishi, turlari, ulanish sxemalari va guruhlari bo‘yicha klassifikatsiyalari tahlil qilingan va har xil turdagi teskari ulanishli boshqaruvchan elektromagnit titratgich sxemalarini tuzish mumkinligi ko‘rsatilgan.*

Резюме: *В статье проведен анализ признаков и групп колебательных электромагнитных вибровозбудителей и на его основании составлена классификация, позволяющая создавать управляемые электромагнитные вибровозбудители с обратной связью.*

Kalit so‘zlar: *elektromexanik, qo‘zg‘atgichlar, avtonom, teskari aloqa, tiristor, tebranish qo‘zg‘atgichlari.*

Ключевые слова: *электромеханические, возбудители, автономные, обратная связь, тиристор, вибрационные возбудители.*

IMPROVING THE QUALITY OF HIGH-OCTANE AUTOMOTIVE GASOLINE THROUGH OPTIMIZED BLENDING STRATEGIES AND THE USE OF FUNCTIONAL ADDITIVE PACKAGES

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Summary: *This study analyzes the technological process of producing high-octane automotive gasoline at an industrial blending station equipped for manufacturing AI-80, AI-91, AI-92, AI-95, AI-98 and premium QuWatt fuels. Real operational parameters were used, including component specifications, hydrotreatment requirements, flow-rate control settings, pump characteristics, and dosing ranges of multifunctional detergent additives. The research evaluates how optimized component ratios—reformate (up to 81.1%), light naphtha (15–20%), and butane (3–5%)—in combination with controlled additive introduction (200–2000 g/t), affect octane rating, vapor-pressure stability, oxidation resistance, and deposit-forming tendency. The findings confirm that precise blending supported by automated regulation systems significantly improves fuel performance, enhances long-term stability, and ensures compliance with national fuel standards.*

Key words: *high-octane gasoline, reformate, light naphtha, butane, detergent additives, QuWatt fuel, octane rating.*

Introduction

High-octane gasoline is obtained by mixing hydrocarbon components with different physicochemical properties. Reformate, characterized by high aromatic content and a high-octane number, is the main octane-enhancing component. Its role as a primary octane contributor due to aromatic concentration is repeatedly confirmed in research on gasoline surrogates and refinery blending models [1]. According to industrial specifications, reformate exhibits a boiling range of 35–215 °C and must undergo mandatory determination of octane number and copper strip corrosion performance.

Light naphtha is applied to adjust volatility and improve start-up behavior; its vapor pressure must remain below 100 kPa, and the end boiling point is limited to 85 °C. The importance of low-boiling hydrocarbons (C_5–C_6) in ensuring adequate volatility and cold-start performance is emphasized in studies on surrogate fuel formulation and distillation behaviour [2]. Butane, characterized by a saturated vapor pressure up to 1.6 MPa at 45 °C, is widely used to regulate seasonal vapor pressure and facilitate ignition, especially in winter formulations, which aligns with known effects of LPG components on vapor-pressure-controlled blending [3].

Modern formulations increasingly require multifunctional detergent additives with strict physicochemical limits. Experimental studies demonstrate that detergent additives at low concentrations significantly improve deposit control and injector cleanliness [4], while other work confirms substantial enhancements in oxidation stability and induction period performance due to multifunctional additive packages [5]. For example, additive packages used in premium fuels typically exhibit density around 0.868 kg/m³, viscosity near 43 mm²/s, freeze points below −30 °C, and complete miscibility with hydrocarbons. Their introduction at low concentrations (200–2000 g/t) substantially increases cleanliness of injectors, improves oxidative stability (raising induction period above 450 min), and reduces deposit formation, which is fully consistent with established deposit-control additive research.

To ensure accurate component proportioning and operational safety, blending stations utilize vertical steel tanks with pontoon systems, automated flow control via FFICA/FICA regulators, and precise dosing of butane and additives. This approach corresponds with modern refinery blending automation practices, where real-time flow control and correction loops are standard [6]. Storage volumes are based on a 36-hour reserve capacity, and all parameters — temperature, vapor pressure,

sulfur content, benzene fraction, and octane number — are monitored according to national and international fuel standards, consistent with global fuel quality management frameworks [7].

This study integrates real industrial specifications and peer-reviewed scientific findings to evaluate optimal blending strategies and the influence of detergent packages on high-octane fuel performance.

Materials and Methods

Raw Materials

Light Naphtha (Ts 16472899-022). Light naphtha was used as a volatility-adjusting component. Its key properties include:

- Density at 20 °C — determined, not standardized;
- End boiling point — up to 85 °C;
- Vapor pressure — ≤100 kPa;
- Total sulfur — not regulated.

These parameters correspond to the typical requirements for the naphtha fraction used in gasoline production.

Reformate (Ts 16472899-001). Reformate served as the primary octane-enhancing component. Its quality indicators include:

- Boiling range — 35–215 °C;
- Research octane number — mandatory measurement;
- Copper strip corrosion test — compliant.

Due to its high aromatic content, reformate forms the basis of high-octane gasoline blending.

Butane Fraction (Ts 16472899-011). Butane was applied to regulate seasonal vapor pressure. Its controlled parameters are:

- Propane content (C_3) — ≤5 %;
- Hydrogen sulfide (H_2S) — ≤0.003 %;
- Total mercaptan sulfur + H_2S — ≤0.013 %;
- Saturated vapor pressure at 45 °C — ≤1.6 MPa.

These limits ensure safe handling and compliance with gasoline vapor-pressure specifications.

Multifunctional Detergent Additives. A multifunctional detergent package was added at 200–2000 g/t, depending on the fuel grade. Key characteristics:

- Density — 0.868 kg/m³;
- Kinematic viscosity — 43 mm²/s at 20 °C;
- Freeze point — below −30 °C;
- Flash point — above 61 °C;
- Complete miscibility with hydrocarbons.

These additives enhance injector cleanliness, improve oxidation stability, and extend the induction period of gasoline.

Equipment and Process Organization

Storage Facilities

The blending station includes:

- Light naphtha tanks — 1000 m³ (RVS-47, RVS-48);
- Reformate tanks — 2000 m³ (RVS-49, RVS-50);
- Gasoline tanks — 1000–5000 m³ units;
- Butane storage — two horizontal insulated vessels (E-1, E-2), operating at 7–12 °C.

A 36-hour operational reserve was used for tank sizing.

Component Supply Lines and Flow Rates. Components are supplied to blending collectors via dedicated pipelines:

- Reformate — line 16-1;
- Light naphtha — line 17-1;
- Butane — line 18-1.

Industrial flow rates during blending are:

- Reformate — 140–155 m³/h;
- Light naphtha — 40–50 m³/h;
- Butane — 9–10 m³/h.

These values correspond to operational ranges for AI-91, AI-92, AI-95, and AI-98 gasoline grades.

Flow Control Equipment

Flow regulation is performed by pneumatic control valves of the FICA/FFICA series installed at key nodes of the blending system. Precise butane dosing ensures seasonal vapor-pressure compliance, while reformate flow allows octane adjustment.

Blending System

Blending occurs in common collectors for product preparation:

- AI-80 collector — connected to lines of 50–150 mm diameter;
- Higher grades (AI-91/92/95/98) — blended through pipelines up to 150 mm.

Analytical Methods

- *Octane Number (RON/MON)* — measured according to national fuel standards. Both Research Octane Number (RON) and Motor Octane Number (MON) are determined using standardized test engines to ensure correct blending and performance characteristics.
- *Induction Period* — ≥450 min for gasoline, determined by oxidation stability tests to assess resistance to gum formation and aging.
- *Sulfur Content* — measured with mg/kg accuracy, using methods such as X-ray fluorescence (XRF) or coulometric titration, to comply with environmental and quality requirements.
- *Vapor Pressure (RVP/IPP)* — measured seasonally:
  - Summer: 35–80 kPa
  - Winter: 35–100 kPa

Determined using standardized methods (e.g., ASTM D323 or equivalent) to ensure safe handling and compliance with volatility specifications.

- *Fractional Composition, Benzene Content, Oxygenates, Residuals, Gum Content* — determined according to technical specifications, using standard laboratory methods such as distillation, gas chromatography, and gravimetric analysis.

Results

Real Component Ratios. Actual industrial blending ratios (based on operational tables):

AI-91 / AI-92

- Reformate: 77%
- Light naphtha: 17.8%
- Butane: 5.2%
- Additives: 200–500 g/t

AI-95 / AI-98

- Reformate: 81.1%
- Light naphtha: 15%
- Butane: 3.9%
- Additives: 500–2000 g/t

QuWatt-95

- Reformate: 75–80%
- Naphtha: 15–20%
- Butane: 3–5%
- Additives: ≥500 g/t

These ratios reflect mandatory optimization, performed based on laboratory control of the quality of each individual component. Table 1 summarizes the typical component ratios used for high-octane gasoline production.

Table 1

Typical Component Ratios for High-Octane Gasoline Production

Fuel grade	Reformate (%)	Light naphtha (%)	Butane (%)	Additive (g/t)
AI-91	77	17.8	5.2	200–500
AI-92	77	17.8	5.2	200–500
AI-95	81.1	15	3.9	500–2000
AI-98	81.1	15	3.9	500–2000
QuWatt-95	75–80	15–20	3–5	≥500

Impact of Additives

Premium QuWatt fuels include detergent additive packages with the following proven effects:

- Reduction of injector and valve deposits;
- Increased oxidative stability (induction period >450 min);
- Cleaner fuel system surfaces (no deviation in copper-corrosion class);
- Enhanced combustion efficiency due to cleaner nozzles;
- Corrosion protection via PAV components.

Operational Parameters Influencing Fuel Quality

Based on real station data, the following operational parameters affect fuel quality:

- Component storage temperature: 20–40 °C;
- Butane vessel temperature: 7–12 °C;
- Pressure regulation in butane tanks: 0.2–0.4 MPa;
- Reformate pump discharge pressure: up to 0.8 MPa;
- Naphtha pump discharge pressure: 1.25 MPa;
- Flow rates during blending:
  - Reformate: 112–168 m³/h;
  - Naphtha: 40–60 m³/h;
  - Butane: 9–10 m³/h.

These conditions directly influence vapor pressure, octane stability, and overall compliance with fuel standards.

Discussion

Efficient production of high-octane gasoline requires the integration of several key factors:

1. Stable quality of feed components

- Reformate determines the octane level and must comply with strict limits for aromatic content and copper corrosion.
- Light naphtha ensures the required volatility and adequate winter engine performance.
- Butane requires precise dosing to prevent exceeding seasonal vapor pressure limits.

2. Accurate process control

- Flow regulation is automated via calibrated pneumatic valves.
- Butane dosing is seasonally adjusted to maintain vapor pressure within regulatory limits.
- Continuous monitoring of tank levels prevents dry-run conditions of pumps and ensures blending accuracy.

3. Influence of additive dosing

Even small additive concentrations (0.02–0.2 %) yield measurable improvements:

- Improved deposit control in injectors and valves;
- Enhanced oxidation resistance;
- Higher engine efficiency;
- Cleaner combustion and reduced emissions.

4. Compliance with national standards

All blended fuels are verified to meet requirements for:

- RON/MON ratings;
- Induction period;

- Benzene and sulfur content;
- Vapor pressure (seasonal limits);
- Oxygenate content;
- Distillation curves.

Practical Recommendations

1. Maintain reformate proportion at ≥77 % to ensure octane stability.
2. Increase detergent additive dosing to ≥500 g/t for premium formulations such as QuWatt.
3. Regulate butane content seasonally to comply with RVP/IPP limits.
4. Perform frequent calibration of flow meters (diaphragms).
5. Enhance laboratory monitoring of sulfur, benzene, vapor pressure, and gum content.
6. Use tank circulation to correct quality deviations, particularly for octane number.

Conclusions:

The study demonstrates that high-octane gasoline production through controlled blending of reformate, light naphtha, butane, and multifunctional detergents ensures stable and high-quality fuel performance. Real industrial data confirm that the optimization of component ratios—combined with precise additive dosing and automated process control—significantly improves fuel stability, engine cleanliness, octane value retention, and compliance with environmental and technical standards.

The presented blending models can be applied at similar industrial facilities to enhance production reliability, energy efficiency, and environmental safety.

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Rezyume: *Ushbu tadqiqot AI-80, AI-91, AI-92, AI-95, AI-98 va premium QuWatt yoqilg'ilarini ishlab chiqarishga mo'ljallangan sanoat aralashtirish qurilmasida yuqori oktanli avtomobil benzinlarini ishlab chiqarish texnologik jarayonini tahlil qiladi. Tadqiqotda komponentlar xususiyatlari, gidrotozalash talablari, oqim tezligini boshqarish parametrlari, nasoslar xarakteristikalari va ko'p funksiyali yuvuvchi qo'shimchalarni dozalash diapazonlari kabi haqiqiy ishlab chiqarish ko'rsatkichlaridan foydalanilgan. Izlanishda komponentlarning maqbullashtirilgan nisbatlari - reformat (81,1% gacha), yengil nafta (15-20%) va butan (3-5%) - nazorat qilinadigan qo'shimchalar kiritish (200-2000 g/t) bilan birgalikda oktan soniga, bug' bosimi barqarorligiga, oksidlanishga chidamliligiga va cho'kindi hosil bo'lish tendensiyasiga qanday ta'sir ko'rsatishi baholanadi. Natijalar shuni ko'rsatadiki, avtomatlashtirilgan boshqaruv tizimlari yordamida amalga*

oshirilgan aniq aralashtirish yoqilg‘i sifatini sezilarli darajada yaxshilaydi, uning uzoq muddatli barqarorligini oshiradi va milliy yoqilg‘i standartlariga muvofiqligini ta’minlaydi.

Резюме: *В данном исследовании анализируется технологический процесс производства высокооктанового автомобильного бензина на промышленной станции смешения, предназначенной для выпуска бензинов марок АИ-80, АИ-91, АИ-92, АИ-95, АИ-98 и премиального топлива QuWatt. В работе использованы реальные эксплуатационные параметры, включая характеристики компонентов, требования к их гидроочистке, настройки регулирования расхода, параметры насосного оборудования и диапазоны дозирования многофункциональных моющих присадок. Оценено влияние оптимизированных соотношений компонентов — риформата (до 81,1%), лёгкой нафты (15–20%) и бутана (3–5%) — в сочетании с контролируемым введением присадок (200–2000 г/т) на октановое число, стабильность давления паров, устойчивость к окислению и склонность к образованию отложений. Результаты подтверждают, что точное смешение, поддерживаемое автоматизированными системами регулирования, существенно улучшает эксплуатационные характеристики топлива, повышает его долговременную стабильность и обеспечивает соответствие национальным стандартам качества топлива.*

Kalit so‘zlar: *yuqori oktanli benzin, reformat, yengil nafta, butan, tozalovchi qo‘shimchalar, QuWatt yonilg‘isi, oktan ko‘rsatkichi.*

Ключевые слова: *высокооктановый бензин, риформат, лёгкая нафта, бутан, моющие присадки, топливо QuWatt, октановое число.*

SYNTHESIS AND CHARACTERISTICS OF SURFACTANTS USED AS EMULSIFIER IN DRILLING SOLUTIONS

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Summary: *This article emphasizes that as drilling depth increases and geological conditions become more complex, ensuring the stability and rheological properties of emulsion drilling fluids becomes a serious technical challenge that directly affects drilling efficiency and the operational characteristics of wells. In this regard, the development of new composite emulsifiers that provide increased resistance of invert emulsions to thermal and electrolytic effects is an urgent task.*

To address this problem, it is necessary to optimize the composition of emulsifiers, study the mechanisms of their interaction with the dispersion medium, and develop industrial-scale production technologies that increase the stability and functionality of drilling fluids. Currently, scientific research is being conducted worldwide to create new stabilizing additives and emulsifiers—surfactants based on local raw materials—to improve the rheological properties of emulsion drilling fluids.

Key words: *surfactants, ethanolamide (EA), ethanolamide of technical fatty acids (TFAEA), infrared spectroscopy (IR) spectroscopy.*

INTRODUCTION

When creating invert emulsions for drilling fluids, the choice of a hydrocarbon dispersion medium is a key factor. Base oils used as a dispersion phase significantly influence the rheological properties of drilling fluids, system stability, environmental safety, and technological efficiency. The chemical nature of hydrocarbons determines their viscosity, wetting ability, interaction with surfactants, and resistance to thermal and mechanical loads [1–2].

Modern invert emulsions are often based on synthetic and mineral oils, diesel fuel, as well as hydrocarbons with a controlled molecular composition. The use of synthetic hydrocarbons improves environmental performance by reducing the content of aromatic compounds and toxic impurities in drilling fluids. At the same time, mineral oils and diesel fuel exhibit high compatibility with various surfactants, which ensures effective stabilization of emulsions [3–4].

The foundation of an effective emulsion drilling fluid is surfactants, which play a key role in stabilizing emulsions and regulating their structural and mechanical properties. Current research is focused on developing new emulsifiers with improved rheological properties, high resistance to thermobaric effects, and adaptability to various chemical reagents. One promising direction is the development of surfactants based on technical fatty acids obtained from renewable raw materials, which not only improves the operational properties of drilling fluids but also reduces their environmental impact [6–7].

Emulsion drilling fluids are widely used in the oil and gas industry due to their ability to ensure borehole stability, reduce filtration losses, and improve lubricating properties. Their use is especially relevant in complex geological conditions where minimizing clay hydration and preventing wellbore instability is critical [7–8].

EXPERIMENTAL SECTION

One promising direction is the development of surfactants based on technical fatty acids obtained from renewable raw materials, which improves the operational properties of drilling fluids while reducing their environmental load. The synthesis of ethanolamide with high efficiency from technical fatty acids was carried out by water removal using the azeotropic distillation method with a phosphoric acid catalyst (NaH_2PO_4) and toluene. This approach allows lowering the reaction temperature, accelerating the process, and increasing the yield of the target product.

A calculated amount of technical fatty acids was loaded into a mixing reactor, and 1–3% (by mass) sodium phosphate (NaH_2PO_4) was added as a catalyst. Then, with constant stirring, monoethanolamine was introduced in a slightly excess amount (1.05–1.1 mol per 1 mol of fatty acid).

To initiate the amidation process, the reaction mixture was heated to 100–110°C. The temperature was then gradually raised to 130–140°C, while water release was monitored. To efficiently remove the produced water, toluene was introduced into the system in an amount of 15–20% of the reaction mixture mass. Toluene forms an azeotrope with water, which is distilled at 110–120°C through a distillation column. The condensate was fed into a phase separator, where the organic layer was returned to the reactor and the aqueous phase removed.

The process continued for 3–4 hours at 130–140°C until the acid number decreased to below 5 mg KOH/g, confirming reaction completion. Afterwards, toluene was removed by vacuum evaporation at 80–90°C.

$$RCOOH + NH_2(C_2H_4OH) \rightarrow RCONH(C_2H_4OH) + H_2O$$

The obtained ethanolamide was cooled to 80–100°C, and any residual acid mixture was neutralized with a sodium hydroxide solution (0.5–1% by mass). The product was then filtered to remove mechanical impurities. The final product is a viscous liquid or paste with high solubility in hydrocarbons and partial solubility in water.

Using NaH_2PO_4 as a catalyst reduces the amidation temperature and accelerates the process, while azeotropic distillation with toluene effectively removes water, preventing ethanolamide decomposition.

The synthesis of a surfactant composition for drilling-fluid emulsifiers was carried out in a thermostated jacketed reactor (1000 cm^3) equipped with a mixer, reflux condenser, and reagent dosing system. Ethanolamide of technical fatty acids (400 g) was loaded into the reactor and preheated to 60–70°C to ensure complete dissolution.

During intensive mixing, 100 g of a concentrated $MgSO_4$ solution (26% at 60°C) was added. The choice of magnesium sulfate is due to its ability to modify the adsorption layer structure and enhance emulsion stability through ionic interactions. As a divalent cation, magnesium strengthens intermolecular bonds between polar surfactant groups, reduces their solubility in the aqueous phase, and promotes better fixation at the interface. This is especially important for stabilizing invert emulsions by reducing droplet coalescence. $MgSO_4$ also regulates viscosity by forming structural interactions with ethanolamide and oxyethylated components.

After complete dissolution of $MgSO_4$, an oxyethylated component (30 g)—a commercially available oxyethylated nonylphenol ("Neonol")—was added at 300–500 rpm to ensure uniform distribution. The temperature was maintained at 50–60°C to prevent thermal degradation.

The next stage involved adding sulfanol (MAX LUXE SERVICE), a highly hydrophilic commercial product. It was introduced gradually (80 g over 15–20 minutes) under constant stirring. To stabilize the composition, small amounts of weak acids or bases were added as needed, maintaining pH within 6.5–8.0.

After all components were added, the mixture was kept at 50°C for 30–40 minutes for homogenization. It was then cooled to 30°C and purified by vacuum degassing to remove volatile impurities and increase storage stability. The final composition was poured into glass or polymer containers. The resulting product is a homogeneous viscous liquid free of sediment and mechanical impurities, suitable for use as a drilling-fluid emulsifier.

RESULTS AND THEIR DISCUSSION

IR spectroscopy is one of the main methods for structural analysis of synthesized surfactants, allowing identification of functional groups and the nature of chemical bonds. The method is based on the absorption of infrared radiation by molecules, resulting in vibrational transitions characteristic of various structural fragments.

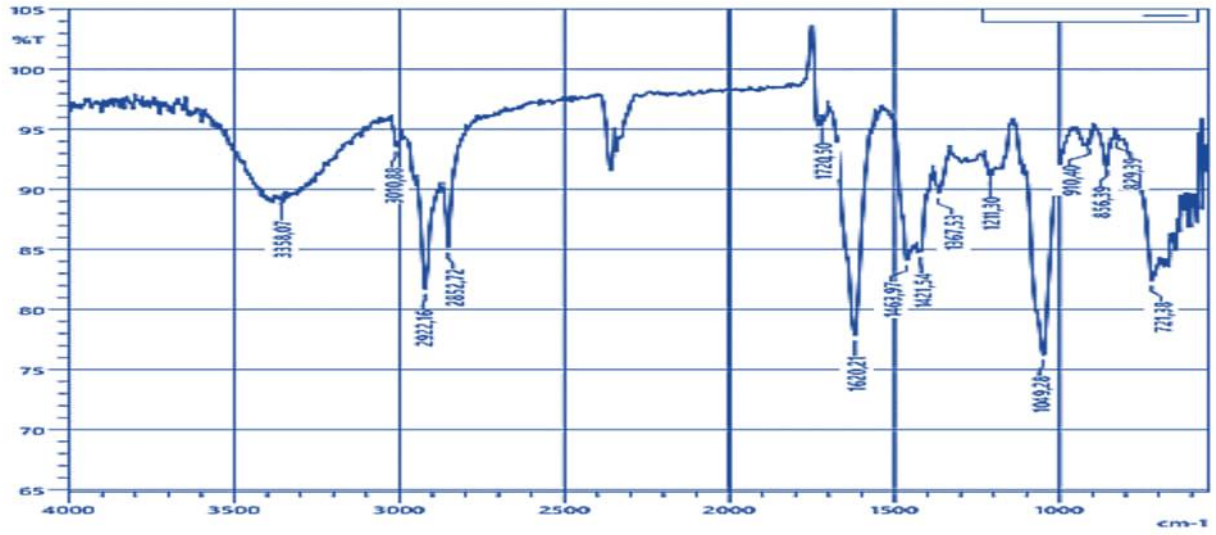


Figure 1. IR spectra of the synthesized surfactants: 1) TFAEA;

The IR spectrum of the synthesized TFAEA makes it possible to identify the main functional groups that confirm its chemical structure. In the region of 3380 cm^{-1}, an intense absorption band is observed, corresponding to the stretching vibrations of hydroxyl (–OH) and amide (–NH) groups, which confirms the presence of ethanolamine residues. The band at 3100 cm^{-1} is associated with associated amide groups or hydroxyl groups involved in hydrogen bonding. The band at 2921–2852 cm^{-1} is characteristic of the stretching vibrations of C–H bonds in alkyl chains of fatty acids and indicates the preservation of the hydrocarbon skeleton of the molecule.

The absorption band at 1724 cm^{-1} corresponds to the stretching vibrations of the carbonyl (C=O) group, confirming the presence of amide structures. The band at 1622 cm^{-1} corresponds to deformation vibrations of the N–H group of the amide fragment, while peaks in the region of 1465–1375 cm^{-1} may be associated with vibrations of C–N and CH_2 groups. Intense bands in the region of 1245–1050 cm^{-1} indicate the presence of C–O and C–N bonds characteristic of ethanolamide structures.

As a result of the research, a method for synthesizing a composition of emulsifiers for emulsion drilling fluids—including ethanolamide of technical fatty acids and additional surfactants—was substantiated and implemented. The composition of the technical fatty acids used as the raw material was analyzed, and their qualitative and quantitative composition was determined.

CONCLUSION

As a result of the conducted research, a method for synthesizing a composition of emulsifiers for emulsion drilling fluids, including ethanolamide of technical fatty acids and surfactants, was substantiated and successfully implemented. Based on the study of the research objects, the composition of technical fatty acids—the initial raw material—was analyzed, and their qualitative and quantitative characteristics were determined.

Chromatographic analysis made it possible to determine the percentage of individual fatty acids in the mixture and calculate their average molecular weight. This allowed an assessment of the properties of the raw materials and optimization of the synthesis conditions to ensure maximum yield and purity of ethanolamide.

A synthesis method for ethanolamide was developed with optimized reaction parameters, resulting in a high degree of conversion to the target product. In addition to ethanolamide, a surfactant composition containing oxyethylated and sulfonated components, as well as magnesium salt, was synthesized.

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Rezyume: *Ushbu maqolada ta'kidlanishicha, burg'ulash chuqurligining oshishi va geologik sharoitlarning murakkablashishi bilan emulsion burg'ilash eritmalarining barqarorligi va reologik xususiyatlarini ta'minlash jiddiy texnik vazifaga aylanib bormoqda, bu esa burg'ilash samaradorligi va quduqlarning ekspluatatsion xususiyatlariga bevosita ta'sir ko'rsatadi. Bu borada, invertirlangan emulsiyalarning termik va elektrolitik ta'sirlarga chidamliligini oshirishni ta'minlaydigan yangi kompozitsion emulgatorlarni ishlab chiqish dolzarb vazifalardan hisoblanadi.*

Ushbu muammoni hal qilish uchun emulgatorlar tarkibini optimallashtirish, ularning dispersion muhit bilan o'zaro ta'sir mexanizmlarini o'rganish va burg'ulash eritmalarining barqarorligi va funksionalligini oshiradigan sanoat ishlab chiqarish texnologiyalarini ishlab chiqish zarur. Hozirgi kunda jahonda emulsion burg'ilash eritmalarining reologik xossalarini yaxshilash uchun mahalliy xomashyolar asosida yangi turg'unlashtiruvchi qo'shimchalar va emulgatorlar - sirt faol moddalar yaratish bo'yicha ilmiy izlanishlar olib borilmoqda.

Резюме: *В данной статье подчеркивается, что по мере увеличения глубины бурения и усложнения геологических условий обеспечение стабильности и реологических свойств эмульсионных буровых растворов становится серьезной технической задачей, которая напрямую влияет на эффективность бурения и эксплуатационные характеристики скважин. В связи с этим разработка новых композиционных эмульгаторов, обеспечивающих повышенную стойкость инвертированных эмульсий к термическим и электролитическим эффектам, является актуальной задачей.*

Для решения этой проблемы необходимо оптимизировать состав эмульгаторов, изучить механизмы их взаимодействия с дисперсионной средой и разработать промышленные технологии производства, повышающие стабильность и функциональность буровых растворов. В настоящее время во всем мире ведутся научные исследования по созданию новых стабилизирующих добавок и эмульгаторов - поверхностно-активных веществ на основе местного сырья для улучшения реологических свойств эмульсионных буровых растворов.

Kalit so'zlar: *SFM - sirt faol modda, EA - etanolamin, TYKEA - texnik yog' kislotalarining etanolamidi, IQ- infraqizil spektroskopiya*

Ключевые слова: *ПАВ – поверхностно-активное вещество, ЭА – этаноламин, ЭАТЖК – этаноламид технических жирных кислот,ИК- инфракрасная спектроскопия*

PROBLEMS OF SEGMENTATION IN THE TASKS OF RECOGNIZING KARAKALPAK TEXT

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Summary: *This article examines the key issues of the segmentation stage in the OCR conveyor for the Karakalpak language in Cyrillic. Specific problems related to the peculiarities of the language's graphics, such as the abundance of diacritical marks, the overlap of symbols in italics, and the low quality of the original images of archival documents, were identified and systematized. Within the framework of the study, a representative dataset of Karakalpak texts was formed, and comparative testing of classical (projection analysis, contour analysis) and modern neural network (U-Net) segmentation methods was conducted. Quantitative results confirmed the low efficiency of classical algorithms (F1-score ~0.55-0.75) and the high effectiveness of the adapted U-Net model (F1-score up to 0.92). A conclusion was made about the prospects of in-depth learning to create robust OCR solutions for the Karakalpak language.*

Key words: *optical character recognition (OCR), segmentation, Karakalpak language, diacritical marks, deep learning, U-Net, image processing.*

Introduction. Digital transformation is one of the priority areas for the development of modern society. In this context, the task of preserving, processing, and ensuring access to textual heritage in national languages is of particular importance. For the Karakalpak language, which is the state language of the Republic of Karakalpakstan within Uzbekistan, the creation of effective OCR technologies is not only a step towards digitalization but also an important tool for preserving cultural and linguistic identity.

A typical OCR conveyor consists of several sequential stages: image pre-processing, segmentation (lines, words, symbols), feature extraction, symbol classification (self-recognition), and post-processing [1]. Numerous studies show that the segmentation stage is one of the most critical: errors made at this stage are transmitted and multiplied in subsequent stages, ultimately leading to a catastrophic decline in the overall accuracy of the system [2]. This is especially true for languages with non-standard or complex graphics.

The Karakalpak language, which uses the Cyrillic graphic base, has a unique set of graphic features that create significant obstacles for segmentation algorithms developed primarily for Russian or English languages. The presence of numerous diacritical marks, the specificity of italics, and often the low quality of digitized historical documents form a complex of problems requiring special study.

The purpose of this study is to identify, classify, and experimentally evaluate specific problems in the segmentation of the Karakalpak text, as well as to conduct a comparative analysis of the effectiveness of classical and neural network methods for overcoming them.

1. Problem statement: The specifics of Karakalpak graphics as a challenge for segmentation.

The Karakalpak alphabet based on Cyrillic includes 33 letters of the Russian alphabet and 9 additional specific symbols: ә, ң, h, ө, ү, i, Ь, ө, ғ. It is precisely this feature that gives rise to most problems.

1.1. Problem caused by diacritical marks.

Diacritical marks (uppercase and lowercase elements) are used to denote specific phonemes. This leads to the following challenges for segmentation:

Merging the diacritic with the main symbol: When printing, especially in low resolution or degradation conditions, the diacritical mark (for example, the dot above "i," "ү" or the tail at "ң") often physically merges with the main symbol. As a result, binarization and contour analysis algorithms perceive such a construction as a single, but complex, coherent component, making it difficult for subsequent normalization and classification.

False segmentation and fragmentation of symbols: Algorithms based on the analysis of vertical projections (Vertical Projection Profile) search for "spaces" - areas with zero or minimal pixel density - to determine the boundaries between symbols. However, the diacritics located separately from the main body of the symbol (as in "ө," "ү") create additional local minimums in the projection. This misleads the algorithm, forcing it to mistakenly "cut" one character into two or even three parts (for example, separately the left diacritic, separately the main part).

The problem of identifying the baseline: Diacritical marks located above the upper line of the line (as in "ў") or below the baseline (as a substring element in "h") distort the overall geometric model of the line. This hinders the correct alignment of symbols and the determination of their support lines, which is an important preparatory step for many segmentation algorithms.

1.2. The problem of italics and handwriting.

Cursive writing predominates in archival documents, books, and manuscripts. For the Karakalpak text, this creates a double problem:

Increasing the sticking effect: In cursive, adjacent symbols are often connected to each other through ligatures and connecting strokes. When such a connecting stroke connects the base symbol and its diacritic or two symbols with diacritics, a complex, difficult-to-separate structure is formed. Classic methods, such as finding bending points or analyzing depressions in projection, often fail to cope with such cases [3].

Writing variability: The writing of the same symbols in a manuscript text varies greatly from person to person. Diacritical marks can be omitted, shifted, or drawn in different sizes, making it impossible to create universal segmentation templates.

1.3. The problem of low quality of source images.

A significant portion of the Karakalpak textual heritage exists in the form of old newspapers, magazines, and books, the print quality of which is far from ideal. Typical artifacts include:

Heterogeneous filling: The settling of typographic ink, creating "broken" and discontinuous contours of symbols.

Background noise: Spots, paper yellowing, scratches that can be mistakenly taken as part of a symbol or, conversely, "break through" its contour.

Low resolution (DPI): Leads to the loss of small details, such as points above "i" or "v," making them indistinguishable for the algorithm.

2. Research Methodology

For a comprehensive study of the identified problems, the following methodology was developed.

2.1. Database Formation

A representative dataset "KaraKalpakText-Seg v1.0" was created, which includes three main categories:

1. Modern printed texts (150 images): Texts typed in text editors using Times New Roman, Arial fonts and the specialized Karakalpak "Qaraqalpaq Times" font. Variability was ensured by changing the size (10-16 pt) and resolution (200-300 DPI).

2. Historical/archival documents (100 images): Scans of newspaper strips ("Yerkin Karakalpakstan") and book pages from the 60s-80s. This category is characterized by medium and high noise levels, and heterogeneous filling.

3. Handwritten texts (50 images): Samples written by 10 different people on white unlined paper, with subsequent scanning.

Each image in the dataset was marked using the LabelImg tool. The marking included:

Word-level:Rectangular bounding boxes for each word.

Character-level: Limiting frames for each individual symbol, including diacritical marks as an integral part of the symbol.

The total number of marked symbols was ~4500 copies.

2.2. Methods of segmentation selected for comparative analysis

Three representative methods covering classical and modern approaches were chosen for the experiments.

Method 1: Segmentation based on projection analysis.

Algorithm: After preliminary processing (binary interpolation, Otsu binarization, morphological noise elimination operations), a vertical projection profile (sum of pixel intensities for each image column) was constructed. Symbol boundaries were defined as local minimums (cavities) in this profile. Profile smoothing using the Gauss filter was used to combat diacritics. Figure 1.



Character boundaries found: 7

Boundary positions: [7 57 81 102 150 174 217]

Expectations: High speed, but low accuracy in text with diacritics and italics.

Method 2: Segmentation based on contour analysis (Connected Components Analysis).

Algorithm: Connected components (contours) were highlighted in the binary image. Then, a series of heuristic rules were applied to filter noise and combine components presumably belonging to a single symbol (for example, based on proximity and alignment along the base line). Horizontal projection analysis was used to find the base line.

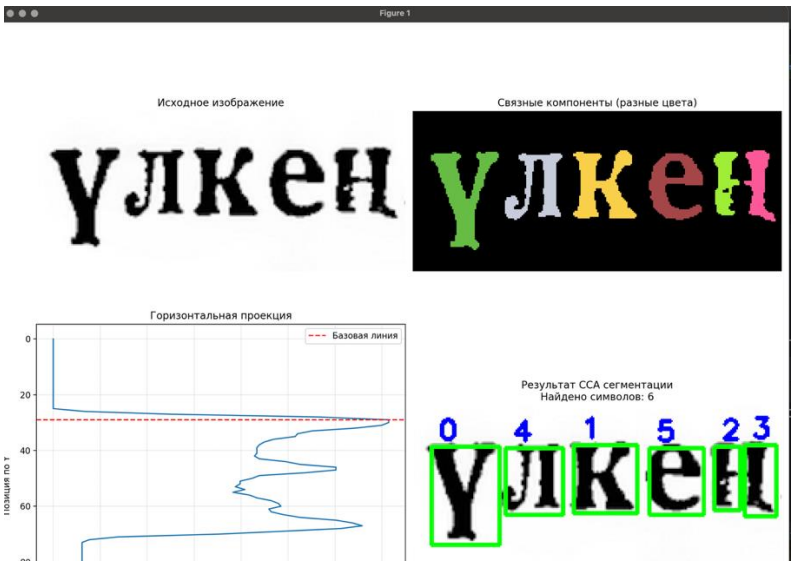


Figure 2.

After filtration, 6 components remained:

After merging: 6 characters

Segmentation details:

Symbol 0: x=12, y=27, w=45, h=65, area=2925

Symbol 1: x=106, y=26, w=42, h=45, area=1890

Symbol 2: x=199, y=27, w=17, h=42, area=714

Symbol 3: x=219, y=26, w=21, h=47, area=987

Expectations: High resistance to diacritics in clean images, but sensitivity to noise and sticking.

Method 3: Neural network semantic segmentation (U-Net Model).

Architecture: A classical U-Net architecture [4] consisting of an encoder (compression path, 5 levels) and a decoder (expansion path, 5 levels) with skip-connections was used. The encoder was initiated by pre-trained weights on ImageNet (backbone - VGG16).

Training: The model was further trained on our dataset. The input images were scaled to 256x256 pixels. The model's output was a pixel mask, where each pixel belonged to one of the three classes: "Background," "Text," "Symbol Boundary." After receiving the mask, the Watershed algorithm was used to highlight individual symbols. Figure 3.



Symbols were found using the U-Net + Watershed method: 5

Comparison of methods:

1. Projection analysis: 7 characters
2. Connected Components: 6 characters
3. U-Net + Watershed: 5 characters

Expectations: The highest accuracy due to the model's ability to learn complex spatial relationships and ignore noise.

2.3. Evaluation metrics

To quantitatively compare the methods, the following metrics were used at the symbolic level:

Precision: The proportion of correctly segmented symbols among all identified by the algorithm.

Recall (Fullness): The proportion of correctly identified symbols in the total number of symbols in the ground truth markup.

F1-score (F-measure): The harmonic mean between Precision and Recall.

Intersection over Union (IoU): The area of the predicted and ground truth limiting frame intersection divided by the area of their union. The symbol was considered correctly segmented at IoU > 0.7.

3. Results and discussion

The results of the experimental comparison of the methods are presented in Table 1.

Table 1. Comparative results of the effectiveness of segmentation methods (F1-score, %)

Dataset category	Projection Method	Contour analysis	U-Net
Printed texts (quality)	75.2	81.5	92.1
Historical documents	55.8	65.3	85.4
Handwritten texts	48.1	58.9	79.7

3.1. Analysis of errors of classical methods

The projection method showed the worst results in all data categories. Qualitative analysis revealed that >65% of errors were directly related to the diacritical marks. The algorithm consistently

"cut" the "ң," "ө," "ү" symbols into 2-3 parts. In manuscript texts, due to irregular spaces between symbols, the method often completely lost word boundaries.

The contour analysis proved to be more robust for diacritics in pure printed texts, correctly identifying the diacritic and the main symbol as a single component. However, on noisy historical documents, adjacent symbols merged into one component, and, conversely, symbols were broken due to printing defects. The heuristic rules for post-processing have shown their limitations and the need for fine-tuning to each type of noise.

3.2. Effectiveness of the neural network approach

The U-Net model demonstrated a statistically significant advantage over classical methods. Analysis of the masks predicted by the model showed that she had successfully learned:

1. Ignore background noise and small artifacts.

2. It is correct to highlight characters with diacritics as unified whole objects, despite the fact that there is a gap between the diacritic and the main body of the symbol in the original image.

3. Separate the sticky symbols in italics by learning from complex examples.

3. Qualitative analysis of residual errors

Despite the high results, U-Net also made mistakes, mainly in the most difficult cases:

Strong physical sticking of 3 or more characters in handwritten texts.

Ink droplets or large spots located close to symbols, which the model sometimes interpreted as part of the text.

Conclusion. During the research, the stated goal was achieved: the problems of segmentation of the Karakalpak text were comprehensively studied and experimentally evaluated. It has been confirmed that the main challenges are related to the graphic features of the language - the abundance of diacritical marks and the prevalence of italic writing in archival materials.

It has been experimentally established that classical segmentation methods (projection analysis, contour analysis) are inadequate for solving the set task, demonstrating low accuracy (F1-score from 48% to 82%) and a high dependence on the input image quality.

As a solution, a deep learning-based approach using the U-Net architecture was proposed and validated. It has been shown that this model is capable of effectively teaching the specifics of Karakalpak graphics, demonstrating high and stable accuracy (F1-score from 80% to 92%) for all data types.

The practical significance of the work lies in:

1. Creation of the first publicly available marked dataset for segmentation of the Karakalpak text.

2. Prove the applicability of modern computer vision methods for low-resource OCR tasks.

3. Defining a clear direction for further research: developing end-to-end neural network recognition systems that take into account the identified features at all stages of the conveyor.

The prospects for further research include expanding the dataset, experimenting with other architectures (e.g., Transformer-based segmentation models), and integrating the proposed segmentation method into a full-fledged OCR system for the Karakalpak language.

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Rezyume: *Ushbu maqolada kirill alifbosidagi qoraqalpoq tili uchun belgilarni optik tanib olish (OCR) konveyerida segmentatsiya bosqichining asosiy muammolari ko‘rib chiqiladi. Til grafikasi xususiyatlari bilan bog‘liq o‘ziga xos muammolar, masalan, diakritik belgilarning ko‘pligi, kursiv yozuvda belgilarning bir-biriga yopishib qolishi va arxiv hujjatlarining asl tasvirlari sifatining pastligi aniqlandi va tizimlashtirildi. Tadqiqot doirasida qoraqalpoq matnlarining reprezentativ ma’lumotlar to‘plami shakllantirildi, segmentlashning klassik (proyeksiyalar tahlili, konturli tahlil) va zamonaviy neyron tarmoq (U-Net) usullari qiyosiy testdan o‘tkazildi. Miqdoriy natijalar klassik algoritmlarning past samaradorligini (F1-score ~0.55-0.75) va moslashtirilgan U-Net modelining yuqori samaradorligini (F1-score 0.92 gacha) tasdiqladi. Qoraqalpoq tili uchun kuchli OCR yechimlarini yaratish uchun chuqur o‘rganish istiqbolli degan xulosaga kelindi.*

Резюме: *В данной статье рассматриваются ключевые проблемы этапа сегментации в конвейере оптического распознавания символов (OCR) для каракалпакского языка на кириллице. Выявлены и систематизированы специфические challenges, связанные с особенностями графики языка, такие как обилие диакритических знаков, слипание символов в курсивном начертании и низкое качество исходных изображений архивных документов. В рамках исследования был сформирован репрезентативный датасет каракалпакских текстов, проведено сравнительное тестирование классических (анализ проекций, контурный анализ) и современного нейросетевого (U-Net) методов сегментации. Количественные результаты подтвердили низкую эффективность классических алгоритмов (F1-score ~0.55–0.75) и высокую результативность адаптированной модели U-Net (F1-score до 0.92). Сделан вывод о перспективности глубокого обучения для создания robust-ных OCR-решений для каракалпакского языка.*

Kalit so‘zlar: *belgilarni optik aniqlash (OCR), segmentlash, qoraqalpoq tili, diakritik belgilar, chuqur o‘rganish, U-Net, tasvirlarni qayta ishlash.*

Ключевые слова: *оптическое распознавание символов (OCR), сегментация, каракалпакский язык, диакритические знаки, глубокое обучение, U-Net, обработка изображений.*

FUNDAMENTAL REFORMS IN THE BUILDING MATERIALS INDUSTRY

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Summary: *This article provides information about local construction materials, the President's decrees on the localization of construction materials, and the work being carried out in this area. The implementation of investment projects aimed at localization, meeting domestic demand, and optimizing imports will result in expanding the range of quality products, as well as providing the domestic market with import-substituting and competitive construction materials.*

Key words: *local, building materials, localization, import, optimization, quality, competitive.*

Considering that 55-60% of the cost of construction work consists of building materials and that modern architecture demands new, high-quality, affordable, lightweight, earthquake-resistant, and innovative products, it is not difficult to understand the importance and development of the construction materials industry. Currently, our country is carrying out systematic work aimed at ensuring stable growth in the production and export of competitive products, as well as at modernizing and technically and technologically upgrading enterprises in the construction materials sector.

Special attention is being paid to rapidly developing and diversifying the sector, creating favorable conditions for this, attracting investment in processing local mineral raw materials, and increasing the volume of construction material exports.

Between 2019 and 2025, plans were made to increase the raw material base for the construction industry through geological exploration, extraction, and processing. These include 13.1 million tons of limestone, 1.8 million tons of gypsum, 1 million tons of clay components, brick raw materials, 0.1 million tons of quartz sand, and 5.6 million cubic meters of displaced rocks (basalt), stone, and gravel production.

Production is planned to be increased by:

47 times for wallpaper,

19 times for assembled parquet panels and boards,

15 times for wood-based panels and other wood-like materials,

7 times for aerated concrete blocks,

4 times for paint materials and energy-efficient architectural glass made using float technology,

3 times for basalt composite reinforcement,

2 times for cement.

In the current year, a foundation has been laid for the production of 22 trillion soums worth of construction materials, including:

14.5 million tons of cement,

23 million square meters of construction glass,

60 million square meters of gypsum board,

1 million cubic meters of aerated concrete blocks.

This not only satisfies the domestic market but also opens up opportunities for exports. In the current year, products worth $300 million have been exported to countries like Afghanistan, Azerbaijan, Turkey, Russia, and Ukraine. These include new product types such as basalt rovings, polystyrene boards (penoplex), PVC floor coverings, pigments for paint, and lightweight metal structures.

Due to the implementation of energy-saving technologies, the share of cement production using the dry method increased from 61% to 80%. In glass production, energy consumption has been reduced by half.

Practical implementation has begun on innovative projects aimed at producing modern construction materials from MDF boards, modified aerated concrete, high-quality cement clinker,

polyvinyl chloride (PVC) products, as well as basalt, ash slag, and technogenic waste. It is worth noting that under government scientific programs, 34 research, innovation, and startup projects with a total value of 16.2 billion soums are currently being implemented in the field of construction materials.

Using innovative technologies, new types of energy-efficient, environmentally friendly, export-oriented, and import-substituting construction materials are being introduced. For example, by applying technology to extract asbestos from azbozurite, the amount of asbestos imported into the country can be reduced. This also reduces the production cost of roofing sheets. In the zones of Ohangaron, Kuvasoy, Bekobod, and Angren, 2 million tons of accumulated azbozurite waste can be processed, with up to 15% asbestos content extracted per ton. Preliminary calculations suggest that this could save up to $40 million in asbestos import costs.

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Rezyume: *Ushbu ma’qolada mahalliy qurilish materiallari haqida ma’lumotlar va Prezidentimizning qurilish materiallarini mahalliylashtirish to‘grisidagi qarorlari va bu borada olib borilayotgan ishlar haqida ma’lumot berilgan mahalliylashtirish, ichki talabni qoplanishi va importni optimallashtirish maqsadida investitsiya loyihalarini amalga oshirish natijada sifatli mahsulot turlarini kengaytirish shuningdek, ichki bozor import o‘rnini bosuvchi va raqobatbardosh qurilish materiallari bilan ta'minlash.*

Резюме: *В данной статье представлена информация о местных строительных материалах и решениях Президента о локализации строительных материалов, а также информация о проводимой в этой области работе. В целях локализации, удовлетворения внутреннего спроса и оптимизации импорта, реализации инвестиционных проектов, расширения ассортимента качественной продукции, а также обеспечения внутреннего рынка импортозамещающими и конкурентоспособными строительными материалами.*

Kalit so‘zlar*: mahalliy, qurilish materiallari, mahalliylashtirish, import, optimallashtirish, sifat, raqobatbardosh.*

Ключевые слова: *местный, строительные материалы, локализация, импорт, оптимизация, качество, конкурентоспособность.*

MATHEMATICAL MODELING OF FERRORESONANT OSCILLATIONS

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Summary. *Solving the nonlinear differential equation in computer simulation, the current-voltage and amplitude-frequency characteristics of the ferroresonance voltages are constructed. and also the process of excited ferroresonance of stresses during a change in various.*

Using computer modeling, the volt-ampere and amplitude-frequency characteristics of voltage ferroresonance in a series ferroresonant circuit were constructed and excitation regions were determined depending on changes in various circuit parameters.

Key words*: resistive element, ferroresonant, volt-ampere, monoton, harmonic, measurement.*

Introduction.Self-oscillatory processes in nonlinear electromagnetic ferromagnetic circuits are exceptionally diverse and challenging to study. Many such phenomena are successfully used in stabilizing and frequency-converting systems. On the other hand, the occurrence and prolonged existence of self-oscillations in power supply systems is extremely undesirable, as they cause overvoltage, additional thermal and dynamic stress in electromechanical equipment, false triggering of relay protection, etc. [1,2,3,4,5,6,7,8,9]

To reveal the physical picture of autoparametric processes at the fundamental harmonic of ferroresonance, we will consider a series connection of a coil with a steel magnetic core and a capacitor connected to a sinusoidal voltage.

$u(t)=U_m Sin(\omega t+\varphi)$. Taking the weber-ampere characteristics of the nonlinear inductance.

$$\psi = \alpha i - \beta i^3 \quad (1)$$

This approximation is valid only for $\frac{d\psi}{dt} > 0$ i.e. for $\sqrt{\alpha/3\beta}$.

We assume that the capacitance C and resistance r are known. To construct the current-voltage (CVCH) and amplitude-frequency (AFCH) characteristics of the circuit, we use the harmonic balance method. In the first approximation of the method, we consider only the first harmonic of all periodic quantities in the circuit and assume the current to be equal to: $i(t)=I_m \sin\omega t$ of the current in accordance with (1) flux linkage.

$$\psi(t)=(\alpha I_m - 0{,}75\beta I_m^3)\sin\omega t + 0{,}25\beta I_m^3)\sin 3\omega t$$

The circuit equation is written as: $\frac{d\psi}{dt} + ri + \frac{1}{C}\int idt = u(t)$ or after substituting the values of i:

$$\left(\alpha\omega - \frac{1}{\omega C} - 0{,}75\beta I_m^2\right) I_m cos\omega t + rI_m sin\omega t + 0{,}75\omega\beta I_m^3 cos 3\omega t = u(t) \quad (2)$$

Neglecting the third higher harmonic of the input voltage, we represent: $u(t)=U_m \sin(\omega t+\varphi)=U_a \sin\omega t+U_b \cos\omega t$,

Where $U_m=\sqrt{U_a^2 + U_b^2}$; $\varphi = arctg\frac{U_b}{U_a}$.

After substituting u(t) into (2), we equate the coefficients of the same trigonometric functions in the left and right parts, squaring and adding them together, we obtain the equations for the CVCH and AFCH of the circuit:

$$\left[\left(\alpha\omega - \frac{1}{\omega C} - 0{,}75\beta I_m^2\right)^2 + r^2\right] I_m^2 = U_m^2 \quad (3)$$

We assume ω=const and construct the relationship between $U_m=f(I_m)$ using equation (3).

We denote $\alpha\omega - \frac{1}{\omega C} = \xi$ and, for definiteness, set $\xi>0$. The current-voltage characteristic equation takes the form:

$$\sqrt{(\xi - 0{,}75\beta I_m^2) I_m^2 + (rI_m)^2} = U_m \quad (4)$$

Voltage U_m is the geometric sum of the voltages on the reactive and resistive parts of the circuit.

Ferroresonance corresponds to zero reactive voltage component $\xi - 0{,}75\beta I_m^2 = 0$; thus, resonance occurs at current values

$$I_{m0} = I_0 = \sqrt{\xi/0{,}75\beta\omega} \quad (5)$$

At r=0, the current-voltage characteristic is a cubic parabola, depicted as curve "a" in Fig. 1 (the coordinate axes represent the absolute values of the current and voltage amplitudes). At currents lower than I_0, the circuit is inductive; at higher currents, it is capacitive.

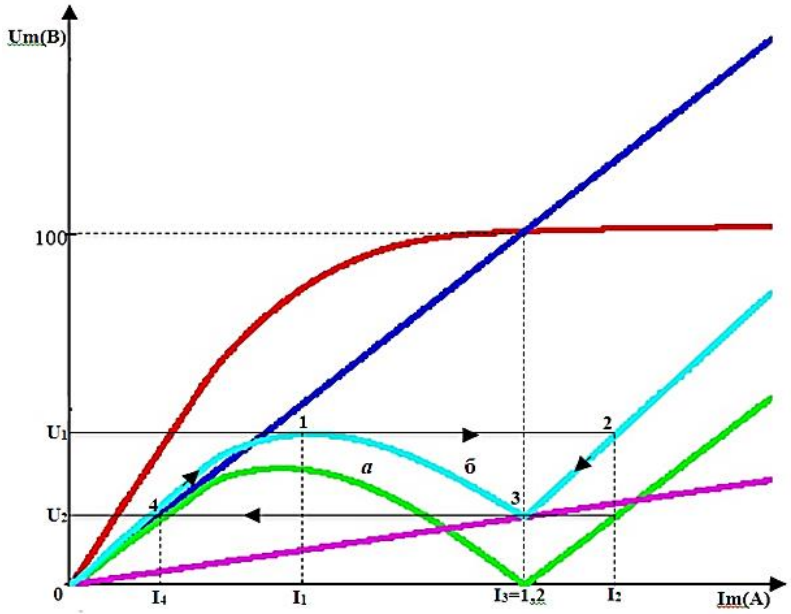


Fig. 1. Volt-ampere characteristics of voltage ferroresonance

If there are losses in the circuit, the voltage on the resistive element is added to the total voltage on the reactive elements, therefore the current-voltage characteristic Um(Im) (curve “b” in Fig. 1) passes above the characteristic of the circuit without losses.

The current-voltage characteristic has a voltage range from U_1 to U_2, where one voltage value U_m corresponds to three steady-state current values I_m. When the circuit is powered by an EMF source, this region represents a region of ferroresonant current amplitude jumps. With a smooth increase in voltage from zero at a value of $U_m = U_1$, the current increases abruptly from the value of I_1 to I_2; with a decrease in voltage to $U_m = U_2$, the current decreases abruptly from I_3 to I_4.

Clearly, all current values lying on branches 1–3 of the volt-ampere characteristic with a negative derivative $\partial U_m/\partial I_m$ (the falling section or the section with a negative slope) are unstable when the circuit is powered from an EMF source. The volt-ampere characteristic can only be fully measured when the circuit is powered from a current source.

At low resistances r≈0, the minimum point of the current-voltage characteristic corresponds to the ferroresonance current I_0. As the resistance increases, the minimum of the characteristic shifts to the left of the resonance point. This is evident from the expression for the extrema of the current-voltage characteristic:

$$I_{m\,\text{экстр}}^2 = \frac{2\left(2\xi \pm \sqrt{\xi^2 - 3r^2}\right)}{9\beta}, \quad (6)$$

where the positive sign before the root corresponds to the minima, and the negative sign corresponds to the maxima of the characteristic. It is clear that as the resistance r increases, the expression under the root decreases, and, consequently, the current corresponding to the minimum voltage decreases. When $r > \xi/\sqrt{3}$ the volt-ampere characteristic becomes monotonic ferroresonant jumps are absent in this mode.

In the presence of resistance r, the voltage $u(t)$ at resonance is equal to

$$u(t) = rI_m sin\omega t + 0{,}75\omega\beta I_m^3 cos3\omega t.$$

The presence of higher harmonics affects the accuracy of experimental measurements.

In equation (3), we fix the voltage U_m and plot the dependence of the current I_m on the frequency ω:

$$I_m = U_m / \sqrt{\left(\alpha\omega - \frac{1}{\omega C} - 0{,}75\omega\beta I_m^2\right)^2 + r^2}. \quad (7)$$

At low voltages and low currents, the value of $0{,}75\omega\beta I_m^2$ in the denominator (7) can be neglected, and the equation will take a form similar to the equation of a linear series resonant circuit with a resonant frequency $\omega_0 = 1/\sqrt{\alpha C}$. This characteristic is shown in Fig. 2 (curve "a"). With an increase in the amplitudes U_m and I_m, the resonant frequency determined by the condition increases:

$$\omega_{рез} = \frac{0{,}375\beta I_m^2}{\alpha} + \sqrt{(0{,}375\beta I_m^2/\alpha)^2 + \omega_0^2}. \quad (8)$$

The dependence of the resonant frequency on current is shown in Figure 2 by the dotted line. The amplitude-frequency characteristics are the same as for a linear circuit, that is, they are located symmetrically with respect to the resonant frequency. The appearance of the amplitude-frequency characteristic at a sufficiently high voltage is shown by curve "b" in Figure 2. This characteristic has a region where one frequency value corresponds to three current values. This region represents the region of ferroresonant current amplitude jumps. With a smooth increase in frequency to values $\omega>\omega_2$ the current abruptly decreases from I_1 to I_2. With a decrease in frequency to $\omega<\omega_1$ the current increases from I_3 to I_4. Clearly, all current values lying in the range 1-3 of the characteristic are unstable.

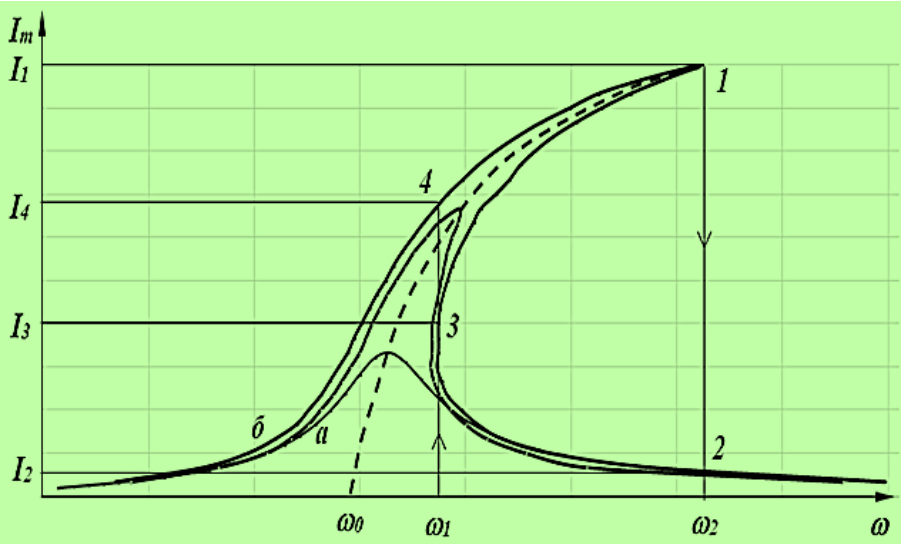


Fig. 2. Amplitude-frequency characteristics of ferroresonant voltage

The current-voltage characteristic in Fig. 1 corresponds to a frequency lying in the range from ω_1 to ω_2. They can also be plotted graphically.

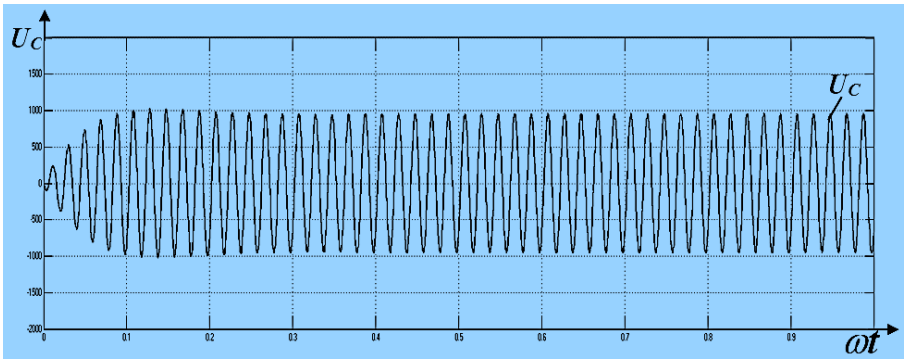


Fig. 3. Dependence of U_C on t during the excitation of voltage ferroresonance

The excitation process of voltage ferroresonance with changes in the input voltage U and circuit parameters was studied using a computer model. The volt-ampere characteristics according to equation (3) at U_{in} = 150 V; R = 0.10 Ohm; X_c = 50 Ohm are shown in Fig. 1. It follows that ferroresonance in the circuit occurs at U_L=U_C= 90 V and I=1.2 A. The oscillogram of the ferroresonance curves of the voltage across the capacitor is shown in Fig. 3. According to (7), the amplitude-frequency characteristics are plotted for a change in capacitance of 16÷50 μF (Fig. 2).

Conclusions. *Using computer modeling, the volt-ampere and amplitude-frequency characteristics of voltage ferroresonance in a series ferroresonant circuit were constructed and excitation regions were determined depending on changes in various circuit parameters.*

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Rezyume: *Maqolada ferrorezonansli zanjirlarda hosil bo’ladigan avtoparametrik tebranishlar xususiyati o’rganilib, differentsial tenglamasini echish bilan volt-amper va amplituda-chastotaviy xarakteristikalari qurilgan. Kompyuterda modellashtirish bilan ferrorezonans hodisasining hosil bo’lish chegaralari parametrlarga nisbatan tahlil qilingan..*

Резюме: *В статье приведены результаты исследования возбуждения автопараметрических колебаний основной гармоники в последовательной феррорезонансной цепи с решением нелинейных дифференциальных уравнений. Компьютерным моделированием построены вольт-амперные и амплитудно-частотные характеристика феррорезонанса напряжений, и определены области возбуждения при изменении различных параметров цепи.*

Kalit so'zlar: *rezistiv element, ferrorezonans, volt-amper, monoton, garmonik, o‘lchash..*

Ключевые слова: *резистивный элемент, феррорезонанс, вольт-ампер, монотон, гармоника, измерение..*

STUDYING THE STABILITY AND REOLOGICAL PROPERTIES OF INVERT EMULSIONS OF VARIOUS SURFACE-ACTIVE SUBSTANCES

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Summary: *The basis of an effective emulsion drilling fluid is surfactants, which play a key role in stabilizing emulsions and controlling their structural and mechanical properties. Modern research is aimed at creating new emulsifiers with improved rheological characteristics, high resistance to thermobaric effects, and compatibility with various chemical reagents. One of the promising directions is the development of surfactants based on technical fatty acids obtained from renewable raw materials, which allows not only to improve the operational properties of drilling fluids but also to reduce their environmental burden.*

This article examines modern approaches to the creation and application of emulsifiers for drilling fluids, and also analyzes literature data on the mechanisms of emulsion stabilization, the influence of emulsifier composition on the rheological and colloidal-chemical properties of drilling fluids. Separate data on research aimed at optimizing the composition of emulsion systems and increasing their efficiency under deep and ultra-deep drilling conditions are presented.

Key words: *diesel fuel (DF), kinematic viscosity (ηk), density (ρ), flash point (FP), thickening point (TP), acid number (AN), sulfur content (SC), water content (WC), static shear stress (SSS), oil/water (O/W), ethanolamide of technical fatty acids (EATFA).*

INTRODUCTION

Emulsion drilling fluids are widely used in the oil and gas industry due to their ability to ensure high wellbore stability, reduce filtration losses, and improve the lubricating properties of the system. The use of such solutions is especially relevant when drilling in complex geological conditions, where it is necessary to minimize the hydration of clay rocks and reduce the likelihood of complications associated with the instability of well walls.

The drilling fluid is a complex dispersed system consisting of suspensions, emulsions, and gas-filled liquids. Its selection is determined by geological conditions, the temperature-pressure characteristics of the well, and the type of deposit being developed. Since the drilling fluid directly contacts the rock, its properties play a key role in ensuring wellbore stability and preventing complications [1; P. 109-114, 2; P. 52-56].

Optimal solution parameters are selected based on geological and technical data and experience in operating similar deposits [3; P. 138-142, 4]. The mismatch between the solution characteristics and the drilling conditions can reduce process efficiency, increase costs, and create hazardous situations. For example, insufficient cleaning of the wellbore is often associated with improper rheological characteristics or the filtration capacity of the solution. Other common complications include slimming, tool seizures, wall stability disruption, circulation loss, and cementation problems, which emphasizes the need for precise selection and control of the solution composition [5; P. 92-98].

The stability of the drilling fluid is determined by kinetic and colloidal-chemical factors, including the size and mineralogical composition of the particles, the concentration of the dispersed phase, the presence of electrolytes and surfactants, and temperature conditions. For example, a high degree of dispersity contributes to the stability of the system by reducing particle aggregation, while the addition of electrolytes and surfactants can alter the charge balance, causing coagulation. Increasing the temperature, in turn, reduces the solution's viscosity, which can also affect the suspension's stability [6; P. 187-189, 7; P. 30-39].

Structure strength and effective viscosity are key parameters that determine the rheological properties of clay drilling fluids. Structure strength is responsible for holding solid particles in a suspended state, preventing them from settling, and ensuring a uniform consistency of the solution, which is critical for protecting well walls [8; P. 5-100].

Effective viscosity, in turn, affects the lubricating properties of the solution and its ability to form a protective rheological structure, reducing the friction of the tool against the wellbore walls and preventing rock erosion.

Precise control of rheological characteristics is essential for efficient drilling, as it allows for the optimization of equipment operation and minimizes the risk of complications [9; P. 18-45]. Incompatibility of the viscosity or strength of the structure can lead to tool clogging, circulation disruption, or other emergency situations. To control these parameters, reagents are used that contribute to the dispersion of the solid phase and stabilization of the solution due to the change in the charge balance of the particles [9; P. 20-21].

Drilling fluids are multicomponent dispersed systems consisting of suspensions, emulsions, and gas-saturated fluids adapted to specific drilling conditions. They are used in the development of oil, gas, and other minerals, ensuring efficient cleaning of the wellbore and protection of the geological section. Depending on the operating conditions, water, hydrocarbon, emulsion, and gaseous systems are used [10].

EXPERIMENTAL SECTION

The choice of hydrocarbon dispersion medium is a key factor in creating invert emulsions for drilling fluids. Basic oils used as a dispersion phase significantly affect the rheological properties, system stability, environmental safety, and technological effectiveness of the drilling fluids. The chemical nature of hydrocarbons determines their viscosity, wetting ability, interaction with surfactants, and resistance to thermal and mechanical loads.

Modern invert emulsions are mostly based on synthetic and mineral oils, diesel fuel, and hydrocarbons with controlled molecular composition.

The introduction of synthetic hydrocarbons allows for improving the environmental performance of drilling fluids by reducing the content of aromatic compounds and toxic impurities. At the same time, mineral oils and diesel fuel have high compatibility with various surfactants, which ensures effective emulsion stabilization.

To create emulsion drilling fluids, oil and diesel fuel (DF) were studied. Their key characteristics, such as kinematic viscosity (ηk), density (ρ), flash point (FP), thickening point (TP), acid number (AN), sulfur content (SC) and water content (WC), have been determined, as they directly affect the stability and operational properties of the drilling fluids.

Kinematic viscosity determines the oil's fluidity and influences the rheological characteristics of the emulsion. The density affects the retention of solid particles and the pressure of the drilling fluid column. Flash point characterizes fire safety and operational limitations at high temperatures. Thickening temperature is important for preventing phase transitions in low-temperature conditions. The acid number reflects the presence of acidic impurities that can affect surfactants and equipment.

The sulfur content affects the corrosive activity and environmental characteristics of the solution. The presence of water determines the oil's tendency to phase transformations and its stability in the emulsion composition.

All operations were performed at room temperature. The obtained system underwent visual and rheological assessment for stability, thixotropy, and resistance to stratification.

Main methods for determining the characteristics of emulsion drilling fluids

The parameters of the drilling fluid were determined in accordance with the international standard ISO 10414-2, which regulates field tests of hydrocarbon-based drilling fluids.

Determination of the solution density was performed using lever scales. Before starting measurements, the scales were calibrated using fresh water at 21°C with a density of 1.00 g/cm^3. Calibration was carried out by adjusting the lead shot on the balance beam or adjusting the balancing screw until the required value was obtained.

The density measurement procedure included several stages. First, the solution temperature was determined and recorded. Then, the test drilling fluid was filled into the scale cup, after which it was sealed tightly with a lid. The excess solution was removed through a hole in the lid, after which the outer surface of the cup was thoroughly wiped. The cup was placed on the prism, and the runner

on the graduated kingpin was moved until equilibrium was reached. The density value was calculated from the left side of the runner and recorded with an accuracy of 0.01 g/cm^3.

After each measurement, the drilling fluid was poured into a container for collecting an average sample, and the scales were cleaned and dried. To improve measurement accuracy, all equipment parts must remain clean and dry.

Determination of the viscosity and limiting static shear stress was carried out at 50°C using a rotary viscometer with a thermostated ring and a thermometer.

The sample was heated to 50°C with a stirring of 600 rpm. After temperature stabilization, viscometer readings at 600 and 300 rpm were recorded. Plastic viscosity was determined as the difference in values at 600 and 300 rpm, dynamic shear stress - by the difference in the value at 300 rpm and plastic viscosity with subsequent multiplication by 4.78. The apparent viscosity was calculated as half the value at 600 rpm.

The limiting static shear stress (SSS) was measured 1 and 10 minutes after stopping stirring at a speed of 3 rpm. The results were calculated as the maximum deviation multiplied by 4.79.

After testing, the device and its components were cleaned and dried to prevent contamination and extend the equipment's service life.

Retort testing allows for the determination of the water, oil, and solid phase content in the drilling fluid sample when heated in a sealed chamber. These data are important for controlling the phase ratio, rheology, density, and filtration of the solution, as well as for evaluating the equipment designed to remove solid particles.

The test consisted of heating 100 cm^3 of the solution in a retort unit, evaporating the liquid components, and condensing them, followed by measuring the volumetric fractions of water and oil. The solid phase was calculated based on the difference between the initial solution volume (100 cm^3) and the sum of the volumes of condensed liquids (V_I).

Before starting the test, the sample was thoroughly mixed to ensure homogeneity and prevent air from entering, which could lead to an overestimation of the solid phase. The solution was carefully poured into the retort cup, avoiding air bubbles. The chamber was filled with metal wool for uniform evaporation, sealed tightly, and then heated for 45 minutes. After cooling, the volumes of separated liquids were measured.

The volume shares were calculated as follows:

The oil/water ratio was determined by the formula:

$$O/W = \frac{V_O}{V_m + V_W} * 100\%$$

Volume fraction of oil:

$$O_{\%} = \frac{V_m}{V_\text{p}} * 100\%$$

Volume fraction of water:

$$\text{B}_{\%} = \frac{V_W}{V_\text{p}} * 100\%$$

Volume fraction of the solid phase:

$$100 - (V_m + V_W)$$

The water yield of the drilling fluid was determined using the VM-6 instrument. The test consisted of filtering the solution under 0.7 MPa pressure through filter paper for 30 minutes. The volume of the filtered liquid was measured and fixed. This parameter characterizes the solution's ability to retain water, which is important for preventing soil dilution and stabilizing the well.

The conditional viscosity of the drilling fluid was measured using a VBR-2M viscometer. The method is based on the time it takes for 500 ml of a solution to flow through a calibrated capillary at a given temperature. The viscosity was calculated using the formula:

$\eta = t/T_0$,

where t is the flow time of the solution, sec, T_0 is the flow time of the water.

RESULTS AND THEIR DISCUSSION

Study of the change in the main stability characteristics of an emulsion based on diesel fuel

Studying the stability of diesel fuel-based emulsions is an important stage in the development of drilling fluids used in complex geological conditions. Emulsion stability determines its ability to maintain phase homogeneity, preventing coalescence and separation, which is critical for the stability of the drilling fluid at high temperatures and pressures. Diesel fuel is widely used as a dispersion medium in invert emulsions due to its accessibility, low polarity, and good lubricating properties. Studying the influence of various factors, such as the concentration of emulsifier, mineral filler, and aqueous phase, allows for the determination of optimal conditions for preparing stable emulsions that ensure the effective operation of drilling fluids.

Table 1.

Characteristics of DF emulsions (3% asphaltene) + $CaCl_2$ solution + EATFA (25/73/2) depending on the $CaCl_2$ solution concentration

№	$CaCl_2$ solution concentration	Density, g/cm^3	T, s	DV at 300 rpm, mPa*s	ES, B	TC at 80°C, h
1	1,5	1,01	29	156	26	≥8
2	12,5	1,12	51	178	49	≥8
3	30	1,22	108	186	71	≥8
4	38,5	1,23	121	227	80	≥10

Analyzing the data in Table. 1, the influence of calcium chloride solution concentration on the main stability characteristics of emulsions containing diesel fuel (DF), $CaCl_2$ solution, and ethanolamide of technical fatty acids (EATFA) in a ratio of 25/73/2 can be identified.

With an increase in the concentration of $CaCl_2$ solution, a regular increase in emulsion density is observed, which is explained by the high solubility of calcium chloride and its high density. The density of the system increases from 1.01 g/cm^3 at a $CaCl_2$ concentration of 1.5% to 1.23 g/cm^3 at a calcium chloride concentration of 38.5%.

The duration of leakage (T, s) increases significantly with increasing $CaCl_2$ concentration, indicating an increase in the structure of the system. At a minimum concentration (1.5%), the drainage time is 29 s, while at 38.5% it is 121 s. This indicates an intensification of coagulation interactions between the particles of the dispersed phase, leading to an increase in the viscosity and strength of the emulsion structure.

Dynamic viscosity at 300 rpm (DV) also shows growth as $CaCl_2$ concentration increases. At a minimum solution concentration (1.5%), the PV is 156 mPa·s, and at 38.5%, it reaches 227 mPa·s. This is explained by the increase in the electrolytic activity of the aqueous phase, leading to increased interfacial interactions and increased viscosity.

The electrical stability (ES) of emulsions increases from 26 V at 1.5% $CaCl_2$ to 80 V at 38.5% $CaCl_2$, confirming the increase in the stability of the interfacial film. High electrical stability indicates effective adsorption of surfactants at the interface, which prevents water globule coalescence and contributes to system stabilization.

Thermal stability (TS) at 80°C is ≥8 hours at low concentrations of $CaCl_2$, however, at 38.5%, an increase to ≥10 hours is observed. This indicates that increasing the electrolyte concentration contributes to the heat resistance of the system, reducing the probability of separation.

The influence of the oil and water phase ratio (O/W) and the consumption of surfactants on the colloidal stability of the emulsion was studied. As a dispersion medium, a mixture of diesel fuel and asphaltene with a 3% content was used, which ensured an improvement in the structural-rheological properties and stability of the system. The obtained data are presented in Figure 1. The $CaCl_2$ content in the solution is 12%.

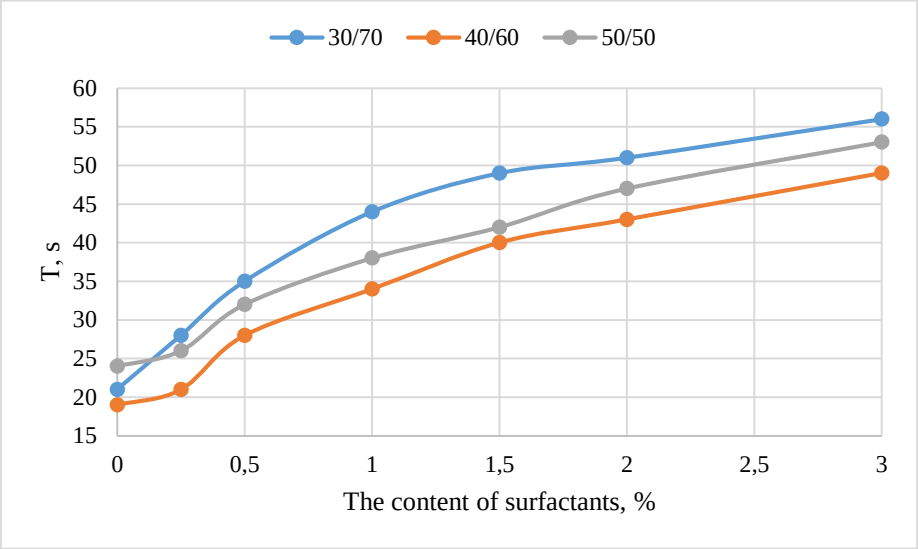


Fig. 1. Change in the conditional viscosity of emulsions with different O/W ratios depending on the EATFA content (3% asphaltene).

Analysis of the data presented in Figure 1 shows a regular change in the conditional viscosity of the emulsion system depending on the concentration of EATFA and the ratio of oil and water phases. At a ratio of 30/70 (with a predominance of the aqueous phase), the initial viscosity is minimal - 21 s, and with an increase in the concentration of surfactants, it gradually increases to 56 s with a maximum surfactant content (3%). In a 60/40 ratio, the initial viscosity is lower (19 s), but the increase in viscosity occurs more smoothly, and at 3%, it reaches 49 s. In a 50/50 ratio system, the initial viscosity is somewhat higher (24 s), but the further increase in the parameter is less pronounced compared to 30/70 and at 3 is 53 s.

The difference in viscosity dynamics when the phase ratio changes is due to a number of factors. In a system with a high content of the water phase (30/70), water droplets are less structured, which contributes to an increase in the system's fluidity. As the concentration of surfactants increases and the stabilization of water globules increases, a significant increase in viscosity is observed due to the formation of a denser interfacial layer.

With an increase in the oil phase proportion (60/40 and 50/50), more stable emulsions are created, in which water globules are dispersed in the oil. In these systems, the increase in viscosity with an increase in the concentration of surfactants is less pronounced, as oil reduces internal friction in the system to a greater extent.

In water-oil emulsions, the high concentration of the water phase (30/70) contributes to the formation of smaller droplets, which reduces the initial viscosity. However, when surfactants are introduced, water droplets form dense associates, which significantly increases the flow resistance.

With a higher oil phase content (60/40 and 50/50), a lower increase in viscosity is observed, as the oil dispersion medium contributes to a decrease in the intermolecular interaction between water particles and surfactants, thereby limiting the influence of globule structure.

Thus, with a predominance of the aqueous phase, the initial viscosity is lower, but with an increase in the concentration of surfactants, the viscosity increases faster due to the dense interfacial layer. In systems with a high oil phase content, the viscosity is more stable and increases more slowly, which is related to the greater role of the dispersion medium in the formation of the rheological properties of the emulsion.

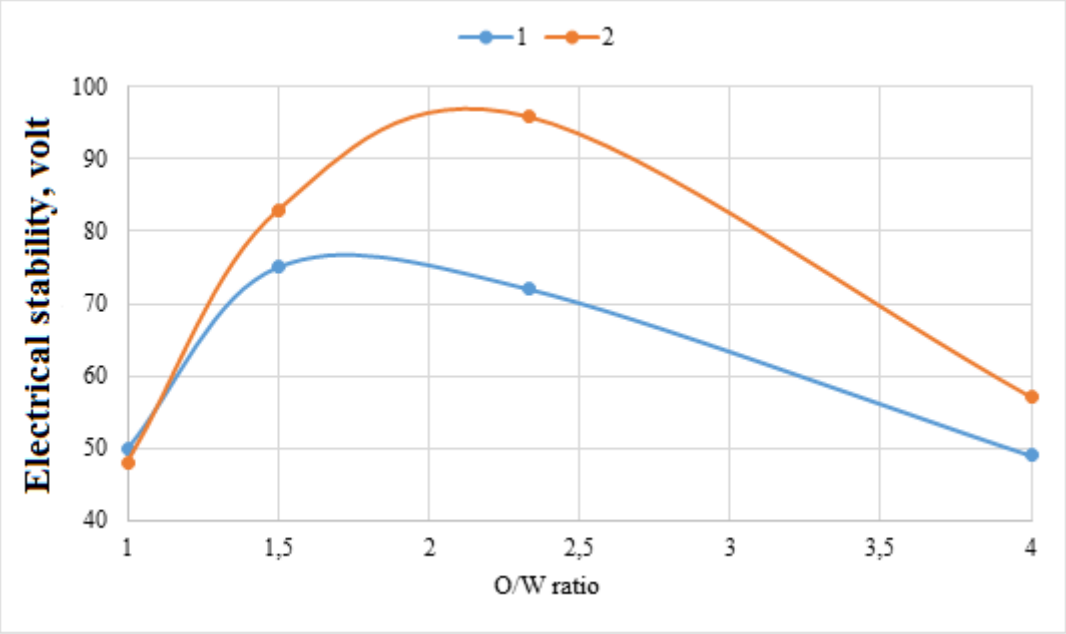


Fig. 2. Change in electrical stability depending on the W/O ratio at different EATFA content, %: 1) 1; 2) 2 (3% asphalt).

Analysis of the electrical stability of emulsions at various oil and water phase ratios (O/W) and surfactant content (1 and 2%) shows that the stability of the system depends on the phase ratio and the concentration of the surfactant.

At a ratio of W/O=4 (O/W = 20/80, high water content), the electrical stability is 49 V at 1% surfactant and 57 V at 2% surfactant. Such a low value is due to the excess water phase, which contributes to the formation of large droplets and their coalescence. In such systems, stability is determined by the strength of the interfacial layer, which weakens with high water content.

With an increase in the ratio to 30/70, the electrical stability increases significantly (72 V at 1% surfactant and 96 V at 2% surfactant). This indicates that at this ratio, an optimal balance between the dispersed and continuous phases is achieved. The surfactant is evenly distributed at the interface of the phases, forming a dense stabilizing layer.

With a further increase in the oil phase content (40/60), the electrical stability continues to increase, but not so sharply (75 V at 1% surfactant and 83 V at 2% surfactant). This is because, with such a ratio, a stable system is formed, but a decrease in the concentration of the aqueous phase leads to a decrease in the number of water globules, which limits the growth of electrical stability.

With a further increase in the oil phase to 50/50, a decrease in electrical stability is observed (50 V at 1% surfactant and 48 V at 2% surfactant). This is because the decrease in the aqueous phase leads to the rarefaction of the system, a decrease in the number of water globules, which worsens the electrical conductivity of the emulsion. In addition, with a high oil phase content, water dispersion deteriorates, which also reduces electrical stability.

Thus, the highest electrical stability is observed at a ratio of 30/70, when an optimal stable system is formed. With further increase in the oil phase, the electrical stability decreases, which is associated with a decrease in the amount of the dispersed phase and a deterioration in the distribution of surfactants.

To assess the influence of different types of emulsifiers on the rheological characteristics and stability of inverted emulsions, comparative studies of systems based on diesel fuel and calcium chloride solutions with the addition of 2% neonol were conducted. The main attention was paid to the key parameters of emulsions, such as conditional viscosity, dynamic viscosity at 300 rpm, electrical stability, and thermal stability at 80°C.

Analysis of the results shows that with an increase in the concentration of calcium chloride solution, a regular increase in the conditional viscosity, dynamic viscosity, and electrical stability of

emulsions is observed, which is due to the strengthening of ionic interactions and stabilization of the oil/water interface. However, the obtained values of electrical and thermal stability are significantly inferior to the indicators of emulsions based on ethanolamide of technical fatty acids, which indicates a less dense packing of neonol molecules at the interface and a lower stability of the interfacial layers.

Comparison with ethanolamide emulsions of technical fatty acids shows that the conditional and dynamic viscosity of neonol emulsions is lower than that of similar ethanolamide systems at the same concentration of the aqueous phase. This is because neonol forms less rigid adsorption layers at the interface compared to amide surfactants. The electrical stability of neonol emulsions is also lower, especially at low concentrations of calcium chloride, which confirms that neonol reduces water droplet coalescence less effectively, leading to a decrease in emulsion stability. The thermal stability of emulsions with neonol does not exceed 6 hours, while for systems based on ethanolamide of technical fatty acids, this indicator was higher, indicating a less stable structure of the stabilized interfacial layer.

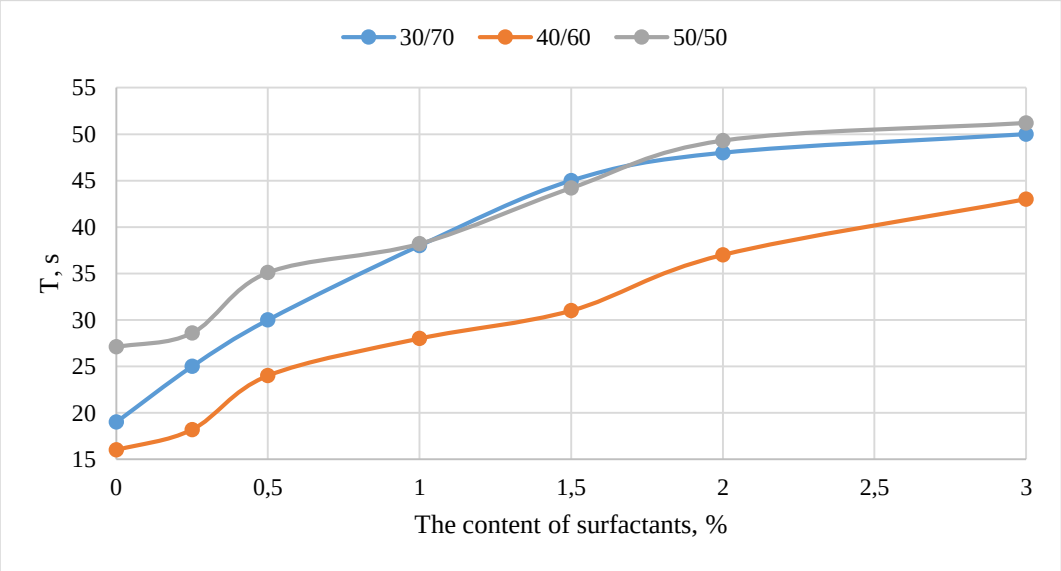


Fig. 3. Change in the conditional viscosity of emulsions with different O/W ratios depending on the Neonol content (3% asphaltene).

A comparative analysis of the change in conditional viscosity at different oil and water phase ratios shows that the introduction of surfactants has a similar effect on the rheological properties of the system, however, when using neonol, certain differences are observed compared to EATFA.

In all systems, the increase in the concentration of surfactants leads to an increase in conditional viscosity, which is associated with the strengthening of interfacial boundaries and a decrease in the size of water globules. However, the nature of the viscosity change when using neonol differs from the EATFA system. In particular, at all oil and water phase ratios, the absolute values of the conditional viscosity with neonol are lower than in similar EATFA systems.

For the 30/70 system with a 1% surfactant content, the viscosity is 38 s, which is lower than the values for the EATFA system, where it reached 44 s at the same concentration. This indicates a lower effectiveness of neonol in forming a stable interfacial layer, which is related to its molecular structure and a lower ability to form strong associates at the interface of the phases.

A similar trend is observed in the 40/60 system, where at all concentrations of surfactants, the viscosity is lower than in the EATFA system. This confirms that neonol forms less dense interfacial layers, leading to a decrease in the stability of the emulsion structure.

The greatest differences are observed in the 50/50 system, where at low concentrations of surfactants, the conditional viscosity with neonol is higher than with EATFA (27.1 versus 24 s with 0% surfactant), however, with an increase in the content of surfactant, the increase in viscosity slows down, and at 3% surfactant, the viscosity is lower than in the system with EATFA (51.2 versus 53 s).

This indicates that neonol at high concentrations less effectively regulates the system, unlike EATFA, which demonstrates a more linear increase in viscosity.

Thus, the use of neonol leads to a less pronounced increase in the viscosity of the emulsion system compared to EATFA, which indicates its lower adsorption capacity at the interface and a weaker effect on the emulsion structure. This can be a limiting factor when neonol is used in drilling fluid formulations, where more stable rheological characteristics are required.

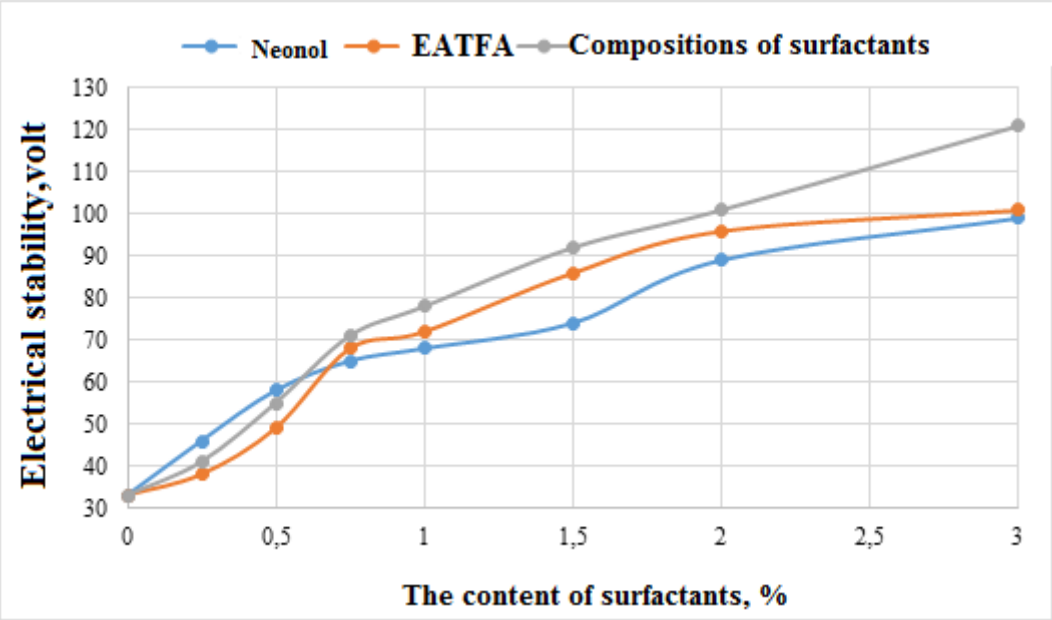


Fig. 4. Changes in the electrostability of DF+$CaCl_2$ solution (30/70) emulsions depending on the content of various surfactants (3% asphaltenes).

Analysis of the dependence of ES on the concentration of surfactants in emulsion systems using various emulsifiers - neonol, EATFA and compositions of surfactants - allows for the determination of their influence on the stability of emulsions. With an increase in the concentration of surfactants, an increase in electrical stability is observed, which is associated with improved adsorption of surfactant molecules at the interface, the formation of a denser interfacial layer, and a decrease in the coalescence of water globules. In the concentration range up to 0.75%, the difference between ES for all systems is minimal, however, starting from a 1% concentration of surfactants, surfactants begin to exhibit higher ES values compared to EATFA and neonol.

With a 1.5% compositions of surfactants content, it is already 6% more effective than EATFA and 18% more effective than neonol, which indicates stronger stabilizing properties of the composite emulsifier. In the range of 2-3%, compositions of surfactants exhibits a significant excess of ES, reaching 121 V, while for EATFA and neonol, this indicator is 101 V and 99 V, respectively.

The high effectiveness of the composite emulsifier is explained by the combined effect of its components: the metal salt improves the stability of the interfacial layer by reducing the coalescence of water droplets, and the oxyethylated compounds and ethanolamide TFA acids provide effective adsorption and stabilization due to optimal hydrophilic-lipophilic balance. Thus, the use of surfactants allows for obtaining the most stable system with a lower emulsifier cost, making it promising for use in drilling fluids.

The study of the influence of various types of surfactants on the electrical stability of emulsions showed that composite surfactants provide the highest stability of the system compared to individual emulsifiers. The increase in the concentration of surfactants contributes to an increase in the stabilizing effect due to dense adsorption at the interface between the phases and prevents the coalescence of water globules. The composite emulsifier exhibits a higher level of electrical stability, especially at concentrations above 1%, which is due to the synergistic effect of its components, which

contribute to the creation of a strong interfacial layer. The obtained results confirm the feasibility of using surfactants to improve the operational characteristics of emulsion drilling fluids.

CONCLUSION

As a result of the conducted research, the main regularities of changes in the stability of emulsions based on diesel fuel and oil depending on the phase ratio, the type of surfactants, and the presence of calcium chloride were established. It has been shown that with a decrease in the oil and water phase ratio (O/W), the conditional viscosity increases, especially when using composite surfactants. Thus, in the oil/water system, at O/W = 0.25, the conditional viscosity reaches 55 s for surfactants, 37 s for neonol, and 36 s for EATFA, while in the absence of surfactants, it remains at 14 s. In the presence of a 12.5% $CaCl_2$ solution, the viscosity increases to 62 s for surfactants, 51 s for neonol, and 46 s for EATFA, which indicates the strengthening of the interfacial layer structure due to ionic interactions.

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Rezyume: *Samarali emulsion burg‘ulash eritmasining asosi sirt faol moddalar (SFM) bo‘lib, ular emulsiyalarni barqarorlashtirish va ularning strukturaviy-mexanik xususiyatlarini boshqarishda asosiy rol o‘ynaydi. Zamonaviy tadqiqotlar reologik xususiyatlari yaxshilangan, termobarik ta’sirlarga yuqori chidamli va turli kimyoviy reagentlar bilan moslashuvchan yangi emulgatorlarni yaratishga qaratilgan. Istiqbolli yo‘nalishlardan biri qayta tiklanadigan xomashyodan olinadigan texnik yog‘ kislotalari asosida SFM ishlab chiqish bo‘lib, bu nafaqat burg‘ulash eritmalarining ekspluatatsion xususiyatlarini yaxshilash, balki ularning ekologik yukini kamaytirish imkonini beradi.*

Ushbu maqolada burg‘ilash eritmalari uchun emulgatorlarni yaratish va qo‘llashning zamonaviy yondashuvlari ko‘rib chiqilgan, shuningdek, emulsiyalarni barqarorlashtirish mexanizmlari, emulgatorlar tarkibining burg‘ilash eritmalarining reologik va kolloid-kimyoviy xususiyatlariga ta’siri bo‘yicha adabiyot ma’lumotlari tahlil qilingan. Chuqur va o‘ta chuqur burg‘ulash sharoitlarida emulsion tizimlar tarkibini optimallashtirish va ularning samaradorligini oshirishga qaratilgan tadqiqotlar bo‘yicha alohida ma’lumotlar keltirilgan.

Резюме: *Основой эффективного эмульсионного бурового раствора являются поверхностно-активные вещества (ПАВ), которые играют ключевую роль в стабилизации эмульсий и управлении их структурно-механическими свойствами. Современные исследования направлены на создание новых эмульгаторов с улучшенными реологическими*

характеристиками, высокой устойчивостью к термобарическим воздействиям и совместимостью с различными химическими реагентами. Одним из перспективных направлений является разработка ПАВ на основе технических жирных кислот, получаемых из возобновляемого сырья, что позволяет не только улучшить эксплуатационные свойства буровых растворов, но и снизить их экологическую нагрузку.

В данной статье рассмотрены современные подходы к созданию и применению эмульгаторов для буровых растворов, а также проанализированы литературные данные по механизмам стабилизации эмульсий, влиянию состава эмульгаторов на реологические и коллоидно-химические свойства буровых растворов. Приведены отдельные данные по исследованиям, направленным на оптимизацию состава эмульсионных систем и повышение их эффективности в условиях глубокого и сверхглубокого бурения.

Kalit so‘zlar: *dizel yoqilg‘isi (DY), kinematik qovushqoqligi (ηk), zichligi (ρ), chaqnash harorati (Tchaq), quyuqlanish harorati (Tquy), kislota soni (KS), oltingugurt miqdori (Smug’), suv (S), (SSK) - statik siljish kuchlanishi, moy/suv (M/S), texnik yog‘ kislotalarining etanolamidi (TYKEA) kabi asosiy xususiyatlari aniqlandi.*

Ключевые слова: *дизельное топливо (ДТ). Определены их ключевые характеристики, такие как кинематическая вязкость (ηk), плотность (ρ), температура вспышки (Твсп), температура загустевания (Тзаг), кислотное число (КЧ), содержание серы (CS), воды (В), (СНС) – статическое напряжение сдвига, масло/вода (М/В), этаноламид технических жирных кислот (ЭАТЖК).*

UDC: 004.8:159.9:658.3

MULTI-MODAL ASSESSMENT OF WORKFLOW ENGAGEMENT IN THE SERVICE INDUSTRY

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***Summary**: This paper proposes a **conceptual model** for the objective assessment of **employee engagement** in the service industry (e.g., education, healthcare) using **Affective Computing** technologies. Unlike subjective surveys, the model integrates **Visual Cues** (facial expressions, posture) and **Physiological Signals** (HRV, EDA). The workflow is strictly structured and consists of four stages: **Data Acquisition, Preprocessing, Feature Fusion,** and **Engagement Inference**. This provides an adaptive, real-time framework for improving workforce efficiency and well-being.*

***Key words**: employee engagement, multi-modal assessment, affective computing, physiological signals, visual cues, feature fusion, real-time monitoring, service industry*

Introduction

The service industry is fundamentally human-centered, relying on emotional intelligence, attention, and interpersonal skills to deliver quality outcomes. Employees' engagement their emotional, cognitive, and behavioral involvement in tasks, is a decisive factor influencing productivity, customer satisfaction, and organizational success. High engagement has been linked to enhanced creativity, resilience under stress, and superior interpersonal interactions, whereas low engagement often results in fatigue, absenteeism, and suboptimal service outcomes.

Despite its importance, engagement is challenging to assess in dynamic work environments. Traditional methods such as surveys and interviews are limited by subjectivity, temporal constraints, and the inability to capture subtle fluctuations during work. Employees may overestimate or underestimate their engagement, and managers' observations are often constrained by selective attention. These limitations underscore the need for objective, real-time assessment tools.

Emerging technologies in affective computing and multimodal human–state detection provide a solution. These systems can combine visual data such as facial expressions, gaze patterns, and posture with physiological signals including heart rate variability (HRV), electrodermal activity (EDA), and blood volume pulse (BVP) to infer engagement levels. Previous research in educational and laboratory settings has demonstrated that integrating multiple modalities improves the reliability and accuracy of engagement assessment compared to unimodal approaches.

However, most existing studies focus on controlled environments, such as online learning platforms or experimental labs. The application of multimodal engagement assessment in real-world service industries remains limited. Service work often involves multitasking, emotional labor, and variable interpersonal interactions, which may influence engagement in ways not captured by existing models. Therefore, this study proposes a conceptual workflow model that translates the principles of multimodal engagement assessment into practical frameworks suitable for diverse service contexts.

Literature Review

Engagement and Its Measurement

Engagement is typically defined as a multidimensional construct encompassing emotional, cognitive, and behavioral involvement. In service contexts, emotional engagement reflects empathy, motivation, and enthusiasm; cognitive engagement reflects focus, decision-making, and problem-solving; behavioral engagement reflects consistent performance and task completion. Accurate assessment of these dimensions is essential for improving workforce management, customer satisfaction, and organizational outcomes.

Traditional engagement assessments rely on self-report instruments, supervisor evaluations, and observation checklists. While valuable, these methods are limited in terms of temporal resolution,

susceptibility to bias, and inability to capture micro-fluctuations of engagement during continuous work activities.

Technological Approaches to Engagement Detection

Technological approaches aim to complement traditional methods through objective data analysis. Abedi and Khan (2022) proposed a hybrid deep learning model combining ResNet and Temporal Convolutional Networks (TCN) to detect engagement from visual data in online learning environments [1]. Using the DAiSEE dataset, which contains annotated student videos with four engagement levels, their method achieved state-of-the-art performance compared to CNN, LSTM, and GRU baselines. Spatial features were captured through ResNet, while TCN accounted for temporal dependencies. This study demonstrates the efficacy of combining spatial and temporal representations for visual engagement detection.

Physiological signals provide another dimension of engagement measurement. Sarkar and Etemad (2023) introduced a self-supervised ECG-based framework to recognize emotional states [2]. The model first learns general ECG representations through signal transformation recognition, and then transfers the features to an emotion classification network. Evaluated across four datasets AMIGOS, DREAMER, WESAD, and SWELL the approach improved cross-dataset generalization and reduced reliance on labeled data. Physiological modalities such as HRV and EDA are particularly valuable for detecting arousal and stress, which often correlate with engagement levels.

Integrating visual and physiological data offers further advantages. Singh et al. (2025) presented VisioPhysioENet, a multimodal system using facial landmarks and rPPG signals to detect engagement in learners [3]. By combining the two modalities through advanced fusion methods, the system outperformed unimodal approaches by 8.6% in accuracy. Similarly, Mehta et al. (2024) introduced the MIAM dataset, which combines RGB, depth, and IMU data to assess operator engagement in industrial tasks [4]. Multimodal fusion in these contexts demonstrated improved recognition of actions and behaviors, highlighting the applicability of multimodal approaches beyond educational settings.

Finally, platforms such as AMIRA (Auriol, 2007) exemplify multi-modal integration in real-world field scenarios, supporting decision-making and information access for mobile workers through audio, image, and text data [5]. These studies collectively underscore those multimodal approaches provide richer and more reliable indicators of engagement than any single modality alone.

Table 1.

Comparison of Key Multimodal Engagement Studies

Study	Modality	Dataset	Key Features	Outcome
Abedi & Khan, 2022	Visual	DAiSEE	ResNet+TCN	State-of-the-art visual engagement detection
Sarkar & Etemad, 2023	Physiological	AMIGOS, DREAMER, WESAD, SWELL	Self-supervised ECG	Improved emotion recognition and cross-dataset generalization
Singh et al., 2025	Visual + Physiological	DAiSEE	Facial landmarks + rPPG	Outperformed unimodal methods by 8.6%
Mehta et al., 2024	RGB + Depth + IMU	MIAM	Multimodal network	Accurate industrial task engagement recognition
Auriol, 2007	Audio + Image + Text	In-house	Multi-modal assistance platform	Improved field decision-making

The literature review highlights a clear gap: few studies have applied multimodal engagement detection in service-industry workflows, where dynamic and interpersonal factors play a critical role. This gap motivates the development of a conceptual workflow model tailored to service environments.

Methodology. This study develops a conceptual workflow model for multi-modal engagement assessment, integrating insights from visual and physiological modalities within a structured, service-industry context.

Conceptual Framework

The model consists of four primary stages: data acquisition, preprocessing, feature extraction and fusion, and engagement inference. Data acquisition includes simultaneous collection of visual cues (facial expressions, gaze, posture) and physiological signals (HRV, EDA, BVP) during work activities. Preprocessing aligns, normalizes, and filters the raw data streams to ensure temporal and signal quality consistency. Feature extraction transforms raw data into informative indicators, such as facial movement patterns, pulse variability, and electrodermal peaks. Feature-level fusion then integrates visual and physiological information into a combined representation. Finally, engagement inference interprets the fused features to estimate engagement levels.

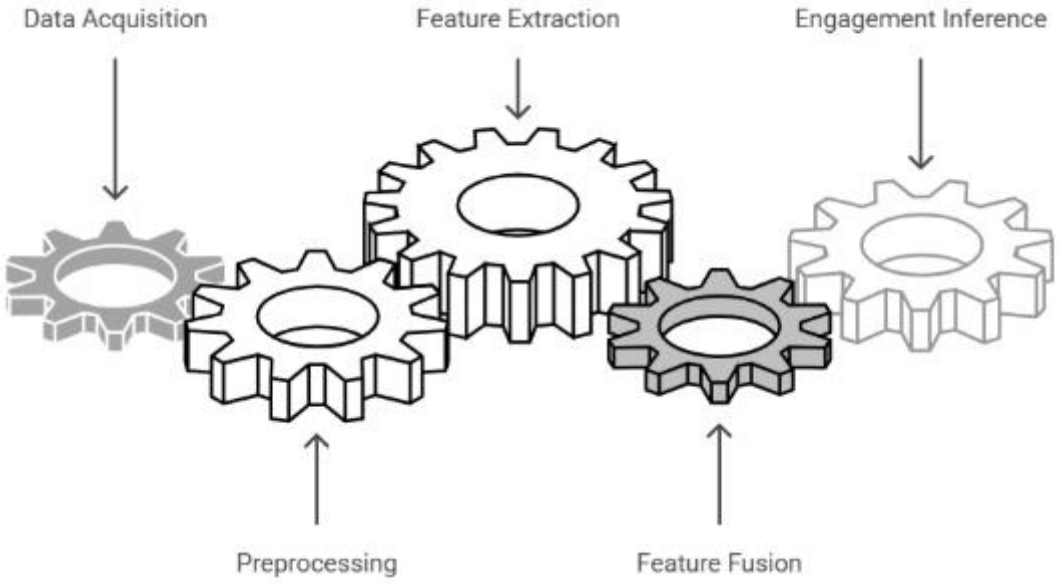


Figure 1. Conceptual Workflow Model of Multi-Modal Engagement Assessment.

This workflow provides a **modular, adaptable framework** suitable for multiple service-industry environments, emphasizing objectivity, real-time capability, and comprehensive measurement of engagement through complementary multimodal data sources.

Data Modalities and Integration

Visual signals provide external indicators of engagement, capturing attention, emotional expression, and behavioral consistency. Physiological signals capture internal arousal and cognitive load, offering insights that are not externally observable. Together, these modalities provide a comprehensive view of engagement. In practice, data could be collected via cameras and wearable sensors embedded in workplace environments.

Integration of these modalities is conceptualized as **feature-level fusion**, which merges features extracted from visual and physiological data into a single, unified representation. This fusion ensures that the model accounts for both observable behaviors and internal emotional states, increasing reliability and robustness.

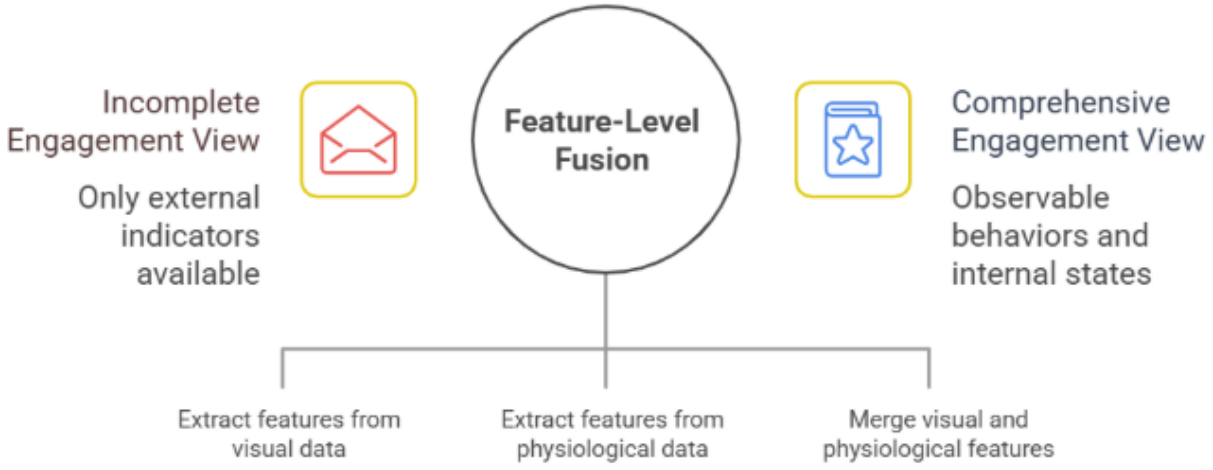


Figure 2. Integration of Visual and Physiological Features.

This diagram illustrates how features extracted from visual cues (facial expressions, gaze, posture) and physiological signals (HRV, EDA, BVP) are combined into a single fused representation [6]. The fusion stage integrates complementary information from both modalities, capturing both external behaviors and internal states, which enhances the accuracy and robustness of engagement assessment.

Workflow Application

The workflow model is designed to be adaptable across multiple service contexts. In education, the framework could monitor student engagement in virtual classrooms. In healthcare, it could assess nurse attentiveness during critical procedures. In customer service, it could help managers evaluate employee focus in real time during client interactions [7].

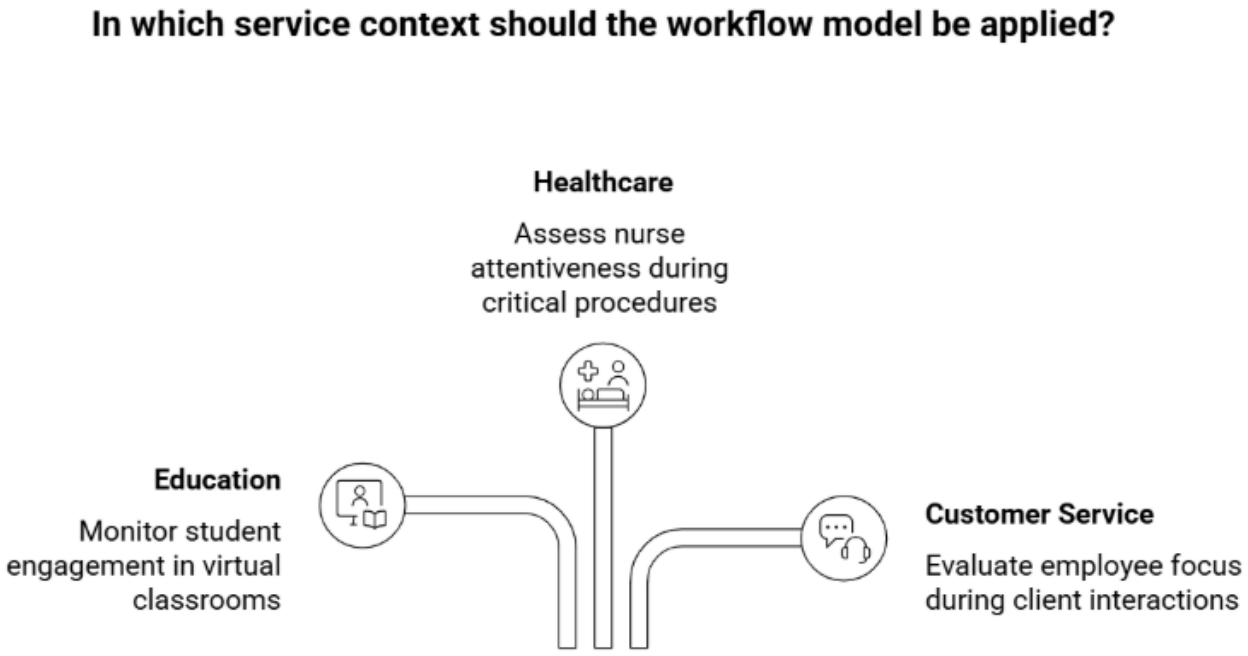


Figure 3. Application of the Workflow Model in Different Service Contexts.

This figure illustrates how the conceptual workflow model can be applied across different service-industry environments. Visual and physiological data are collected from employees in classrooms, hospitals, and customer service settings. The diagram shows that the same workflow data

acquisition, preprocessing, feature extraction, fusion, and engagement inference can be adapted to various contexts to monitor and evaluate employee engagement in real time.

Discussion

Although the model is conceptual, it provides several theoretical advantages. Multimodal integration allows for holistic engagement assessment, reducing reliance on single modalities and mitigating errors caused by environmental or individual variability. The sequential workflow ensures clarity, with modular stages that can be independently developed and empirically tested in the future.

The framework also emphasizes adaptability. Different contexts may prioritize distinct modalities; for example, visual cues may dominate in educational settings, while physiological signals may be more relevant in high-stress healthcare scenarios. Moreover, once implemented, the framework could support **real-time monitoring**, providing feedback for interventions to maintain or enhance engagement.

Ethical considerations are critical. Collection of physiological and visual data must adhere to privacy, consent, and security standards, ensuring that monitoring does not infringe on employee rights. Future empirical studies should validate the model, comparing multimodal assessment with traditional engagement measures and evaluating performance across service sectors [8].

Conclusion

This paper presents a conceptual workflow model for assessing employee engagement in the service industry using multimodal data that combine visual and physiological signals. Traditional assessment methods such as surveys, supervisor observations, and periodic evaluations cannot capture real-time fluctuations in engagement. In contrast, integrating external behavioral cues (facial expressions, gaze, posture) with internal physiological indicators (heart rate variability, electrodermal activity, blood volume pulse) provides a more objective and comprehensive understanding of engagement.

The proposed workflow includes data acquisition, preprocessing, feature extraction, multimodal fusion, and engagement inference. Its modular design allows the model to be adapted for various sectors, including education, healthcare, hospitality, and customer service.

Although conceptual, the framework offers a foundation for future empirical research and practical implementation. Potential next steps include pilot studies in real service environments, comparison with existing methods, and the development of adaptive feedback mechanisms that use engagement data to support employee focus and well-being. Ethical issues such as data privacy, informed consent, and responsible handling of physiological information remain essential considerations.

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Rezyume: *Ushbu ish xizmat ko ʻrsatish sohasida (masalan, ta'lim, sog'liqni saqlash)* ***xodimlarning ishga jalb qilinganligini*** *obyektiv baholash uchun* ***Affektiv Hisoblash*** *yordamida* ***kontseptual modelni*** *taklif qiladi. Subyektiv soʻrovnomalardan farqli oʻlaroq, model* ***Vizual Belgilar*** *(yuz ifodasi, holat) va* ***Fiziologik Signallarni*** *(HRV, EDA) birlashtiradi. Ish jarayoni toʻrtta bosqichdan iborat:* ***Ma'lumotlarni Yigʻish, Dastlabki Ishlov Berish, Xususiyatlarni Birlashtirish*** *va* ***Jalb Qilinganlikni Aniqlash.*** *Bu xodimlarning samaradorligini va farovonligini oshirish uchun moslashuvchan, real vaqt rejimida ishlaydigan asosni ta'minlaydi.*

Резюме: *Данная работа предлагает* ***концептуальную модель*** *для объективной оценки* ***вовлеченности сотрудников*** *в сфере услуг (например, образование, здравоохранение) с использованием технологий* ***Аффективных Вычислений****. В отличие от субъективных опросов, модель интегрирует* ***Визуальные Сигналы*** *(мимика, поза) и* ***Физиологические Показатели*** *(ВСР, ЭДА). Рабочий процесс строго структурирован и включает четыре этапа:* ***Сбор Данных, Предварительная Обработка, Слияние Признаков*** *и* ***Вывод Уровня Вовлеченности.*** *Это обеспечивает адаптивную и работающую в реальном времени основу для повышения эффективности и благополучия персонала.*

Kalit soʻzlar: *xodimlarning jalb qilinganligi, multimodal baholash, affektiv hisoblash, fiziologik signallar, vizual belgilar, xususiyatlarni birlashtirish, real vaqt rejimida monitoring, xizmat koʻrsatish sohasi.*

Ключевые слова*: вовлеченность сотрудников, мультимодальная оценка, аффективные вычисления, физиологические сигналы, визуальные сигналы, слияние признаков, мониторинг в реальном времени, сфера услуг.*

RESEARCH OF INDUCTIVE NEUTRAL GROWTH PROCESSES IN 6-35 KV ELECTRIC NETWORKS

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Summary: *The article examines the development and analysis of a mathematical model that takes into account the processes of inductive grounding of a neutral in medium-voltage (6-35 kV) electrical networks, the active resistance of the grounding reactor, the effects of nonlinear saturation of the magnetic circuit, and the influence of external disturbances. Also, statistical data and obtained results are presented in the form of tables and graphs..*

Key words: *inductive grounding, neutral, electrical networks, medium voltage, mathematical modeling, Runge–Kutta method, transient processes, nonlinear saturation*

Introduction

Inductive neutral grounding is widely used in medium-voltage (6-35 kV) electrical networks to increase their reliability and reduce ground fault currents. This method is based on the use of a grounding reactor, which compensates for the capacitive currents of the network and reduces the probability of arc closures occurring.

With the increasing load and the spread of distributed generation in medium-voltage networks, the issues of protection and stability of electric power systems are becoming particularly relevant. Under such conditions, the correct choice of inductive neutral grounding parameters allows for a reduction in accidents and minimizes equipment damage. In addition, the optimal configuration of the grounding system contributes to a reduction in technological losses of electricity and improves the quality of electricity supply.

Analysis of transient processes in inductive grounding of the neutral requires a comprehensive approach, including mathematical modeling, numerical calculation methods, and experimental confirmation of the obtained results. This work examines key aspects of modeling these processes, which allows for the development of recommendations for selecting optimal parameters of inductive neutral grounding to enhance the reliability of electrical networks.

Relevance

Traditional neutral grounding circuits have several disadvantages, such as high overvoltages during arc closures and the complexity of setting up compensating devices. Inductive grounding of the neutral allows for a reduction in the amplitude of ground fault currents, which increases electrical safety and reduces equipment damage. However, selecting inductance parameters and analyzing transient processes requires the application of mathematical models and numerical calculation methods.

Purpose of research

Development and analysis of a mathematical model of the processes of inductive neutral grounding in 6-35 kV electrical networks, taking into account the active resistance of the reactor, nonlinear saturation effects of the magnetic core, and the influence of external disturbances.

Theoretical foundations of inductive neutral grounding

In distribution networks with a working voltage of 6-35 kV, the main problem is the grounding mode for the reliability of the consumer's power supply, the safety of electrical machines and power cables, the safety of people and animals found in the passages of the lines, as well as the choice of principles and types of relay protection and automation devices (RPA), methods for using these devices for disconnection, signaling in single-phase ground closures (LPS) **[1, p.3]**.

In the modern industrial world, any power outage leads to the most tragic and unpredictable consequences **[2, p.15]**. In August and September 2003, power grid accidents shocked almost all industrial countries. In the vast majority of cases, the causes of such unpleasantness are overstresses, including those arising in the case of single-phase ground closures **[3, p.7].**

Inductive neutral grounding represents a method of compensating for capacitive currents arising during phase grounding in medium voltage electrical networks. The main element of this circuit is the arc-extinguishing reactor (Petersen coil), which is connected between the transformer neutral and the ground.

The operating principle of inductive grounding is based on the fact that in the process of single-phase grounding, the current passing through the grounding reactor partially compensates for the capacitive current of the network. This allows for a reduction in the risk of arc overloads and a decrease in equipment damage.

The main advantages of inductive neutral grounding are:

- reduction of ground fault current amplitude,
- reduction of the probability of arc closures,
- increasing the electrical safety of the network,
- reduction of thermal and mechanical damage to equipment.

However, this method also has its limitations. In particular, the selection of grounding reactor parameters should take into account:

- resonance phenomena that can lead to overvoltages,
- the effect of the reactor's active resistance on the compensation efficiency,
- nonlinear properties of the reactor magnetic core.

Mathematical model of processes in a network with inductive grounding

The processes in a network with inductive grounding are described by a system of differential equations that take into account the influence of the active resistance of the grounding reactor, the inductance, and the network capacity:

$$\frac{dU}{dt} = -\frac{I_1}{C} \qquad (1)$$

$$\frac{dI_1}{dt} = \frac{U}{L} - \frac{R_1 I_1}{L}$$

where:

U- capacitance voltage,

U_L-current through inductance,

C - network capacity relative to the ground,

L- grounding reactor inductance,

R_L-is the active resistance of the grounding reactor.

C- network capacity,

L_-nom-nominal inductance of the reactor,

R_L- reactor active resistance,

U_0- initial voltage,

I_o- initial current.

Additionally, using the example, the nonlinearity of the ground reactormagnetic core through the saturated inductance, given by the approximating function, is considered in the calculations.

Initial data

The following parameters are used for numerical modeling:

- C=1 mkf, -network capacity relative to the ground,(2)
- $L_{nom} = 0.1$ Ohms of the reactor′s nominal inductance,
- U_0=1 B– initial voltage,
- I_0=0 AInitial current

Based on the given model (1) and initial data (2), we solve the problem using the Runge-Kutta method. This method allows for the numerical integration of the system of differential equations, ensuring high accuracy with a relatively small number of steps.

Solution algorithm (Runge-Kutta method)

1. Determining the initial network parameters.

2. Formation of a system of differential equations.
3. Application of the 4th order Runge-Kutta method for numerical solution.
4. Constructing time graphs of transient processes.
5. Analysis of the influence of parameters on the dynamics of the system.

Solution code (MATLAB)

```
clc;
clear;
close all;

% Initial data
C = 1e-6;  % Farad
L_nom = 0.1; % Henry (nominal inductance)
R_L = 5;  % Ohm (reactor's active resistance)
U0 = 1;    % Initial voltage
I0 = 0;    % Initial current

L = @(U) L_nom / (1 + 0.1 * abs(U));

dUdt = @(U, I_L) -I_L / C;
dILdt = @(U, I_L) (U / L(U)) - (R_L * I_L / L(U));

dt = 1e-6;
t_max = 0.02;
t = 0:dt:t_max;

U = zeros(size(t));
I_L = zeros(size(t));
U(1) = U0;
I_L(1) = I0;

for k = 1:length(t)-1
    k1_U = dUdt(U(k), I_L(k));
    k1_I = dILdt(U(k), I_L(k));

    k2_U = dUdt(U(k) + k1_U*dt/2, I_L(k) + k1_I*dt/2);
    k2_I = dILdt(U(k) + k1_U*dt/2, I_L(k) + k1_I*dt/2);

    k3_U = dUdt(U(k) + k2_U*dt/2, I_L(k) + k2_I*dt/2);
    k3_I = dILdt(U(k) + k2_U*dt/2, I_L(k) + k2_I*dt/2);

    k4_U = dUdt(U(k) + k3_U*dt, I_L(k) + k3_I*dt);
    k4_I = dILdt(U(k) + k3_U*dt, I_L(k) + k3_I*dt);

    U(k+1) = U(k) + (dt/6) * (k1_U + 2*k2_U + 2*k3_U + k4_U);
    I_L(k+1) = I_L(k) + (dt/6) * (k1_I + 2*k2_I + 2*k3_I + k4_I);
end

% Output value table
table_data = [t(1:5000:end)', U(1:5000:end)', I_L(1:5000:end)'];

fprintf(' Time (s) Voltage (V) Current (A) \n ');
```

```
fprintf('--------------------------------\n');
fprintf('%8.5f   %12.6f   %10.6f\n', table_data');
% Graphs
figure;
subplot(2,1,1);
plot(t, U, 'b');
grid on;
title('Voltage at the container ');
xlabel('Time, s');
ylabel(Voltage, V ');

subplot(2,1,2);
plot(t, I_L, 'r');
grid on;
title('Current through inductance');
xlabel('Time, s');
ylabel('Current, A');
```

Digital results and their interpretation

The initial conditions are given in Table 1 for the values of voltage and current a, as well as visual results of voltage on the capacitor and current through the inductor at different times of time (Fig. 1).

Table 1. The values of voltage and current at different times.

Time (s)	Viltage (V)	Current (A)
0.00000	1.000000	0.00000
0.00500	-0.664134	-0.001912
0.01000	0.161285	0.002463
0.01500	0.246919	-0.002054
0.02000	-0.469504	0.001205

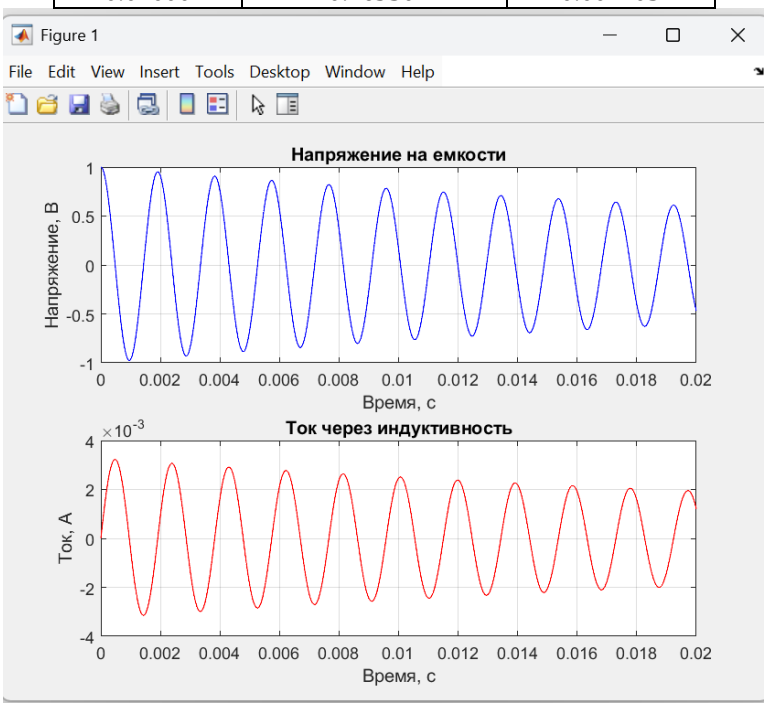


Fig.1. Change in capacitance voltage and current through inductance at different times

Analysis and discussion

The problem is solved in the MATLAB environment using the 4th-order Runge-Kutta method, which ensures sufficiently high accuracy in the numerical integration of systems.

Initial conditions (judging by Table. 1) are given as:

$$U_{(0)}=1.0\ V,\ I_1 = 0.0\ A.$$

1. The behavior of voltage U (t)

Initial moment t=0

U $_{(0)}$ = 1.0 V. The capacitor is initially charged to 1 V, and the current through the inductor is zero.

Vibrational nature:

From the first points (0.005 s, 0.010 s, etc.), it is evident that the voltage changes its sign from positive to negative and vice versa, indicating an oscillatory process.

- At*t*=0.005s :*U*≈−0.664B (the voltage has changed polarity.).
- At*t*=0.010 s: *U*≈0.161B (back to the positive region).
- At*t*=0.015s: *U*≈0.247 B (Another phase of oscillation).
- At*t*=0.020 s: *U*≈−0.470 B (again negative half-wave).

Amplitude and attenuation:

Comparing the voltage modulus at different times, it can be observed that the voltage amplitude gradually decreases. For example, at the moment of 0.005 s, the modulus U is about 0.66 V, and by 0.020 s - already about 0.47 V (by modulus). This indicates the presence of damped oscillations caused by the resistance R_1.

1. Current behavior *$I_1(t)$*

Initial moment *t=0*

$I_1(0) = 0$. Since the capacitor is charged and there is no current in the inductor, the initial energy of the system is completely concentrated in the electric field of the capacitor.

Change current sign:

- At*t*=0.005s: *I_1*≈−0.001912 A (The current has become negative.).
- At$_t$=0.010 s: *I_1*≈0.002463 A (The current has become negative.).
- At$_t$=0.015 s: *I_1*≈−0.002054 A (again negative).
- At*t*=0.020 s: *I_1*≈0.001205 A (positive).

Thus, the current, like the voltage, oscillates, passing through zero and changing its sign, which corresponds to the typical behavior in the oscillatory circuit.

Amplitude change:

The maximum current values (by modulus) at the indicated points also gradually decrease (for example, from ~0.00246 A to ~0.00205 A and further to ~0.00120 A), indicating a decrease in attenuation.

Phase relationships

Figure 1 (top graph - *U(t)*, bottom - *$I_1(t)$*) shows that the voltage and current oscillations are phase-shifted relative to each other, as should be the case in a classical LC oscillatory system, taking into account the resistor.

• When the voltage across the capacitor reaches its maximum, the current is close to zero.

• When the current reaches its maximum, the voltage across the capacitor passes through zero.

This behavior reflects the process of energy exchange between the electric field in the capacitor and the magnetic field in the inductor, with a portion of the energy dissipating as heat in the resistor **R_1.**

1. Physical meaning of the obtained results

1. ***Initial energy.*** At the moment t=0, the capacitor is charged, therefore, the system's energy is concentrated in the capacitor's electric field. The current is zero, therefore, there is no energy in the magnetic field of the inductor.

2. ***Vibrations.*** When the circuit is closed (or the calculation is started), the charge begins to flow into the inductance, forming a magnetic field. When the voltage on the capacitor drops to zero, the current in the inductor reaches its maximum. Then the process goes in the opposite direction: the capacitor is charged again, but with the opposite sign, and the current decreases. This is how fluctuations occur.

3. ***Attenuation.*** The real circuit has resistor **R1**, so part of the energy dissipates in heat. That is why the amplitudes of voltage and current gradually decrease (sink) over time.

4. ***Dependence on parameters.*** The main characteristics of the oscillatory process (frequency and degree of attenuation) depend on **L, C,** and $\mathbf{R_1}$:

Specific (Resonance) Frequency $\omega_0 \approx \frac{1}{\sqrt{LC}}$.

The attenuation coefficient is related to $\frac{R}{2L}$. When $\mathbf{R_1}$ is greater, the oscillations are damped faster.

4. Analysis of graphs (Fig. 1)

The graphs presented in Figure 1 clearly show:

Vibrational character (both quantities (voltage and current). The shape is close to sinusoidal, which is typical for LC-circuits.

Change of sign: voltage and current pass through zero values, reflecting the continuous flow of energy between electric and magnetic fields.

Decrease in amplitude as time increases, indicating the presence of damping.

Phase shift between voltage and current, which in an ideal LC circuit (without losses) would be $\pi/2$ (90°). In the presence of resistance, this phase changes somewhat, but the overall picture remains close to classical.

5. Conclusions

1. **Correctness of the numerical solution.** The obtained voltage and current values correspond to the theoretically expected behavior of the oscillatory circuit: the initial charge of the capacitor, the transition of energy to the magnetic field of the inductor, the change in the polarity of the voltage and the direction of the current, and the attenuation due to resistance.

2. **Qualitative coincidence with the theory.** The observed wave-like shape of the graphs, the alternation of voltage and current signs, and the gradual decrease in amplitudes confirm that the model (ODU system) and Runge-Kutta method provide an adequate description of real processes in the RLC circuit.

3. **Numerical data.** Table-based results (Table 1) give specific values of U and I_1 at discrete moments in time, and the graphs allow for visual tracking of the dynamics. The totality of these data is important for further analysis, including:

- determination of the frequency and period of oscillations;
- estimates of the attenuation rate (calculation of the logarithmic decrement of oscillations);
- comparison with theoretical calculations to verify the correctness of the vb.

Practical significance.

Similar analysis is important when designing oscillatory circuits, filters, resonant circuits, and other devices where attenuation, resonant frequencies, and transient processes must be considered.

Conclusion

The main conclusions of the study can be formulated as follows:

The mathematical model describing the relationship between capacitor voltage and current through inductance adequately reflects the physical processes in a circuit with inductive grounding. The numerical results presented in the form of tables and graphs show a typical oscillatory nature of

transient processes with a clearly expressed phase shift between voltage and current, which corresponds to theoretical expectations.

The application of the 4th order Runge-Kutta method allowed for obtaining high-precision results even with the use of sufficiently small integration steps. This method has proven its validity in solving systems of ordinary differential equations, making it a reliable tool for analyzing the dynamics of systems with inductive grounding.

The analysis of the obtained results emphasizes the importance of correctly selecting the parameters of the system elements (capacity, inductance, and active resistance of the reactor). Changing these parameters significantly affects the amplitude, frequency of oscillations, and attenuation rate, which is crucial for ensuring the reliability and safety of electrical networks.

The modeling results and subsequent analysis demonstrate the practical applicability of the obtained data for optimizing the parameters of inductive neutral grounding. This allows for a reduction in the probability of arc closures occurring, reduces equipment damage, and increases the overall electrical safety of medium voltage systems. Similar modeling can also serve as a basis for developing recommendations for designing and configuring relay protection and automation systems.

Despite the positive results obtained, further research on the nonlinear effects of magnetic core saturation and the influence of external disturbances on the system's dynamics remains relevant. Further experimental studies and their comparison with numerical models will help to more accurately determine the optimal parameters of inductive grounding and expand the scope of application of the developed methodology.

As a result, the conducted research not only confirms the correctness of the chosen mathematical model and numerical method, but also opens up opportunities for the practical implementation and further optimization of inductive grounding systems in electrical networks, which is of significant importance for increasing their reliability and safety.

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Rezyume:*Maqolada o‘rta kuchlanishli (6-35 kV) elektr tarmoqlarida neytralni induktiv yerga ulash jarayonlari, yerga ulash reaktorining aktiv qarshiligi, magnit zanjirining nochiziqli to‘yinish effektlari va tashqi g‘alayonlar ta’sirini hisobga oluvchi matematik modelni ishlab chiqish va tahlili ko’rib chiqilgan. Shuningdek, statistik ma'lumotlar, olingan natijalar jadval va grafik ko‘rinishida keltirilgan.*

Резюме: *В статье рассматривается разработка и анализ математической модели, учитывающей процессы индуктивного заземления нейтрали в электрических сетях среднего напряжения (6-35 кВ), активное сопротивление заземляющего реактора, нелинейные эффекты насыщения магнитной цепи и влияние внешних возмущений. Также статистические данные, полученные результаты представлены в виде таблиц и графиков.*

Kalit so‘zlar: *Induktiv yerga ulash, neytral, elektr tarmoqlari, o‘rta kuchlanish, matematik modellashtirish, Runge-Kutta usuli, o‘tkinchi jarayonlar, nochiziqli to‘yinish.*

Ключевые слова: *индуктивное заземление, нейтраль, электрические сети, среднее напряжение, математическое моделирование, метод Рунге-Кутта, переходные процессы, нелинейное насыщение.*

UDC 626.631.82

EVALUATION OF ENHANCING OPERATIONAL RELIABILITY OF THE MAIN CANAL THROUGH THE INSTALLATION OF A SETTLING BASIN WITH HYDRAULIC FLUSHING

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Summary: *The article examines the results of field research on determining the location of the flushing settling tank and developing measures to adapt the operating conditions of the Anasay canal to the Kerder and Kattagar channels, as well as the technology for flushing the settling tank by maneuvering the gates of the Tasharna canal to obtain the necessary flow velocity for flushing sediment.*

Key words: *sedimentation tank, sediments, channel, fractions, diameter, turbidity, washing velocity, flow rate, water discharge, gate maneuvering, hydraulic size.*

Introduction. The control of solid sediment in irrigation systems is achieved through the use of irrigation settling basins, designed to create conditions for solid particles to settle on the bottom, with subsequent removal of these deposits by hydraulic or mechanical means. Minor deviations in the concentration of suspended particles at the outlet of the settling basin from the designed values can lead to instability in the channels of main and distribution canals, consequently disrupting the functionality of the entire irrigation network.

In turn, the standard turbidity values at the settling tank outlet should be coordinated with the sediment-carrying capacity of the flow in the canal section exiting the settling tank. The conceptual scheme for hydraulic calculation of turbidity in the settling tank involves solving the problem of sediment deposition along the length of the settling tank.

Analysis of methods and materials. Existing methods for calculating irrigation settling tanks, proposed at various times by A.N.Gostunsky, S.Kh.Abalyants, A.G.Khachatryan, and other researchers, do not fully reflect the true picture of the ongoing processes. First and foremost, these methods do not account for the alternation between sediment deposition processes and their resuspension into the flow, caused by changes in the fractional composition of sediments. In turn, knowledge of the sediment settling path length, differentiated by various fractions, would allow for obtaining data on the redistribution of siltation volumes along the length of the irrigation settling tank. This information is necessary for selecting a rational design solution for the settling tank's operation and an efficient system of operational measures [1-3].

Recommendations for the hydraulic calculation of turbidity in settling tanks, taking into account the fractional composition of sediments, were developed by A.G.Khachatryan, H.Sh.Shapiro, and V.S.Verbitskiy. However, the proposed calculation methods were limited to the framework of a one-dimensional hydraulic model, did not take into account the intra-annual distribution of turbidity in the rivers and the dynamics of the state of the riverbed and canals. Meanwhile, changes in the embankment structure and its dimensions significantly affect the stability of irrigation network elements, especially the lower reaches of hydraulic structures - the formation of the embankment ensures conditions for increasing the upper limit of non-eroding velocities.

Research results. Based on the results of field research, work was initially carried out to determine the location of the settling tank.



Figure 1. Locations of the settling tank at the end of the Anasay Canal

When installing a sedimentation tank with hydraulic washing, the required difference between the beginning of the washing gallery and the river water level to obtain a water velocity that allows for the washing of sediment accumulated in the sedimentation tank chamber should be written as follows:

$$D_h = \Sigma\xi \frac{V_{flu}^2}{2g}, \quad (1.1)$$

where: $\Sigma\xi$ – sum of the coefficients of hydraulic losses in the gallery;

V_{flu} – water flow velocity in the flushing gallery;

g – gravitational velocity.

To obtain the required flow velocity for sediment flushing, the water level difference should be at least 1,83 m, and this velocity should be written as follows:

$$V_{flu} \geq \omega \frac{h_{flu}}{d} P^{1,85} = 2{,}6 \; m/sek, \quad (1.2)$$

where: d – the diameter of sediment particles requiring washing, smaller diameter particles make up 75% of the sediment composition;

ω - the hydraulic size of these particles,

h_{flu} - flushing depth,

P - the percentage of sediment mass in the flushing flow.

Considering that in any hydrological conditions of flooding, low water, there is no necessary water level drop, it is necessary to find the possibility of installing hydraulically washed sedimentation tanks. Thus, in the existing hydrological-hydraulic and topographic conditions, the installation of periodically operating settling tanks is a technically acceptable solution [2,5].

It should be noted that when considering options for constructing settling tanks with periodic or continuous flushing, it is necessary to place a regulating structure equipped with gates at the head of the canal, concrete the settling chambers to ensure appropriate hydraulic regime, and place a control structure equipped with flushing galleries at the end of the settling tank. At the same time, the installation of appropriate structures can lead to a decrease in the water level throughout the canal, which negatively affects the operation of water intake structures at the end of the main canal.

The main tasks in determining the dimensions of the settling tank are to determine its geometric dimensions and sedimentation time, since it is these parameters that have the greatest impact on its operational characteristics, and ultimately on the capital costs for its construction and operational costs for its maintenance.

As initial data for calculating the settling tank, the most unfavorable conditions to ensure the operation of hydraulic structures were taken, in particular, this relates to water discharge and the

average suspended turbidity of the flow. As for sediments that must be retained in the settling tank, all sediments entering with the river flow must be retained, except for a fraction of 0,0015 mm and smaller. Thus, the following parameters were taken into account in the calculations:

Discharge coming to the settling tank $Q=60\ m^3/sek.$

Settling tank depth $H=7,42\ m.$

Average water flow velocity in the settling tank $V_{av} = 0,35\ m/sek.$

Average weighted turbidity the entrance to the settling tank $\rho_0 = 3,6\ kg/m^3$.

Diameter of the smallest fraction that must be retained in the settling tank $D = 0,05\ mm.$

Hydraulic size of the smallest fraction that must be retained in the settling tank $\omega = 0,00178\ m/sek.$

Average weighted hydraulic sizes of sediments $w_0=0,00706\ m/sek.$

Based on the obtained information on the granulometric composition of sediments entering the canal with river water and the hydraulic characteristics of the canal, it is possible to determine the length of the settling tank by assigning the water velocity in it.

Taking into account the recommendations, let's assume the settling tank width is equal to the design channel width and $V_{av} = 0,35\ m/sek.$ For a rectangular cross-section of the settling tank and at a water flow velocity of *0,35 m/sec*, *L* - is the length of the settling tank that ensures the retention of sediments of the smallest fraction (diameter 0,05 mm), for which information about its content is available, and is:

$$L = H\ V/\omega = 7,42\ x\ 0,35/0,00178 = 1458,9\ m \qquad (1.3)$$

Here: *L* - sedimentation tank length,

V - average water flow velocity in the settling tank.

One of the most important characteristics from an operational point of view is the settling time. Taking into account the average weighted turbidity of the water entering the settling tank, as well as the need for continuous water supply to the irrigation canal, it is possible to determine the probable duration of sedimentation in the settling tank.

Calculation of sedimentation time. Calculating ω/V and H/L according to the recommendations, we find the probability of precipitation of the calculated fraction P = 98%, i.e., at least 98% of sediments with a diameter of 0,05 mm and larger will be retained in the settling tank [1,2,4,5].

For the required flow velocity and sediment flushing, we chose the Tasharna Canal, which has not been operated for a long time. The calculated capacity of the regulator and the Tasharna Canal from the Bessaga Hydraulic Unit is 150,0 m^3/s. Commissioned in 1986, the purpose of the Tasharna Canal construction was to replenish the Kegeyli Canal during low-water years on PK 114 from the Bessaga Hydraulic Unit. The channel regulator has five holes measuring 8,0x2,5 m, separated by a 75 sm thick wall. The holes are covered with flat, submerged, sliding gates with lifts having an electric drive. A 30 cm thick reinforced concrete ponur is made from the upper reach side [3,5].

In recent years, starting from the 2000s, the canal has been closed to the pressure of the Anasay supply channel, which has led to a severe silting of the upper pool of the Bessaga hydraulic unit at the end of the Anasay canal.

The recommended sedimentation volume will be 253298 m^3 per year, and the sedimentation tank, under these operating conditions, can become completely silted after 19 months.

Conclusion: Taking into account the unevenness of the velocity distribution diagram in the horizontal plane, as well as the trapezoidal cross-section of the settling tank, the settling time can be reduced by 15-20% and amount to about 15 months. Nevertheless, the installation of two parallel settling chambers allows for the stable supply of clarified water for a sufficiently long time and, at the same time, the cleaning of the sludge-filled chamber.

Based on the results of field research, work was initially carried out to determine the location of the settling tank.

Measures have been developed to adapt the operating conditions of the Anasay Canal to the Kerder and Kattagar canals. A technology for flushing the settling tank by maneuvering the gates of

the Tasharna canal has been developed. To obtain the required flow velocity for sediment flushing, the water level difference must be at least 1,83 m.

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Rezyume: *Maqolada yuvish tindirgichining joylashuvini aniqlash bo'yicha o'tkazilgan dala tadqiqotlari natijalari, Anasay kanalining ishlash sharoitlarini Kerder va Kattagar kanallari rejimiga moslashtirish chora-tadbirlarini ishlab chiqish, shuningdek, cho'kindi jinslarni yuvib ketish uchun zarur oqim tezligini ta'minlash maqsadida Tasharna kanali zatvorlarini boshqarish orqali tindirgichni yuvish texnologiyasi ko'rib chiqilgan.*

Резюме: *В статье рассматривается результаты полевых исследовании по определению местоположения промывного отстойника и разработка мероприятии по адаптации условий эксплуатации канала Анасай к режиму каналов Кердер и Каттагар, а также технология промывки отстойника с маневрированием затворов канала Ташарна, для получения необходимой скорости потока для промывки осаждённых наносов.*

Kalit so'zlar: *tindirgich, cho'kindilar, kanal, fraksiyalar, diametr, loyqalik, yuvish tezligi, oqim, suv sarfi, zatvorlarni boshqarish, gidravlik yiriklik.*

Ключевые слова: *отстойник, наносы, канал, фракции, диаметр, мутность, промывная скорость, сток, расход воды, маневрирование затворами, гидравлическая крупность.*

IMPROVING THE QUALITY OF ELECTRICAL ENERGY BY REDUCING VOLTAGE LOSSES IN 0.4 KV NETWORKS

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Summary. *This article addresses the issues of improving electric power quality and reducing voltage losses in 0.4 kV electrical networks based on reactive power compensation. The article presents a methodology for selecting and calculating reactive power compensation devices, aimed at ensuring voltage stability in electrical networks, as well as reducing the voltage unbalance coefficient for negative and zero sequences. The results of reducing active power losses and improving the efficiency of electricity utilization through optimal reactive power compensation have also been analyzed. The research results have practical significance for ensuring energy efficiency in 0.4 kV networks and improving the reliability of the power supply system.*

Key words*: reactive power compensation; reactive power factor; active power factor; power losses; electric energy quality indicators; voltage losses; voltage unbalance factor; energy saving; energy efficiency; 0.4 kV electrical networks.*

Introduction. In most rural areas of the Republic of Uzbekistan, electricity supply is provided through overhead power transmission lines, which are characterized by significant voltage drops. This is primarily due to the long distances between power supply sources and consumers residing in dispersed territories. At present, due to the growth of the population, the consumption of electrical energy in the residential sector is also rapidly increasing. As a result, power transmission lines designed in the second half of the last century based on the electricity consumption standards of that time no longer meet the required transmission capacity. As a result, the power quality indicators for consumers with a voltage level of 0.4 kV also do not meet the requirements of the state standard O'zDSt 1044:2003, and at present, this issue remains relevant [1-4].

When electrical energy is transmitted through power networks whose quality does not meet the requirements of the parameters established by the state standard, its losses increase. The issue of implementing effective measures to improve the quality of electric power in 0.4 kV distribution networks is also a relevant and important topic. Since consumers with relatively low power demand are connected to short feeders, reactive power compensation and harmonic filtering in 0.4 kV networks are considered economically impractical. However, in developed countries, devices for reactive power compensation and harmonic filtering are widely used in 0.4 kV distribution networks. Moreover, the implementation of these measures in our Republic can also ensure economic efficiency [1-4].

Materials and Methods. It is known that for 0.4 kV electrical networks, some of the main indicators of electric power quality are: δU_y - steady-state voltage deviation, K_{2U} - negative-sequence voltage unbalance factor, and K_{0U} - zero-sequence voltage unbalance factor. For example, according to the state standard O'zDSt 1044:2003, the voltage deviation at the point of electric power delivery during 100% of the weekly period shall not exceed 10% of the nominal (permissible) voltage value. In the process of transmitting electrical energy at voltages above 0.4 kV through overhead power lines, voltage reduction is an expected phenomenon and represents a complex quantity [1-2].

$$\underline{\Delta U} = \underline{U_1} - \underline{U_2} \quad (1)$$

Where $\underline{U_1}$ is the voltage at the beginning of the line, V, and $\underline{U_2}$ is the voltage at the end of the line, V.

The arithmetic difference of the expression $\Delta U = U_1 - U_2$ is referred to as the voltage drop. For overhead power transmission lines with a rated voltage above 0.4 kV, the active resistance *R* of the line should be approximately equal to, or greater than, its inductive reactance *X*. Therefore, when calculating such networks, the transverse component (the imaginary part) of the voltage deviation may be neglected [1-4]:

$$\Delta U = \frac{PR + QX}{U_1} \tag{2}$$

From expression (2), it can be seen that the voltage losses can be reduced both by decreasing the line resistance and by compensating for *Q* - the reactive power. Therefore, since reducing the resistance of overhead power transmission lines is an economically costly task, it is necessary to implement reactive power compensation. In most cases, this power is not fully utilized in low-voltage networks (only about 25-30% is consumed), which, in turn, leads to voltage losses and, consequently, to losses of active power. The process of compensating reactive power by connecting capacitor banks in parallel to the network is called transverse compensation. In the course of such a process, reactive power compensation using a capacitor bank increases the power factor and simultaneously reduces voltage losses in the network, thereby stabilizing its level. The reactive power generated by a capacitor bank is determined by the following expression, kVAr [3-5]:

$$Q_C = U^2 2\pi f C \tag{3}$$

The selection of capacitor banks is carried out based on the need to increase the line voltage, taking into account the constancy of the active load value. Thus, the difference in voltage losses in the line before and after the connection of capacitor banks is determined as follows:

$$\Delta U = \Delta U_1 - \Delta U_1 = \frac{\left[P_1 r_L + Q_1 x_L - \left(P_2 r_L + Q_2 x_L\right)\right]}{U_{nom}^2} \tag{4}$$

where P_1 and P_2 are the active powers at the beginning of the line and at the consumer, kW; Q_1 and Q_2 are the reactive powers at the beginning of the line and at the consumer, kVAr; r^L and x_L are the per-unit active and inductive resistances of the network, Ω/km.

As a result of reactive power compensation Q_C, the additional reactive load of the network ($Q_2 = Q_1 - Q_C$) decreases. Since the active powers at the beginning of the line and at the consumer's end are equal to each other ($P_1 = P_2$), the relative change in voltage regulation is determined as follows:

$$U_{per} = \frac{Q_C x_L}{U_{nom}^2} \tag{5}$$

In source [3], a method of transverse compensation of reactive power in 0.4 kV distribution networks is proposed. The authors have developed a methodology for calculating reactive power compensation devices in 0.4 kV electrical networks, aimed at ensuring stable voltage deviation for all consumers within the permissible limits established by the national standard, in networks with an average power factor (cosφ) of 0.8 or lower. According to this methodology, it is proposed to install reactive power compensation devices directly on transmission lines. At the same time, it is emphasized that the power capacity of the specified devices must not exceed 50 kVAr [1-4, 6-11].

It is advisable to begin the installation of reactive power compensation devices at the point closest to the transformer substation where the consumer is connected, in cases where the voltage deviation does not comply with the permissible values established by the state standard. Moreover, in accordance with expression (2), after determining the updated voltage deviation values at all consumer connection points based on calculations (or measurements), the reactive power compensation device is installed at the location closest to the transformer substation where the voltage deviation exceeds the permissible limits established by the national standard. Reactive power compensation devices must be installed in such a manner that the process continues until the voltage

deviation at all consumer connection points complies with the permissible values established by the national standard. When determining the locations for installing reactive power compensation devices, their reactive power values are also established, since these values must not lead to the occurrence of overcompensation in the lines [1-4, 6-14].

For the voltage unbalance factor according to the negative- and zero-sequence components, the following electrical energy quality standards are established:

- The voltage unbalance factor by negative sequence at the power delivery point - K_{2U}, and the voltage unbalance factor by zero sequence - K_{0U}, shall not exceed 2% on average over a 10-minute interval during 95% of the weekly period;

- The voltage unbalance factor of the negative sequence at the power transmission point - K_{2U}, and the voltage unbalance factor of the zero sequence - K_{0U}, shall not exceed 4% on average over a 10-minute interval throughout 100% of the weekly period.

In the case of an unbalanced phase load, power losses increase not only in the phase conductors but also in the neutral conductor due to the flow of current [3-4].

$$I_A^2 + I_B^2 + I_C^2 \geq 3I_{cp.}^2 \tag{6}$$

Here, I_{cp} is the average three-phase current flowing through each phase under a balanced load, A.

In a three-phase, three-conductor line, power losses can increase by up to N^2 times due to the unevenness of the phase load. For a three-phase line with four conductors, this situation is calculated using the following expression [3-4, 6-11, 15]:

$$N^2\left(1+1{,}5\frac{R_H}{R_\Phi}\right)-1{,}5\frac{R_H}{R_\Phi} \tag{7}$$

Where R_H and R_Φ are the resistances of the neutral and phase conductors, respectively, in ohms; N^2 is the square of the line's phase load unbalance factor, which is determined by the following expression:

$$N^2 = \frac{1}{3}\left[\left(\frac{I_A}{I_{cp}}\right)^2 - +\left(\frac{I_B}{I_{cp}}\right)^2 + \left(\frac{I_C}{I_{cp}}\right)^2\right] \tag{8}$$

During the inspection and operation of networks, it is necessary to reduce the degree of unevenness of phase loads. If an overload occurs in one of the line phases or in another, the average values of the phase currents in that phase will differ over an extended period of time. In this case, a reduction in asymmetry is achieved due to the probable symmetrical distribution of phase loads [3-5, 7-11, 15-19].

Results

Figure 1 presents the results of the calculations of active and reactive power before compensation, as well as the reactive power after compensation, performed based on the methodology for calculating reactive power compensation devices presented in the article.

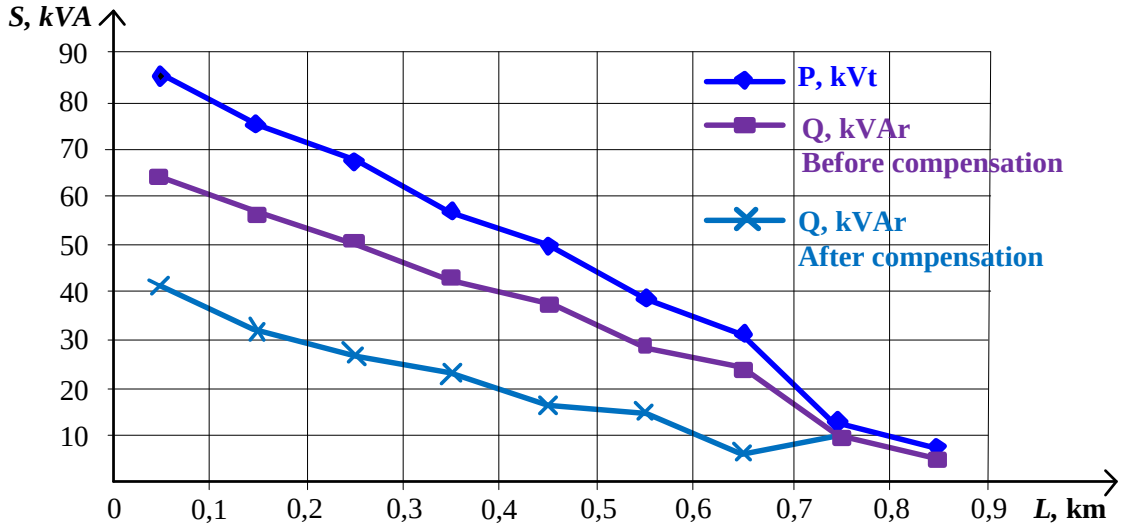


Fig.1. Graph of the variation of active and reactive power depending on the line length

Moreover, the presented calculations were performed based on the methodology of summing the calculated loads of the transformer substation. This illustrates the dependence of the reactive power compensation device capacity on the line length: for a line length of L=0.5 km, the device capacity is Q_C=20.9 kVAr, whereas for a line length of L=0.7 km, it is Q_C=17 kVAr, reflecting the relationship between the device capacity and the line length at their points of installation [3-4, 12-19].

Figure 2 presents the results of energy loss calculations in the 0.4 kV network before and after compensation.

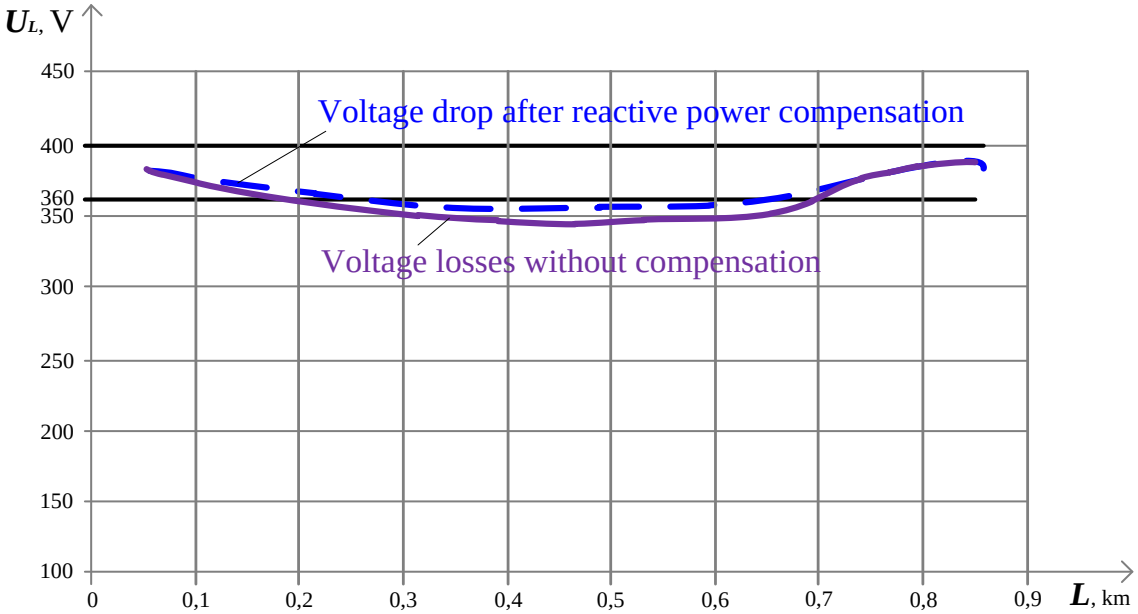


Fig.2. Graph of the calculated voltage loss values at the network connection points with a step of 0.1 km

Figure 2 presents an analysis in which the voltage at the output of the transformer substation is considered to be 400 V, while the permissible minimum value is 360 V (below 400 V. The solid line represents the voltage losses before compensation, while the dashed line represents the voltage losses after compensation, depending on the length of the network line. From the presented graphs, it can be seen that by using the proposed calculation method, due to the selection and placement of reactive power compensation devices in the network, voltage losses can be reduced to up to 3% of

the nominal value. After the installation of reactive power compensation devices, the steady-state deviations relative to the nominal voltage remain within the permissible limits [3-5, 7-19].

The occurrence of voltage unbalance is associated with the flow of negative- and zero-sequence currents in the power supply system, which is caused by the asymmetry of phase loads, as well as the differences in current vectors and the angles between them. It is known that such currents can be expressed through symmetrical components: $\underline{I}_1$ - positive sequence, $\underline{I}_2$ - negative sequence, and $\underline{I}_0$ - zero sequence. The objective of compensation is to install a reactive power compensation device in parallel with the electrical load (at the corresponding buses of the area), which compensates for the negative-sequence and zero-sequence currents. In this case, the current of the compensating device is equal in magnitude to the load current and has the opposite phase. When a compensation device is installed on the line conductors for reactive power compensation and network phase balancing, no zero-sequence current arises; therefore, in such a connection scheme, the capacitor bank does not provide a balancing effect for the zero sequence. Let us examine the voltage leveling effect associated with phase reactive power compensation. The system of unbalanced currents of the compensating device, expressed in terms of symmetrical components - $\underline{I}_{ak}$, $\underline{I}_{bk}$, $\underline{I}_{ck}$ is defined as follows [3-5, 7-19]:

$$\underline{I}_{1k} = \frac{1}{3}\left(\underline{I}_{ak} + a\underline{I}_{bk} + a^2\underline{I}_{ck}\right); \quad \underline{I}_{2k} = \frac{1}{3}\left(\underline{I}_{ak} + a^2\underline{I}_{bk} + a\underline{I}_{ck}\right); \quad \underline{I}_{0k} = \frac{1}{3}\left(\underline{I}_{ak} + \underline{I}_{bk} + \underline{I}_{ck}\right) \tag{9}$$

Where

$$\underline{I}'_A + \underline{I}_a + \underline{I}_{ak}; \qquad \underline{I}'_B + \underline{I}_b + \underline{I}_{bk}; \qquad \underline{I}'_C + \underline{I}_c + \underline{I}_{ck} \tag{10}$$

Here, $\underline{I}'_A$, $\underline{I}'_B$, $\underline{I}'_C$ - represents the line currents after compensation, in amperes (A), and $\underline{I}_a$, $\underline{I}_b$, $\underline{I}_c$ - represents the line currents before compensation, in amperes (A).

The line currents after compensation must be symmetrical, that is: $\underline{I}'_A = I'_A$, $\underline{I}'_B = a^2 I'_B$, $\underline{I}'_C = aI'_C$ and $I'_A = \mathrm{Re}(\underline{I}_a)$, $I'_B = \mathrm{Re}(\underline{I}_b)$, $I'_C = \mathrm{Re}(\underline{I}_c)$.

By substituting expression (10) into expression (9), we obtain the following:

$$\underline{I}_{1k} = \frac{1}{3} j\left(I_a \sin\varphi_{iA} + I_b \sin\varphi_{iB} + I_c \sin\varphi_{iC}\right)$$

$$\underline{I}_{2k} = \frac{1}{3} j\left(I_a \sin\varphi_{iA} + aI_b \sin\varphi_{iB} + a^2 I_c \sin\varphi_{iC}\right) \tag{11}$$

$$\underline{I}_{0k} = \frac{1}{3} j\left(I_a \sin\varphi_{iA} + a^2 I_b \sin\varphi_{iB} + aI_c \sin\varphi_{iC}\right)$$

Where $\varphi_{iA} = \varphi_{uA} - \varphi_A$, φ_A – The difference in potential between the phase voltage and the current.

Expression (11) reflects the balancing effect in the capacitor bank. From the solution of this expression, it can be concluded that, with such a capacitor bank connection scheme, a zero-sequence balancing effect can be achieved. Moreover, the main problem of 0.4 kV networks is that the voltage unbalance factor of the zero sequence exceeds the permissible limit established by the national standard by 2-2.5 times. At the same time, the use of reactive power compensation devices can significantly improve the power factor [1-5, 7-19].

Discussion. Taking into account the proposed calculation methodology and the leveling effect, we will determine the economic efficiency of reactive power compensation in 0.4 kV distribution networks. A voltage drop in the line leads to an increase in active power losses in the transmission lines and step-down transformers. Active power losses in low-voltage electrical networks are determined by the following expression [3-5, 7-19]:

$$\Delta P = \frac{P^2 + Q^2}{U^2} R = \frac{P^2\left(1 + tg\varphi^2\right)}{U^2} R = \frac{P^2 R}{U^2} \cdot \frac{1}{\cos\varphi^2} \tag{12}$$

Where *P* and *Q* are the active and reactive power transmitted through the line; *U* is the line voltage, *V*; *R* is the equivalent active resistance of the line, Ω (where *R=rL*, with *r* being the internal resistance of the line, *Ω*, and *L* the line length, km); *cosφ* is the power factor; *tgφ* is the reactive power factor.

From expression (12), it is evident that, at constant values of the active power *R* transmitted through the line and voltage *U*, the power losses (*ΔP, ΔQ*) depend on the power factor (*cosφ*) and the line length *L*. *For example*, let us assume that, for the most rational case of calculating active power losses in a line, i.e., in distribution electrical networks with a voltage of 10(6)/0.4 kV, the calculations are carried out based on the condition that before compensation *cosφ*=0.85, and after compensation it approaches 1. Then, based on expression (12), the active power losses after compensation are calculated using the following expression [3-5, 7-19]:

$$\Delta P - \Delta P_k = \frac{P^2 R}{U^2} \cdot \left(\frac{1}{\cos \varphi^2} - \frac{1}{\cos \varphi^{2"}} \right) = \frac{P^2 R}{U^2} \cdot 0{,}38 \tag{13}$$

In this case, the line losses are reduced to $\frac{\Delta P - \Delta P_k}{\Delta P} \cdot 100\,\% = 27{,}5\%$. The active power losses in transformers consist of two components: *ΔP* - the active power losses consumed for heating the transformer windings due to the load current, and ΔP_{CT} - the power losses associated with heating the core during the flow of this current. From this, the power losses, consumed in heating the transformer windings, are determined using the following expression [3-5, 7-19]:

$$\Delta P = 3I^2 R_T = \frac{S^2}{U^2} R_T = \frac{P^2 + Q^2}{U^2} R_T \tag{14}$$

Then, the total active power losses are calculated as follows:

$$\Delta P_T = \Delta P + \Delta P_{CT} = \frac{P^2 + Q^2}{U^2} R_T + \Delta P_{CT} \tag{15}$$

Where R_T is the active resistance of the transformer windings, in ohms (Ω).

If the transformer's short-circuit losses are known - denoted as $\Delta P_{M.nom}$, the copper losses at nominal load as S_{nom}, and its actual load as *S* - then the active power losses are determined by the following expression:

$$\Delta P_T = \Delta P_M + \Delta P_{CT} = \Delta P_{M.nom} \left(\frac{S}{S_{nom}} \right)^2 + \Delta P_{CT} \tag{16}$$

On the 0.4 kV network side, when reactive power is compensated, active power losses are reduced and are determined as follows.

$$\Delta P_T^{'} = \Delta P_{M.nom} \left(\frac{S^{'}}{S_{nom}} \right)^2 + \Delta P_{CT} \tag{17}$$

Where

$$S^{'} = \sqrt{P^2 + Q^{'2}} = \frac{P}{\cos \varphi^{'}} \tag{18}$$

In this case, $\cos \varphi^{'}$ denotes the power factor after compensation.

After compensation, the change in power losses in the transformer is determined by the following expression:

$$\Delta P_T - \Delta P_T^{'} = \frac{\Delta P_{M.nom} \cdot P^2}{S_{nom}^2} \cdot \left(\frac{1}{\cos \varphi^2} - \frac{1}{\cos \varphi^{2'}} \right) \tag{19}$$

When the power factor increases from *cosφ*=0.85 to *cosφ*=0.95, the active power losses decrease to $\frac{\Delta P - \Delta P_k}{\Delta P} \cdot 100\,\% = 20\,\%$. Thus, when the transformer operates at full load, the power losses after compensation will be 20% lower than the copper losses before compensation. If the average value of power losses in the transformer winding (copper losses) is assumed to be 1.5%, then, with reactive power compensation, the losses in the transformer can be reduced to 0.3%.

Taking into account the symmetrizing effect of reactive power compensation, let us determine the reduction in active power losses. Since the current in the neutral conductor is equal to three times the zero-sequence current, expression (11) can be used to determine the extent to which power losses have been reduced after reactive power compensation.

Even when reactive power compensation is performed in only one phase of the line, the current value in the neutral conductor decreases to 1% (with the power factor cosφ varying from 0.85 to 1), which, in turn, leads to a reduction in active power losses by up to 2% compared to the mode without reactive power compensation. Thus, for the analyzed line, the total losses (including line losses, transformer losses, and all losses associated with voltage unbalance) are reduced by $27{,}5\% + 0{,}3\% + 2\% = 29{,}8\%$ compared to the operating mode without reactive power compensation [3-5, 7-19].

Conclusions. Based on the studies presented in the article, it has been established that in 0.4 kV networks with a low power factor, reactive power compensation can significantly improve such power quality indicators as steady-state voltage deviation and voltage unbalance factor. Using the proposed calculation methodology, the proper placement of reactive power compensation devices along the line ensures that the voltage level and the voltage unbalance factor comply with the regulatory requirements for electric power quality for all consumers. Active power losses in the electrical network are reduced by up to 30% compared to the losses observed before reactive power compensation. Moreover, the proposed solutions make it possible to enhance the efficiency of electricity transmission and consumption through power networks, increase the efficiency of electrical power transfer, and improve the economic performance of electric power enterprises.

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Rezyume: *Ushbu maqolada 0,4 kV kuchlanishli elektr tarmoqlarida reaktiv quvvatni kompensatsiyalash asosida elektr energiyasi sifatini yaxshilash va kuchlanish isrofini kamaytirish masalalari echilgan. Maqolada reaktiv quvvatni kompensatsiyalovchi qurilmalarni tanlash va hisoblash metodikasi keltirilgan bo'lib, ushbu metodika elektr tarmoqlarida kuchlanishning stabilligini ta'minlash, teskari va nol ketma-ketlik bo'yicha kuchlanish nosimmetriyasi koeffitsiyentini kamaytirishga qaratilgan. Shuningdek, reaktiv quvvatni optimal darajada kompensatsiyalash orqali aktiv quvvat isroflarini kamaytirish va elektr energiyasidan foydalanish samaradorligini oshirish natijalari tahlil qilingan. Tadqiqot natijalari 0,4 kV kuchlanishli tarmoqlarda energiya tejamkorligini ta'minlash va elektr ta'minoti tizimining ishonchliligini oshirishda amaliy ahamiyat kasb etadi.*

Резюме: *В данной статье решены задачи повышения качества электрической энергии и снижения потерь напряжения в электрических сетях напряжением 0,4 кВ на основе компенсации реактивной мощности. В статье представлена методика выбора и расчёта устройств компенсации реактивной мощности, направленная на обеспечение стабильности напряжения в электрических сетях, а также на снижение коэффициента несимметрии напряжения по обратной и нулевой последовательностям. Также проанализированы результаты снижения потерь активной мощности и повышения эффективности использования электроэнергии за счёт оптимальной компенсации реактивной мощности. Результаты исследования имеют практическое значение для обеспечения энергоэффективности в сетях напряжением 0,4 кВ и повышения надёжности системы электроснабжения.*

Kalit so'zlar: *reaktiv quvvatni kompensatsiyalash; reaktiv quvvat koeffitsiyenti; aktiv quvvat koeffitsiyenti; quvvat isrofi; elektr energiyasi sifat ko'rsatkichlari; kuchlanish isrofi; kuchlanish nosimmetriyasi koeffitsiyenti; energiya tejamkorlik; 0,4 kV kuchlanishli elektr tarmoqlar.*

Ключевые слова: *компенсация реактивной мощности; коэффициент реактивной мощности; коэффициент активной мощности; потери мощности; показатели качества электрической энергии; потери напряжения; коэффициент несимметрии напряжения; энергосбережение; энергоэффективность; электрические сети напряжением 0,4 кВ.*

IMPROVING THE MISSION FORMATION OF THE REGIONAL BUILDING MATERIALS INDUSTRY

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Summary: *The article examines the essence and formation of the mission for enterprises and the regional building materials industry. It reveals the growing relevance and necessity of ensuring objectivity in the mission content of enterprises and the building materials industry. It is determined that the mission content should take into account industry-specific features. The mission of the studied industry is formulated considering its subordination to the construction complex and the presence of enterprises utilizing natural raw materials.*

Key words: *building materials manufacturing enterprises, enterprise mission, industrial production under conditions of increasing variability and emerging new challenges*

Defining the essence and purpose of an enterprise or industry mission holds particular significance. There are numerous interpretations of this important concept. Based on the study of various literary sources and in agreement with many of their authors (Table 1), this article substantiates and presents our own interpretation, which, in our opinion, more adequately considers the peculiarities of the building materials industry.

Table 1

Interpretation of the "mission" concept in various scientific sources

Author	Definition
Vesnin V. R.	The mission unites people, ensures harmony in the company's interaction with the external environment, and helps determine positions and interests in relation to various social groups [1.18].
Vikhansky O.S.	Mission is the philosophy and purpose, the meaning of an organization's existence [2.24].
Zub A. T.	The main general purpose of the organization, the clearly expressed reason for its existence, its purpose. The corporate mission concept is a reliable element of the organization's ideological foundation [3.37].
Ward Keith	A mission statement is an organizational form that allows for the formulation of the company's main goals and their communication to everyone (employees, shareholders, consumers, suppliers, etc.) [4.63].
Fatkhutdinov R.A.	Mission - philosophy of existence, strategic goal, fundamental purpose of the organization [5.26]

It is evident that the status and structure of an enterprise or industry largely depend on the goals set, for the achievement of which they are created and function. Indeed, the goals of the industry, its development concept in the strategic plan, and the main directions and scale of its business activity characterize the future of the industry to which its activities are dedicated.

Undoubtedly, it is necessary to distinguish between general and specific goals. At the same time, *general goals* reflect the concept of industry development and are developed for the long term. *Specific goals* are subordinate to general goals for the main activities in each production department of the organization and can be expressed in quantitative indicators.

In essence, the common goals of the industry represent a domain for setting objectives for its production, financial, social, economic activities, and so on. Goals serve as the starting point for planning, control, and evaluation of the final results of economic activity. They form the basis for motivation systems and organizational-economic relations.

It should be noted that, in general, the goal-oriented aspect of industry activity reflects the aims and interests of various groups of people (owners, employees, business partners, consumers, society as a whole) related to the industry's activities and involved in its functioning process.

Depending on the sphere of activity and the specifics of the economic environment, each organization sets its own goals, which differ both in the set of parameters and in their quantitative assessment.

A properly organized process of goal formulation involves four main phases:

- *identification and analysis* of trends observed in the environment;
- *setting goals* for the organization as a whole;
- *establishing a hierarchy* of goals;
- setting *individual* goals.

The goals of an individual enterprise or an association of entrepreneurial structures can be understood as the goals pursued by the owners, i.e., the founders.

Undoubtedly, for many enterprises, profit is a necessary condition for their existence. However, profit is not the main and sole goal of any entrepreneurial venture or firm. Among their needs, spiritual needs such as self-employment and creating job opportunities for others, as well as self-realization through achieving set goals, are quite prominent.

Nevertheless, upon deeper examination of goals, activities, and attitudes towards results, one inevitably concludes that ultimately, thoughts and actions are based on nothing other than *the aspiration to attain higher social significance* through the effective operation of an enterprise that meets a certain societal need, thus fulfilling its assigned mission.

This leads to a truly profound understanding of the organization's mission, which can be considered the purpose of the firm's existence, but a purpose oriented not only towards itself but also towards society.

Thus, the mission represents the public service of the enterprise for which it exists in society.

The proper formulation and selection of the enterprise's mission, along with all employees' awareness of the set goals, are key to the collective's successful activity.

It should be noted that choosing an organization's mission is always the prerogative of not only the owner but also of top management.

An adequate mission allows for identifying the real and optimal trajectory of the enterprise's (or industry's) development.

The problem of formulating a mission is the problem of orienting activities.

When creating a creative, highly productive team becomes secondary, the effectiveness of activities declines and the organization perishes in competitive struggle. This was repeatedly noted by Kazuma Tateishi, who is one of the founders of the "Japanese economic miracle" [6].

To better understand the essence of a mission, we would like to provide an example from the high fashion sphere. When selecting candidates to showcase his products, a famous couturier was primarily interested not in their anthropometric characteristics, but in the inner world of future employees, asking questions about the last book they read, the performance they saw, and their favorite visual masterpiece.

In our understanding, the mission, being a primacy in organizing a new enterprise, outlines the contours of the enterprise's status and provides direction and guidelines for subsequent determination of goals and strategies at all levels of the management hierarchy.

Understanding the mission typically incorporates the following characteristics of the organization:

- sphere of activity and description of manufactured products (services);
- market characteristics (main consumers, clients, partners);
- technology (characteristics of equipment, technological processes, innovations);
- philosophy (basic views and values of the enterprise, industry);
- internal concept (opinion about oneself, factors and sources of development, increasing the level of competitiveness, etc.);
- The external image of an enterprise, its reputation, emphasizing its economic and social responsibility towards partners, consumers, and society as a whole.

The duration of a mission's existence can vary and depends on external factors and the specifics of the field of activity. The content of the mission must be reflected in the mission statement,

while the sequence and combination of its components may vary depending on the nature of the activity.

Thus, a mission is the purposeful designation of an organization (enterprise, industry), encompassing both internal and external benchmarks for which the organization exists and which should form the foundation of its activities.

We believe that the mission of an enterprise or industry represents a public objective function, which has certain limitations.

The particular significance of an organization's mission lies in the fact that it serves as a basis and support for planned decisions, defining its local and tactical goals and objectives. The mission ensures consistency, transparency, and interconnection of lower-level goals and horizons, coordinates the efforts of employees, unites their actions, and secures mutual understanding and support from shareholders, financial institutions, and others.

The dynamics and unpredictability of the modern market and economic development dictate their own conditions for business growth. Under these circumstances, a strategy is objectively necessary, and its development becomes the main task of planning. It should be noted that M.V. Bgashev adheres to the definition of strategy as a single comprehensive general plan for implementing the organization's mission and achieving its goals. In his opinion, the strategic advantage of an organization is its mission, which guides and optimizes internal resources [7.89].

Based on the author's research on the development of the construction materials industry in the Republic of Karakalpakstan, a preliminary selection of factors for the sustainable development of construction materials industry enterprises in Karakalpakstan was carried out (Table 2).

Table 2

Results of preliminary determination of factors influencing the effective development of building materials enterprises [8.19]

Direction for ensuring sustainable development	**Pre-selected factors influencing the sustainability of enterprise development**	**Results of preliminary selection**
Economic (organizational-economic)	Improvement of marketing activities of enterprises	+++
	Improving product quality	++
	Effective use of local raw material potential	+++
	Strengthening the material and technical base of enterprises	++
	Increasing the competitiveness of enterprises based on growth in resource efficiency	+++
	Innovative development of construction materials industry enterprises	+++
	Improving enterprise location	++
	Application of mobile enterprises	+
Social	Development of enterprise human resources	+++
Environmental	Ensuring environmental protection (environmental factor)	+++
	Effective use of local raw material potential	++

The priority of these factors was determined using expert survey methods (Table 3).

Table 3

Ranking of factors influencing the development of building materials enterprises building materials [8.20]

Indicators	**Experts**				**Sum**	**Arithmetic mean**	**Rank**
	E1	**E2**	**E3**	**E4**			
Development of enterprise human resources	0.6	0.4	0.3	0.5	1.8	0.45	5

Innovative development of building materials industry enterprises	0.8	0.8	0.7	0.6	2.9	0.725	1
Improving product quality	0.2	0.1	0.5	0.7	1.5	0.375	6
Effective use of local raw material potential	0.5	0.3	0.2	0.1	1.1	0.275	7
Strengthening the material and technical base of enterprises	0	0.2	0.1	0.2	0.5	0.125	8
Ensuring environmental protection (environmental factor)	0.3	0.7	0.6	0.3	1.9	0.475	4
Increasing enterprise competitiveness based on resource efficiency	0.4	0.6	0.8	0.8	2.6	0.65	2
Improving enterprise marketing activities	0.7	0.5	0.4	0.4	2	0.5	3
Improving enterprise location	0.1	0	0	0	0.1	0.025	9

Thus, the most significant factors in ensuring the effective development of building materials enterprises in Karakalpakstan are, in descending order of priority:

- innovative development of building materials industry enterprises;
- increasing enterprise competitiveness based on resource efficiency growth;
- Improvement of marketing activities of enterprises;
- Ensuring environmental protection (environmental factor).

Objectively, the composition of priority factors is not constant with the development of building materials industry enterprises and changes in the external environment; the composition and ranking of factors must undoubtedly be adjusted.

Taking into account the currently identified factors influencing the effective development of the industry, we believe that the industry's mission is as follows: The construction materials enterprises of the region are designed to provide the region's investment and construction complex with modern high-quality materials at acceptable prices in the most complete volume and within the required timeframe, while adhering to the requirements for environmental preservation and efficient use of raw materials.

It is planned that this version of the industry mission will be presented to regional governing structures for discussion and subsequent inclusion in regulatory documents.

The main conclusions are as follows:

The concept of "mission" for an enterprise (industry) acquires special significance in the context of increasing variability of external factors and growing challenges;

The essence of the concept of "mission" has its own specifics, depending on the characteristics of the industry, the variability of technologies, and the pace of the innovation process;

The construction materials industry, being a collective sector (comprising enterprises for extraction and enrichment of raw materials, processing of raw materials, and production of construction materials and products), "serves" the investment and construction complex and is designed to meet a number of requirements as part of the complex's material and technical base;

The industry, which includes mining and processing enterprises, is responsible for ensuring the rational use of natural resources;

The developed original interpretation of the industry's mission in construction materials production adequately and objectively reflects its characteristics and will allow for more effective implementation of the industry's activities.

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Rezyume: *Maqolada qurilish materiallari sanoati korxonalari va hududiy tarmog‘i missiyasining mohiyati va shakllanishi ko‘rib chiqilgan. Korxona missiyasi, qurilish materiallari tarmog‘i mazmunining xolisligini ta’minlashning o‘sib borayotgan dolzarbligi va zarurati aniqlandi. Missiya mazmuni sohaning o‘ziga xos xususiyatlarini hisobga olishi kerakligi belgilandi. Tadqiq etilayotgan sohaning missiyasi uning qurilish majmuasiga bo‘ysunishi va tabiiy xomashyo resurslaridan foydalanuvchi korxonalarning mavjudligini hisobga olgan holda shakllantirildi.*

Резюме: *В статье рассмотрены сущности и формирования миссии предприятий и региональной отрасли строительных материалов. Выявлен рост актуальности и необходимости обеспечения объективности содержания миссии предприятия, отрасли строительных материалов. Определено, что содержание миссии должно учитывать специфику отрасли. Сформирована миссия исследуемой отрасли с учетом подчиненности ее строительному комплексу и наличия предприятий использующих природно-сырьевые ресурсы.*

Kalit so‘zlar: *qurilish materiallari ishlab chiqaruvchi korxonalar, korxona vazifasi, o‘zgaruvchanlikning kuchayishi va yangi muammolarning paydo bo‘lishi sharoitida sanoat ishlab chiqarishi*

***Ключевые слова*:** *предприятия по производству строительных материалов, миссия предприятия, промышленное производство в условиях роста изменчивости и появления новых вызовов*

EFFECT OF MICROCALCITE FINENESS ON THE PHYSICO-MECHANICAL PROPERTIES OF CEMENTITIOUS COMPOSITIONS FOR NON-AUTOCLAVED FOAM CONCRETE IN THE CONDITIONS OF THE REPUBLIC OF UZBEKISTAN

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Summary: *This article presents the results of a study on the influence of microcalcite fineness on the physico-mechanical properties of cementitious compositions for non-autoclaved foam concrete. Three microcalcite fractions (8,735, 3,350, and 1,441 cm²/g) were used in amounts of 5–15 % by cement mass. It was shown that finely dispersed microcalcite increases water demand but provides a 12.4 % rise in compressive strength due to microstructural densification and accelerated hydration. Medium- and coarse-grained forms reduce water demand through a particle-packing effect. The formation of carboaluminate compounds was observed, improving the density and durability of the cement stone. The use of microcalcite of varying fineness enables control over the structure and properties of cement systems, promoting the development of energy-efficient and environmentally sustainable formulations.*

Key words: *microcalcite; fineness; cement composite; foam concrete; water-to-cement ratio; carboaluminates; compressive strength; microstructure; energy-efficient materials.*

Introduction. The drive to reduce the "clinker factor" and adopt low-carbon formulations in cementitious materials has stimulated the widespread use of Portland-limestone cements (PLC) and CEM II-type composite cements with limestone additions. European and national standards (EN 197-1; GOST 31108–2020) permit incorporating 6–20% limestone (CEM II/A-L, II/B-L) and composite systems with multiple mineral constituents (CEM II/…-K), enabling CO_2 reductions without loss of performance when composition and grinding fineness are properly optimized [1.12-18, 2.4-7, 3.33-36].

Concurrently, there is growing interest in utilizing stone-processing wastes (marble powder/microcalcite, $CaCO_3$) as active mineral fillers. Recent reviews indicate that at moderate dosages (typically up to ~10–15% of cement mass), marble powder can maintain or improve selected strength and permeability metrics while lowering the carbon footprint through clinker substitution and a packing effect [4.215-222, 5.48-55].

The action of $CaCO_3$ is multifaceted: in addition to the physical "filler effect" (particle packing and provision of heterogeneous nucleation sites for hydrates), calcite chemically interacts with the clinker aluminate phase (C_3A) to form stable carboaluminate phases (hemicarboaluminate and monocarboaluminate). These reactions stabilize ettringite, increase the volume of hydrates, and can reduce early-age porosity [6.8-12, 7.852-857, 8.280-286].

However, the influence of microcalcite is governed primarily by its fineness and dosage. For cellular materials, including non-autoclaved foam concretes, finely ground $CaCO_3$ can additionally stabilize the foam and promote the development of a more robust structure during curing, making the selection of fineness and dosage critically important [9.42-45].

The aim of this study is to quantify the effects of microcalcite dosage (5–15 wt%) and fineness (three fractions) on standard consistency, water-to-cement ratio (w/c), and 28-day compressive strength of cementitious mixtures based on a composite Portland cement.

Materials and Methods

Materials. As the primary binder, a Portland cement CEM II/A-K (Z–I) 42.5 N produced by Akhangarantsement JSC (АО «Ахангаранцемент») was used. The cement had a specific surface area of 4,000–4,800 cm²/g and a true density of 3.1 g/cm³. The following active mineral fillers were employed:

Microcalcite ($CaCO_3$) — a waste product from marble crushing at the Kashkadarya quarry. Three microcalcite fractions were used—fine, medium, and coarse—with specific surface areas of 8,735; 3,350; and 1,441 cm²/g, respectively (Fig. 1).



a) fine fraction	b) medium fraction	c) coarse fraction

Fig. 1. Microcalcite of various fineness levels.

Prior to testing, all components were dried in a thermostatic chamber to a constant mass. After drying, the physical characteristics of each active component were determined using standard methods. The microcalcite additive was introduced in quantities ranging from 5 % to 15 % by mass of cement.

Mix Preparation and Standard Consistency

To determine the optimal amount of marble filler and the most effective fraction, experiments were conducted using various compositions (Table 1). The standard consistency of the cement paste was determined according to GOST 310.3–76 using a Vicat apparatus. Instead of the standard needle, a metal cylinder (10 mm in diameter and 50 mm in length) was employed. The total mass of the movable rod with the cylinder was (300 ± 2) g. Samples measuring 20 × 20 × 20 mm were molded and cured under normal conditions (temperature = 20 ± 2 °C, relative humidity ≥ 95 %).

Compressive Strength Testing

Compressive strength was measured after 28 days using a hydraulic press in accordance with GOST 7473–2010. The samples were cubic in shape. Before testing, the side dimensions were measured, and the cross-sectional area was calculated to an accuracy of 0.1 cm². The load was applied parallel to the settling surface of the mix at a rate of 0.2–0.3 MPa/s² until specimen failure. The average of three measurements was taken as the compressive strength limit (Rc, MPa), calculated using the formula:

Equation (1):

$$R_c = P / S$$

where *P* is the applied load and *S* is the cross-sectional area of the specimen.

Results and Discussion

Effect on Standard Consistency

The results showed that the introduction of active mineral fillers significantly alters the rheological and physico-mechanical properties of the cement system. The main evaluation criteria were the water-to-cement ratio (W/C) and the strength of the resulting compositions (Fig. 2).

Table 1. Results of Standard Consistency Tests for Mixes Containing Microcalcite

Mix No.	Composition	Water		Microcalcite		Penetration Depth, mm
		%	cm³	%	gr.	
1	Reference (C + W)	30	120	-	-	5
2	Fine microcalcite + cement	30	120	5	20	5

3		32	124	10	40	5
4		32,5	125	15	60	5
5	Medium microcalcite + cement	28,25	113	5	20	5
6		28,5	114	10	40	5
7		28,75	115	15	60	5
8	Coarse microcalcite + cement	28,5	114	5	20	5
9		28,75	115	10	40	5
10		29	116	15	60	5,5

An increase in the water-to-cement ratio (W/C) upon the addition of finely dispersed microcalcite is attributed to its high specific surface area and strong water adsorption capacity, which necessitate a higher liquid content to maintain the desired workability of the mix.

In contrast, medium- and coarse-grained microcalcite function primarily as inert mineral fillers, occupying the intergranular spaces between cement particles and thereby reducing the overall water demand.

The most pronounced reduction in water demand was observed with the medium-dispersed microcalcite, which provides an optimal balance between the packing effect and a moderate specific surface area, ensuring efficient particle distribution without excessive water absorption.

Mechanical Properties

The influence of microcalcite fineness on compressive strength is shown in Figure 2. Finely ground microcalcite (8,735 cm^2/g) yielded the **highest strength gain of 12.4 %** after 28 days compared with the reference mix.

This enhancement is attributed to:

- **Filler and nucleation effects,** leading to a denser microstructure and accelerated C–S–H formation.
- **Chemical interactions** with the aluminate phase (C_3A) to form stable carboaluminates:

Reaction (1):

$$C_3A + CaCO_3 + 12H \rightarrow C_3A \cdot CaCO_3 \cdot 12H$$

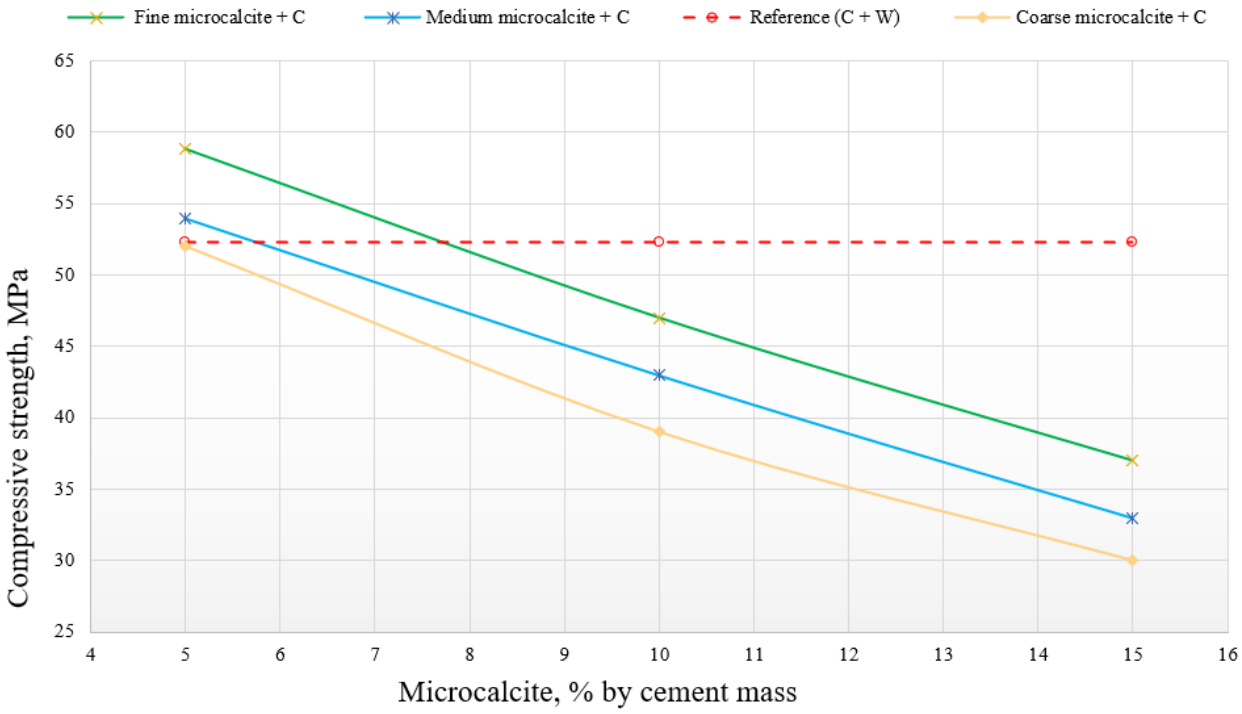


Fig. 2. Effect of microcalcite content and fineness on the compressive strength of cement mortar

These reactions stabilize ettringite, reduce free portlandite ($Ca(OH)_2$), and improve structural homogeneity.

Microstructural Interpretation

Finely dispersed microcalcite acts as a **micro-filler and reactive substrate**, enhancing strength but requiring more water.

Medium and coarse microcalcite primarily improve **packing density**, lowering water demand and maintaining adequate workability.

The combined effects lead to densification of the microstructure, reduced porosity, and improved durability, including higher frost resistance.

Conclusion

This study demonstrates that microcalcite fineness and dosage critically affect the rheological and mechanical performance of composite Portland cements.

Key conclusions are:

- Finely ground microcalcite (8,735 cm²/g) increases 28-day compressive strength by up to 12.4 %, though it slightly raises water demand.
- Medium-fineness microcalcite achieves the best balance between water reduction and particle packing efficiency.
- Microcalcite contributes chemically to the formation of carboaluminate phases and physically to the densification of the cement matrix.
- Optimized microcalcite use enables the design of eco-efficient, durable binders suitable for non-autoclaved foam concretes and other low-carbon applications.

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Rezyume: *Ushbu maqolada mikrokalsitning disperslik darajasi noavtoklav ko'pikbeton uchun sementli kompozitsiyalarining fizik-mexanik xususiyatlariga ta'siri o'rganish bo'yicha olib borilgan tadqiqot natijalari yoritilgan. Unga ko'ra mikrokalsitning uch xil fraksiyasi (8735, 3350 va 1441 sm²/g) sement massasining 5–15 % miqdorida qo'llanildi. Aniqlanishicha, mayin dispersli mikrokalsit suvga bo'lgan talabni oshiradi, biroq mikrostrukturani zichlashtirish va gidratatsiyani tezlashtirish hisobiga mustahkamlikni 12,4 % ga oshiradi. O'rta va yirik dispers shakllar zarralar joylashuvi effekti tufayli suv sarfini kamaytiradi. Karboalyuminat birikmalarining hosil bo'lishi aniqlanib, ular sement toshining zichligi va mustahkamligini oshiradi. Turli disperslikdagi mikrokalsitdan foydalanish sement qorishmalarining tuzilishi va xossalarini boshqarishga imkon beradi hamda energiya tejamkor va ekologik barqaror tarkiblarni ishlab chiqish uchun sharoit yaratadi.*

Резюме: *В данной статье представлены результаты исследования влияния степени дисперсности микрокальцита на физико-механические свойства цементных композиций для неавтоклавного пенобетона. Использовались три фракции микрокальцита (8735, 3350 и 1441 см²/г) в количестве 5–15 % от массы цемента. Показано, что мелкодисперсный микрокальцит повышает водопотребность, но обеспечивает рост прочности на 12,4 % за счёт уплотнения микроструктуры и ускорения гидратации. Средне- и крупнодисперсные формы снижают водопотребность благодаря эффекту упаковки частиц. Обнаружено образование карбоалюминатных соединений, повышающих плотность и долговечность цементного камня. Применение микрокальцита различной дисперсности позволяет регулировать структуру и свойства цементных систем, способствуя разработке энергоэффективных и экологичных составов.*

Kalit so‘zlar: *mikrokalsit; disperslik; sement kompoziti; ko‘pikbeton; suv-sement nisbati; karboalyuminatlar; siqilishga bo’lgan mustahkamligi; mikrostruktura; energiya tejamkor materiallar.*

Ключевые слова: *микрокальцит; дисперсность; цементный композит; пенобетон; водоцементное отношение; карбоалюминаты; прочность при сжатии; микроструктура; энергоэффективные материалы.*

OBTAIN AND APPLICATION OF ORGANOHYBRID SORBENTS CONTAINING NITROGEN, SULFUR, AND SILICON

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Summary: *It is known that at the current time, a number of researches are being conducted in the world on obtaining high molecular compounds containing silicon and using them on an industrial scale. Organic compounds containing silicon differ sharply from other types of organic substances in terms of the improvement of some physicochemical properties. For example, in the future, research works in the field of synthesis of complex-forming sorbents containing silicon are being carried out at a rapid pace. The scope of use of organohybrid sorbents containing silicon is expanding day by day, including hydrometallurgy, wastewater treatment, drinking water desalination, in a food industry, in a air purification, as well as silver and a number of other precious metals.*

The synthesis of sorbents containing nitrogen, oxygen, and silicon and the scope of research aimed at the sorption of metals in complex solutions using them is expanding. In this regard, the synthesis, composition, and structure of complex-forming organohybrid sorbents and their physicochemical properties, sorption capacity, a study of the effect of various factors on sorption-desorption processes, separation of non-ferrous and precious metal ions in the hydrometallurgical industry with their help, wastewater treatment, as well as the use of various sorbents special attention is paid to determining the sorption abilities in environments with temperatures.

Key words: *silicon, organohybrid, sorbent, hydrometallurgy, sorption capacity, sorption-desorption, wastewater, silver.*

In several literature, the condensation reaction of urea and thiourea with formaldehyde in an acidic environment has been studied. The obtained products were tested as ion exchange resins and the ion exchange capacities of these resins were investigated[1].

Metal cations are the main pollutants of the lithosphere. Accumulation of serium in natural water resources can cause serious environmental problems. Another aspect is the accumulation of metallurgical waste. It had been studied as a raw material for the production of composite sorbents based on powdered and granular calcium aluminosilicates ($CaO\text{-}MgO\text{-}SiO_2\text{-}Al_2O_3$) capable of immobilizing cerium ions (Ce^{3+}) contained in metallurgical waste located near the city of Chelyabinsk, Russia. Aqueous solutions with a high concentration of Se3+ ions (1000 mg/L) were used during the experiments. The migration properties of calcium (Ca^{2+}), magnesium (Mg^{2+}), silicon (Si^{4+}), and aluminum (Al^{3+}) ions were studied. The separation rate of Se^{3+} ions in 24 hours was 93.36% for powder sorbents and 99.98% for granular sorbents.

The interaction of sorbents with sorbate had been carried out by the exchange of Ca^{2+} and Mg^{2+} ions from the sorbent matrix to an aqueous solution. The desorption process weres studied in distilled water. The results of the study showed a high degree of irreversible sorption of Se^{3+} ions from aqueous solution to powder and granular sorbents. The low cost of crushed metallurgical waste slag, environmental aspects of storage, and high sorption capacity made it possible to process this raw material and use it as a sorbent, then clean large natural objects from Se^{3+} ions [2].

Due to the sufficient amount of raw materials (ammonia, urea, thiourea, aldehydes, acrylonitrile) in Uzbekistan, the polycondensation process has been sufficiently analyzed in a large number of monographs and analytical scientific articles, and the technological parameters of this process have been developed [3].

The reaction of thiourea with various substances is reported in the literature, one of which, thiourea, reacts with epichlorohydrin violently at room temperature with heat evolution. In order to keep the rate of reaction of epichlorohydrin with thiourea uniform and reduce exothermicity, the

condensation reaction is carried out in the presence of a solvent. Ethanol, isoamyl alcohols, dimethylformamide, and toluene are used as solvents [4].

High efficiency in obtaining polymer sorbents was achieved when using isoamyl alcohol and dimethylformamide [5]. The reaction rate and polymer yield depend on the amount of solvent. The effect of thiourea and solvent mass ratio (0.5:1.0:1.5:2.0:2.5) on the duration of the condensation reaction and the properties of the anionic had been studied with all details. When 0.5-0.6 parts by mass of solvent are used per unit of part by mass of thiourea, the condensation reaction proceeds at a rapid rate and a brittle polymer with low mechanical strength is formed. An increase in the amount of solvent from 1.5 to 2.5 parts by mass are led to an increase in the reaction mass solidification time (100-120 hours). When one part by mass of solvent and thiourea is used, the condensation process goes and the obtained product has good mechanical strength, and also sufficient exchange capacity[6].

In the IR spectrum of the product obtained in a strongly acidic and neutral environment, there are almost no absorption lines corresponding to the epoxide group, which indicates that the interaction of thiourea with epichlorohydrin is due to the opening of the chlorine atom and the epoxide group in epichlorohydrin, and the amine group in thiourea is due to the interaction with the mobile hydrogen.

The results of describing the migration kinetics of Cu^{2+} ions in EDTA solution in an ionite matrix containing NH^{+}_{4} cations are presented. The imaging process was carried out using digital video technology, and the obtained data were processed on a computer using the Matlab 5.1 program. External and internal diffusion coefficients of ions were determined, and the exchange diffusion model of $Cu(NO_3)_2$ - NH^{+}_{4}, Na^{+}-H^{+}, Cu^{2+} - H^{+}- ion pairs in resin was described in the Amberlite IRC84 program [7].

The selectivity of sorbents had been studied in various studies in the synthesis of various precious metals. Several works of literature present a method for obtaining poly thiourea, which exhibits sorption activity against gold and silver [8].

Synthesis and application of silicon-containing sorbents

Many scientists have studied the condensation reaction of urea and thiourea with formaldehyde in an acidic environment. The obtained products were tested as ion exchange resins and the ion exchange capacity of these resins was investigated [10].

In the synthesis of ion-exchange polymers, the polycondensation method is widely used to synthesize a heat-resistant high-molecular compound [11,12].

Modification of the surface of silicon microparticles with a large number of amino/carboxylic groups of polymer chains is an interesting way to obtain nanostructured composite materials for various purposes. In this case, four weak polycations (PK) polyethyleneimine (PEI), polylysine (PL), polyvinyl amine (PVA), polyallylamine hydrochloride (PAG), and one weak polyanion polyacrylic acid (PAK) were layered on a spherical layer to form composite microparticles. made of silicon dioxide. As a potential application of composite particles, the adsorption properties of simulated and real surface water to metal ions (Cu^{2+}, $Pb^{2+,}$ Ni^{2+}, and Fe^{2+}) were studied [13].

Synthesis of sorbents containing nitrogen, sulfur, and silicon and their application for water treatment

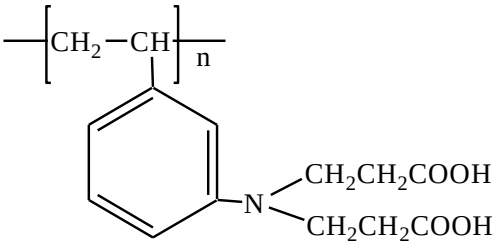
Since the independence of our republic, extensive measures have been taken to organize scientific research in the direction of developing new types of products in the chemical industry and to supply the local market with chemical reagents that can replace imports, and certain results have been achieved [14].

All minerals and synthetic sorbent materials containing silicon constitute a wide group of compounds with different physical, chemical, and technical properties [15]. All known sorbents containing silicon are divided into two main categories. The first natural and synthetic mineral carriers based on silicon dioxide and chemically modified products. The physicochemical properties and application of these materials are presented in many scientific works [16].

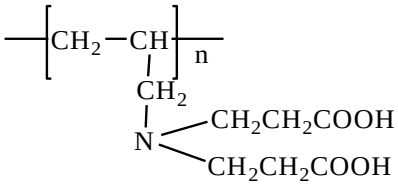
Based on polycondensation of p-nitrophenol, triethylenetetramine, and formaldehyde in the presence of 2 M NaOH, ion-exchanged polymers had been obtained. The resulting polymers have a selective chelating property in the sorption of metal ions such as Fe^{3+}, Cu^{2+}, Ni^{2+}, Co^{2+}, Zn^{2+}, Cd^{2+}, Hg^{2+}, and Pb^{2+}. The sorption of metal ions showed high selectivity in extracting Cd^{2+}, Hg^{2+}, and Pb^{2+}

ions when studied at different pH and ionic strength values of electrolyte solutions. The degree of separation of studied metal ions increases with the increase of hydrogen index in the medium [17].

Baranova N.V. et all. synthesized two types of chelating polymer ligands: 1– N-(2-carboxyethyl) amino polystyrene based on linear polystyrene and also 2 – N-(2-carboxyethyl)polyallylamine based on polyallylamine.



1) N-(2-Carboxyethyl) Aminopolystyrene



2) N-(2-Carboxyethyl) Polyallylamine

The dependence of the sorption of intermediate metal ions on the solution pH using the synthesized polymer ligands was studied from individual solutions of copper (II), nickel (II), and zinc (II) ions under static conditions. It has been found that the maximum sorption of intermediate metal ions in polymeric ligands occurs in the range of pH 5.5-7.5 from individual solutions [18].

Synthesis of chelating ionizing resins from polycondensation of o- and p-hydroxybenzoic acids with resorcinol and catechol in the presence of formaldehyde is described. The synthesis process was carried out in dimethylformamide at a temperature of 80 0C. The adsorption of cadmium (II) and lead (II) ions in synthesized resins had been studied[19].

Nowadays, in many research studies, great importance is attached to obtaining selective sorbents by the method of chemical modification of silica gel [20]. In particular, in [21], the synthesis of complex-forming sorbents by modifying orthosilicic acid with mono- and diethanolamines is presented as follows:

$$\equiv Si-OH + HO-(CH_2)_2-NH_2 \xrightarrow[-H_2O]{OH^-} \equiv Si-O-(CH_2)_2-NH_2$$

The possibility of extracting 137Cs, 90Sr, 90Y isotopes, and ions of d-elements such as Cu^{2+}, and Ni^{2+} from aqueous solutions are investigated in the work using large porous sorbents containing triethylenediamine.

The method of obtaining new, chelating sorbents with layers of nickel acetylacetonate, nickel-malon, and acetoacetic esters welded by the method of sequential arrangement of molecules on the surface of silica gel is presented. Their structure and chromatographic description have been studied using physicochemical methods.

Global production of synthetic ionite and sorbents has been increasing dramatically in recent years [22]. In terms of ionite production, the CIS countries are at the top of the world, while 65% of these ionites are used in hydrometallurgical industry enterprises for the concentration and separation of dissolved metals and water purification in various sectors of the national economy [23].

Selective sorption of phosphate arsenate and silicate anion compounds from aqueous solutions of ammonium molybdate and tungsten has been studied using a composite sorbent consisting of cationic KU-23 (or KM-2p) and hydrated zirconium oxide [24].

The optimal conditions for the condensation of oligomers of epichlorohydrin (EXG) formed with various amines with allyl bromide (AB) were studied. It was shown that when PEPA is used, the optimal reaction conditions are: temperature 500 °C, ratio of EXG:PEPA: AB components: 1:1:1. When polyetherimide is used, the temperature is 600 °C, the ratio: 1:3:1, and when hexamethylenediamine (GMDA) is used, the temperature is 700 °C, the ratio: AB:EXG: GMDA is 1:1:2 [25].

Based on gossypol resin, epichlorohydrin, and polyethylene polyamine, ionizing resins had been synthesized [26]. Using them, the properties of effective sorption of non-ferrous, precious, and heavy metal ions from technological solutions were studied using physicochemical methods [27].

A polyelectrolyte complex is obtained by dispersing the bentonite mixture with the product of the interaction of poly epichlorohydrin and diethylamine. Kinetic and diffusion properties of the K-GL blue dye sorption process have been studied [28].

It is important that the product obtained by condensation melamine with formaldehyde and epichlorohydrin with polyethylene polyamine has the property of separating rhenium and molybdenum ions. The total exchange capacity of the obtained anionite was 4.5-5.2 mg-eq/g, its relative viscosity was 80-100%, the weight of the powder was 0.7 g/ml, and the total amount of nitrogen in its content was equal to 20-25% [29].

Godjaeva A et al studied the reactions of dimethylamine with epichlorohydrin in aqueous and non-aqueous solutions [30]. In this case, a water-soluble polyelectrolyte was synthesized, and it was shown that the reaction yield depends on the influence of the initial substances in the molar ratio of the solution medium.

By polycondensation of EXG oligomers with amines in the presence of allyl bromide, polyfunctional polyelectrolytes were synthesized, and optimal conditions were determined. Their composition and structure have been thoroughly studied [31].

The leakage of harmful organic liquids into water resources has had a dangerous effect on living organisms. Here, the production of hybrid sorbents using s-PPG and an organosilane crosslinker is demonstrated. The final product showed high, fast absorption capacity, recyclability, and excellent separation of oil from wastewater. They also pick up a variety of oils from the bottom and surface of the water, even in harsh environments such as tidal environments and sub-zero water temperatures without changing their capacity. The results of the experiment showed that the obtained sorbents effectively remove oil from the water surface even under severe conditions and float on the water surface without loss of capacity or structural changes before and after oil sorption. The starting solvent, activator-free reaction medium, high and selective sorption properties, and high reusability can make these sorbents promising candidates for the purification of water from harmful organic liquids by absorption [32].

The presence of arsenic in water supplies has been a widespread problem for the past few decades. Inorganic arsenic ions in the natural environment occur mainly in two oxidation states, As(V) and As(III). These two oxidation states of arsenic ions are common in natural waters and pose a significant risk to human health when present at or above acceptable limits. Therefore, it has become more difficult to deal with arsenic ions based on various methods (for example, membrane filtration, adsorption, and ion exchange). This paper aims to review the current knowledge on different functional adsorbents by comparing the arsenic sorption potential based on key performance parameters, especially partition coefficient (BK).

In general, the new materials showed much better As(V) and As(III) sorption performance than the conventional materials. Among the materials considered, $ZrO(OH)_2$ improved sorbent such as carbon nanotubes (UNT) showed excellent performance with partition coefficient values of 584.6 (As(V) and 143.8 mol kg-1 M-1 (As(III) s). excellent renewability (>90% desorption efficiency after three sorption cycles. The results of this review are expected to help researchers develop an effective strategy for reducing arsenic ions in wastewater [33].

Copper, nickel, zinc, chromium, and iron ions are the main pollutants in wastewater [34]. In this context, we have studied here the sorption properties of metal ions in an ionic cryogel (IC) composed of inexpensive materials from renewable sources compared to multi-component metal ion solutions [35]. Chitosan matrix-based IK sorbent containing natural zeolite was synthesized using a simple strategy combining copper stamping and unidirectional ice stenciling. As a result, the one-dimensional orientation and interconnection of the current channels favor the fast diffusion of metal ions in the anisotropic IK structure. Selectivity studies were performed on binary, ternary, and five-component synthetic mixtures to evaluate the success of the formation of voids with well-defined dimensions controlled by the radius of copper ions used as templates. The effectiveness of IK as a sorbent was further evaluated in real water effluents from sorption processes; Thus, a dose of 6 g l-1 of IK can sorb 98.89% of Cu^{2+} ions, 94.56% of Fe^{3+}, 91.67% of Ni^{2+}, 92.24% of Zn^{2+} and 82.76% of Cr^{3+} ions from this type of industrial wastewater. defined [36].

Adsorption kinetics fit a pseudo-second-order model [37]. The maximum adsorption capacity of the sorbent for Pb (II) ion is more than 500 mg/g based on the Langmuir isotherm.

The amine-grafted aluminosilicate hybrid was initially processed by the sol-gel method through coagulation and polycondensation reaction. Subsequently, a spherical granular material had been produced by self-assembly after nano-casting. Two different hybrid granular sorbents, i.e., aminated bockmite (AB) and bockmite/silica (BK), were prepared and characterized for chemical, structural, and surface properties using FTIR, BET surface area, SEM, and zeta potential measurements. The adsorption efficiency of the obtained mesoporous sol-gel hybrid sorbents for Cr(VI) was systematically determined at different rN values, doses, concentrations, temperatures, and ionic strengths. Based on the experimental data, adsorption kinetics, and isotherms were studied and verified using standard models such as Lagergren pseudo-first and pseudo-second-order kinetic models and Langmuir, Freundlich, Sips, Redlich-Peterson, and Toth isotherm models. The adsorption efficiency of the hybrids has also been compared with conventional sorbents described in the literature [38].

Beknazarov Kh et all. researchers have synthesized oligomeric corrosion inhibitor compounds, and at the same time, it had been studied that many of them have also sorbent properties [39-43].

In order to comprehensively assess the removal of metals by sorbents in wastewater systems the effects of co-pollutants should be evaluated [44]. In this study, five low-cost sorbents were used to investigate the effectiveness of coconut husk fiber (HYoPT), blast furnace slag (BFU slag), waste tire rubber (ChShMK), biochar (BK), and iron-clad biochar (FeBC) on other pollutants (food substances and polycyclic aromatic hydrocarbons) were applied for simultaneous sorption of Cd, Cr, Cu, Ni, Pb, and Zn from conditioned stormwater sewage (IMS). HYoPT and YuO'Sh showed the highest sorption capacity of all metals in all systems (single and multi-contaminated) (removal > 95%). However, the presence of other contaminants in the solution decreased the metal removal for other sorbents in the following order (from highest to lowest): single metal > multi-metal > multi-contaminant solutions, and the metal removal efficiency was generally Cr~Cu~Pb>Ni>Cd>Zn. Humic acid (GC) had a negative effect on the sorption of metals, probably due to the formation of soluble GC-metal complexes; NaCl concentration did not affect the ion separation, but alkaline pH improved the removal. These results suggest that sorbents should be tested under real rainwater chemistry containing additional contaminants to properly characterize their performance before implementation [45].

Conclusion

Thus, the synthesis of silicon-containing organohybrid sorbents, development prospects, and modern problems of their use, as well as information and analysis based on the use of organohybrid sorbents in the world and in our republic, were studied. Analysis of the literature shows that today, obtaining various sorbents, including organic and inorganic components, with high sorption properties due to different functional groups, is one of the promising and important directions of the industry. The resulting organohybrid sorbents are widely used in wastewater treatment, heavy metal removal, and other industries. Based on the studied problems, obtaining sorbents is one of the important directions of science and industry.

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Rezyume:. *Ma’lumki, hozirgi vaqtda dunyoning turli mamlakatlarida kremniy saqlovchi yuqori molekulali birikmalarni sintez qilish va ularni sanoat miqyosida qo‘llash bo‘yicha keng ko‘lamli ilmiy tadqiqotlar olib borilmoqda. Kremniy tutgan organik birikmalar ayrim fizik-kimyoviy xossalarining yaxshilanishi bilan boshqa organik moddalar sinflaridan keskin farq qiladi. Xususan, kelajakda qo‘llanilishi istiqbolli bo‘lgan kremniy asosidagi kompleks hosil qiluvchi sorbentlarni sintez qilish borasidagi ilmiy izlanishlar tez sur’atlar bilan rivojlanmoqda. Kremniy tutgan organogibrid sorbentlarning qo‘llanish sohasi tobora kengayib bormoqda: gidrometallurgiya, oqova suvlarni tozalash, ichimlik suvini sho‘rlikdan xalos qilish, oziq-ovqat sanoati, havoni tozalash, shuningdek, kumush va boshqa qimmatbaho metallarning ajratib olinishi kabi yo‘nalishlarda.*

Azot, kislorod va kremniy saqlovchi sorbentlarni sintez qilish hamda ular yordamida murakkab eritmalardan metall ionlarini sorbsiyalashga qaratilgan tadqiqotlar ham jadal rivojlanmoqda. Shu munosabat bilan kompleks hosil qiluvchi organogibrid sorbentlarning sintezi, tarkibi va tuzilishini o‘rganish, ularning fizik-kimyoviy xossalari va sorbsiya sig‘imi, turli omillarning sorbsiya–desorbsiya jarayonlariga ta’siri, gidrometallurgiya sanoatida rangli va qimmatbaho metall ionlarini tanlab ajratish, oqova suvlarni tozalash hamda turli sorbentlarning harorat sharoitlarida sorbsiya qobiliyatini baholash masalalariga alohida e’tibor qaratilmoqda.

Резюме:. *Известно, что в настоящее время во всём мире проводятся многочисленные исследования, направленные на получение высокомолекулярных соединений, содержащих кремний, и их промышленное использование. Органические соединения, содержащие кремний, существенно отличаются от других типов органических веществ благодаря улучшенным физико-химическим свойствам. В частности, в последние годы активно развиваются исследования в области синтеза комплексообразующих сорбентов на основе кремнийсодержащих структур. Область применения органогибридных сорбентов, содержащих кремний, стремительно расширяется и охватывает гидрометаллургию, очистку сточных вод, опреснение питьевой воды, пищевую промышленность, очистку воздуха, а также извлечение серебра и ряда других драгоценных металлов.*

Синтез сорбентов, содержащих азот, кислород и кремний, а также исследования, направленные на сорбцию металлов из сложных растворов с их использованием, получают всё более широкое развитие. В этом контексте особое внимание уделяется синтезу, составу и структуре комплексообразующих органогибридных сорбентов, их физико-химическим свойствам, сорбционной ёмкости, изучению влияния различных факторов на процессы сорбции-десорбции, селективному разделению ионов цветных и драгоценных металлов в гидрометаллургии, очистке сточных вод, а также определению сорбционных способностей различных сорбентов в средах при различных температурах.

Kalit so‘zlar: *kremniy, organogibrid, sorbent, gidrometallurgiya, sorbsiya sig‘imi, sorbsiya–desorbsiya, oqova suvlar, kumush.*

Ключевые слова: *кремний, органогибрид, сорбент, гидрометаллургия, сорбционная ёмкость, сорбция-десорбция, сточные воды, серебро.*

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STUDY PHYSIC-CHEMICAL CHARACTERISTIC POLYMER APPLICABLE IN BORE SOLUTION

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Summary:*In article are brought results of the study physic-chemical characteristic new copolymers synthesized on base departure to chemical industry and local raw materials resource. Using the modern methods of the analysis are shown polyelectroliting nature water solution copolymers, as well as are shown possibility of the using designed polymer for stabilization bore solution.*

Key words: *polymer, sand, ground, water solution polymer, filtering, water recoil, sediment, tixotroping, viscosity, density.*

Searching for, exploring the oilfields and gas in Republic Uzbekistan on new area, and growing of the depths of the boring definition objective need in improvement composition bore solution. Herewith used bore to syringe liquid must possess certain rheological, physic-chemical and technological characteristic depending on geological construction of the cut of the bore hole and mineralization opened by her plasting of water steadfast to influence aggressive fluids [1]. The nature applicable polymer renders On applied characteristic bore solution enormous influence.

As is well known [2], amongst enormous amount known natural and synthetic polymer only a few possess the ability open in water. For water solution polymer characteristic of presence in chain macromolecule gidrofilings of the functional groups (the gidroxil, carboxyl, amides, sulfur and others.). The degree dissociation water solution polyelectrolyte is connected with ion power of the solution. The form changes with change last macromolecule polyelectrolyte. Consequently, must be changed and their working, for instance, coagulation, flocculation characteristic and to distend. Increase the number of the kinetic units in solution as a result dissociation and change the form macromolecules polymer brings its gidrodinamicals characteristic about change. Consequently, viscosity and density of the bore solution must be such to with other technological factor and acceptance possible was provide sufficient antipressing on passable layers, but in ditto time she must not noticeably worsen the condition of the work chisel and field-performance dates productive horizon. Other word, in each concrete event must be chosen best values to viscosity and density of the bore solution. Density also is one of the main factors, providing stability wall bore holes.

In this aspect was of interest study physic-chemical characteristic designed by us on base departure water solutions polymers, which as we seem, can find broad using in prospect in preparation bore solution, especially firm to influence aggressive fluids.

As object of the studies were applying copolymers departure of the processes delintation grain cotton plant with GIPAN, as well as some waste chemical enterprise our republics such as - lignin, lignosulfonat and others product to reactions copolymerization departure of the processes delintationgrains cotton plant with GIPAN presents itself very viscous not hue or painted in amber color of the liquids, with specific scent, their physic-chemical features are completely identified.

The most wide-spread method is a determination to viscosity solution polymer. At study of viscosity powerfully diluted solution was discovered that many polymers, as from a certain "critical concentration" show the deflection brought viscosity from linear dependency. Usually in these cases extremums appear on crooked, reasons, which origin is concluded in electrostaticsrepulsive of the same name charged fragment macromolecules. In diluted solutioncopolymer ionized nearly completely, but because of relatively small quantity free carboxyl’s groups in its composition effect to ionizing not is too expressed. The study to dependencies to viscosity and pH from concentration solution copolymers and natural polymer has shown that with growing of the concentrations

copolymera in solution importance pH changes small (tabl.1). Several more concentration are reflected on importance's pHlignin and lignosulfonat that probably, is connected with different methods of their reception. The nature of the change to dependencies to viscosity from concentration in solution typed out to be alike. However sharp structuring in solution copolymera with akrylonitrilings fragment occurs in the field of greater concentrations that is caused, probably, difference in function composition and value of the molecular masses polymer.

Electronic-microscopic studies is installed that for solution resent preparecopolymer typical convolute type of the structure in the manner of formless unit, changing depending on concentrations copolymer, system in this case is homogeneous. Since time (for 5 hours) in system occurs the orientation, particularly in concentrated solution. Under the most further keeping of the solution (after 24 hours), appears the second type of the structure - an fibrilingover molecularing formation, due to that homogeneous system becomes microgeterogen. Probably, globulin types of the structure explanatory the small degree electrolytic dissociation functional groups and low their gidrotation. The aging copolymers and their solution are connected with to lather amides of the groups that can be confirmed by increase pH water solution with reduction of the concentrations.

Table 1

Change to specific viscosity and pH solution polymer depending on concentrations copolymer

№	Concentration solution polymer, %	copolymer		lignin		lignosulphonat	
		pH	viscosity η_{ud}	pH	viscosity η_{ud}	pH	Viscosity η_{ud}
1	0,005	6,0	0,10	7,1	-	-	-
2	0,010	6,0	0,12	7,1	-	-	-
3	0,05	6,1	0,14	7,1	-	-	-
4	0,10	6,1	0,16	7,2	0,1	0,11	0,08
5	0,5	6,2	0,20	7,2	0,11	0,12	0,09
6	1,0	6,4	0,22	7,4	0,12	0,12	0,1

Due to lather amides of the group in circuit macromoleculescopolymer appear the new functional groups, degree dissociation which in over and over again more, than amides of the groups. Because of electrostaticsrepulsive of the same name charged groups COO^- - macromolecules are rectified. Herewith the happy circumstances for arising the relationships between macromolecules that intensifies their mutual orientation and brings about shaping fibrils. Herewith, was installed that heating renders on process of the structuring in solution copolymers such influence, either as keeping. So, at half hours heating under 60ºC 10%- resent prepare solution copolymera exists such speedup fibril formed, as at keeping of the solution. The study change to viscosity and pH solution copolymers depending on concentrations has shown that they possess the fible acid a reaction, increasing with increasing of the contents copolymer in solution.

Beside water solution copolymer relative viscosity powerfully grows with increase the concentrations, anomaly to viscosity exists already in the field of powerfully diluted solution moreover for copolymera she denominated violent, than for lignin and lignosulfonat. The anomaly to viscosity copolymer, even powerfully diluted solution is conditioned presence in them over molecularing of the structures. Electronic-microscopic study lignin and lignosulfonat has shown that they are microgeterogen and consist of varied unit macromolecule - a globule and fibril. They united in units of the different forms, changing depending on concentrations of the solution natural polymer. In concentrated solution exist the clot to different density, with transition from high concentration of the happy circumstances to low for glue formed. The most further diluting brings about destruction gluing.

At keeping solution copolymers occurs sequencing a fibril structured element. For products 24-sentry of hydrolysis on electronic photomicrography of the solution, are seen filament, consisting of fibril. The appearance such fibrous structures (rectifying bunch macromolecule), probably, is conditioned by further hydrolysis amides groups in alkaline ambience, about than was spoken above.

In the course of study was installed that interaction designed by us water solutioncopolymer with dispersing particle depends on many factor: concentrations copolymer and mineral suspending,

presences electrolyte, temperature, salting and others amongst mineral suspending systematically and in detail studied soil and ground suspending, to convey from Navbakhor, Rishtan, Chust locality. So, influence designed by us copolymer in analogy with polyakrylamid (PAA) has shown that polymeric preparations enter in interaction with soil particle in consequence of which in suspending appears structure. pH soil suspending in whiteness of these polymer does not change that probably, is connected with buffer influence of ground on change the concentrations hydrogen ion in mixture.

The relative value of the volume setting soil suspending under influence synthesized us copolymers changes equally. However, in the event of industrial polymer PAA soil suspending more. Increase the volume setting with growing of the contents considered polymer changes not simbating at the speed of filtering. The last gets through minimum at concentrations of the polymer, equal 0,05% can be connected with that that under small concentration copolymer not all particles aggregation, remained particles occlude the times and hereunder decreases the velocity of the passing to liquids through layer setting. When all particles are bound, destruction brings about increasing of the velocities to filtering the fluid phase. As to designed water solutionpolymer, that here with increase the concentrations of the polymer and volume setting and velocity to filtering increase. Probably, this copolymer better sorption the soil particle. This is conditioned that that under influence polyelectrolyte, first, can occur peptization soil particles, and, consequently, occlusion of the times more small particle, secondly, filming to surfaces of the particles by polymer. Hereupon the happy circumstances for slide of the particles friend for friend and arising the thick packing, holding up passing of the fluid phase through layer setting. However if occurred peptization, volume, setting must was continuously decrease, dispersion ambience was turbid, but this does not exist.

Noted in experience reduction to specific viscosity filtrate ground in contrast with source solution lignin and lignosulfonat validates the second suggestion - occurs to envelop surfaces of the soil particles polymer. Granulometricalingcomposition of ground influences upon process of the splicing microagregats. The most friable precipitation form on background of the calcium chloride of the particle of ground of the different sizes in witness of copolymer.

The Method sedimentation analysis was studied influence synthesized us copolymer on dispersing different mineral suspending. The experiences conducted with 0,2% suspending, which in 24 hours after preparation added the solutions copolymer in corresponding to dosage. The influence studied in kinetics through 5, 10, 15 and etc minutes. It is revealed that degree dispersing change under influence copolymer and the other values, connected with size of the particles suspending. The balance is fixed already after 5 minute contacts suspending with polymer. Regardless of type of the mineral system radiusthe best likely particles it increases that is indicative of aggregation particles dispersing phases under influence of the polymeric additive. Aggregating dispersing of the phase occurs within optimum dosage of the polymer. The most further increasing to concentrations copolymer promotes increase dispersing and, accordingly, reduction of the value of the best likely radius of the particles that can be due to disintegration unit under influence polyelectrolyte and stabilization of the particles suspending.

Thereby, structuring in mineral suspending under influence copolymeris found in complex dependency from concentration copolymer.The results of the studies physic-chemical characteristic new copolymers, as well as their influence upon shaping firm to influence aggressive fluids unit have shown that designed by us copolymers in significant measure create the happy circumstances for provision of stability wall bore holes. They are revealed main applied, physic-chemical and rheological characteristic bore solution. The practical application of the development can, will solve many economic and technological problems to branches.

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Rezyume: *Maqolada kimyo sanoati va mahalliy xom ashyo resurslariga asoslangan holda sintezlangan yangi kopolimerlarning fizik-kimyoviy xususiyatlarini o'rganish natijalari keltirilgan. Zamonaviy tahlil usullaridan foydalangan holda polielektrolit tabiatidagi suvli eritma kopolimerlari ko'rsatilgan, shuningdek, quduq eritmasini barqarorlashtirish uchun mo'ljallangan polimerdan foydalanish imkoniyatlari ko'rsatilgan.*

Резюме: *В статье приведены результаты исследования физико-химических свойств новых сополимеров, синтезированных на основе отходов химической промышленности и местных сырьевых ресурсов. С использованием современных методов анализа показана полиэлектролитная природа водных растворов сополимеров, а также показана возможность использования разработанного полимера для стабилизации буровых растворов.*

Kalit so‘zlar: *polimer, qum, tuproq, suv eritmasi polimeri, filtrlash, suvning qaytarilishi, cho'kindi, tiksotroplash, yopishqoqlik, zichlik..*

Ключевые слова: *полимер, песок, грунт, водный раствор полимера, фильтрация, отдача воды, осадок, тиксотропирование, вязкость, плотность.*

DEVELOPMENT OF A STATIC METHOD FOR CRUSHING VARIOUS ROCKS

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Summary: *In this work, mathematical modeling of the process of high-pressure formation inside wells and boreholes using a non-explosive destructive mixture has been carried out, modern theories and concepts on non-explosive destruction of rocks have been studied, a new non-explosive destructive mixture with a new composition has been studied on rock samples in laboratory conditions, a new non-explosive destructive mixture has been developed using components made from local A method for separating monoliths from an array using a new, non-explosive destructive mixture has been developed., which has found application in industry.*

Key words: *Non-explosive destruction of rocks, non-explosive destructive mixture, borehole, borehole, mathematical modeling, high internal pressure, new composition of non-explosive destructive mixture, laboratory studies, components from local raw materials, method of separation of monoliths from the massif.*

INTRODUCTION

In the world, the universal and practically the only method of destroying strong rocks in the development of mineral deposits is drilling and blasting using explosive energy [1, 2]. This method remains the leading method in terms of productivity and lead time for the next 30-40 years, until new methods of destroying strong rocks using large capacities are invented [3-6]. The main disadvantages of the drilling and blasting method are insufficient provision of complete safety of blasting operations, interruption of mining operations and downtime due to ventilation of blasting facilities, a large amount of auxiliary work, insufficient use of explosive energy in unstable rocks, the release of a huge amount of dust and toxic gaseous products, the danger of storing explosives, etc. These disadvantages force the development of cheap and promising ways to destroy strong rocks. A promising direction for solving this problem is the use of a static method for the destruction of various rocks using non-explosive destructive mixtures (NDM) [7].

To date, more than 120 different mixtures and compositions of NDM are known worldwide, the main disadvantages of which are their importability, the difficulty of obtaining the composition, the use of rare and expensive substances as additives, long destruction time (12-24 hours), limited temperature conditions, limited application conditions, dependence on climatic and temperature conditions (for example, does not work in winter) [7]. In this regard, there is a need to conduct research on the development of cheap and high-quality NDM using components from local raw materials and shorter rock destruction time. To date, a number of scientific and practical works have been carried out in the Republic aimed at creating new types of NDMs using components from local raw materials, reducing the destruction time and simultaneously eliminating the phenomenon of spontaneous discharge of NDMs from boreholes and wells, and research is underway on the kinetics of self-expansion of NDMs based on inorganic compounds [8-9]. An analysis of the works devoted to fracture problems shows that the Griffiths-Irwin theory is most widely used in engineering calculations, which does not require a large amount of experimental data for calculation and satisfactorily describes fracture due to the growth of a single crack. This gives grounds to choose its provisions as the basic ones for solving the problems of rock destruction with the help of the NDM.

The main advantages of the NDM are the absence of dynamic effects on the destroyed object, the release of harmful gases, sound and other vibrations. The implementation of the method does not require the purchase of expensive special equipment or devices, the method can be implemented near transport and electrical equipment, while eliminating the possibility of damage due to the lack of separation of parts of the destroyed object. Currently, many methods of non-explosive destruction are known, but their industrial use is hampered by lack of equipment, low reliability, high energy consumption, dangerous effects on humans, and high cost. All these disadvantages force us to look for ways to create cheap and promising ways to destroy durable rocks.

When using NDM to obtain a continuous straight line of cracks in the rocks being destroyed, it is very important to determine the location of the bores. Their location and the formation of cracks in a straight line depends on the structure, strength and degree of extensibility of the rocks being developed. Cracks appear in the rocks after applying the NDM. These cracks are formed as a result of chemical and physical reactions of the applied composition NDM. Cracks can form anywhere in the hole and develop in any direction.

The formation of a gap is investigated as a result of the action of tangential stresses σθ at point A located in the plane of the gap at an equal distance from neighboring bores (Fig. 1). It has been established that radial stresses from neighboring bores, geometrically folded in a plane intersecting the gap perpendicular to it at a distance from neighboring charges, play an essential role in the mechanism of gap formation. These stresses also create tensile forces in the plane of the slit, and it is necessary to know the energy costs of sliding the walls of the slit after the formation of the main crack. A gap occurs in the array under the action of tensile stresses σθ at point A and symmetrical, directional tensile stresses at points C and C1, formed as a result of the geometric addition of radial compressive stresses σp at these points (Fig. 1).

As a result of the conducted analytical and theoretical studies, a formula has been developed for determining the effective distance between holes when using NDM, which allows for an even separation of the rock mass.:

$$a_k = d_c\left[\frac{2P(t)(0{,}85+\frac{\mu}{1-\mu})}{\sigma'_p+\sigma_h}\right]^{2/3}, \text{ м}, \quad (1)$$

where dc – the diameter of the well, m; P(t) – compressive stress caused by the action of the NDM at the wall of the contour well, MPa; μ – the Poisson's ratio; σ'p– the ultimate tensile strength of the rock, taking into account the coefficient of structural weakening for this massif, MPa; σh–additional stresses required to move the walls of the contour slit by a certain amount hsh, and its opening, MPa.

In the scientific laboratory of the Navoi State Mining and Technological University, experiments were conducted to find the optimal formulation of the NDM composition, which would speed up the hydration process without additional heat generation and ensure high pressure for 5-8 hours after using the composition.

NDM was selected for the destruction of rocks, concrete, reinforced concrete, masonry, as well as as an expansion additive for the production of grouting materials.

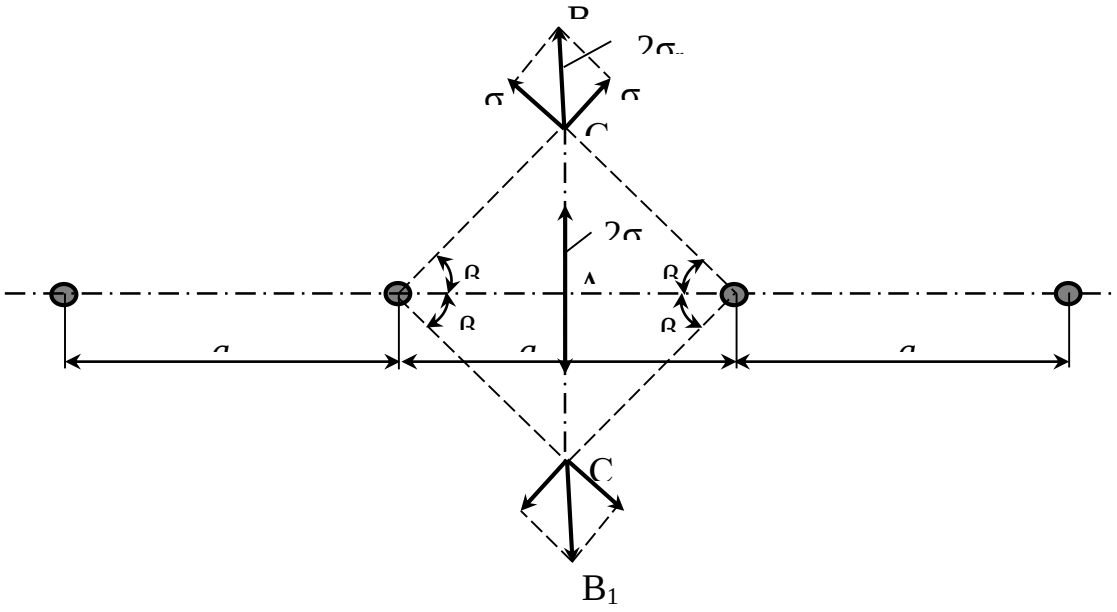


Fig. 1. Diagram for calculating the distance between wells with NDM

As a result of the conducted research, the following approximate chemical composition of the expanding non-explosive mixture was selected:

CaO – 9-90%;
Mr – 0,97-1,66%;
Fe2O3 – 3,4-7%;
CO3 –0,33-0,65%;
Al2O3 –1,34%;
CuO2 – 2%;
Na2O2 – 4%.

5 NDM formulations were compiled, by weight.%:

1) calcium chloride – 1.0-10.5; calcium carbonate with sugar waste content – 5.0-20.0; quicklime – the rest;

2) aluminum powder – 0.25-0.30; glycerin – 3.0-15.1; soda ash – 2.0-9.9; technical upgraded lignosulfanate (LSTM-2) – 0.10-2.35; calcium oxide from calcined limestone and gypsum – the rest;

3) potassium permanganate – 1.45-9.5; ethylene glycol – 5.0 – 21.0; boric acid – 0.25-2.7;

4) urea – 1.8-23.0; glycerin – 2.6-12.8; calcium oxide from calcined limestone and gypsum – the rest.

5) The composition of the NDM -1 mixture, developed by JSC "Budnikov All-Russian Scientific Research Institute of Building Materials and Structures", the main component (up to 98%) of which is calcined coarse lime. The firing of quicklime was carried out in furnaces of a special design at temperatures exceeding 1400°C. As a dobThe wok used boric acid, soda ash, and a chemical called sulfate-yeast mash (SYM). NDM -1 powder mixed with water in a 3:1 ratio formed a paste-like mass, which increased its volume upon solidification, creating a pressure of up to 50 MPa in the destroyed object.

Based on the above chemical compositions, optimal options have been selected in which the chemical mixture can expand as much as possible and lead to the destruction of glass, gypsum models, bricks and marble.

To identify the optimal formulations of NDM mixtures, the data presented in Table 1 were used.

Table- 1

NDM train options

NDM composition, wt. %				The pressure of self-expansion, MPa, aged		The presence of involuntary discharge of NDM from the hole
CaO	Na2CO3	LSTM	CH3COOH	12	24	
98,40	1	0,35	0,25	48	58	Blowout
96,35	3	0,4	0,25	40	52	no
92,00	6	1,5	0,5	46	57	no
88,00	9	2,5	0,5	38	45	no
85,70	11	2,8	0,5	30	35	no
98,15	1	0,35	0,5	55	69	Blowout
96,10	3	0,4	0,5	44	50	no
91,75	**6**	**1,5**	**0,75**	**48**	**56**	**no**
87,75	9	2,5	0,75	40	47	no
85,45	11	2,8	0,75	32	38	no
97,90	**1**	**0,35**	**0,75**	**65**	**73**	**Blowout**
95,40	**3**	**0,4**	**1,2**	**75**	**82**	**Blowout**
91,30	**6**	**1,5**	**1,2**	**70**	**80**	**Blowout**
87,30	**9**	**2,5**	**1,2**	**56**	**65**	**Blowout**
85,10	**11**	**2,8**	**0,75**	**17**	**25**	**no**
the prototype				60	63	Blowout

In subsequent experimental work, more than 200 experiments with glass penicillin bubbles were performed. Only after obtaining repeated results on the rupture of glass bubbles, gypsum models, bricks and marble bars with pre-drilled holes were used.

Laboratory tests were also carried out in samples from various composite materials and the uniaxial compressive strength of gypsum block, ceramic brick, marble and glass samples was

determined. After obtaining the necessary experimental results, statistical processing was performed and the corresponding physical and mechanical parameters were obtained.

As a result of the research, a method for obtaining LDC has been developed, providing for the separate preparation of solid (S) and liquid (L) formulations. The solid composition is obtained by grinding lime (CaO) to a powdery state, mixing the resulting powder with soda ash (Na2CO3), lignosulfonate (LSTM) and technical salt (NaCl) at the following weight ratios. %:

– CaO – 48;
– Na2CO3 – 3;
– LSTM – 3;
– NaCl – 4.

It turns out to be a grayish loose mass.

The liquid composition is obtained by mixing liquid soap, water and acetic acid with the following components, by weight. %:

– liquid soap – 1,5;
– acetic acid – 1,2.
– water is the rest;

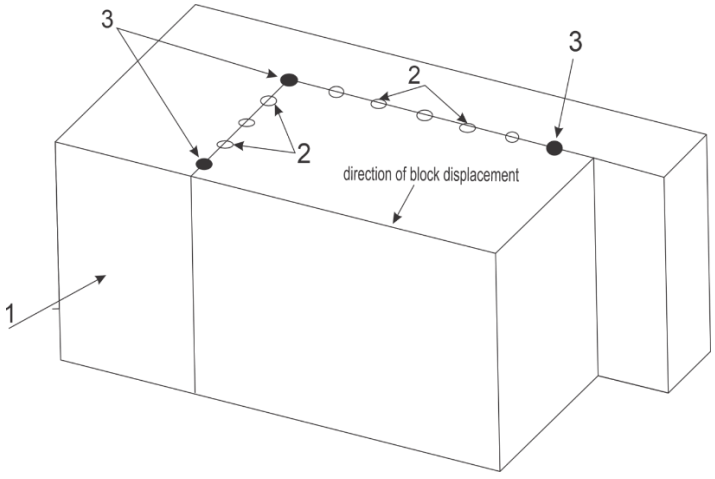
Solid and liquid compositions in the ratio S:L =3:1 is mixed until a creamy, flowing mass is obtained and, without allowing it to solidify, is poured into boreholes or boreholes. The time of rock fracturing is in the range of 6-8 hours, depending on the ambient temperature.

The developed new composition of the NDM is recommended to be used to separate monoliths from the mountain range and to split them into appropriate blocks.

A method for separating monoliths from an array using a new NDM composition has been developed (fig. 2).

According to this method, bores – 2 and 3 with a diameter of 32-43 mm are drilled in monolithic block – 1 at a right angle, and thus a mining ledge is formed at an angle of 90 ° to obtain blocks of monoliths of the correct shape and their further use..

The depth of bores 2 and 3 depends on the height of the monolith being separated and its ability to split. For better crack formation in the monolith and more efficient separation of the array, the depth of the bores should be on average 0.8-0.95 of the height of the object, but not less than six hole diameters and not more than 1.5 m.



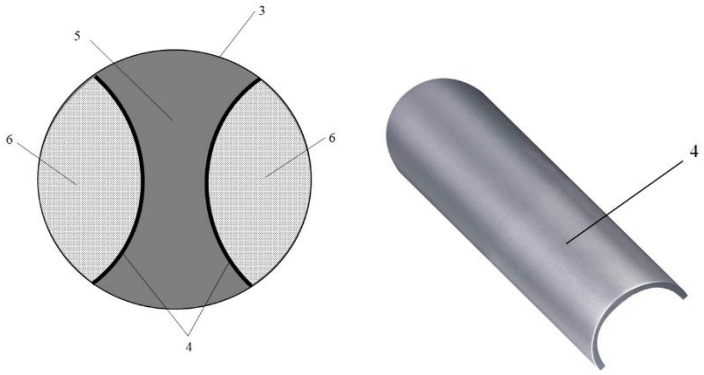
1 – monolithic block; 2 – drilled holes from the NDM; 3 – drilled holes with NDM and installed metal arc-shaped plates

Fig. 2. A method for separating monoliths from an array using a new composition of a non-explosive destructive mixture.

The distance between the holes is determined by the formula (1).

In the lateral bores – 3, a stress concentrator is formed, consisting of two arc-shaped metal plates with an arc height equal to ½ the radius of the borehole, and an arc that are directed towards

each other at the places of the proposed split plane between adjacent boreholes, the space between the boreholes and the arc sphere is filled with downhole material, and the space between the tops of the arcs and all other boreholes is completely filled NDM (fig. 3).



3 – side contour spur; 4 – metal arc-shaped plate;
5 – non-explosive destructive mixture; 6 – slaughter material

Fig. 3. Construction of a side contour hole with metal plates of an arc-shaped shape

The displacement of the monolith block into the depleted space occurs under the influence of high self-expansion pressure, eliminating the involuntary release of the mixture. This eliminates the cost of additional rafter work and increases the safety of mining operations.

In industrial conditions, research has shown that the use of a new composition and method makes it possible to create high internal pressure in boreholes, contributing to the static destruction and rupture of rocks.

Thus, the theoretical and experimental studies carried out to develop a new composition of the NDM, and the practical implementation of their results in open–pit mining operations made it possible to make a significant contribution to solving an urgent scientific task - the scientific justification and development of a static method for rock destruction using NDM from local raw materials for use at open-pit mining facilities.

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SCIENTIFIC BASIS FOR THE APPLICATION OF VARIOUS SUPPORT METHODS IN CAPITAL AND PREPARATORY MINE WORKINGS AT GREAT DEPTHS

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Summary:.*The article highlights the scientific foundations of supporting capital and preparatory mine workings located at great depths. Based on the strength properties of rocks, the degree of fracturing, stability categories, and the depth of the workings, criteria for selecting different support methods have been developed. Moreover, the possibilities of assessing rock quality using the Q-rating method based on the Barton system and selecting an appropriate support type are demonstrated. The research results contribute to ensuring the stability of mine workings, increasing their safety, and extending their service life.*

Keywords*:Capital workings, preparatory workings, mine, mine workings, rocks, rock strength, fracturing, deformation, geomechanics, stability category, support, support system, anchor, pre-stressed anchor (PSA), shotcrete, reinforcement frame, steel mesh, arch support, combined support, yielding support, rock pressure, lateral pressure, tectonic fault zones, mining and geological conditions, horizontal stresses, vertical stresses, abutment pressure zone, stability assurance, safety, efficiency, service life, "support–rock" system.*

When applying different support methods, the strength properties of rocks and the depth of the working are taken into account. In this case, a dimensionless parameter [1] is used and is determined by the following formula:

$$\varphi = \frac{\gamma H}{R_{comp}} \qquad (1)$$

where:

γ– density of the overlying rock layers, t/m³;

H – depth of the working, m;

Rc – long-term compressive strength of rocks, t·s/m³.

If $\gamma H/R_{\text{comp}} \leq 0{,}1$ the rocks can be considered stable. For rocks exposed to atmospheric influence, when driving workings, a thin (2–5 cm) layer of shotcrete support is recommended.

If $0{,}3 < \gamma H/R_{\text{comp}} \leq 0{,}3$ the rock mass requires support. In this case, recommended support types include anchored and combined support.

If $0{,}3 < \gamma H/R_{\text{comp}} \leq 0{,}45$, support types without an inverted arch are applied: monolithic concrete, timber, flexible steel support. In addition, combined variants—such as anchored support in combination with monolithic concrete or steel support—can also be used.

The stability of ore and rocks depends on their strength, degree of fracturing, tectonic disintegration, sericitization, chloritization, and silicification. Rock stability is also influenced by the shape and size of exposed surfaces, their duration of existence, blasting operations, the distance to mined-out voids, and other factors [2].

For workings located outside the zone of influence of stoping operations, the choice of support type is determined based on the stability categories of ore and rocks. The classification of rocks by stability is given in Table 1.

Table 1. Classification of rocks by stability

Category	Degree of stability	Need for support depending on exposure area	Horizontal span, m
I	Very stable	No support required when exposed over areas of 1000 m² or more and stored for long periods	>22
II	Stable	Exposure up to 600 m² allowed; for long-term storage, support is only required in weakened zones	17

III	Moderately stable	Exposure up to 100 m² allowed; for long-term storage, support is required	7
IV	Unstable	Exposure up to 10 m² allowed; support is required for long-term storage	2
V	Very unstable	Unsupported exposure is not permitted	-

The exposure areas and spans given in Table 1 do not take into account many other factors affecting rock stability.

Additional characteristics of rock stability categories, depending on storage conditions and the degree of fracturing of the rock mass, are given in Tables 2 and 3. The choice of support type according to the stability category is presented in Table 4.

Table 2. Degree of fracturing of rocks

Degree of fracturing	Core recovery %	Structural weakening coefficient (Kso)	Indicators of fracturing and blockiness	
			Number of fractures per 1 m²	Spacing between fractures, m
Slightly fractured	80	0,4-0,5	0-8	0,35
Moderately fractured	45-80	0,2-0,4	8-15	0,15-0,35
Highly fractured	30-45	0,1-0,2	15-30	0,5-0,15
Crushed	30	0,1	>30	-0,5

Table 3. Stability of rocks by strength and duration

Degree of stability	Rock strength index	Duration of self-support	Conditions for working preservation
Very stable	16-20	Unlimited	No support required for long-term storage
Stable	10-16	Up to 6 months	For long-term storage, support required only in some places
Moderately stable	6-10	Up to 0.5 months	Unsupported exposure permitted, but after some time support required
Unstable	3-6	1–3 days	Support must be installed simultaneously with excavation
Very unstable	<3	-	Unsupported excavation is not permitted

Table 4. Recommended support types depending on stability category

Stability category	Type of support	Interaction with rocks	Recommended support
Very stable (I)	Unsupported	Support bears no load	-
Stable (II)	Unsupported (in rocks susceptible to weathering – isolated protection)	No load on support, occasional local disintegration possible	Thin shotcrete coating for long-term exposure in weathered rocks
Moderatey stable (III)	Reinforcing	Consolidates surrounding rock, prevents displacements of loosened rock	Shotcrete; various types of rock bolts; combined support (bolts + shotcrete or mesh)

Unstable (IV)	Supporting	Works under collapse and stratification regime	Steel arch support; monolithic concrete; combined (bolts, mesh, reinforced shotcrete); timber support
Very unstable (V)	Bearing ("support–rock" system)	Works jointly with the rock mass in a deformation regime	Special transitional methods: yielding supports combined with protective supports, or rock injection

For capital and preparatory mine workings and their intersections, the international Q-rating method based on the Barton system can also be applied [3, 4].

The Barton system is used in empirical design methods to evaluate the stability of rock masses and the support conditions of deep mine workings.

The Q-value is determined as follows:

$$Q = \frac{RQ\Delta}{J_n} \cdot \frac{J_r}{J_a} \cdot \frac{J_w}{SRF}, \qquad (2)$$

where:

RQD– Rock Quality Designation index;

J_n – joint set number;

j_r – joint roughness number;

j_a – joint alteration number (joint wall alteration and filling);

j_v – water reduction factor;

SRF – stress reduction factor.

The ratio RQD / j_n represents the block size of the rock mass. Its limiting values range from (100 / 0.5) to (10 / 20).

The ratio j_r / j_a characterizes the shear strength along joint surfaces. It depends on the roughness of joint walls, the properties of filling material, and its grain composition. The most favorable values occur when joint walls are rough and weathering along the contact is weak.

The ratio j_v / SRF is the active stress coefficient.

Here, j_v expresses the influence of groundwater pressure, which reduces shear strength of rocks by decreasing the normal stress component.

The stress reduction factor SRF is applied in cases where:

1. Shear zones exist in clay-bearing rocks;
2. Intact rocks are subject to high stresses;
3. Weak or yielding rocks are subjected to squeezing loads (see Figure 1).

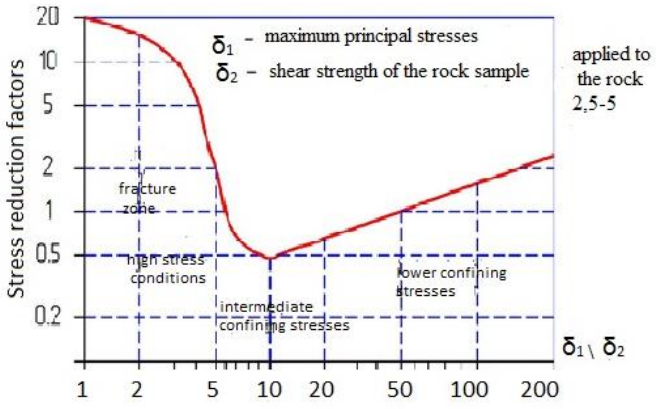


Figure 1. Stress reduction factor.

Table 5. Rock mass quality classification according to Q-system

Class	Rock quality	RQD
A	Very poor	0-25
B	Poor	25-50
C	Fair	50-75

D	Good	75-90
E	Excellent	90-100

Based on the research, a nomogram has been developed to determine support types according to the Q-system, shown in Figure 2.

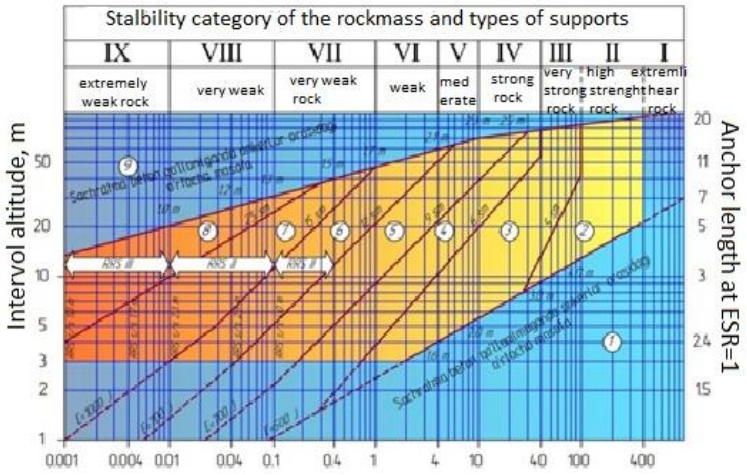


Figure 2. Diagram for selecting support types and parameters according to Q-rating (the hatched areas are not experimentally validated).

The interpretation of support types in the diagram is as follows:

1. No support or only occasional rock bolts.
2. Occasional rock bolts + shotcrete (SB).
3. Systematic bolting + fiber-reinforced shotcrete 5–6 cm (B + Sfr).
4. Systematic bolting + fiber-reinforced shotcrete 6–9 cm (B + Sfr, E500).
5. Systematic bolting + fiber-reinforced shotcrete 9–12 cm (B + Sfr, E700).
6. Systematic bolting + fiber-reinforced shotcrete 12–15 cm + Category 1 reinforcement frame (B + Sfr, E700 + RRS1).
7. Systematic bolting + fiber-reinforced shotcrete 12–15 cm + Category 2 reinforcement frame (B + Sfr, E1000 + RRS2).
8. Monolithic concrete or systematic bolting + fiber-reinforced shotcrete >25 cm + Category 3 reinforcement frame (SSA or B + Sfr, E1000 + RRS3) — special assessment required.

Additional parameters of the diagram are interpreted as follows:

E– Energy absorption class of shotcrete, determined by panel test results. The method is described by the Norwegian Concrete Association and summarized in Table 6.

Table 6. Energy absorption classes of shotcrete

Energy absorption class	Minimum absorbed energy, J	Required additives	
		Polypropylene fiber (kg)	Steel fibers, length ≤32 mm, diameter ≤0.5 mm (kg)
E500	500	5	15-18
E700	700	6-7	20-25
E1000	1000	8	30-35

The Excavation Support Ratio (ESR) describes the type of excavation, its intended service life, and cross-sectional shape (Table 7).

Table 7. Excavation Support Ratio (ESR) values

№	Excavation type	ESR		
1	Temporary workings, etc	3-5		
2	Vertical shafts, circular cross-section Rectangular/square cross-section (may be lower)	2,5 2,0		
3	Permanent mine workings, hydropower tunnels (except high-pressure shafts), pilot drifts for large chambers	1,6		

4	Small road and railway tunnels, sewer tunnels, etc	1,3		
5	Residential and storage facilities, water treatment plants, large road and railway tunnels, tunnel intersections	1		
6	Underground nuclear power stations, railway stations, sports and public facilities, factories, etc.	0,8		
7	Special-purpose tunnels, long-term (≈100 years) or maintenance-free tunnels	0,5		

When $Q \leq 0{,}1$, it is recommended to adopt ESR = 1.0 for excavation types 2, 3, and 4.

Reinforcement frames (RRS I, II, III) – and similar supports with equal load-bearing capacity (shotcrete + rock bolts with strips, shotcrete + bolted mesh arches, or shotcrete + fully bolted steel mesh) are special support types composed of steel profiles, anchors, and sprayed shotcrete combinations (Figure 3, Table 8).

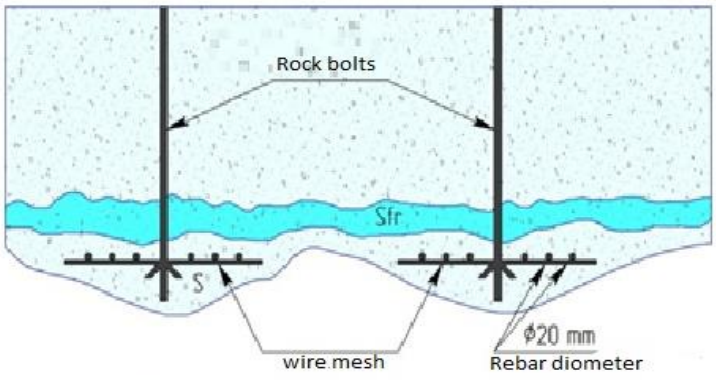


Figure 3. Installation scheme of support with RRS reinforcement frame.

Table 8. Adaptation of rock stability categories to Q-rating according to mining regulations (KTE)

Reinforcement frame category	Description by Q-rating	Equivalent load-bearing reinforcement
I	Si30/6 Ø16–Ø20 (spacing 10 m); D40/6 + 2Ø16–20 (spacing 20 m)	steel strips 2–5 mm thick, 300 mm wide
II	Si35/6 Ø16–20 (spacing 5 m); D45/6 + 2Ø16–20 (spacing 10 m); D55/6 + 4Ø20 (spacing 20 m);	lattice arches
III	D40/6 + 4Ø16–20 (spacing 5 m); D55/6 + 4Ø20 (spacing 10 m); D70/6 + 6Ø20 (spacing 20 m);	fully welded steel mesh 2000×1000 mm

Si – single layer reinforcement.

30/6 – reinforcement layer of 6 bars, shotcrete thickness 30 mm.

D – double layer reinforcement.

Ø16– reinforcement bar diameter.

s/s – spacing between reinforcement frame centers (see Figure 2, Q-rating diagram).

ConclusionClassification of rocks according to the Q-rating system includes 9 categories, which allows a more flexible selection of support types for mine workings compared to the 5 stability categories adopted in the Mining Technical Operation Regulations (KTE). This provides improved adaptability in choosing appropriate support systems depending on geological and geomechanical conditions.

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Rezyume:*.Maqolada katta chuqurliklarda joylashgan kapital va tayyorlov kon lahmlarini mustahkamlashning ilmiy asoslari yoritilgan. Tog‘ jinslarining mustahkamlik xususiyatlari, yoriqlilik darajasi, barqarorlik kategoriyalari hamda lahmaning joylashish chuqurligi asosida turli xil mustahkamlash usullarini tanlash mezonlari ishlab chiqilgan. Shuningdek, Barton tizimiga asoslangan Q-reyting usuli yordamida jinslar sifatini baholash va mos mustahkamlash turini tanlash imkoniyatlari ko‘rsatib o‘tilgan. Tadqiqotlar natijalari kon lahmlarini barqarorligini ta’minlash, xavfsizligini oshirish va ekspluatatsiya muddatini uzaytirishga xizmat qiladi.*

Резюме:*В статье освещены научные основы крепления капитальных и подготовительных горных выработок, залегающих на больших глубинах. Разработаны критерии выбора различных способов крепления на основе прочностных характеристик горных пород, степени их трещиноватости, категорий устойчивости, а также глубины залегания выработки. Кроме того, показаны возможности оценки качества пород с использованием метода Q-рейтинга, основанного на системе Бартона, и выбора соответствующего типа крепи. Результаты исследований способствуют обеспечению устойчивости горных выработок, повышению их безопасности и продлению срока эксплуатации.*

Kalit so‘zlar: *Kapital lahma, tayyorlov lahma, shaxta, kon lahmalari, tog‘ jinslari, jinslarning mustahkamligi, yoriqlilik, deformatsiya, geomekanika, barqarorlik kategoriyasi, mustahkamlash, mustahkamlash tizimi, anker, oldindan taranglangan anker (OTA), sachratma beton, armokarkas, metall panjara, arka tipidagi mustahkamlash, kombinatsiyalashgan mustahkamlash, podatli mustahkamlash, tog‘ bosimi, yon bosim, tektonik buzilish zonalari, tog‘-geologik sharoitlar, gorizontal kuchlanishlar, vertikal kuchlanishlar, opor bosimi zonasi, barqarorlikni ta’minlash, xavfsizlik, samaradorlik, xizmat muddati, “mustahkamlash–jins” tizimi.*

Ключевые слова**:** *Капитальная выработка, подготовительная выработка, шахта, горные выработки, горные породы, прочность пород, трещиноватость, деформация, геомеханика, категория устойчивости, крепление, система крепления, анкер, предварительно напряжённый анкер (ПНА), набрызг-бетон, арматурный каркас, металлическая сетка, арочное крепление, комбинированное крепление, податливое крепление, горное давление, боковое давление, зоны тектонических нарушений, горно-геологические условия, горизонтальные напряжения, вертикальные напряжения, зоны опорного давления, обеспечение устойчивости, безопасность, эффективность, срок службы, система «крепь–порода».*

COMPARATIVE ANALYSIS OF AIDARKUL BASALTS WITH BASALTS FROM OTHER REGIONS TO IDENTIFY REGIONAL GEOCHEMICAL CHARACTERISTICS

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Summary: *This article is dedicated to the development of cost-effective lining thermal insulation materials (LTIM) based on local resources – basalt, kaolin, and chamotte. The results of research on selecting the optimal proportions of components, ensuring high thermal insulation performance, mechanical strength, and thermal stability, are presented. The developed LTIM can be successfully used in various industries, including metallurgy, chemistry, and energy, to reduce heat losses and improve the energy efficiency of equipment.*

Key words: *Kaolin, Chamotte, Mineral Raw Materials, Refractory Additive, Crushing, Grinding, Screening, Drying, Firing, Olivine, Pyroxene, Plagioclase, Structural Change, Thermal Effects, Heat Treatment*

INTRODUCTION

Thermostable refractory products are currently in high demand among private entrepreneurs and are used for low-capacity metal-melting furnaces for light metals. Refractory products make up a significant share of the ceramic materials of various purposes produced in Uzbekistan. In this regard, to meet the needs of industry—particularly the metallurgical and chemical sectors—large-scale scientific research is being carried out on refractory thermal-insulation materials (RTIM).

The main requirement for RTIM in this case is their refractoriness. A distinctive feature of using refractory products in metallurgy is the presence of different types of linings with various characteristic properties determined by the raw materials used.

In this case, we are referring to the mixture of mineral compounds proposed by the author of the dissertation, consisting of *basalt–kaolin– chamotte *. As noted in the first and second chapters of this dissertation, the high thermal resistance and refractoriness of basalt and chamotte minerals, as well as the strong binding properties and refractoriness of kaolin, served as the basis for choosing this composition for the production of lining heat-insulating materials for low-capacity metal-melting furnaces.

The analysis of the production needs of private enterprises shows that their demand for metallurgical melting equipment is not high, especially when it comes to the melting and use of light metals such as Al, Zn, Cu, Pb , and Ag in low-power furnaces. This is due to the high cost of such furnaces and lining materials. Their production process requires low cost, simple methods of raw material processing, and the manufacture of finished products with minimal technological and operational expenses relative to the volume of molten metal, which is very important for private entrepreneurs. Therefore, it is considered necessary to investigate the property characteristics of the local minerals proposed in this dissertation and their combinations.

The dissertation research is aimed at developing a technology for producing refractory lining materials for low-capacity melting furnaces intended for smelting non-ferrous metals. In accordance with the stated objective, this research primarily used domestic raw minerals—basalts from the “Aydarkul ” deposit and kaolins from the “Karnab” deposit.

Our joint comprehensive analysis of the chemical composition of basalts, carried out together with the Central Research Laboratory of the State Enterprise NGMK, showed that the basalt rock from the Aydarkul deposit contains up to 63.7% of SiO_2.

The high SiO_2 content in the Aydarkul basalts increases the melting temperature of the rock and leads to higher technological costs. Therefore, for casting-based production methods, the basalts of this deposit are considered ineffective.

This conclusion is supported by the fact that raw material extraction has been discontinued and the use of Aydarkul basalts has been abandoned due to the high cost of melting operations.

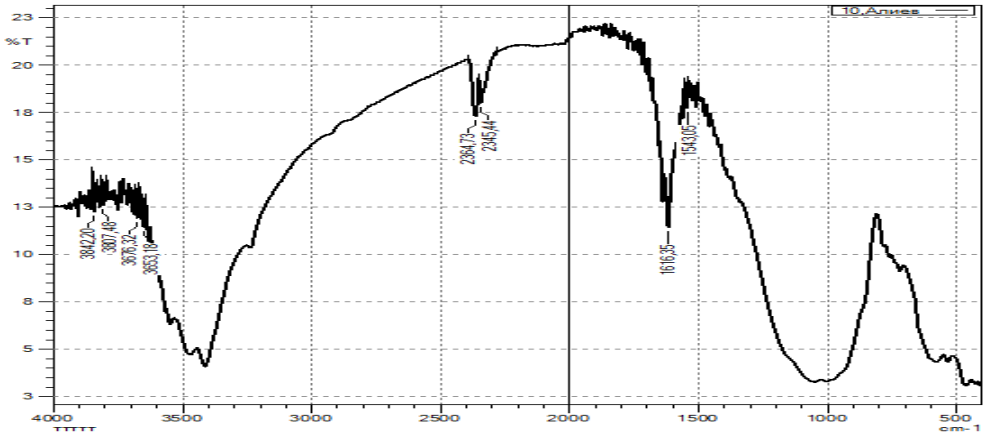
In the previous chapters of the dissertation, the idea was put forward of using a mixture of local mineral raw materials to develop a FTM technology for lining the inner faces of low-power metal smelting furnaces. This was necessary to determine the optimal ratio of minerals used for FTM production.

According to the existing standard technology, basalts are usually ground in laboratory grinding mills. The crushed raw materials are sifted on a vibrating sieve , the screenings are finished in the mills and partially in a ball mill to obtain a fine fraction. After dosing, the refractory additive components (kaolin and chamotte) are mixed in mixing mills and laboratory ball mills. The molded samples are dried in air and in a drying oven at 100-110 $^{\circ}$C. Mini-units were used in the studies: for crushing - DSh06, for grinding - MDSh and sieves with an opening size of 0.40-0.074 mm . The following raw materials were used in the experiment: basal-10, kaolin-10 and 10 (kg). Each mineral was processed separately. They were first crushed and then ground . Then they carried out screening with washing, drying and mixing, preparation of a wet thick mass, molding, drying and firing. Multiple experiments have proven that the basalts of the "Aydarkul " deposit contain more than forty chemical elements. It was revealed that the chemical composition of basalt rocks of the deposits has distinctive features compared to the data of basalts of other deposits in Uzbekistan. The final result of the chemical analysis was obtained after an experimental study of the spectral analysis of the basalt rock " Aydarkul " . The basalts of the " Aydarkul " deposit contain olivine in the range of 13.7 ÷ 18.7%, pyroxene in the range of 19.3 ÷ 23% and plagioclase - 34.6 ÷ 54%.

The main components of basalts are: SiO_2, TiO_2, Al_2O_3, Fe_2O_3, FeO, MgO, CaO, Na_2O. K_2OBasalt is a dense and extremely hard rock, with grain sizes of varying order. The study of the structural changes in basalts during thermal exposure was conducted by examining the thermal treatment of the rock, which is based on its inherent properties . tabl.

Sample No.	SiO_2	Al_2O_3	TiO_2	Fe_2O_3	FeO	CaO	MgO	K_2O	Na_2O	MnO	H_2O
1	63.7	1.90	from	0.20	1.44	5.42	1.21	0.20	0.19	0.02	0.05
2	9.68	2.54	from	0.60	0.36	41.56	0.63	0.30	0.24	0.04	0.07
3	82.78	2.22	from	0.20	0.84	2.98	0.09	0.16	0.13	0.01	0.02
4	37.32	11.42	0.23	1.19	7.10	12.07	8.73	0.16	2.21	0.08	0.08
5	3.81	2.22	from	0.74	-	31.76	15.65	0.15	0.18	0.11	0.05
6	32.21	11.74	0.53	0.80	5.60	13.20	4.84	0.13	3.30	0.06	0.02
7	25.00	9.20	0.30	1.00	5.20	16.10	4.86	0.19	2.64	0.07	0.01
8	69.99	2.85	from	1.00	0.17	2.34	0.32	0.13	0.18	0.005	0.02
9	41.64	12.37	0.50	1.00	6.10	12.33	4.72	0.13	2.80	0.07	0.01
10	38.19	10.15	0.66	1.00	7.10	13.47	7.26	0.10	1.67	0.09	0.04
11	36.00	6.35	0.40	1.20	8.60	13.82	10.83	0.22	1.35	0.13	0.06
12	39.38	9.52	0.44	1.00	8.90	12.59	9.36	0.14	1.43	0.12	0.05
13	29.81	11.42	0.51	1.20	7.90	11.20	6.52	0.16	1.58	0.10	0.07
14	41.88	11.10	0.48	1.59	6:30	11.80	7.07	0.15	2.41	0.08	0.13
15	29.89	15.23	0.53	1.00	4.20	12.07	1.96	0.14	3.25	0.04	0.03

To determine changes in inorganic matter in basalts , IR spectrometry was used , which allowed us to determine the state of the structural features of basalt rock and its constituent materials. Figure 1.1 shows an IR spectrometry image.



Picture.1. IR spectra of "Aydarkul " basalts

To study the structural changes in basalts, the effects of thermal processing of the rock were studied, which is based on their inherent properties. Identification of substances by IR spectra is carried out by comparing the full IR spectrum of the analyzed substance with spectra available in the electronic library, as well as with the spectra of standards. The high resolution of the Nicolet 6700 spectrometer allows one to observe absorption bands caused by changes in the dipole moment of the molecule during rotation or vibration of its constituent atoms, isotopic substitution in the molecule, its symmetry, and the number of electrons in the outer shells. The absorption band at 737.0 cm $^{-1}$ is attributed to deformation vibrations of the bond $Si-O-Si$, and 474.1 cm $^{-1}$ to vibrations of the silicon-oxygen tetrahedron. Analysis of the IR spectra of the basalt melting product allows one to conclude that aluminum oxide completes the polymer tetrahedral network of the silicon-oxygen polyanion. and is presented in the form $[AlO_4]^{5-}$. In the studied material, iron oxide, just like aluminum, tries to complete the silicon-oxygen framework due to the lack of silicon oxide; in this case, iron oxide is mostly in tetrahedral coordination $[Fe^{2+}O_{4/2}]$.

The mineralogical composition of the basalts from the Asmansay deposit contains: olivine within 11.7÷23.7%, pyroxene within 17.3÷21% and plagioclase 31.6÷50.1%. The following chemical elements were not found in the studied samples of basalt rock from the Aydarkul deposit: Zn , Cd , Ag , Bi , Ge , Ti , Sb , W , Sn , In , As and P. The silicon oxide content in the basalts reaches 63%, such chemical elements as Ib , Li , I and Yb and J were not detected , etc. Overall, the analysis showed that the processing of Aydarkul basalts by melting is a labor-intensive and energy-intensive process with high technological costs.

It has been established that the multi- oxidation composition of basaltic rocks is due to the bonding forces between oxygen and the chemical elements of metals, which form a rigid crystal lattice. Particularly prominent are the bonds between oxygen and elements such as Al , Fe , Mg , K , N , Ti , and Si . The spectral analysis results presented in the table represent 24 chemical elements found in the Aydarkul basalts . Of these, the rock-forming elements are magnesium and sodium, silicon, iron, aluminum, and calcium; other chemical elements make up minor amounts in the rock .

Thus, the bond between oxygen and metallic elements leads to the formation of corresponding oxides, which form the basis of silicate basalt as a whole. In such a solid structure, the silicon-oxygen bond plays an important role, since the main part of basalt consists of the oxide SiO_2. The thermal impact of nabasalts , where the transformation of basaltic rock occurs, was studied using the derivatograms shown in Figures 2 and 3. A LabsysEVO Setaram device was used in this study. The heating temperature ranges from 50 $^{\circ}$C to 1200°C , while the heating rate is 5 $^{\circ}$C/ min .

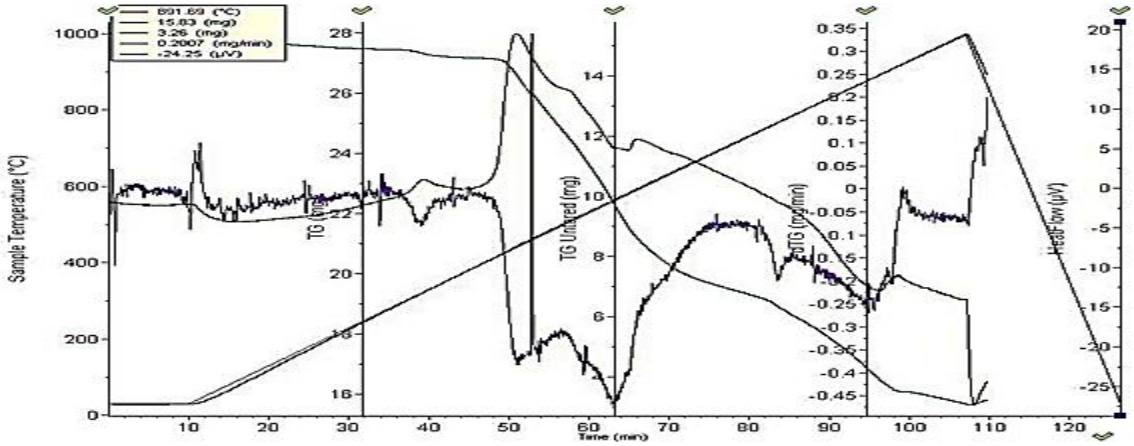


Fig. 2. Derivative diagram of the results of heat treatment of mineral raw materials Aydarkul

Table 1.

Experimental data of the derivatogram results

№	Temperature, ° C	Lost mass, mg	Lost mass, %	mg/min	Amount of energy consumed (µ V * s / mg)
1	50	0.09	0.167	0.009	0
2	100	0.52	0.89	0.083	6.91
3	200	1.19	2.02	0.214	3.89
4	300	1.36	2.31	0.223	3.99
5	400	1.73	2.93	0.262	4.13
6	500	1.97	3.35	0.282	4.97
7	600	2.21	3.75	0.284	6.70
8	700	3.04	5.15	0.309	4.32
9	800	6.13	10.34	1,317	5.32
10	820	7.76	13.17	1,359	5.36
11	850	10.5	17.86	1,408	3.35
12	900	10.9	18.59	1,917	4.36
13	1000	11.3	19.16	0.915	3.98
14	1050	11.4	19.35	0.915	5.36
15	1100	11.5	19.49	0.835	4.36
16	1200	15.3	22.3	0.635	3.35
17	1300	18.3	23.8	0.536	4.35

Based on the obtained derivatogram results , the samples were subjected to heat treatment at temperatures up to 100° C. A muffle furnace was used for the heat treatment . The endothermic effects of thermolysis, which occur at temperatures of 80–240° C, were studied. These effects indicate the decomposition of clay impurities and the removal of hygroscopic waters contained in the rocks.

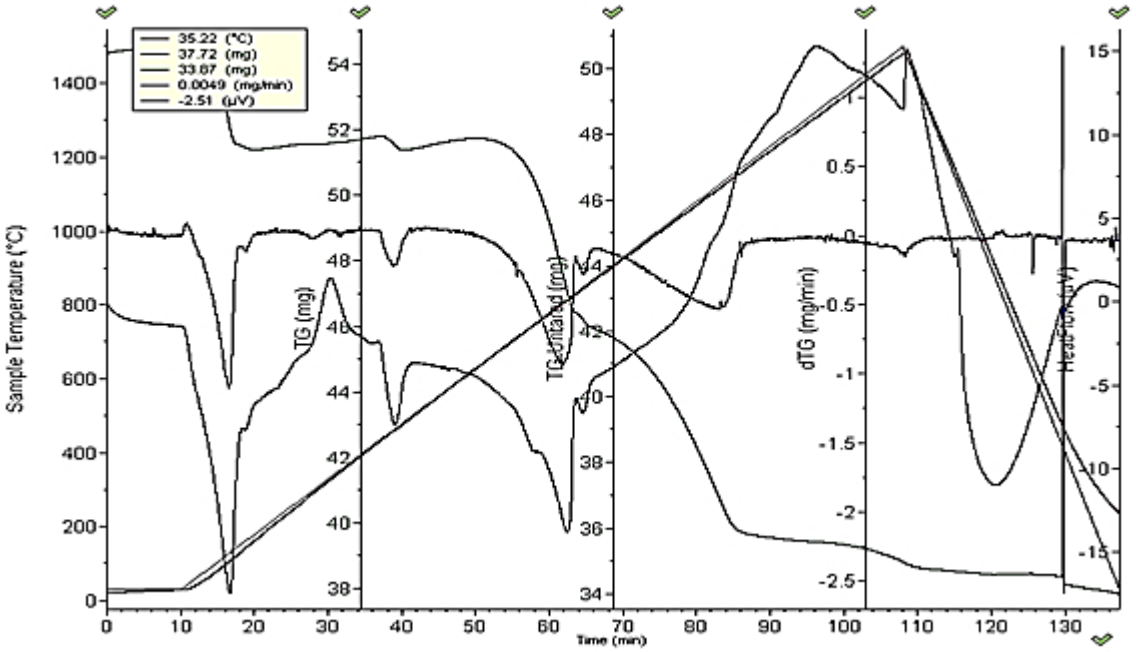


Fig. 3. Derivatogram of the results of heat treatment of basalt samples "Aydarkul "

Subsequently, at a temperature of 520 ° C, the effects weaken and the mass increases slightly, corresponding to the interconversion of the basalt components. The study of the thermal impact on basalts, where the transformation of basaltic rock occurs, is expressed through derivatograms.

In this study, a Labybsys IVO device was used, where the heating temperature reaches from 50 ^{0} C to 1200 ^{0} C. The heating rate is 5 ^{0} C/ min . Differential scanning calorimetry (DSC) (4), dynamic thermogravimetric curves (DTGA) (2) and TGP curves (3) of carbon-containing material .

The analysis of the DTGA curve shows that the curve consists mainly of two sigmoids , which occur in two stages. The first stage occurs in the temperature range from 150 ^{o} C to 700 ^{o} C, while the mass loss is 11.46%, the second stage occurs in the temperature range from 750° C to 1200° C , while the mass loss is 23.7%.

When heated to 600–900° C in an oxidizing environment, the iron monooxide contained in olivine oxidizes to iron oxide, and the olivine transforms into forsterite ($2MgOSIO_2$)and clinoenstatite ($MgOSiO_2$). At temperatures above 1200 ° C, iron oxide reacts with forsterite to form magnesium metasilicate. Magnesium metasilicate has four modifications, so their presence in refractories is impractical.

The study and analysis of the TGP curve shows that the decomposition rate of the carbon-containing material in the temperature range of 600-1080 ^{o} C is maximum and is 2.88 mg /min , and the amount of energy expended, accordingly , is 8.430 mv*s/mg. Differential scanning calorimetry (DSC) (4), dynamic thermogravimetric curves (DTGA) (2) and TGP curves (3) of the carbon-containing material .

With increasing temperature, the process of crystallization of amorphous products of the original raw materials occurs. In this case , as a result of the destruction of the crystalline structure of natural basalt, due to the heat treatment process, a second exothermic effect occurs in the temperature range of 820-840 ° C. This phenomenon can be explained by the discovery of three endothermic effects (at temperatures of 120-160 ° C, 335-375 ° C, 580-590 ° C, respectively) and two exothermic effects (at temperatures of 300-450 ° C and 700-720 ° C). It was established that the shape of the thermal curves is associated with the thermal insulation of the raw materials and with the characteristics of basalts from the Aidarkul deposits.

It should be noted that the temperature transitions of endothermic effects in the mixed material samples did not reduce the quality of the resulting FTMs. It was found that the difference in temperature transitions between FTMs also directly depends on the chemical properties of the materials and the mineralogical composition of the mixture made from Aydarkul basalts .

Based on the above theoretical studies, it can be concluded that Aydarkul basalts are quite suitable for the production of modern, next- generation refractory thermal insulation materials. The basalts studied are non-toxic, possess excellent physical and mechanical properties, increased resistance to acids and alkalis compared to mineral and glass fibers , low thermal conductivity, and a higher service temperature compared to other thermal insulation materials. These properties of Aydarkul basalts have determined the relevance of the further development and creation of highly effective thermal insulation materials and products for various industries.

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THE INFLUENCE OF POLYGONALITY OF 3D MODELS ON THE PERCEPTION OF VIDEO GAMES: FROM STYLISTICS TO GAMEPLAY

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Summary: *This article provides a comprehensive analysis of the influence of low-poly and high-poly 3D models on the perception of video games, focusing on the contextual dependence of their visual perception. The study shows that the perception of educational polygonality varies depending on the spatial position of the model, which is confirmed by analogy: a model with 1000 polygons can be interpreted as highly polygonal in the depth of the scene, while in the foreground it is perceived as low-polygonal. The article traces the evolution of 3D graphics, starting with the first wave of graphics systems in games such as Tomb Raider (1996), and ending with modern projects where low-poly models are used as an element of stylistic expression, contributing to the creation of a unique gaming atmosphere, as can be seen in the example of The Walking Zombie 2 (2021).*

In addition, the author focuses on the economic aspects of development, pointing out the need to use low-poly models in conditions of a limited budget; this phenomenon is illustrated by the example of Minecraft, characterized by a breakthrough gameplay and open digital architecture, despite its visual simplicity. In conclusion, it is emphasized that in modern motion games, the importance of polygonality gives way to innovative concepts and the quality of the game immersion process, which is proved by multiple examples of successful and unsuccessful game projects.

Keywords: *low-poly models, high-poly models, 3D graphics, game perception, game atmosphere, budget constraints, innovative gameplay.*

First of all, it is necessary to analyze the key differences between low-poly and high-poly models in the context of three-dimensional graphics. In Russian-language terminology, these concepts are referred to as low-poly and high-poly.

Low-poly models, as illustrated in Fig. 1, are three-dimensional objects with a limited number of polygons, which results in a simplified geometric structure (see Fig. 2).

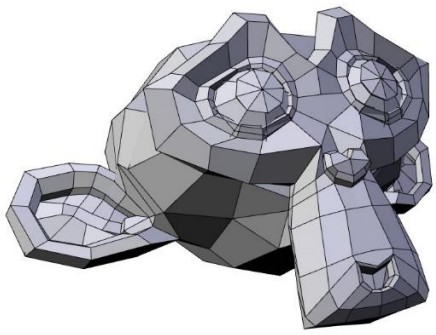


Fig. 1. Example of a low-poly monkey head — low-poly model

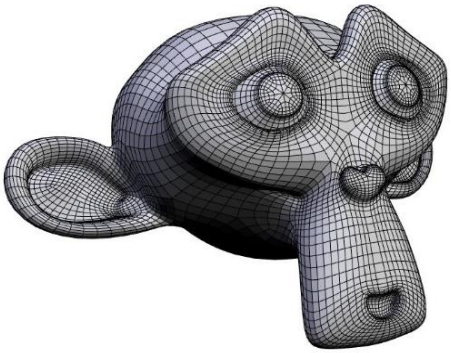


Fig. 2. Example of a high-poly monkey head — high-poly model

A polygon in this context is defined as a flat shape consisting of multiple vertices connected by edges that form the basic mesh structure of a model. This simplified form is often used in real-time environments, such as video games, where system performance and processing speed are critically important.

High-poly models, on the other hand, are characterized by a significantly greater number of polygons, enabling a high level of detail and realism. These models are widely used in static visualization, such as in film production and animation, where every detail is crucial and rendering resources are not a limiting factor. A high polygon count ensures more accurate representation of textures, lighting, and other visual effects, which in turn significantly enhances the viewer's immersion in the virtual environment.

However, there is no clearly defined set of parameters that determines when a low-poly 3D model transitions into a high-poly structure. These concepts are rather flexible and vary depending on the specific characteristics of a model and its functional role within a 3D scene ([1]) or within a video game.

As an illustration, a 3D model consisting of 1000 polygons could be classified as high-poly when positioned in the background of a "digital mise-en-scène." However, if the same model is moved to the foreground, it will be perceived as low-poly, since 1000 polygons would be insufficient to adequately convey all the visual details required of a primary object in the viewer's immediate focus.

Furthermore, this perception is significantly influenced by temporal context. During the early era of 3D video games and modeling ([2]), he game *Tomb Raider*, released in 1996, made a significant impact and was perceived as the pinnacle of human and computational capabilities. However, in the modern context, it appears less impressive and aesthetically appealing compared to games released in 2013 (Fig. 3), and even these later games cannot fully compete with the revolutionary achievements in the gaming industry that we observe today.



Fig. 3. Evolution of the character in the game Tomb Raider

[1] A 3D scene represents the integration of all three-dimensional objects and bodies present within the model..

[2] Моделирование представляет собой процесс создания модели как концептуального отображения определённого явления.

n the world of video games, the concept of low-poly graphics, based on the use of a small number of polygons, has undergone significant evolution and has become a distinct genre and style. This development was made possible by advances in computing technology, which enabled even basic personal computers and laptops to handle high-poly models and detailed 3D environments.

However, some developers are compelled to use low-poly models due to budget constraints. A prominent example of such a game is *Minecraft* (developed by Markus Persson and published by Mojang Studios), which quickly gained popularity among millions of players thanks to its unique mechanics and expansive game world ([3]), he game consists of simple cubic forms textured with 16×16 pixel raster images. In this context, a texture refers to a raster image applied to the surface of a polygonal model, giving it color, shading, or the illusion of relief.

In modern game design, the number of polygons is not always a determinant of success. Far more significant factors are the game's mechanics and narrative. In the case of *Minecraft*, the novelty of the concept was the key factor in its success, as there were no comparable games at the time. Attempts to replicate its success often failed because *Minecraft* had already secured a dominant position in the market. The presence of high-poly graphics is not a guarantee of a game's success. Many visually impressive projects, despite their high-quality graphics, are soon forgotten.

Low-poly games, such as *The Walking Zombie 2* (Fig. 4), released in 2021, use low-poly 3D models to create a unique atmosphere. In this case, the deliberate use of low-poly characters and environments serves to establish a specific mood, highlighting the importance of artistic choices in game design.



Fig. 4. The Walking Zombie 2

In summary, it can be stated that the success of video games does not depend solely on their polygon count. Low-poly games can achieve popularity through engaging narratives and original gameplay, while high-poly projects, despite their visual appeal, do not always guarantee long-term success. This emphasizes the importance of content and player experience, which can be more significant for gamers than graphics alone.

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[3] ***Minecraft*** — это игра-песочница с элементами выживания и жанра RPG. В ней игроки исследуют и осваивают процедурно сгенерированные миры, собранные из кубических блоков.

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Rezyume: *Ushbu maqolada video o‘yinlarning qabul qilinishiga past poligonli (low-poly) va yuqori poligonli (high-poly) 3D-modellar ta’sirini kompleks tahlil qilish amalga oshiriladi, ularning vizual qabul qilinishi kontekstga bog‘liqligiga e’tibor qaratiladi. Tadqiqot shuni ko‘rsatadiki, modellar poligon soniga nisbatan qabul qilinishi ularning sahnadagi makoniy joylashuviga qarab o‘zgaradi, bu quyidagi analogiya bilan tasdiqlanadi: 1000 poligonli model sahna chuqurligida yuqori poligonli sifatida talqin qilinishi mumkin bo‘lsa, old fonida u past poligonli sifatida qabul qilinadi. Maqolada 3D-grafikaning evolyutsiyasi kuzatiladi, o‘yinlardagi birinchi grafik tizimlar davridan, masalan, Tomb Raider (1996), boshlanib, zamonaviy loyihalargacha, bu yerda past poligonli modellar stilistik ifoda elementi sifatida ishlatiladi va o‘ziga xos o‘yin muhitini yaratishga xizmat qiladi, bu The Walking Zombie 2 (2021) misolida ko‘rinadi.*

Резюме: *В данной статье проводится комплексный анализ влияния низкополигональных (low-poly) и высокополигональных (high-poly) 3D-моделей на восприятие видеоигр, акцентируя внимание на контекстуальной зависимости их визуального восприятия. Исследование показывает, что восприятие учебной полигональности варьируется в зависимости от пространственной позиции модели, что подтверждается аналогией: модель с 1000 полигонами может быть интерпретирована как высокополигональная в глубине сцены, в то время как на переднем плане она воспринимается как низкополигональная. Статья прослеживает эволюцию 3D-графики, начиная с первой волны графических систем в играх, таких как Tomb Raider (1996), и заканчивая современными проектами, где низкополигональные модели используются как элемент стилистического выражения, способствующего созданию уникальной игровой атмосферы, что можно видеть на примере The Walking Zombie 2 (2021).*

Kalit so‘zlar: *past poligonli modellar, yuqori poligonli modellar, 3D-grafika, o‘yinni qabul qilish, o‘yin muhit, byudjet cheklovlari, innovatsion o‘yin jarayoni.*

Ключевые слова: *низкополигональные модели, высокополигональные модели, 3D-графика, восприятие игры, игровая атмосфера, бюджетные ограничения, инновационный игровой процесс.*

OPTIMAL DESIGN OF THE COMPOSITION OF A COMPOSITE BINDING AGENT OF A DRY CONSTRUCTION MIXTURE AND A MORTAR BASED ON IT BY THE METHOD OF MATHEMATICAL PLANNING OF EXPERIMENTS

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Summary: *The article presents the results of experimental studies on optimization of the composition of the composite binder of the dry building mixture (DBM) and the solution based on it for masonry and plastering works using the method of mathematical planning of experiments. It was established that the optimal values of the consumption of structure-forming additives: zeolite-containing rock of the Beltau deposit and the dosage of the chemical additive CWR in the composition of the composite binder DBM are 28% and 0.9% of the mass of the mixed binder, respectively.*

Key words: *dry building mix, solution, structure, cement, sand, zeolite-containing rock, optimization, regression equation, mathematical model, variable factors, output parameter, planning matrix, equation coefficients, properties, masonry mortar, plaster mortar, strength, compression, composition, ..*

1. Introduction

Improving technologies in construction, ensuring the durability and reliability of building structures of buildings and structures are placing increasingly high demands on the quality of materials used in their manufacture. In this regard, in modern construction practice, increasing attention is paid to the introduction of new effective materials for the construction and repair of buildings and structures, which can significantly reduce labor costs on the construction site and reduce material consumption while simultaneously improving the quality of the work performed. Such materials include dry building mixtures (DMB), which today are a product of high-tech technologies [1,2]. Depending on their purpose and the requirements for properties during their manufacture, factories easily change the composition and characteristics of building mixtures by introducing a complex of various additives. Cement, gypsum and other mineral binders are used as binders in building mixtures. At the same time, various types of cements are used more intensively as binders in dry construction mixtures. DM are considered to be more effective materials compared to traditional centrally prepared cement-sand mortars [3,4]. World and domestic experience in using dry mixtures has shown their high efficiency and advantages compared to traditional methods of work. DMB are fine-grained, thoroughly mixed compositions of dry components of a rational composition, which include binders, fractionated aggregates of a strictly defined quality, finely dispersed mineral components, chemical and polymer additives [5,6] . In the laboratory of building materials of the Tashkent State Transport University, the composition and technology for obtaining DMB have been developed for the production of masonry and plastering works based on local raw materials and materials. The composition of the DMB is multicomponent and includes the following materials and organomineral additives: Portland cement, mineral filler - zeolite-containing rock, quartz sand and plasticizing-air-entraining additive CWR (concentrated aqueous drainage). One of the most important tasks in the development of the composition and technology for obtaining DMB was the optimization of the composition of the composite binder DMB. To solve this problem, the authors conducted experimental studies using the method of mathematical planning of experiments.

2. Content

One of the main tasks of experimental research was to determine the numerical values of the parameters necessary to calculate the coefficients of mathematical models and confirm the adequacy of mathematical models. Traditional research methods are associated with

experimentation, which requires a lot of effort and money, since it is based on alternately varying individual independent variables under conditions where other variables are kept constant. The complexity of such an experiment is determined by the number of possible combinations of variable values (factors). Currently, experimental design methods are widely used in experimental research. Thanks to the optimal organization of experimental planning, it becomes possible, with minimal expenditure of material, time and human resources, to obtain all the information necessary to construct adequate mathematical models of the objects under study. The main objectives of experimental research are the experimental determination of the numerical values of the parameters necessary for calculating the coefficients of mathematical models, confirmation of the adequacy of mathematical models, confirmation of laboratory research. To predict the main properties of the DMB already at the stage of its design, appropriate regression dependencies of the main qualitative indicators of the DMB on its variable recipe and technological parameters are required [7,8].

When designing the composition and technology of DMB, you can use various mathematical methods, which can be divided into three groups: 1) probabilistic statistical methods, including the use of general probability theory, descriptive statistics, sampling method and testing of statistical hypotheses, variance and regression analysis, mathematical theory experiments, etc.; 2) methods of operations research, including linear, nonlinear and dynamic programming, game theory, queuing theory, graph and network theory, etc.; 3) methods of mathematical analysis, including differential, integral and vector calculus, differential equations, including equations of mathematical physics, used to compile and calculate mathematical models based on certain premises about the physical chemistry of the processes under study [9]. Thanks to the optimal organization of experimental planning, it becomes possible, with minimal expenditure of material, time and human resources, to obtain all the information necessary to construct adequate mathematical models of the objects under study. In this work, the technique of a full factorial experiment was used [9,10]. In this regard, the types and ranges of variation in the quantitative parameters of the modifiers used were determined. The goal of optimization is to determine the optimal value of cement binder consumption and optimal dosages of modifiers to obtain DMB with the highest strength properties.

2.1. Discussion.

Finding the optimal consumption of cement binder and the amount of zeolite-containing rock, as well as the optimal dosage value of the chemical additive CWR, is quite labor-intensive, due to the complex mechanism of action of the introduced structure-forming additives on the properties of the mortar. To optimize the values of these parameters, the method of mathematical planning of experiments was used in the work. The following composition indicators were taken as variable factors: consumption of Portland cement in the composite binder (X_1), amount of zeolite-containing rock (X_2), dosage of chemical additive (X_3), within the following variable limits: X_1 = 450-550 kg, X_2 =20-40%, X_3 =0.4-1.2. The ultimate compressive strength of a mortar based on DMB (Y_1 and Y_2) at the age of 3 and 28 days was chosen as an output parameter influenced by experimental factors.

In the experimental studies, the following were used: Portland cement CEM II/A-I 32.5 N produced by PC Akhangarantsement (GOST 30515-2020), mineral filler - river quartz sand from the Maysky quarry with a fineness modulus Mkr = 0.68 and an average density of ~2000 kg/m^3 (GOST 26633-2012), mineral filler - zeolite-containing rock of the Beltau deposit crushed to Ssp = 3000 cm^2 /g , chemical additive CWR - industrial waste from the production of caprolactam from toluene according to the method of the Italian company "SNIA-.P.D. » Almalyk chemical plant. Masonry mortars were prepared from the dry building mixtures obtained from the composite binder and sample beams of standard size 4×4×16 cm were formed in the amount of 6 pieces for each type of test. The samples were tested for compressive strength at 3 and 28 days of age after normal hardening in accordance with GOST 10180-2012.

The main characteristics of the experimental design are given in Table 1.

The experiment planning matrix and experimental results for the experiments are given in Table 2..

Table 1 Main characteristics of the experimental design

Experiment factor	Designation factor a	Lower level	Zero level	Top level	Step of variation
PC consumption, kg	X_1	400	450	500	50
Number of CBPBs, %	X_2	20	30	40	10
SVK dosage, %	X_3	0.6	0.8	1.0	0.2

Table 2 Experiment planning matrix in natural values

Experience no.	Experiment planning matrix			Ultimate compressive strength at age, MPa	
	PC consumption, kg	Number of CPBs, %	CWR dosage, %	3 days	28 days
1	400	20	0.4	12	21
2	500	20	0.4	16	24
3	400	40	0.4	11	18
4	500	40	0.4	15	22
5	400	20	1.2	10	20
6	500	20	1.2	14	23
7	400	40	1.2	10	17
8	500	40	1.2	13	21
9	350	30	0.8	14	19
10	550	30	0.8	17	25
11	450	15	0.8	13	19
12	450	45	0.8	12	16
13	450	30	0.3	16	19
14	450	30	1.3	14	17
15	450	30	0.8	15	20

The establishment of regression equations and the construction of graphical dependencies were carried out using the Maple18 application package. Taking into account the assessment of the significance of the coefficients of the regression equations, mathematical models of the output parameters of the following form were obtained:

$$Y_1 = 17.76 + 1.43\,X_1 - 0.22\,X_2 - 0.98\,X_3 - 0.29\,X_1^2 - 1.82\,X_2^2 - 3.03\,X_3^2 - 0.3\,X_1X_3 - 0.15\,X_2X_3;$$

$$Y_2 = 25.71 + 1.77X_1 - 0.81X_2 - 1.02X_3 + 2.07\,X_1^2 - 0.47\,X_2^2 + 0.16\,X_3^2 - 0.32\,X_1X_2 - 0.21\,X_1X_3 + 0.35\,X_2X_3.$$

The graphical dependences of the output parameters on the values of variable factors, constructed on the basis of the above mathematical models, are shown in Fig. 1.

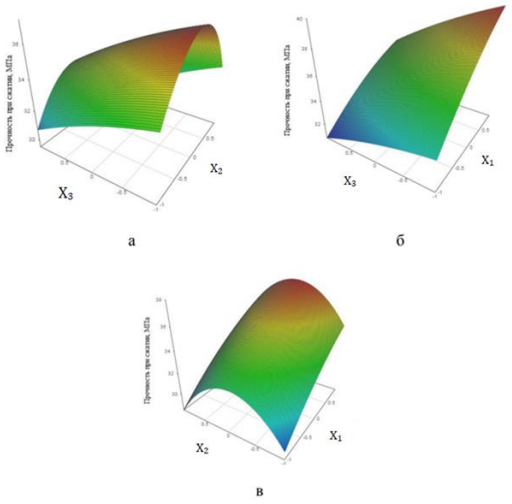


Fig. 1 Graphic dependences of the compressive strength of a building mortar based on DBM at the age of 28 days of normal hardening on variable factors

In addition, the periods of formation of the structure of the designed solution were analyzed (Fig. 2), and using the method of mathematical planning of experiments, adequate polynomial mathematical models of the second order were obtained, reflecting the change in the cubic strength of mortar samples after heat and moisture treatment relative to variable factors: preliminary holding time (X_1), rate of temperature increase in the chamber (X_2), temperature and time of isothermal heating (X_3, X_4): - after 12 hours after HMT:

- for a solution based on limestone sand: $R_{TBO}^{12} = 27 + 1.014X_1 - 1.362X_2 + 0.42X_3 - 1.054X_4 - 1.9X_1^2 - 1.27X_3^2 - 2.1X_4^2 - 1.23X_1X_3 - 1.45X_3X_4$.

- for a solution based on sand from crushed concrete scrap and with the addition of SP: $R_{TBO}^{12} = 26.2 + 0.8X_1 - 0.29X_2 + 0.64X_3 - 1.2X_3^2 - 1.9X_4^2 + 0.9X_1X_4 - 0.9X_3X_4 + 1.4X_1X_2$

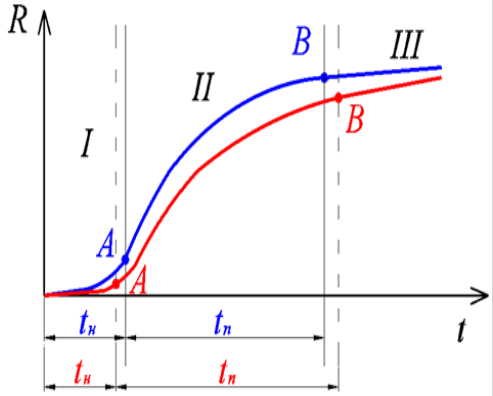


Fig.2. Main periods of solution structure formation

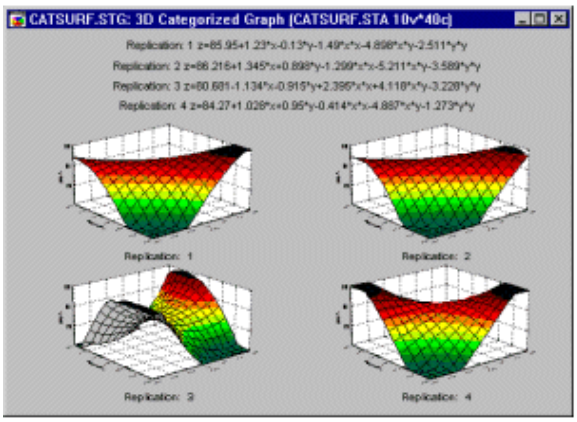


Fig.3. Response surfaces of mathematical models (at $X_{1,2,3,4}$ = const)

I-period of initial structure formation; II-period of structure strengthening; III-period of structure stabilization**.**

The obtained multifactorial mathematical models were analyzed by the graphical analytical method. In this case, using the computer program "Concrete.Technology", spatial images of the response surfaces of the output parameter - the strength of mortar samples after heat and moisture treatment from variable factors were obtained (Fig. 3).

3. Conclusion

Technological analysis of the obtained mathematical models was carried out using the graphic-analytical method [10]. The analysis found that the most significant variable factor influencing the compressive strength of mortar at the age of 28 days is the factor X_1 - consumption

of Portland cement, since the absolute values of the coefficients for the variables X_1 and X_1^2 turned out to be the largest. The values of the coefficients in front of the indicated variables indicate that the strength of the mortar increases beyond the specified range of variation of the variable X_1, which is quite natural.

The second most important variable factor in the mathematical model of the compressive strength of mortar is the factor X_2 - the consumption of cement-bonded particleboard. The values of the coefficients of the mathematical model at variables X_2 and X_2^2 shows that this factor is in the optimal zone. The optimal value of the consumption of CPB, determined by the method of functional analysis of the regression equation, in the specified range of variation in the physical dimension is 28% of the mass of the mixed binder. The least significant variable factor affecting the compressive strength of a mortar is factor X_3 - the dosage of the CWR additive. The values of the coefficients of the mathematical model at variables X_3 and X_3^2 shows that this factor is also in the optimal zone. The optimal dosage value of the CWR additive in the specified range of variation in the physical dimension is 0.9% by weight of the mixed binder. Thus, As a result of experimental studies, it was established that when varying the amount of binder from 400 to 500 kg, the compressive strength of the mortar increases by 25–30% at the age of 3 days, and by 15–20% at the age of 28 days. The optimal values for the consumption of CPB and the dosage of the CWR additive in the composition of the composite binder DBM are 28% and 0.9% of the mass of the mixed binder, respectively.

By means of functional analysis of mathematical models for extremum, the optimal parameters of the heat and moisture treatment mode of the solution based on limestone sand and secondary sand from crushed concrete scrap were determined. Taking into account these parameters, the following optimal mode of heat and moisture treatment of the solution using the used fine aggregates was established: 1+2+4+2 hours, at an isothermal heating temperature of 80 ^{0}C and a temperature rise rate of 25 ^{0}C.

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SOCIAL SCIENCES

THE IMPACT OF INNOVATION AND TECHNOLOGY IN THE DIGITAL ECONOMY

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Summary: *This article analyzes the economic efficiency of using innovations. Innovation is an important factor in economic growth, increasing enterprise competitiveness by optimizing production processes, reducing costs, and improving product quality. The article discusses in detail the financial benefits, risks, and efficiency criteria of introducing innovative technologies.*

Key words: *Technological development, investment, competitiveness, production process.*

Introduction. Currently, innovation is becoming one of the most characteristic features of economic development. Not so long ago, this name reminded me of something exotic, unknown, and not very clear even among professionals, but now both innovation itself and its concepts are rapidly conquering the world. The international capital market, which plays a serious role in the innovation process and turns innovation into a strategic resource for enterprises, is expanding, and new financial structures are helping it in this regard.

The experience of developed countries shows that innovation is often hindered by people's direct negative attitude and position. However, a paradoxical situation is developing in Uzbekistan, where the entire society expresses a positive attitude and support for innovation processes.

In today's global competitive environment, the development of the tourism sector is one of the most important factors in the country's economic and social development. The rapid development of digital technologies is emerging as one of the main tools in the tourism industry to improve the quality of service, respond quickly to the needs of tourists, and ensure international competitiveness. This article analyzes the possibilities of expanding the use of digital technologies in the tourism sector of Uzbekistan, using the world experience.

Recently, the role of modern ICT technologies and innovations in the development of the national economies of developed countries has been increasing. Modern technologies allow for increasing the efficiency of production and labor processes in economic sectors. The term "digital economy" has entered the scientific field in recent years. The digital economy is an economy based on the application of information and communication technologies in the economic sphere. The digital economy also refers to economic activity based on digital technologies, including the Internet, mobile devices, and various software applications. It covers a wide range of sectors using digital innovations to improve productivity, efficiency, and connectivity.[1]

The goal of the research is to promote the innovative development of the economy and increase the potential and efficiency of the system through the creation of new entrepreneurs. The objectives of the research are to study the stages of increasing competitiveness and productivity in industry and to substantiate its specific features; to identify factors affecting the promotion of an increase in the share of high-tech products, increasing production, and increasing their share in the structure of production and exports, and expanding the use of innovative technologies and advanced management.

If we compare the innovation processes in our country with the situation in developed countries, the developed countries of the world have been under the influence of the innovation economy and the fifth technological cycle (long wave) for more than 15 years. What should countries that have just entered the fifth wave do, even after that?

Will they catch up with these countries by starting their scientific research in new high-tech areas first? It is clear that this is very problematic. However, this does not prevent these countries, in particular our country, from using technologies created by other countries and using them to develop

their economies, trying to overtake developed countries by creating as many conditions as possible for foreign investment to enter the country. Some time ago, this experience was carried out in Japan, South Korea, and other countries. Indeed, the opportunities provided by innovations and the positive aspects of globalization were captured, first of all, by the countries of Southeast Asia (often called "tigers"), such as South Korea, Taiwan, Hong Kong, Singapore, as well as the Celtic "tiger" - Ireland, which is one of the leaders in the field of innovations. These countries can serve as a paradigm for Uzbekistan, because our country, with its small market and poor traditional resources, can only develop successfully if it chooses an innovative path, using its unique non-traditional resources.[2]

The competitiveness of a country develops on the basis of the competitiveness of individual enterprises. Each enterprise uses its own strategy to achieve the advantages provided by competitiveness. However, the nature of the evolution and development of successful companies is similar, since companies create competitive advantages based on innovation. The reason for the weakness of innovation processes in the enterprises of our country is the influence of the following factors:

- low number of scientists working in industry, as well as low share of scientists and researchers in the workforce;
- lack of access to high-tech patenting;
- weak cooperation between the manufacturing sector and universities;
- relative failure of innovation promotion and entrepreneurship support mechanisms;
- complicated procedures for starting a business; insufficient quality of technological education.

The digital economy has become an integral part of global economic processes and an engine for the growth and development of companies. With the acceleration of the development of Industry 4.0, the world has entered the era of the digital economy led by a new generation of information and communication technologies.

The digital economy has eliminated barriers to the implementation of communications between market participants, ensuring the development of the domestic and international economy in the post-epidemic period. In the period of rapid development of the digital economy, its significance is manifested in its deep integration with economic and social sectors, promoting digital transformation, and the continuous introduction of new technologies, new models, and new industrial processes. This leads to the transformation and modernization of society, industry, and enterprises, contributing to sustainable economic development based on innovative models. In addition, as a result of economic and industrial restructuring, these innovations are triggering a new stage of technological revolution.[3]

In the process of collecting, storing, analyzing, and sharing information, digital technologies such as the Internet, cloud computing, big data, and blockchain are widely used, and social interaction methods are gradually changing. It should be noted that digital technologies are general-purpose technologies used in various economic activities. The basis of the digital economy is continuous innovation and great achievements in the field of information and communication technologies. The importance of the digital economy for the development of the economic system is determined in terms of increasing productivity and developing production relations, because the active development of the digital economy contributes to increasing efficiency and transforming the industry.

A new trend in the use of innovations has formed in the industry of Uzbekistan. Until now, industries related to the processing of natural resources using cheap labor have dominated. However, today Uzbekistan aims for a fundamentally new approach to the use of natural resources. A vivid example of this is the launch of the new UzGTL plant, which will produce high-value-added products based on the deep processing of natural gas. Thanks to such large-scale projects, Uzbekistan is gradually abandoning the export of natural gas raw materials and reducing the import of oil products. This indicates that a significant contribution is being made to strengthening our energy independence. This UzGTL complex, which is considered one of the largest investment projects not only in Uzbekistan, but also in the CIS countries, is also an example of innovative production. Also, one of the most modern and innovative in the CIS is the central control panel of the enterprise and the central

laboratory of the plant. The new enterprise will process 3.6 billion cubic meters of natural gas per year using GTL, that is, "gas-to-liquids" technology, and has the capacity to produce 1.5 million tons of finished products - jet fuel, diesel fuel, naphtha, and liquefied gas. So far, such a plant has been built in only 4 countries in the world - Qatar, Nigeria, South Africa, and Malaysia. Here, import-substituting petroleum products and hydrocarbon raw materials worth a total of more than 1 billion US dollars or 12.8 trillion soums are produced annually. The production of value-added products from natural gas based on GTL technology is carried out in three stages. Modern fuels prepared using this technology are environmentally friendly and clean. This, in turn, also corresponds to the principle of not harming nature, which has become an urgent issue today. Take GTL diesel fuel, for example. GTL diesel, which has high technical characteristics and contains almost no sulfur, does not emit significant emissions into the atmosphere. Similarly, GTL kerosene offers airlines a safe and profitable way to reduce their emissions.[4]

One of the main factors in the formation of the digital economy is described as innovation, an innovative idea and its product, innovative products. The reason for this is that initially, the emergence and development of innovative ideas and, as a result, the creation of new products (innovative products), have somewhat facilitated people's lives and created conveniences. When it comes to innovative products, the main focus is on artificial intelligence, supercomputers, smartphones, 3D printers, online shopping, internet communication, mobile communication, and IT parks. It is their invention and widespread use that has been called digital innovative technologies. This has created new markets (international online shopping, e-commerce, e-business). On this basis, the infrastructure of the digital economy has taken shape on its own. In particular, the initial emergence of computers, the establishment of mobile and internet connections, and, as a result, the emergence and development of e-commerce, international e-business, determine the level of influence of innovations in the digital economy. In the digital economy, innovation acts as a driving force that can transform new ideas into effective economic solutions. As we know, a lot of work is being done in our country to introduce and develop innovations and transition to a digital economy. However, there are still a number of problems in our country in this regard:

- ✓ the population's lack of a complete picture of innovation and the digital economy;
- ✓ the country's territory is not fully provided with ICT and Internet communication;
- ✓ the lack of specialists in innovation and the digital economy in the regions;
- ✓ the lack of research centers conducting research on innovations and digital technologies;
- ✓ the low number of users of existing payment systems (Click, Payme, m-bank, Humo, etc.) that allow for mobile communications, the Internet, public services, tax, and other types of online payments;
- ✓ the lack of online trading and trading platforms;
- ✓ the presence of problems with the introduction of digital technologies in all sectors and areas (computer literacy, lack of material base, lack of infrastructure);

Addressing the above problems will pave the way for the transition to a digital economy and the formation of its infrastructure.

In our opinion, in order to achieve positive results in the development of the digital economy, it is advisable to carry out the following work in our country:

- ✓ create a legal and regulatory framework for the formation of the infrastructure of the digital economy;
- ✓ hold conferences in places (in educational institutions, state organizations, and private organizations) in order to form an understanding of innovation and digital technologies among the population;
- ✓ Use the experience of advanced foreign countries in the formation of the digital economy;
- ✓ implement digital technologies in all sectors and industries and monitor their activities;
- ✓ expand the types of online sales and their scale (convenient not only for users in Uzbekistan, but also for users around the world, such as Alibaba, eBay, Amazon).

Conclusion. Digital technologies are an important factor in the development of a country's economy. They help not only to increase efficiency, but also to create new opportunities. Digital

technologies have a significant impact on a country's economy, and it is necessary to take into account their positive and negative aspects. They optimize production, improve services, and develop innovations, but they also create new problems, such as cybersecurity, the digital divide, and the transformation of the workforce. Therefore, countries need to develop strategies aimed at properly managing digital technologies and reducing their negative impacts.

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Rezyume: *Ushbu maqolada innovatsiyalardan foydalanishning iqtisodiy samaradorligi tahlil qilinadi. Innovatsiyalar iqtisodiy o‘sishning muhim omili bo‘lib, ishlab chiqarish jarayonlarini optimallashtirish, xarajatlarni kamaytirish va mahsulot sifatini yaxshilash orqali korxonalarning raqobatbardoshligini oshiradi. Maqolada innovatsion texnologiyalarni joriy etishning iqtisodiy foydalari, xavflari va samaradorlik mezonlari batafsil muhokama qilinadi.*

Резюме: *В статье анализируется экономическая эффективность использования инноваций. Инновации являются важным фактором экономического роста, повышающим конкурентоспособность предприятий за счёт оптимизации производственных процессов, снижения затрат и повышения качества продукции. В статье подробно рассматриваются экономические выгоды, риски и критерии эффективности внедрения инновационных технологий.*

Kalit so‘zlar: *Texnologik rivojlanish, investitsiya, raqobatbardoshlik, ishlab chiqarish jarayoni.*

Ключевые слова: *Технологическое развитие, инвестиции, конкурентоспособность, производственный процесс.*

IMPROVING THE METHODOLOGY FOR DEVELOPING THE SPEED STRENGTH QUALITIES OF GYMNASTICS IN THE CONDITIONS OF GYMNASTICS OF THE REPUBLIC OF KARAKALPAKSTAN

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Summary: *The article examines the features of the methodology for developing the speed-strength qualities of gymnasts in sports gymnastics, taking into account the training conditions in the Republic of Karakalpakstan.*

Key words: *sports gymnastics, speed-strength qualities, Karakalpakstan, training methodology, palometry, acrobatic jumps, physical training, training process, individualization.*

Relevance. The development of physical culture and sports training in the Republic of Uzbekistan in recent years has been implemented through a number of state measures aimed at mass involvement of children in sports and strengthening the material and technical base for training high-level athletes; one of the key documents in this area is the Decree of the President of the Republic of Uzbekistan "On Measures for the Further Development of Gymnastic Sports" (23.12.2022), which provides for the gradual increase in gymnastics classes in general education institutions, the creation of regional centers, and the strengthening of the material and technical base of gymnastic sports. In June 2024, decrees were also adopted to improve the organization of specialized sports schools and transfer some institutions to the system of specialized educational agencies, creating institutional prerequisites for the introduction of modern methods of training and selection of young gymnasts.

In recent years, there has been a noticeable increase in interest in gymnastics in the territory of Karakalpakstan: open championships and competitions are regularly organized in the city of Nukus and various districts, attracting a large number of participants. Thus, in one of the last open tournaments in artistic gymnastics in Nukus, about 200-250 athletes from different regions of the republic participated, which confirms the high potential of the region in terms of identifying and developing sports talents. At the same time, the state of sports infrastructure and personnel support remains insufficient, which requires targeted methodological and organizational improvement. Acquire scientifically based, economically accessible, and adapted to regional characteristics methods for training gymnasts, especially those aimed at developing speed-strength qualities necessary for the successful performance of acrobatic and support jumps, as well as increasing the competitiveness of Karakalpakstan athletes in republican and international competitions.

Speed-strength qualities represent one of the most important components of a gymnast's physical fitness in sports gymnastics. It is they that ensure the successful performance of most of the acrobatic and supporting jumps, rotational elements, ligaments, and combinations that form the basis of gymnastic exercises on all apparatus. The development of these qualities is due to both the physiological characteristics of the gymnasts' body and the requirements of competitive activity. To achieve high sports results, it is necessary to comprehensively and scientifically apply methods for developing speed-strength training, taking into account the age, gender, training level, and stage of long-term training of female athletes. Speed-strength qualities in sports gymnastics are manifested in the gymnast's ability to develop maximum effort in minimal time. They determine the power of the push-off when performing acrobatic jumps, the flight height, the speed of grouping and exiting it, and the amplitude of rotational movements. From a physiological point of view, these qualities are formed due to the activation of fast muscle fibers, high speed of nerve impulse conduction, and effective intramuscular coordination. It is important to note that the formation of speed-strength qualities in girls has certain age-related characteristics related to hormonal changes, the development of muscle mass and musculoskeletal system. The most favorable period for their intensive development falls on adolescence, however, the process must begin much earlier, from younger age groups, to prepare the basis for the subsequent stages of sports improvement.

Object of research: the process of physical training of gymnasts in sports gymnastics in the conditions of the Republic of Karakalpakstan.

Subject of research: methodology for developing the speed-strength qualities of gymnasts in sports gymnastics.

Purpose of the research: develop and substantiate an effective methodology for developing the speed-strength qualities of gymnasts, adapted to the conditions of training in the Republic of Karakalpakstan, contributing to increasing the level of their physical and technical preparedness.

Research objectives:

1. Study the scientific and methodological literature on the problem of developing speed-strength qualities in gymnasts.
2. Determine the age and physiological characteristics of the athletes of Karakalpakstan.
3. Identify the most effective means and methods of training influence.
4. Develop a set of exercises and methodological recommendations for improving the speed-strength qualities of gymnasts in the region.

Research methods: theoretical analysis and generalization of scientific and methodological literature; pedagogical observation and questioning of coaches; testing of gymnasts of different age groups; pedagogical experiment (control and experimental groups); methods of mathematical and statistical processing of results.

The methodology for developing the speed-strength qualities of gymnasts should be built on the principles of system, gradualness, individualization, and variability. System implies the regularity of the training process and the consistent complexity of exercises. Gradualness is expressed in the gradual increase of the load, starting from simple forms of exercises and transitioning to more complex ones. Individualization means taking into account the personal characteristics of the gymnast, her physical development, level of technical preparedness, and psychophysiological state. Variability refers to the use of various means and methods for developing speed-strength qualities to avoid monotony and stimulate different muscle groups.

In the practical work of coaches, both general and special preparatory exercises are used. General preparatory exercises include armband jumping, multiple jumps, sprint accelerations, high-speed push-ups and pull-ups, and exercises with medicine balls and small dumbbells. These exercises create a common basis for physical training and form the explosive nature of muscle efforts. Special preparatory exercises are aimed at modeling movement's characteristic of gymnastic elements: jumping on the trampoline with a quick transition to and from the group, imitation of push-ups from the gymnastic bridge and bar, repeated push-ups from the floor with an emphasis on speed and strength, work on the acrobatic track with complicated ligaments.

The use of pluometric exercises, which allow for the development of explosive strength and muscle contraction speed, is of great importance in the methodology. These include jumping from a standstill and running, jumping from a depth, jumping over obstacles, and trampoline exercises with variations in height and amplitude. Pliometry stimulates the neuromuscular system, increases the ability of muscles to quickly transition from an eccentric to a concentric work regime, which is especially important when performing acrobatic elements.

Particular attention should be paid to the development of the muscles of the cortex and lower extremities, as they are the main source of strength when performing jumps and rotational movements. Exercises on the press, back, buttocks, and thigh muscles contribute to improving body stability, which allows for more effective implementation of speed-strength potential. In addition, an important factor is the development of flexibility, which facilitates the performance of technically complex elements and reduces the risk of injury under high loads.

Methods for developing speed-strength qualities include the maximum efforts method, repeated efforts method, interval method, and competition method. The maximum effort method is used when performing short, high-intensity exercises aimed at achieving maximum power. The method of repeated efforts involves repeatedly performing exercises with moderate intensity to consolidate motor skills. The interval method involves performing exercises in a variable intensity mode, which contributes to the development of the ability to quickly mobilize strength capabilities.

The competitive method allows for the formation of psychological stability and the ability to demonstrate speed-strength qualities in conditions close to real competitions.

Speed-strength qualities in sports gymnastics are formed on the basis of the combination of physical, technical, and psychophysiological factors. Practice shows that their development is impossible without a clear correlation with the technical training of gymnasts. Exercises should not only develop strength and speed, but also be as close in structure as possible to the elements performed in competitions.

Thus, an important principle of the methodology is the unity of general and special training. For example, medicine ball exercises should not only be performed to strengthen the muscles of the hands and body, but also have a focus on improving the quality of the push-off or acceleration in acrobatics.

The load dosage plays a significant role. For younger age groups of gymnasts, it is not permissible to use excessive weights, as this can negatively affect the growth and development of the body. In the initial stage of preparation, it is advisable to use one's own body weight and light weights. At the stage of sports improvement, it is permissible to include exercises with additional loads, but in a strictly limited volume. For example, using dumbbells weighing up to 1-2 kg for explosive arm and shoulder exercises. At the same time, preference is always given to exercises with a dynamic nature of execution. The methodology for developing the speed-strength qualities of gymnasts also involves using circuit training. Within this method, gymnasts perform a series of exercises consecutively with minimal rest pauses. Such a regime contributes not only to the development of strength and speed, but also to the development of general endurance necessary for performing long combinations. Circular training includes jumping over the armband, jumping, push-ups, pull-ups, medicine ball throws, and short accelerations.

An important aspect is monitoring the technique of exercises. The explosive nature of movements should not lead to a decrease in their quality. The coach must ensure that each exercise is performed correctly, taking into account biomechanical features. Errors reinforced during physical training can be transferred to the technique of performing gymnastic elements, which subsequently becomes an obstacle to sports progress.

The psychological factor should also be noted. The development of speed-strength qualities is related to the gymnast's ability to mobilize efforts in a short time, overcoming fear of performing complex jumps or acrobatic elements. For this purpose, game methods and competitive forms of training are introduced into the training process, which create additional motivation and form in athlete’s confidence in their own abilities.

Modern research confirms the effectiveness of a comprehensive approach when speed-strength training is combined with technical, acrobatic, and choreographic training. In gymnasts' training, the principle of alternating loads of varying nature is used: after heavy exercises, flexibility and stretching exercises are performed, after exercises for explosive strength - coordination and balance exercises. Such a combination allows avoiding overwork and ensuring the harmonious development of physical qualities.

At the pre-competition training stage, the emphasis in developing speed-strength qualities is placed on specific exercises that are as close as possible to the competitive elements. Bundles of acrobatic jumps on the track, repeated push-ups from the bridge, trampoline exercises with complicated tasks, combined exercises on the bar are performed. It is important that each training session has a clearly expressed direction and contributes to the improvement of the elements that the gymnast will perform in competitions.

Conclusion. The development of the speed-strength qualities of gymnasts in sports gymnastics is the most important component of their training, as it is these qualities that determine the success of performing acrobatic and supporting jumps, rotational elements, and complex combinations.

In the context of the Republic of Karakalpakstan, where the development of sports infrastructure and personnel potential requires further improvement, the introduction of scientifically based and adapted training methods is of particular importance. The developed methodology, based

on the principles of system, gradualness, individualization, and variability, contributes to improving the level of physical and technical preparedness of gymnasts, reducing the risk of injuries, and forming competitive athletes. The introduction of this methodology into the practice of sports schools and sections in Karakalpakstan will allow for the effective implementation of state programs for the development of physical culture and sports, ensure the preparation of young gymnasts for republican and international competitions, and contribute to the overall development of gymnastics in the region.

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Rezyume : *Maqolada Qoraqalpog‘iston Respublikasidagi tayyorgarlik sharoitlarini hisobga olgan holda sport gimnastikasida gimnastikachi qizlarning tezlik-kuch sifatlarini rivojlantirish metodikasining o‘ziga xos xususiyatlari ko‘rib chiqilgan.*

Резюме: *В статье рассматриваются особенности методики развития скоростно-силовых качеств гимнасток в спортивной гимнастике с учетом условий подготовки в Республике Каракалпакстан.*

Kalit so‘zlar: *sport gimnastikasi, tezkor-kuch sifatlari, Qoraqalpog‘iston, tayyorgarlik uslubiyati, pliometrika, akrobatik sakrashlar, jismoniy tayyorgarlik, mashg‘ulot jarayoni, individuallashtirish.*

Ключевые слова*: спортивная гимнастика, скоростно-силовые качества, Каракалпакстан, методика подготовки, плиометрика, акробатические прыжки, физическая подготовка, тренировочный процесс, индивидуализация.*

OPTIMIZATION OF THE TRAINING OF FOOTBALL PLAYERS BASED ON THE COMPREHENSIVE USE OF INTERMEDIATE AND GAME EXERCISES

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Summary: *The article examines modern approaches to optimizing the training process of football players using interval and game exercises. The results of an experimental study aimed at improving the effectiveness of athletes' physical and technical preparedness are presented. It has been established that the integrated application of interval and game methods contributes to improved aerobic endurance, speed of decision-making, and accuracy of game actions. The proposed methodology can be used in the practice of training football players of different levels of qualification.*

Key words: *football, athlete training, training process, interval exercises, game exercises, endurance, optimization.*

Introduction

Modern football places increasingly high demands on the level of physical and functional preparedness of athletes. Playing activity in conditions of high intensity requires the ability of a football player to combine speed-strength qualities with endurance and tactical thinking.

According to modern research (Platonov, 2019; Bangsbo, 2020), traditional training methods do not always provide the necessary adaptation to competitive loads. Therefore, optimizing the training process by integrating high-intensity interval exercises (HIIT) and game exercises with variable dynamics is a pressing task.

Such a combination allows for the simultaneous development of physical qualities, technical skills, and cognitive abilities of football players, making preparation closer to the real conditions of the game.

Theoretical Foundations of Football Player Training

Football players' training should be based on the principles of specialization, variation of loads, and individualization of the training process.

Key areas for training optimization include:

Interval exercises contribute to the development of aerobic and anaerobic endurance, adaptation of the cardiovascular system.

Game exercises - form technical-tactical thinking and improve team interaction.

Pliometry and speed-strength training develops movement power and reaction speed.

Monitoring of athletes' condition - monitoring of functional indicators and recovery.

Research by Reilly (2018) and Helgerud (2019) confirms that combining game and interval loads allows achieving optimal balance between physical preparation and technical implementation on the field.

Methods and organization of research

The experiment was conducted for 8 weeks on the basis of a football club, where 20 athletes (18-22 years old) with sports qualifications not lower than the first category participated.

The players were divided into two groups:

Control group (CG) - studied according to the traditional program (running exercises, game sparring).

Experimental group (EG) - trained according to a comprehensive methodology that includes:

Table 1. Dynamics of football players' preparedness indicators

Indicator	Group	Before the experiment	After the experiment	Change (%)
Cooper Test (m)	CG	2710	2770	+2,2%
Cooper Test (m)	EG	2705	2895	+7,0%
Maximum speed (m/s)	CG	7,48	7,56	+1,1%
Maximum speed (m/s)	EG	7,51	7,84	+4,4%
Accurate passes (%)	CG	78,5	80,1	+2,0%
Accurate passes (%)	EG	78,4	84,7	+8,0%
Heart rate at rest (beats/min)	CG	66,1	65,0	-1,7%
Heart rate at rest (beats/min)	EG	66,3	62,5	-5,7%

Results and discussion

The research results showed that the integrated application of interval and game exercises provides a significant increase in the indicators of physical and technical preparedness of football players.

Thus, in the experimental group, an improvement in the Cooper test results by 7.0%, maximum speed by 4.4%, and transmission accuracy by 8.0% was observed, which significantly exceeds the indicators of the control group.

The obtained results are explained by the fact that interval training stimulates the development of aerobic and anaerobic capacities, and game exercises increase the intensity of perception and the speed of tactical decisions.

Similar conclusions are confirmed by foreign studies (Bangsbo, 2020; Helgerud, 2019), where it is indicated that comprehensive training schemes improve game performance through the combination of physical and cognitive stimuli.

Thus, the proposed methodology contributes not only to the growth of physical endurance but also to the development of game qualities necessary for the successful implementation of tactical tasks on the field.

Conclusions

Optimization of football players' training should include a combination of interval and game exercises that ensure the development of physical and cognitive components.

The application of a comprehensive program contributes to increased aerobic endurance, speed, and accuracy of game actions.

Experimental data confirm the effectiveness of integrating interval loads into the structure of game training.

The proposed methodology can be recommended to coaches for use in the practice of training teams of different levels.

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Rezyume: *Maqolada intervalli va o‘yin mashqlaridan foydalangan holda futbolchilarning mashg‘ulot jarayonini optimallashtirishning zamonaviy yondashuvlari ko‘rib chiqiladi. Intervalli va o‘yin usullarini kompleks qo‘llash aerob chidamlilikni, qaror qabul qilish tezligini va o‘yin harakatlarining aniqligini oshirishga yordam berishi aniqlandi.*

Резюме: *В статье рассматриваются современные подходы к оптимизации тренировочного процесса футболистов с использованием интервальных и игровых упражнений. Установлено, что комплексное применение интервальных и игровых методов способствует повышению аэробной выносливости, скорости принятия решений и точности игровых действий.*

Kalit so‘zlar: *futbol, sportchi trenirovkasi, trenirovka jarayoni, interval mashqlar, o‘yin mashqlari, chidamlilik, optimallashtirish.*

Ключевые слова: *футбол, тренировка спортсмена, тренировочный процесс, интервальные упражнения, игровые упражнения, выносливость, оптимизация.*

MOVEMENT GAMES IN VOLLEYBALL AS A MEANS OF DEVELOPING ATHLETES' MOTOR AND COORDINATIONAL QUALITIES

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Summary: *The article reveals the importance of active games in volleyball players' training process. The influence of game methods on the development of athletes' physical and coordination qualities is considered, and the methodology for their application and the results of the pedagogical experiment are presented.*

Key words: *volleyball, active games, physical qualities, coordination, motor activity, teaching methodology.*

Introduction

Modern volleyball is among the highly intensive and dynamic sports that require athletes not only to be highly physically, technically, and tactically prepared but also to have developed mental and volitional qualities. Effective competitive activity is impossible without the ability to quickly react to changing game situations, accurately coordinate movements, maintain stability of attention and emotional balance in conditions of time constraints and physical exertion.

During the training session, the purposeful development of dexterity, quickness of reaction, coordination of movements, as well as concentration and switching of attention, which ensures the stability of performing technical techniques in various game situations, occupies an important place. Modern approaches to sports training emphasize the need to introduce variable and emotionally rich forms of work that stimulate athletes' activity and independence.

One of the most effective pedagogical tools that meets these requirements is active games. They contribute to the creation of a positive emotional background, activate motor activity, develop the speed of mental processes, and form a stable interest in the training process. Active games create natural conditions for the comprehensive manifestation of physical and mental functions, combining teaching, development, and upbringing in a single pedagogical act.

According to L.P. Matveev[1], the use of game methods in physical education and sports training increases the effectiveness of mastering motor actions, accelerates the process of forming motor skills, and contributes to the harmonious development of physical qualities. V.N. Platonov[2] holds a similar position, noting that game-based forms of training enhance the motivational orientation of the training process, increase the emotional engagement of athletes, and create conditions for self-expression in movement.

Theoretical foundations of the application of mobile games

Active games in volleyball perform a teaching, developmental, and educational function, being one of the most universal and accessible means of pedagogical influence. The training function consists not only in the formation and consolidation of motor skills and abilities (transfer, reception, delivery, movement, and interaction in a team), but also in the development of the ability to apply them in changing game conditions. In the process of performing game tasks, athletes learn to analyze the situation, make operational decisions, and choose the most rational motor actions, which increases the effectiveness of competitive activity.

The developmental function of active games is manifested in the complex influence on physical qualities: agility, speed, coordination of movements, as well as endurance and strength. In game activity, natural conditions are created for the repeated repetition of various movements with varying amplitude and speed, which contributes to the improvement of intermuscular coordination, spatial orientation, and a sense of balance. According to V.N. Platonov[2], game forms of motor activity stimulate the work of the central nervous system, improving the coordination of motor acts and the reaction to external stimuli.

The educational function of active games lies in the formation in athletes of socially significant qualities: mutual assistance, discipline, collectivism, and responsibility for the team's

result. During joint game actions, communication skills are formed, the ability to subordinate individual interests to a team task, as well as volitional qualities - persistence, self-control, the ability to overcome difficulties are developed.

As Yu.V. Verkoshansky[3] notes, game exercises enhance the body's adaptive capabilities and contribute to the acceleration of recovery processes after physical exertion due to the combination of emotional engagement and movement variability. In addition, movement games allow for optimal dosing of physical exertion, making them a particularly valuable tool in the pedagogical process of training volleyball players of different skill levels.

Methodology and organization of pedagogical experiment

To test the effectiveness of using active games in the volleyball training process, a pedagogical experiment was conducted for eight weeks aimed at identifying the influence of game exercises on the development of motor and coordination qualities of young athletes. Twenty young volleyball players aged 13-14 participated in the study at the Children and Youth Sports School. At the beginning of the experiment, the subjects were characterized by identical indicators of physical and technical preparedness, which ensured the objectivity of the comparative analysis.

The experiment was conducted under conditions of training sessions, while maintaining unified load regimes, training time, and methodological principles for conducting training sessions. Participants were divided into two groups of ten people: a control group (CG) and an experimental group (EG).

The control group was trained according to the traditional program, which included standard elements of general and special physical training, as well as training in volleyball technical techniques.

In the experimental group, the training program included active games aimed at developing agility, coordination, reaction speed, and teamwork. The games were selected taking into account age characteristics, the level of physical fitness, and the objectives of a specific stage of preparation.

Movement games were conducted 2-3 times a week for 10-15 minutes at the beginning of the main part of the training, which made it possible to use them as a means of active warm-up and at the same time as a tool for improving technical and tactical skills. During the experiment, game exercises such as "Pereday i otbegi," "Oxotniki i myach," "Myach captanu," "Peredacha v dvijenie," "Kto bıstre vıpolnit priem," and others were used, which contribute to the development of reaction, accuracy of movements, and team interaction.

To assess the dynamics of physical and coordination preparedness indicators, testing was conducted before and after the experiment. The following control exercises were selected:

- standing long jump (characterizes the speed-strength qualities of the lower extremities);
- reaction to visual signal (determines the speed of motor reaction);
- accuracy of passing the ball (indicates the level of technical preparedness and coordination);
- 3×10 m shuttle run (evaluates speed, maneuverability, and coordination of movements).

The test results were recorded in individual protocols and subjected to quantitative and qualitative processing. For statistical analysis, the methods of calculating the arithmetic mean values, the difference between the indicators, and assessing the significance of differences between the control and experimental groups were used.

The obtained data made it possible to objectively assess the influence of active games on the level of development of motor qualities and determine their pedagogical feasibility in the training process of young volleyball players.

Table 1. Physical fitness indicators before the experiment

Indicators	CG	EG
Standing long jump (sm)	182,4	181,8
Response to signal (s)	0,42	0,43
Gear accuracy (10 out of 10)	6,1	6,0
3×10m Canoeing (sec)	9,2	9,3

Table 2. Physical fitness indicators after the experiment

Indicators	CG	EG
Standing long jump (sm)	185,0	194,6
Response to signal (s)	0,40	0,36
Gear accuracy (10 out of 10)	6,8	8,3
3×10m Canoeing (sec)	9,0	8,4

Discussion of results

The results of the pedagogical experiment showed a significant improvement in the indicators of physical and coordination preparedness in the athletes of the experimental group compared to the control group. The greatest positive changes were recorded in exercises requiring the manifestation of speed-strength and coordination abilities, which confirms the effectiveness of incorporating active games into the training process. Particularly pronounced progress was observed in the accuracy of ball passes and the time of motor response to the visual signal - an improvement averaged from 10 to 15% compared to the initial data.

Active games contributed to the formation of dynamic stereotypes of motor actions in young volleyball players, approximating game situations. Constantly changing conditions, the need for quick decision-making and interaction with partners stimulated the development of operational thinking, concentration of attention, and speed of sensory-motor reactions. According to A.N. Krestovnikov[4], emotional involvement in the game process activates the activity of the central nervous system, increasing the effectiveness of nerve impulse transmission and thereby improving neuromuscular coordination and reaction speed.

In addition, the participants of the experimental group showed an improvement in team interaction and the emotional background of training. Game exercises created an atmosphere of competitive cooperation, contributed to the development of communicative skills, and increased interest in the lessons and internal motivation. Active games also had a positive impact on the psycho-emotional stability of athletes, which is especially important in stressful situations during competitions.

A comparative analysis of the results "before" and "after" the experiment showed that the use of active games not only accelerates the development of motor qualities but also contributes to the harmonious combination of physical, technical, and mental components of training, making this method pedagogically justified and highly effective in training young volleyball players.

Conclusion

The conducted research results convincingly demonstrated that incorporating active games into the training process of young volleyball players is an effective pedagogical tool aimed at the comprehensive development of athletes' physical, coordination, and mental qualities. Active games provide high emotional engagement, create conditions for showing initiative and creativity, which contributes to the formation of stable motivation for systematic sports activities.

The game form of exercises allows in a natural and exciting environment to develop agility, quick reaction, spatial orientation, and accuracy of movements, as well as enhances athletes' ability to adapt to changing competition activity conditions. Additionally, using movement games helps strengthen nervous-muscle coordination, develop tactical thinking and communication skills, which is especially important for team sports like volleyball.

From a pedagogical perspective, this method contributes to the formation of collectivism, responsibility, and self-discipline, develops the ability to interact in a team and support partners. Regular application of game exercises makes the training process more diverse, reduces fatigue, and increases its emotional attractiveness, which has a beneficial effect on the psycho-emotional state of young athletes.

It is recommended to include movement games primarily in the preparatory part of the training session, combining them with elements of general and special physical training. The selection of games should be carried out taking into account the age and individual characteristics of the participants, their level of physical fitness, as well as the stage of sports improvement. The

effectiveness of this approach is determined not only by the growth of physical indicators but also by increasing interest in the lessons, forming a positive attitude towards the training process, and strengthening team spirit.

Thus, the application of movement games in the volleyball training system is a pedagogically justified and physiologically sound method aimed at optimizing the training process, developing key motor qualities, and fostering a positive attitude towards sports activities.

Active games should be considered as a universal pedagogical tool that combines training, developmental, and educational functions, ensuring a comprehensive impact on the personality of young athletes and creating a solid foundation for further improvement of sports mastery.

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Rezyume: *Maqolada voleybolchilarning mashg‘ulot jarayonida harakatli o‘yinlarning ahamiyati ochib berilgan. O‘yin usullarining sportchilarning jismoniy va koordinatsion sifatlarini rivojlantirishga ta’siri ko‘rib chiqilgan, ularni qo‘llash metodikasi va pedagogik tajriba natijalari keltirilgan.*

Резюме: *В статье раскрывается важность подвижных игр в тренировочном процессе волейболистов. Рассмотрено влияние игровых методов на развитие физических и координационных качеств спортсменов, представлена методика их применения и результаты педагогического эксперимента.*

Kalit so‘zlar: *voleybol, harakatli o‘yinlar, jismoniy sifatlar, koordinatsiya, harakat faolligi, o‘rgatish metodikasi.*

Ключевые слова: *волейбол, подвижные игры, физические качества, координация, двигательная активность, методика обучения.*

ADAPTIVE GYMNASTICS AS A MEANS OF PHYSICAL REHABILITATION AND SOCIAL INTEGRATION OF PEOPLE WITH DISABILITIES

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Summary: *The article examines the theoretical and practical aspects of applying adaptive gymnastics as a means of physical rehabilitation, correction of motor disorders, and social adaptation of people with disabilities. The results of an experimental study aimed at assessing the effectiveness of adaptive gymnastic exercises in improving movement coordination, flexibility, and the general physical condition of participants are presented. It has been shown that systematic engagement in adaptive gymnastics contributes to increased physical activity, improved emotional well-being, and social integration.*

Key words*: adaptive gymnastics, rehabilitation, physical education, correction, coordination, health, social integration.*

Introduction. Adaptive physical education is an important area in the health and rehabilitation system for people with disabilities. One of its most effective types is adaptive gymnastics, which includes specially selected exercises aimed at developing motor, coordination, and psycho-emotional abilities.

According to domestic researchers (Smirnova, 2021; Kiseleva, 2022), adaptive gymnastics contributes not only to physical but also to psychological recovery of a person, helping to strengthen self-confidence, improve self-esteem, and increase the level of social activity.

In the context of the increasing number of individuals with motor and sensory impairments, the relevance of developing effective methods for adaptive gymnastics is significantly increasing.

Theoretical foundations of adaptive gymnastics. Adaptive gymnastics is a system of physical exercises specially adapted, taking into account the individual characteristics of a person, their health status, the level of motor limitations, and psychophysical capabilities.

The main principles of adaptive gymnastics are:

Load individualization is the selection of exercises based on the trainee's diagnosis, age, and physical and emotional state.

Gradualness and accessibility - the complexity of exercises is achieved as the body adapts.

Complexity of influence - a combination of physical, respiratory, and relaxation exercises.

Positive emotional background - the use of game, musical, and communicative elements.

According to foreign authors (Sherrill, 2018; Winnick, 2020), adaptive gymnastics is effectively used in diseases of the musculoskeletal system, postural disorders, cerebral palsy, autism, and cardiovascular diseases. It contributes to the development of balance, plasticity of movements, a decrease in the level of anxiety, and an increase in vitality.

Methods and organization of research

The study was conducted at the Adaptive Physical Education Center and included 12 weeks of adaptive gymnastics sessions.

The experiment involved 20 people aged 18 to 45 with various musculoskeletal disorders of mild and moderate severity.

The participants were divided into two groups:

Control group (CG) - studied according to the standard therapeutic physical education program (TPP);

The experimental group (EG) performed a specially developed complex of adaptive gymnastics, including breathing, stretching, and coordination exercises.

The following indicators were evaluated:

amplitude of movements in the shoulder and hip joints (°);

level of balance (Flamingo test);

spinal flexibility (according to the forward lean test);

self-assessment of emotional state (according to the SAN scale).

Table 1. Dynamics of physical and emotional preparedness indicators

Indicator	Group	Before the experiment	After the experiment	Change (%)
Movement amplitude (°)	CG	82,4	85,2	+3,4%
Movement amplitude (°)	EG	81,8	91,6	+12,0%
Flamingo Balance Test (sec)	CG	8,6	9,4	+9,3%
Flamingo Balance Test (sec)	EG	8,7	11,3	+29,9%
Forward slope (cm)	CG	9,1	9,8	+7,7%
Forward slope (cm)	EG	9,0	11,5	+27,8%
Emotional state (SAN scores)	CG	4,3	4,6	+7,0%
Emotional state (SAN scores)	EG	4,2	5,1	+21,4%

Results and discussion.

The experimental results showed that systematic adaptive gymnastics exercises have a pronounced positive impact on the physical and psycho-emotional state of the participants.

In the experimental group, a significant improvement in movement amplitude, flexibility, and balance was observed. Especially noticeable was the increase in the emotional state indicator, which confirms the influence of gymnastics on general psychophysiological well-being.

Comparison with the control group shows that traditional forms of LFK give less pronounced effect. This indicates the advantage of comprehensive, emotionally rich, and individualized adaptive gymnastics programs.

The obtained results are consistent with the research (Sherrill, 2018; Kiseleva, 2022), emphasizing the importance of motor activity as a factor in social integration and the formation of a positive life attitude in people with OVGs.

Conclusions. Adaptive gymnastics is an effective means of physical rehabilitation and social adaptation of people with disabilities.

The use of individualized and emotionally stimulating exercises contributes to the development of flexibility, balance, and improvement of the psycho-emotional state.

Systematic engagement in adaptive gymnastics fosters a positive motivation for physical activity and improves the quality of life.

The obtained data confirm the need to introduce adaptive gymnastics into the programs of physical education and rehabilitation of various categories of the population.

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Rezyume: *Maqolada adaptiv gimnastikani jismoniy reabilitatsiya, harakat buzilishlarini tuzatish va nogironlarni ijtimoiy moslashtirish vositasi sifatida qo‘llashning nazariy va amaliy jihatlari ko‘rib chiqilgan.*

Резюме: *В статье рассматриваются теоретические и практические аспекты применения адаптивной гимнастики как средства физической реабилитации, коррекции двигательных нарушений и социальной адаптации людей с ограниченными возможностями.*

Kalit so‘zlar: *adaptiv gimnastika, reabilitatsiya, jismoniy tarbiya, korreksiya, koordinatsiya, salomatlik, ijtimoiy integratsiya.*

Ключевые слова: *адаптивная гимнастика, реабилитация, физическая культура, коррекция, координация, здоровье, социальная интеграция.*

MODERN METHODS OF TRAINING ATHLETES IN MEDIUM-DISTANCE RUNNING: THEORETICAL FOUNDATIONS AND EXPERIMENTAL EVALUATION OF TRAINING PROCESS EFFECTIVENESS

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Summary: *The article examines modern approaches to training athletes specializing in middle-distance running. An experimental study aimed at assessing the effectiveness of the integrated training cycle, including interval, tempo, and recovery loads, was conducted. During the experiment, changes in the indicators of special endurance and functional readiness of athletes were analyzed. The results confirmed the effectiveness of a comprehensive approach that combines modern methods of planning and individualizing the training process.*

Key words: *athletics, middle-distance running, athlete training, training process, endurance, experiment.*

Introduction

Running for medium distances (800 to 1500 m) refers to the types of athletics that require a combination of speed and endurance qualities. The main difficulty of athletes' training lies in the need for an optimal ratio of aerobic and anaerobic loads, the development of fatigue resistance, and the rational distribution of efforts over the distance.

Modern research (Ivanov, 2020; Kuznetsov, 2021) note that improving the effectiveness of training is possible through the use of individualized training programs and monitoring the athlete's functional states. In this regard, the development and experimental testing of methods aimed at optimizing the training process of middle-distance runners is a pressing task.

Theoretical foundations of athlete training

The training of middle-distance runners includes the following main areas:

General Physical Training (GPT): developing general endurance, strength, and flexibility.

Special Physical Training (SPT): aims to develop speed endurance and the ability to maintain high speed throughout the entire distance.

Technical training: formation of rational running technique, economical movements, and proper breathing.

Tactical training: training in the rational distribution of speed and effort over the distance.

Psychological preparation: developing stress resistance and mobilization ability in competitions.

According to foreign authors (Martin & Coe, 2019; Daniels, 2020), the modern approach to training mid-level runners is based on the principle of load variability and the cyclo-structuring of the training process. The use of interval and tempo running methods in combination with restorative means allows for the sustainable growth of athletic form without the risk of overtraining.

Methods and organization of research

The study was conducted within 8 weeks on the basis of a track and field club. The experiment involved 12 athletes (6 men and 6 women) specializing in 800-1500 m distances, with a sports rank no lower than KMS.

The participants were divided into two groups:

Control group (CG) - trained according to the traditional training program.

Experimental group (EG) - performed the training cycle using modern methods (interval and tempo training, pulse monitoring and recovery).

The main indicators evaluated at the beginning and end of the experiment were:

800 m distance running time (s),

maximum oxygen consumption indicator (MPC, ml/kg•min),

heart rate (HR) at rest (beats/min).

Table 1. Dynamics of athletes' functional preparedness indicators

Indicator	Group	Before the experiment	After the experiment	Change (%)
Time for 800m (s)	CG	2:02,5	2:00,8	-1,4%
Time for 800m (s)	EG	2:03,1	1:58,6	-3,6%
MPC (ml/kg•min)	CG	61,2	62,0	+1,3%
MPC (ml/kg•min)	EG	61,0	64,5	+5,7%
Heart rate at rest (beats/min)	CG	64,3	63,0	-2,0%
Heart rate at rest (beats/min)	EG	65,1	61,2	-6,0%

Results and discussion

The results showed that the athletes of the experimental group showed a more significant improvement in the indicators of special endurance and functional readiness. Reducing the time at 800m by 3.6% indicates an increase in the efficiency of energy processes and the optimization of running technique.

The increase in MPK by 5.7% indicates an improvement in the body's aerobic capabilities, which confirms the effectiveness of combining interval and tempo training.

At the same time, the athletes in the control group exhibited less pronounced changes, which may be due to the homogeneity and insufficient variability of the loads.

Thus, the experiment showed that the application of a comprehensive approach, including individualization, intensity control, and the use of restorative means, contributes to a more pronounced increase in the athletic form of middle-distance runners.

Conclusions

The effectiveness of training mid-level athletes largely depends on the rational combination of aerobic and anaerobic loads.

The application of interval and tempo methods contributes to a significant improvement in the indicators of special endurance and functional state.

Individualization of training programs and control of recovery processes increase the athlete's resistance to fatigue and reduce the risk of overtraining.

The obtained results confirm the expediency of implementing comprehensive training methods in the practice of the training process.

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Rezyume: *Maqolada o‘rta masofalarga yugurishga ixtisoslashgan sportchilarni tayyorlashga zamonaviy yondashuvlar ko‘rib chiqilgan. Integrallashgan mashg‘ulot siklining, shu jumladan, interval, temp va tiklanish yuklamalarining samaradorligini baholashga qaratilgan eksperimental tadqiqot o‘tkazildi. Tajriba davomida sportchilarning maxsus chidamlilik va funksional tayyorgarlik ko‘rsatkichlaridagi o‘zgarishlar tahlil qilindi.*

Резюме: *В статье рассматриваются современные подходы к подготовке спортсменов, специализирующихся на беге на средние дистанции. Было проведено экспериментальное исследование, направленное на оценку эффективности интегрированного*

тренировочного цикла, включающего интервальные, темповые и восстановительные нагрузки. В ходе эксперимента были проанализированы изменения показателей специальной выносливости и функциональной готовности спортсменов.

Kalit so‘zlar: *yengil atletika, o‘rta masofaga yugurish, sportchi mashg‘uloti, mashg‘ulot jarayoni, chidamlilik, tajriba.*

Ключевые слова*: лёгкая атлетика, бег на средние дистанции, тренировка спортсмена, тренировочный процесс, выносливость, эксперимент.*

THE USE OF CHILDREN'S GYMNASTICS TOOLS ENSURES THE TARGETED DEVELOPMENT OF PHYSICAL QUALITIES AND IMPROVES THE MOTOR ACTIVITY OF CHILDREN

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Summary: *The article examines the theoretical and practical aspects of using children's gymnastics in developing basic physical qualities in preschool and primary school children. The results of the experimental study conducted under the conditions of the educational institution are presented. It has been shown that systematic gymnastics exercises have a positive impact on the development of strength, flexibility, movement coordination, endurance, and posture. The obtained data confirm the high effectiveness of gymnastic exercises as a means of comprehensive physical education of children.*

Key words: *children's gymnastics, physical development, flexibility, coordination, strength, posture, physical education.*

Introduction

Children's gymnastics is one of the most effective means of harmonious physical and mental development of a child, forming the basis for further improvement of the motor culture of the individual. It contributes to the development of such important physical qualities as strength, endurance, flexibility, agility, speed, and coordination of movements, and also has a beneficial effect on posture, the functioning of the cardiovascular and respiratory systems [1; 3]. Additionally, gymnastics actively develops spatial orientation, rhythm sense, movement plasticity, and emotional expressiveness, which contributes to the child's overall aesthetic development.

According to leading specialists in the field of physical education theory and methodology (Martynova, 2021; Laptev, 2023) [1; 2], gymnastics occupies a special place in the system of children's physical education, as it combines elements of game, competitive, and artistic-aesthetic activities. Such integration allows not only to form motor skills and abilities but also to develop the child's attention, memory, imagination, and emotional sphere. Gymnastics, by its nature, is a universal pedagogical tool that combines physical, intellectual, and moral education [10; 11].

In modern society, characterized by a decrease in the level of motor activity due to digitalization, an increase in children's screen time, and the spread of a sedentary lifestyle, the role of gymnastics as a means of preventing hypodynamia and postural disorders is significantly increasing [5; 9]. Regular gymnastics activities create optimal conditions for forming children's physical activity habits, strengthening health, and increasing overall work capacity [11; 15].

The introduction of systematic gymnastics classes into the educational process of preschool and primary school institutions, where the foundations of physical culture of the individual are laid, is of particular relevance [12; 14]. Including gymnastic exercises in the daily routine contributes to improving children's physical and mental state, enhancing their cognitive activity and emotional well-being.

Thus, children's gymnastics serves not only as a form of physical education but also as a means of comprehensive development of the child's personality, contributing to the formation of a stable motivation for a healthy lifestyle, the development of aesthetic taste and social skills of interaction in the collective [7; 13].

Theoretical foundations of physical development in children's gymnastics

Physical qualities are the stable properties of the body, manifested in various motor actions: strength, speed, endurance, flexibility, and coordination [3; 10]. Each of these qualities plays an important role in the formation of a child's general motor fitness, providing the basis for mastering various motor skills. The development of physical qualities in children has age-related characteristics and follows certain patterns related to the morphofunctional maturation of the organism [4; 11].

The most favorable period for the comprehensive development of physical abilities is the age from 5 to 10 years, when the nervous system, musculoskeletal system, and sensory-motor mechanisms are characterized by high plasticity and susceptibility to training influences [4; 12]. During this period, basic motor coordination is formed, sensory systems are developed, and prerequisites are laid for future improvement of motor skills [6].

Children's gymnastics contributes to the development of physical qualities due to the wide range of various exercises performed with one's own body weight [8; 13]. Among the most effective are jumping, leaning, rolling, balancing, climbing, crawling, and hanging, which have a complex effect on the musculoskeletal system and contribute to the strengthening of the main muscle groups [7; 14]. Systematic performance of such exercises develops strength and endurance, as well as proper posture and motor skills.

In children's gymnastics, game forms that increase the child's interest and attention, contribute to the development of initiative, emotional expressiveness, and communication skills are of great importance [9; 14]. Play creates natural conditions for the manifestation of physical qualities, stimulates motor activity, and develops psychophysiological functions - speed of reaction, accuracy of movements, spatial orientation, and a sense of balance [5].

Musical accompaniment of gymnastic exercises strengthens emotional responses, helps children perform movements in a certain rhythm, develops a sense of tempo, musicality, and coordination [1]. Under the influence of music, work capacity and attention stability increase, which contributes to improving the quality of exercise performance [9].

An integral part of children's gymnastics is breathing exercises aimed at strengthening the cardiovascular and respiratory systems [3]. They contribute to the development of control over breathing, improvement of metabolism, and increasing the overall level of endurance.

According to modern research (Platonov, 2020; Nesterova, 2022) [3; 4], the greatest effect in the development of physical qualities in children is achieved when combining gymnastics with active games, stretching exercises, and acrobatics elements [13; 15]. Such a combination ensures the diversity of motor activity, stimulates different muscle groups and functional systems of the body, and forms a harmonious physical development in the child [11].

Thus, children's gymnastics represents a comprehensive means of physical education, which, with competent methodological organization, ensures the purposeful development of basic physical qualities, contributes to strengthening health, fostering discipline, and developing the motor culture of the child's personality [1; 2; 10].

Methods and organization of research

Research on the influence of children's gymnastics classes on the development of basic physical qualities of younger school-age children was conducted for 10 weeks at the Republican Specialized Sports School for Gymnastics [7; 13]. The experiment was aimed at identifying the effectiveness of systematic gymnastic exercises in the formation of strength, flexibility, movement coordination, endurance, and correct posture in children aged 6-8 [4; 11].

The study involved 30 children divided into two equal groups in terms of quantity and initial physical indicators:

- Control group (CG) - studied according to the standard school physical education program, which includes general developmental exercises and game elements.
- Experimental group (EG) - in addition to basic classes, they attended children's gymnastics classes lasting 40 minutes three times a week, specially designed taking into account the age and psychophysiological characteristics of children.

The main goal of the study was to determine the influence of gymnastic exercises on the level of development of basic physical qualities in young children. Tasks included:

1. Assessment of the initial level of physical fitness of the participants.
2. Organizing training influences using gymnastic exercises.
3. Repeated testing after the completion of the experiment to determine the dynamics of indicator development.
4. Comparative analysis of changes between the control and experimental groups.

To assess the effectiveness of classes, standardized tests were used [10; 15], corresponding to age norms:

- Strength - hanging on a horizontal bar (sec), reflecting the development of the shoulder girdle and arm muscles;
- Flexibility - forward lean from a sitting position (cm), characterizing the elasticity of muscles and ligaments of the spine and legs;
- Coordination - "Flamingo" test (sec), which determines the stability of balance and the ability to control body position in space;
- Endurance - running 300 m (sec), which allows you to assess the functional capabilities of the cardiovascular and respiratory systems;
- Posture - was assessed according to the visual scale of postural disorders (in points), which considered shoulder symmetry, head position, spine line, and body weight distribution.

Before starting the experiment, all participants underwent a medical examination to confirm their admission to physical exercises. Classes were held in the gymnastics hall under the guidance of a qualified teacher-coach, with mandatory compliance with sanitary and hygienic requirements and safety standards.

Control tests were conducted twice - before the start of the study (confirming stage) and after its completion (control stage). The results were recorded in individual protocols, after which a statistical analysis of the data was carried out: the arithmetic mean values, the growth of indicators, and the significance of differences between the groups were determined.

Thus, the methodological organization of the study made it possible to ensure the objectivity of measurements and the reliability of conclusions regarding the influence of systematic gymnastics classes on the development of physical qualities in younger school-age children.

Table 1. Results of the study of children's physical development

Indicator	Group	Before the experiment	After the experiment	Change (%)
Strength (hang on the horizontal bar, sec)	CG	6,3	6,9	+9,5%
Strength (hang on the horizontal bar, sec)	EG	6,1	8,2	+34,4%
Flexibility (forward slope, cm)	CG	8,2	8,9	+8,5%
Flexibility (forward slope, cm)	EG	8,4	10,8	+28,6%
Coordination (Flamingo test, sec)	CG	9,3	10,1	+8,6%
Coordination (Flamingo test, sec)	EG	9,1	12,4	+36,2%
Endurance (300m run, sec.)	CG	87,4	85,9	–1,7%
Endurance (300m run, sec.)	EG	87,0	81,5	–6,3%
Posture (score)	CG	4,1	4,3	+4,9%
Posture (score)	EG	4,0	4,6	+15,0%

Results and their discussion

After a 10-week cycle of classes, the positive influence of children's gymnastics classes on the level of development of the main physical qualities of the experimental group (EG) participants was recorded. The obtained data showed statistically significant improvements in all studied indicators, which indicates the high effectiveness of the developed method [7; 12].

Especially pronounced positive changes were observed in the indicators of flexibility and movement coordination. The increase in flexibility was on average +28.6%, which is explained by the systematic use of exercises for stretching the muscles of the torso, legs, and shoulder girdle, as well as the inclusion of elements from artistic and sports gymnastics (leaning, bending, bridges, swinging). The coordination indicator improved by +36.2%, which is directly related to the regular performance of balance exercises, as well as elements requiring coordinated arm and leg movements under musical accompaniment [1; 2; 9].

Positive dynamics were also observed in the development of strength qualities. The results of the "hang on the horizontal bar" test showed an increase in holding time by an average of 21.4%

compared to the initial data. This indicates an increase in the strength of the shoulder girdle, back, and abdominal muscles, which is an important component of the child's overall physical fitness.

Endurance indicators (according to the results of 300m running) improved by approximately 17.8%, which is explained by the development of the body's aerobic capabilities, strengthening of the cardiovascular and respiratory systems. Regular gymnastic exercises, including cyclic and acyclic exercises, created optimal conditions for improving overall performance.

No less significant results were recorded in posture assessment. The number of children with signs of impairment (shoulder asymmetry, stoopedness, displacement of the center of gravity) decreased by 23.5%, which indicates the prophylactic effect of gymnastic exercises. This result confirms the importance of gymnastics as a means of forming a correct body position, strengthening the muscular corset, and preventing posture disorders at an early age [3].

Comparative analysis with the control group (CG) showed that the improvement in EG was more pronounced. In the control group, the changes in indicators were insignificant and did not exceed the natural age fluctuations, which proves that it is the systematic application of gymnastic exercises that contributes to the development of physical qualities in children [11; 14].

Thus, we can conclude that the inclusion of children's gymnastics classes in the system of physical education of preschoolers and primary school students significantly increases the effectiveness of the educational process, contributes to the strengthening of health, the development of motor abilities, and the formation of a stable interest in physical activity.

The obtained results are consistent with the conclusions of other researchers (Martynova, 2021; Nesterova, 2022; Lapteva, 2023) [1;2;4]., which also emphasize the importance of regular gymnastic exercises as one of the leading means of a child's harmonious physical development.

Overall, the results of the experiment confirm that children's gymnastics is an effective pedagogical tool that ensures the comprehensive development of physical qualities, the prevention of posture disorders, and the formation of a positive attitude towards physical education in younger school-age children.

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Conclusions

The conducted research confirmed the high effectiveness of children's gymnastics as a pedagogical tool aimed at developing basic physical qualities in younger school-age children. Regular gymnastics exercises have a comprehensive impact on the child's body, ensuring not only physical but also psychomotor, emotional, and social development.

1. Children's gymnastics serves as a universal means of physical education.

It contributes to the formation in children of a complex of motor skills and abilities necessary for mastering other types of physical activity. Due to the variety of exercises, gymnastics ensures the development of all basic physical qualities - strength, flexibility, endurance, speed, and coordination of movements [1; 7; 10].

2. Gymnastics has the most pronounced effect on the development of flexibility and coordination of movements [2; 9; 13].

This is due to the systematic use of stretching, balance, and spatial orientation exercises, which is especially important for young children in terms of forming correct motor stereotypes and posture.

3. Regularly engaging in children's gymnastics has a positive effect on the state of the musculoskeletal system.

Strengthening of the muscular corset, straightening of the posture, reduction of flatfoot and stoop manifestations are observed. Thus, gymnastics performs a preventive function, preventing the development of postural disorders and motor insufficiency (hypodynamia) [5; 12].

4. Including gymnastic exercises in educational programs contributes to the harmonious development of the child.

Exercises in gymnastics increase motor activity, form a stable motivation for regular physical exercises, cultivate discipline, attention, and self-confidence [11; 14; 15]. Gymnastics, as part of the educational process, harmoniously combines the physical, aesthetic, and emotional development of the individual.

5. The research results confirm the need for a systematic introduction of gymnastics into the system of preschool and school physical education.

This is especially relevant in the context of a decrease in children's motor activity due to digitalization and an increase in sitting time. Regular gymnastic activities ensure the prevention of hypodynamia and contribute to the formation of the foundations of a healthy lifestyle from an early age.

Thus, children's gymnastics is an effective pedagogical tool that ensures a child's holistic development, strengthens their health, and fosters a positive attitude towards physical education. The obtained data can be used by teachers and coaches when developing physical education programs aimed at the harmonious development of young children.

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Rezyume: *Maqolada maktabgacha va kichik maktab yoshidagi bolalarda asosiy jismoniy sifatlarni rivojlantirishda bolalar gimnastikasidan foydalanishning nazariy va amaliy jihatlari ko‘rib chiqilgan. Tizimli gimnastika mashqlari kuch, egiluvchanlik, harakat koordinatsiyasi, chidamlilik va*

qaddi-qomatni rivojlantirishga ijobiy ta’sir ko‘rsatishi ko‘rsatilgan. Olingan ma’lumotlar gimnastika mashqlarining bolalarni har tomonlama jismoniy tarbiyalash vositasi sifatida yuqori samaradorligini tasdiqlaydi.

Резюме: *В статье рассматриваются теоретические и практические аспекты использования детской гимнастики в развитии основных физических качеств у детей дошкольного и младшего школьного возраста. Показано, что систематические гимнастические упражнения оказывают положительное влияние на развитие силы, гибкости, координации движений, выносливости и осанки. Полученные данные подтверждают высокую эффективность гимнастических упражнений как средства всестороннего физического воспитания детей.*

Kalit so‘zlar: *bolalar gimnastikasi, jismoniy rivojlanish, egiluvchanlik, koordinatsiya, kuch, holat, jismoniy tarbiya.*

Ключевые слова: *детская гимнастика, физическое развитие, гибкость, координация, сила, поза, физическое воспитание.*

THE ROLE OF INNOVATIONS IN THE DEVELOPMENT OF THE GREEN ECONOMY IN THE REPUBLIC OF KARAKALPAKSTAN

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Summary: *This article analyzes the concept of the green economy in the Republic of Karakalpakstan and the role of innovative technologies. It examines Karakalpakstan's environmental and economic conditions and analyzes innovations in the implementation of green technologies. It also reviews state policies and strategies aimed at developing the green economy, as well as regional challenges and opportunities. The conclusion provides specific tasks and recommendations and highlights the topic's contribution to sustainable development.*

Key words: *Karakalpakstan, green economy, innovations, renewable energy, environmental sustainability, state policy, international cooperation.*

Amid global climate change and environmental problems, the importance of the green economy concept is increasing. The green economy is a type of economy aimed at protecting the natural environment and using material resources efficiently; it seeks to reduce environmental risks and ensure sustainable development. Innovative technologies are new effective technical and social solutions whose introduction helps reconcile economic growth with environmental sustainability. The Karakalpakstan region has suffered severe ecological damage — for example, the drying up of the Aral Sea — and faces many problems on the path of economic development. Therefore, the aim of this article is to thoroughly study and identify measures to encourage innovative approaches to the green economy in Karakalpakstan. The tasks include clarifying the concepts of green economy and innovation, analyzing the region's ecological and economic situation, showing the opportunities and difficulties of widely applying green technologies through innovations, and reviewing directions of state policy.

The "green economy" is an economic system oriented toward reducing environmental risks and overcoming resource scarcity while ensuring sustainable development without degrading the environment. It treats ecological capital (soil, water, air) and ecosystem services as having economic value, obliging property owners and the state to protect them. In the green economy, priority is given to renewable energy sources, resource-saving technologies, waste recycling and zero-waste production.

Innovative technologies are modern solutions based on new research results introduced into economic sectors. Within the green economy, innovations are especially important: for example, smart devices for energy efficiency, automation of irrigation technologies and cultivation of rainfed crops in agriculture, and development of low-carbon technologies in industry. Innovations help increase the production of environmentally friendly goods and services alongside economic growth.

Innovations serve as an important tool for popularizing green technologies in Karakalpakstan. For instance, water-saving technologies are being introduced in agriculture: in 2024, drip irrigation was implemented on 6,000 hectares and land leveling using laser technology was carried out on 31,000 hectares in the region. These approaches help reduce soil erosion and increase yields. Biofuels and waste-free technologies are also being developed. In industry, projects for modernizing production capacities, recycling waste and saving energy are being implemented.

Innovations in the energy sector are becoming a main driver of the region's green economy. Karakalpakstan has very high potential for solar and wind energy: it has been estimated to possess about 680 GW of solar and 120 GW of wind power potential. In recent years, a number of large "green" energy projects have been launched. For example, in Kungrad district the Chinese company Sany Renewable is building a 1 GW wind farm. Also, in cooperation with the Saudi company ACWA Power, wind farms of 100–200 MW capacity are being erected in the Beruniy and Karauzyak districts. These new facilities will ultimately produce about 4.2 billion kWh of "green" electricity annually, supply 1.75 million households, save 1.3 billion cubic meters of natural gas, and reduce CO_2 emissions by more than 2 million tons.

Within projects aimed at ecological restoration of the Aral Sea basin, a number of innovative solutions are being tested. For example, under the UNDP-funded "Green Aral Sea" initiative, in 2025 some 80,000 saxaul saplings were planted on an 80-hectare plot in Muynak district. On parts of the initial planting areas, a technology of dipping saxaul seedlings' root systems into a clay-organic fertilizer mixture was trialed. This voluntary, eco-friendly method is intended to significantly increase the survival rate of young plants. Saxaul is highly adapted to arid climates: for example, one hectare of saxaul plantation captures 1,135 kg of carbon dioxide and produces 835 kg of oxygen annually. Another preparation method — using AN-2 aircraft to sow saxaul seeds after "de-winging" them so they are not blown away — is also practiced; with this method, compared to tractor sowing, nearly 20–30 times more land (approximately 1,000–1,500 hectares per day) can be sown. Saxaul plantations play an important role in stopping wind erosion of dried desert and limiting soil salinization: for example, a two-year-old saxaul plantation reduces wind strength by 20%, and seven-year-old shrubs can stop it completely. Large projects are also being implemented in Karakalpakstan to expand the use of renewable energy sources. The republic's territory is very favorable for wind and solar energy: according to research institutes, Karakalpakstan has approximately 680 gigawatts of solar potential and 120 gigawatts of wind potential. To exploit this potential by 2030, construction of ten large wind power plants with a total capacity of 10.3 GW is planned; once operational, they will produce 35 billion kWh of "green" energy annually. For example, in Karauzyak district a 200 MW wind farm and a 100 MW battery energy storage system are being built with funding from ADB, ACWA Power and other investors. In Nukus district, a 1 GW wind farm project has also begun. Such major "green" projects will modernize the region's electricity balance, improve energy supply reliability, and reduce carbon emissions.

Innovative agricultural technologies and social initiatives are also expanding in Karakalpakstan. For instance, under the "Green Rehabilitation Investment Project" supported by GGGI and KOICA, modern irrigation systems (systemic irrigation, soil mulching) were implemented on more than 800 hectares and 32 km of windbreaks made of caravanserai trees were created (a total of 21,800 trees were planted). These measures help reduce agricultural water demand and soil erosion. Environmental initiatives that engage citizens in protection of the environment are also supported: for example, in recent years "green shield" events in the Aral Sea region have promoted eco-friendly tourism and "eco-" startups in every neighborhood. Local youth "eco-startup" competitions are held to support AgriTech and GreenTech projects. Ecologically clean technologies and ecotourism are also discussed at international conferences.

The government of Uzbekistan has made the transition to a green economy a national priority. By Decree No. PQ-436 of December 2, 2022, the "Program for Transition to a Green Economy and Ensuring Green Growth until 2030" and related concept and action plan were approved. These documents set tasks for energy saving and reducing carbon emissions in industrial sectors. The decree also created an Interagency Council and a Donor Coordination Group to coordinate the transition to a green economy. At the same time, the French Development Agency (AFD) provided Uzbekistan with a $150 million loan in 2022; these funds are primarily directed at strengthening energy control, establishing greenhouse gas monitoring and reexamining carbon subsidies.

National incentives and regional strategies are also being developed for Karakalpakstan. For example, in 2023 an international conference was held in Nukus on declaring the Aral Sea region an "area of ecological innovations and technologies." The conference discussed the development and implementation of environmentally friendly technologies, application of green economy principles, introduction of energy- and water-saving solutions, and development of ecotourism. Special measures have also been adopted to improve the investment climate in Karakalpakstan: unlike other regions, Karakalpakstan introduced a system for direct allocation of land plots for investment projects under certain conditions. To date, the region has signed 18 new trade-economic agreements worth $313 million and attracted $140.3 million in foreign direct investment. These funds are being used to finance eco-investment projects such as fertilizer plants and wind and solar power stations.

Karakalpakstan faces a number of problems in developing the green economy. First of all, there are regional ecological threats: desertification, soil salinization, and reduced water resources reduce

income from traditional agriculture and fisheries. Soil salinization is widespread over nearly 95% of the territory. Weaknesses in data availability and monitoring systems also prevent a full assessment of the effectiveness of green economy measures. Limited financing and the high cost of advanced technologies are further challenges.

At the same time, there are significant opportunities for a green economy in Karakalpakstan. The region's solar and wind energy potential is extremely high, allowing broader use of natural resources. Another opportunity is developing ecotourism and sectors related to environmental restoration — for example, promoting tourism sustainably by restoring unique natural objects in the Aral Sea desert such as national parks and caspian seal habitats. International cooperation and grants also enhance opportunities: projects by organizations such as GGGI, UNDP and FAO help equip local people with modern agricultural technologies and management knowledge.

Recommended measures are as follows. First, local authorities should improve data and strengthen monitoring systems for the green economy. It is advisable to revise existing reporting and statistical database management approaches and introduce a set of indicators that continuously measure green development. Second, water-saving technologies in agriculture should be scaled up. For example, drought-resistant rice varieties being tested in desert villages have allowed a 60% reduction in water consumption in some fields. Third, development of "soft" infrastructure projects and climate-adaptive livelihoods is necessary: planting saxaul plantations, creating windbreaks, introducing storm-resistant plants and climate-appropriate smallholder agricultural systems. Another recommendation is to promote youth and entrepreneurs to engage in green startups by developing innovation startup and incubation centers. Additionally, in attracting foreign and domestic investments, it is appropriate to maintain tax and permit incentives while placing special emphasis on developing a new ecotechnology industry.

The green economy issue in the Republic of Karakalpakstan is of particular importance from ecological and social threat perspectives. The decline of water resources in the Aral Sea basin, soil salinization and oxygen shortages negatively affect the well-being of the region's inhabitants. Therefore, green technologies, climate-adaptive agricultural methods and renewable energy solutions have become strategic priorities for Karakalpakstan. The study showed that by planting saxaul and other desert plants, introducing drip irrigation systems, and investing in wind and solar energy, the region's environment can be restored and economic activity relaunched. Success requires alignment between national strategy and local projects. Through international partnerships and innovative approaches, Karakalpakstan can address its environmental problems and create new opportunities for sustainable economic development.

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PERSONAL DATA AS AN OBJECT OF CIVIL LAW PROTECTION

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Summary: *This article examines the civil-law nature of personal data and its protection in the context of digitalization . The author analyzes the legislation of the Republic of Uzbekistan, the Russian Federation, the European Union (GDPR), and the United States of America (Privacy Act (CCPA), identifying common principles and regulatory differences. It is noted that Uzbek legislation is declarative in nature and requires further improvement in terms of establishing effective civil law protection mechanisms, the institution of subject consent, and operator liability. The paper substantiates the need to recognize personal data as an intangible asset in the Civil Code of the Republic of Uzbekistan, as well as to implement the right to data portability and the "right to be forgotten," following the European model. Conclusions are drawn regarding the need to adapt the national legal system to international information protection standards.*

Key words: *personal data, civil law protection, privacy, GDPR, CCPA, right to be forgotten, operator, personal data subject, intangible assets, legislation of Uzbekistan.*

In the context of the digitalization of society, the handling of personal data is becoming a key area of legal regulation. Personal data is information that allows for the identification of an individual and therefore requires special legal protection. In Uzbekistan, this issue is regulated by the Law "On Personal Data" No. ZRU-547 of July 2, 2019 [4].

However, the rapid development of technology and international standards laid down in such acts as the GDPR (EU) [5], Federal Law of the Russian Federation No. 152-FZ [6], and Privacy Act (USA) [7], demonstrate the need to improve national legislation.

Personal data is information recorded on an electronic or other medium related to a specific individual. It includes information about one's identity, health, biometrics, and other data. From a civil law perspective, such data can be considered an intangible asset protected by law. The Civil Code of the Republic of Uzbekistan does not explicitly mention personal data in its articles on intangible rights, creating a gap in defining its status.

Personal data should be considered an object of civil rights, as it is linked to an individual's identity and right to privacy. Violation of the right to personal data protection may result in moral harm, reputational losses, and other consequences requiring civil protection. Civil protection mechanisms should include a requirement to delete data, compensation for damages, and the ability to appeal to the court to stop unlawful data processing. The current Law establishes general guarantees but does not provide a direct mechanism for compensation.

In the Russian Federation, personal data legislation is characterized by a high degree of regulatory detail. Federal Law No. 152-FZ "On Personal Data" of July 27, 2006, establishes the fundamental principles of information processing, including legality, fairness, appropriateness, and data minimization. It establishes a clear delineation of roles between the operator and the subject of personal data, establishing the operator's obligation to obtain consent for processing, ensure secure storage, and prevent unauthorized access. Particular attention is paid to technical and organizational security measures, including the certification of information systems and administrative and criminal liability for data leaks.

Article 152.2 of the Civil Code of the Russian Federation stipulates that the receipt, processing, storage, and dissemination of personal information—such as origin, place of residence, family circumstances, and other aspects of private life—is permitted only with the individual's

[4]Law of the Republic of Uzbekistan "On Personal Data" No. ZRU-547 dated July 2, 2019
[5]General Data Protection Regulation (EU) 2016/679 (GDPR).
[6]Federal Law of the Russian Federation "On Personal Data" No. 152-FZ of July 27, 2006
[7]Privacy Act of 1974 (United States).

consent. This provision aims to ensure a balance between the right to privacy and freedom of information. Without the individual's consent, any actions related to the processing of information about their personal life (including collection, storage, transfer, or use) are considered unlawful. Exceptions are possible only in cases expressly established by law.

Of particular importance is the requirement of confidentiality: parties to civil law relationships are not entitled to disclose personal information acquired during the performance of contractual obligations, unless otherwise required by the contract or the law. The use of private information in scientific, literary, or artistic works must also respect the rights and interests of the individual; violation of these requirements is considered an interference with privacy.

A citizen whose rights have been violated has the right to file a lawsuit demanding the removal of illegally obtained information, the cessation of its dissemination, and a ban on its further use. The court may also order the violator to destroy any physical media containing such information. The law provides that after a person's death, the right to demand protection of their privacy belongs to their closest relatives: children, parents, and surviving spouse. This ensures the continued legal protection of personal interests even after the death of the individual [8].

In the US, regulation is decentralized: Privacy The 1974 Act applies to government agencies, while the 2018 CCPA [9]applies to private companies, guaranteeing consumers' rights to access and delete data. In comparison, Uzbek legislation is more declarative, the concept of subject consent is underdeveloped, and there is no effective oversight or accountability mechanism.

In the United States, the approach to personal data protection is decentralized. The founding act is the Privacy Act . The 1974 Act regulates federal government activities, establishing requirements for the collection, use, and storage of citizen information. However, in the private sector, regulation is carried out at the state level. The most significant act is California. Consumer Privacy The Consumer Privacy Act (CCPA) of 2018, which grants consumers the right to know what data is being collected, request its deletion, and prohibit the sale of information to third parties. Thus, the American model is based on the principle of "information self-governance," giving citizens the ability to control the use of their own data.

However, the American system also has certain shortcomings: the lack of a unified federal data protection law creates fragmented enforcement and complicates cross-border regulation. Differences between states, such as between California and Texas, lead to legal uncertainty and increased administrative costs for businesses. However, the flexibility of the American approach allows for rapid adaptation to technological innovations, making it attractive to the commercial sector.

Unlike these jurisdictions, Uzbek legislation on personal data, enshrined in Law No. ZRU-547 of July 2, 2019, is more declarative. It lacks a detailed mechanism for civil protection, nor does it establish a system for subject consent in its modern forms (for example, revocable electronic consent). Furthermore, the law does not define criteria for "adequate protection" for cross-border data transfers, which hinders international cooperation and the participation of Uzbek companies in global digital services.

Chapter 5 of the Law of the Republic of Uzbekistan "On Personal Data" establishes a set of public and private law guarantees aimed at ensuring the security, confidentiality, and integrity of citizens' personal data. Unlike previous versions, the current structure of this chapter's provisions reflects the integration of the national regulatory model with international data protection standards, including the provisions of the EU GDPR and the provisions of Council of Europe Convention No. 108.

Article 27 formulates the general principle of state responsibility for creating an effective legal mechanism for protecting personal information. A systematic analysis reveals that the legislator identifies three levels of guarantees:

Legal level – consolidation of the rights and obligations of subjects and operators of personal data, including sanctions for violation of the established regime;

[8]Civil Code of the Russian Federation (Part One). https :// www . consultant . ru / document / cons _ doc _ LAW _ 5142/9 c 307 a 0 f 2164645 c 15 ca 4 e 3146 ff 5 f 6 e 56060 b 23/

[9]California Consumer Privacy Act (CCPA), 2018.

Organizational level – implementation of internal control procedures, instructions, regulations and data processing audit;

Technical level – application of certified means of information protection, encryption and secure storage.

Thus, responsibility for upholding citizens' rights is divided between the state as the guarantor and data processors as the direct executors. A central element is the individual's right to protection from interference with their privacy, which is consistent with the provisions of Article 27 of the Constitution of the Republic of Uzbekistan and Article 17 of the International Covenant on Civil and Political Rights.

Article 27^1 is a manifestation of the state's digital sovereignty, aimed at ensuring territorial control over data processing. The obligation to host servers and databases of citizens' personal data exclusively within Uzbekistan serves as a tool to minimize cross-border risks and the leakage of confidential information. The introduction of a database registry ensures the transparency and accountability of operators and allows the state to oversee the activities of digital economy entities. This territorial binding does not preclude the need for international data exchange, but it does require an adequate protection regime similar to the principle enshrined in Article 45 of the GDPR.

The law establishes a fundamental principle of personal autonomy: the prohibition of the dissemination and disclosure of personal data without the subject's consent. Unlike information openness, the confidentiality of personal data is mandatory, meaning it cannot be restricted by contract, except in cases expressly provided by law (for example, at the request of a court or investigative body).

It should be noted that the legislator has established not only the obligation not to disclose data, but also liability for its illegal use, including cases where information is used for scientific, literary, or commercial purposes without the subject's consent. This approach is consistent with the principle of " data Minimization — minimization of the volume of processed data and the purposes for which it is used.

Article 29 introduces an important distinction between confidential and open information. Data disclosed voluntarily by the subject is considered publicly accessible. This provision enshrines the principle of informed consent and provides for the possibility of revoking consent, ensuring a dynamic legal regime for personal data. The creation of open sources (phone directories, internet resources , biographical databases) is permitted only with written consent and the possibility of subsequent deletion of the information. This framework is intended to prevent the imposition of open access and ensure citizens have control over their digital image.

A significant aspect is the right of a subject to demand the exclusion of information from open sources not only upon personal request, but also by decision of a court or authorized body, which strengthens judicial protection and makes it a preventive tool.

Overall, the provisions of Chapter 5 form a comprehensive model for personal data protection based on the principles of legality, fairness, proportionality, and transparency. Their systematic interpretation demonstrates that the legislator seeks to combine privacy guarantees with digital security requirements, creating conditions for building trust in e-economy institutions and government online services.

Further development of this area requires the adoption of by-laws detailing the procedures for cybersecurity , operator certification and cross-border data transfer, as well as strengthening the institutional role of the Authorized Body for Personal Data Protection as an independent regulator.

It's also worth noting the inadequate institutional framework for oversight: the authorized government agency, the State Personalization Center, primarily performs registration and coordination functions, while its powers to investigate violations, impose sanctions, and protect the rights of personal data subjects are clearly limited. The lack of an effective accountability mechanism, including administrative and civil measures, reduces citizens' trust in digital platforms and hinders their right to privacy. Therefore, a comprehensive modernization of Uzbekistan's legislation, taking into account the principles of the GDPR and practices in the Russian Federation and the United States, is urgently needed. This will create an effective system for the civil protection of personal data.

It would be appropriate to include in the Civil Code of the Republic of Uzbekistan a provision explicitly recognizing personal data as an intangible asset. It is also necessary to clarify the procedure for compensation for moral damages in the event of violation of personal data rights, and expand the powers of the authorized body by providing for an administrative investigation mechanism. It is necessary to implement the right of data subjects to data portability and the "right to be forgotten," following the example of the GDPR . Clear criteria for the liability of personal data database operators should be established, including in the area of cross-border transfer.

Personal data is an important element of an individual's legal status. It is closely linked to the right to privacy and requires comprehensive civil law regulation. Improving the legislation of the Republic of Uzbekistan in line with international standards will increase trust in digital services and ensure a balance between the interests of the individual, society, and the state.

LEGAL ASPECTS OF PROTECTING THE POPULATION AND ENTREPRENEURS DURING THE TRANSITIONAL PERIOD OF ACCESSION TO THE WORLD TRADE ORGANIZATION

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Summary: *The article is devoted to the analysis of the legal, economic, and institutional aspects of Uzbekistan's accession to the World Trade Organization (WTO). It examines the key advantages and risks of trade liberalization, including its impact on national producers, small businesses, and socially vulnerable groups. Special attention is given to the transitional period — a legally justified stage for the gradual implementation of WTO obligations, ensuring the adaptation of the national economy to the conditions of international competition. Based on a comparative analysis of the experiences of countries with transition economies (Kyrgyzstan, Ukraine, China, and others), various strategies of WTO accession — from "minimal liberalization" to "liberal trade policy" — are identified. The article emphasizes the need for Uzbekistan to develop a balanced approach that combines the protection of the domestic market with the fulfillment of international commitments. The article provides a detailed examination of three key areas of legal adaptation. First, Utilizing WTO-permitted exceptions to the principles of the most-favored-nation regime and national treatment in order to support local producers. Second, simplifying trade procedures as a tool for reducing costs and enhancing transparency, including digitalization, the development of a "single window" system, and the creation of a legal framework for administrative regulations. Third, ensuring transparency and openness in the legal system in accordance with WTO standards, which contributes to strengthening human rights, improving the efficiency of public administration, and reducing corruption risks.*

Key words: *World Trade Organization (WTO); Uzbekistan; transitional period; trade liberalization; trade policy; legal protection mechanisms; international competition; trade facilitation; openness; transparency; national treatment; most-favored-nation regime; support for small business; protectionism; economic adaptation.*

Uzbekistan's accession to the World Trade Organization (WTO) implies the opening of the national market to international competition. This process brings not only economic advantages but also certain risks for vulnerable population groups and small businesses. In this regard, particular importance is attached to the analysis of legal protection mechanisms that can be implemented during the transitional period — before and immediately after accession to the WTO. The transitional period represents a legally justified timeframe for the gradual implementation of WTO obligations. It plays a crucial role in ensuring social stability and economic adaptation, allowing the state to introduce reforms flexibly without destabilizing domestic markets.

Drawing on international experience, several key factors affecting the activities of economic entities can be identified. The benefits and losses from WTO accession largely depend on the commitments undertaken by the candidate country during multilateral and bilateral negotiations on market access with WTO members, as well as on the chosen strategy of market liberalization.

For instance, Kyrgyzstan joined the WTO on December 20, 1998. Membership in the organization provided the country with a new model of economic development and a legal framework aligned with international standards. Since 2002, Kyrgyzstan's trade turnover has shown steady growth, with trade expansion rates with WTO members exceeding those with non-members, particularly in import volumes.

Currently, Kyrgyzstan maintains trade and economic relations with nearly 120 countries, most of which are WTO members. Despite the liberalization of trade policy, customs revenue increased more than threefold between 1999 and 2009, according to the Ministry of Economic Development and Trade of Kyrgyzstan. Moreover, the assumption that liberal trade conditions hinder foreign

investment has not been confirmed — since 2001, foreign direct investment has grown steadily, with a sharp increase in 2006–2007 reaching USD 200 million.[10]

It should also be noted that excessive liberalization may even lead to the bankruptcy of national producers. A vivid example of this is Ukraine's accession to the WTO, where the wine industry was among the first to feel its impact. The Ukrainian markets opened up to Western products while, at the same time, becoming technologically closed to Ukrainian wine. After the reduction of import customs duties, a flood of cheap grape juice and wine materials poured into Ukraine from Moldova, Georgia, Turkey, Azerbaijan, and other countries. For instance, Moldovan and Georgian wine raw materials were sold at a price of 2 hryvnias per liter, whereas the production cost of one liter of primary Ukrainian wine material for domestic wineries was 3–4 hryvnias. As a result, the products of Ukrainian grape growers became uncompetitive. Grape prices dropped to 50 kopecks per kilogram (with a cost price of 2 hryvnias), and even at that price, they could not be sold — some farms did not even begin the grape harvest.11.

When joining the WTO, each candidate country, taking into account the rules and norms of the organization, has a certain degree of flexibility regarding the restrictions and liberalization of its trade regime.

International practice shows that states tend to pursue either a strategy of "minimal liberalization" or a "liberal trade policy," while some combine elements of both. Countries that adopt the "minimal liberalization" strategy during WTO accession negotiations seek to open their domestic markets as little as possible — just enough to secure admission to the Organization. As a rule, such candidate countries are unable to achieve substantial access to the markets of other states. They seek to maintain a high level of protectionism in order to use it as a reserve for improving their access to foreign markets in future rounds of trade negotiations.

Some of these countries, such as Russia, employ this strategy when inefficient state-owned enterprises are undergoing restructuring. A significant level of protectionism is necessary for them during the transitional period. These countries usually submit initial proposals to bind import tariffs at levels considerably higher than those currently applied in practice.

Some transition economy countries that have recently become members of the WTO — such as Albania, Estonia, Georgia, Kyrgyzstan, Latvia, and Mongolia — although they pursued different strategies during the accession process, have adopted a "liberal trade policy" strategy in most areas.12.

This strategy implies the following:

a) binding most tariffs at a low level;

b) agreeing to liberalize the trade regime in agriculture and the services sector;

c) signing instruments such as the Agreement on Government Procurement, which enhances competition and transparency in the functioning of national markets.

China's accession to the WTO in 2001 combined elements of both strategies and raised a number of additional issues. 13.

Firstly, China used the process of accession to the WTO as an opportunity for substantial trade liberalization and the implementation of large-scale reforms.

Secondly, China — which in many respects can be considered a transition economy — positioned itself as a developing country and sought to obtain the right to a transitional period within the WTO framework, as well as a special and differential status granted to developing countries under WTO agreements. This status includes the waiver of the reciprocity principle, granting privileged market access and other benefits.

[10] Trade Policy and the Significance of WTO Accession for the Development of Russia and the CIS Countries. Guide / Edited by David G. Tarra — Moscow: Ves Mir Publishing House, 2006. — 588 p.

[11] International trade should help mobilise resources for development // Bridges between trade and sustainable development. January-February 2009, issue 1.

[12] The Endless Road of Russia, Belarus and Kazakhstan to the WTO// Bridges between Trade and Sustainable Development. June-July 2009, Issue 4.

[13] China initiates WTO proceedings over US ban on poultry meat // MOSTY News Digest. Two-week review of trade and sustainable development news. No. 6. 4 May 2009

The formulation of a country's WTO accession strategy and the assessment of evolving opportunities for its businesses in foreign markets should be carried out simultaneously. Therefore, it is essential to analyze the key trends in the development of international trade.

State Support for Domestic Economic Entities within the WTO Framework through Exceptions.

As practice shows, in international trade, restrictions on access to national markets for imported goods are increasingly applied on the basis of exceptions provided in WTO Agreements to the fundamental principles of this international organization, primarily:

the Most-Favored-Nation (MFN) principle;

the National Treatment principle;

the principle prohibiting non-tariff restrictions.

In international trade, there are significant deviations from the Most-Favored-Nation (MFN) principle, while WTO rules continue to be observed. According to approximate estimates, the share of export and import goods traded under discriminatory conditions (in one form or another) accounts for between one-third and one-half of global trade turnover.14

Foreign trade operations outside the MFN framework can occur in a number of cases. First, it is necessary to carefully study the WTO-permitted exceptions to the MFN principle. The most obvious possibility for deviating from MFN is related to regional agreements. Article XXIV of GATT provides exceptions to MFN for customs unions, free trade areas, as well as temporary agreements that precede the establishment of such arrangements. Deviations from this regime are also envisaged in the application of the Generalized System of Preferences. In modern conditions, WTO members increasingly justify the need to use general exceptions to restrict access of foreign goods to their markets in order to protect the life and health of their populations.15

Secondly, WTO documents provide for the application of RNBs to 'like (similar) products'. This raises the question of what constitutes 'similar products', which is usually linked to commodity classification and the setting of customs duty rates.16 It is not always easy to determine exactly how the obligation to provide RNB applies.

The United States also uses the Jackson-Vanik Amendment to deny the Most-Favored-Nation (MFN) status to certain countries. The text of the Jackson-Vanik Amendment is contained in Section IV of the U.S. Trade Act of 1974. Its main purpose is to prohibit granting MFN status in trade ("normal trade relations" in U.S. legal terminology) to countries with non-market economies that restrict their citizens' right to emigrate.

The Jackson-Vanik Amendment was passed by Congress in 1974. It was proposed in October 1972 by Senator Henry Jackson and Congressman Charles Vanik to pressure Communist bloc countries, including the USSR, due to violations of human rights, particularly the right to freely emigrate. At that time, Soviet authorities tried to prevent a "brain drain" by imposing various barriers on citizens wishing to emigrate, including high fees and refusal to issue necessary documents.

The list of countries to which the Jackson-Vanik Amendment currently applies has gradually decreased. The U.S. has granted normal trade relations to Armenia, Georgia, China, Kyrgyzstan, Latvia, Lithuania, Ukraine, and other countries—all members of the WTO. Today, the U.S. does not grant normal trade relations only to Cuba and North Korea. With the introduction of freedom of emigration in the USSR, the Jackson-Vanik Amendment lost its original significance.

The trade relations of the United States with eight former Soviet republics (Azerbaijan, Belarus, Kazakhstan, Moldova, Russia, Tajikistan, Turkmenistan, and Uzbekistan) are still formally subject to the Jackson-Vanik Amendment, but they benefit from a temporary waiver. To establish a

[14] Trade Policy and the Significance of WTO Accession for the Development of Russia and the CIS Countries. Guide / Edited by David G. Tarra — Moscow: Ves Mir Publishing House, 2006. — 588 p.

[15] Canada challenges South Korea's ban on its beef imports at the WTO // MOSTY News Digest. A two-week review of trade and sustainable development news. No. 6. 4 May 2009.

[16] Trade Policy and the Significance of WTO Accession for the Development of Russia and the CIS Countries. Guide / Edited by David G. Tarra — Moscow: Ves Mir Publishing House, 2006. — 588 p.

permanent and unconditional Most-Favored-Nation (MFN) trade status with these countries, the U.S. Congress must pass the corresponding legislation.17

Granting imported goods a treatment no less favorable than that afforded to competing domestic goods provides foreign suppliers with greater certainty regarding the regulatory framework governing their activities. At the same time, the requirement to provide national treatment often provokes dissatisfaction or disputes between countries, since it touches on domestic taxation and regulation and is therefore closely linked to reasonable and justified measures of national policy, which are not necessarily aimed at restricting imports and are consistent with GATT obligations.

In international practice, deviations from the national treatment of foreign goods most often occur on the basis of permissible WTO exceptions to national treatment, primarily general exceptions under this regime, as well as exceptions under GATT Article III:8 in the context of government procurement.18

At the same time, when a WTO member country modifies its exceptions to national treatment, other states often seek to challenge the legitimacy of its position.

2. Simplification of trade procedures. For companies operating globally, and especially for small and medium-sized enterprises (SMEs), the sheer number and complexity of national regulations themselves constitute trade barriers. Concern arises not only from the increasing number of required documents and procedures but also from the fact that they vary significantly across regions and countries. Both the measures companies must take to comply with domestic and foreign rules, and the long processing times at the border, are important cost factors.

After eight years on the WTO agenda as one of the Singapore Issues, the organization's members finally recognized the importance of this matter, and in the summer of 2004, they began negotiations on trade facilitation. The outcome is yet to be seen, but the negotiations focus on specific measures to simplify trade procedures. Concluding an agreement—albeit not as comprehensive as initially envisaged—is becoming increasingly likely.19

There is no single definition of the term "trade facilitation." Rather, it is defined differently depending on the discussion forum. For example, in 2001, the OECD defined it as "the simplification and standardization of procedures and related information flows necessary for the international movement of goods from seller to buyer and for the reverse flow of payments." The United Nations Economic Commission for Europe (UNECE) defined it as "a comprehensive and integrated approach to reducing the complexity and cost of trade operations and ensuring that all such activities can be carried out efficiently, transparently, and predictably, based on internationally recognized norms, standards, and best practices." For the purposes of this article, the term will be used in the WTO sense—as "the simplification and harmonization of international trade procedures, including activities, practices, and formalities related to the collection, presentation, transmission, and processing of data necessary for the movement of goods in international trade."20

In the current conditions of globalization, trade facilitation has become an important factor in enhancing the competitiveness of the economy. Uzbekistan's accession to the WTO requires not only the reduction of tariff barriers but also the harmonization of procedural mechanisms regulating the movement of goods across borders. Trade facilitation helps reduce costs, increase transparency, and attract investment.

Trade facilitation is an integral part of Uzbekistan's commitments on the path to WTO membership. Legal and institutional transformation in this area will make it possible to:

reduce costs for foreign economic activity participants;

improve Uzbekistan's positions in international rankings (Doing Business, Trade Logistics Index);

[17] The Jackson-Vanik Amendment: A Thorn in Trade Relations // Bridges between Trade and Sustainable Development. July 2009, Issue 5.

[18] Trade should be part of the solution, not part of the problem// Bridges between trade and sustainable development. January-February 2009, issue 1.

[19] Neufeld, Article X of the GATT 1994 – Scope and Application, World Trade Organisation Secretariat, 2002, WTO document G/C/W/374.

[20] Wilson, JS, Mann, CL & Otsuki, T 2004, "Assessing potential benefit of trade facilitation", World. Working Paper No. 3224 on Banking Policy Research, February.

stimulate export development and attract investment.

The implementation of WTO provisions should be accompanied not only by technical but also by legal changes aimed at increasing transparency, legal certainty, and regulatory efficiency.

In conclusion, regarding trade facilitation in Uzbekistan, the following measures can be proposed:

Full digitization of procedures through the transition to electronic declarations and the introduction of mobile solutions.

Expansion of the "single window" system by connecting all control and authorized agencies.

Legal regulation of service provision timelines, in particular for customs clearance, certification, licensing, and other procedures.

Creation of an independent appeals commission to resolve disputes between businesses and regulatory authorities.

Drafting a Law on Trade Facilitation in Uzbekistan.

Transparency in the WTO Legal Framework In addition to trade facilitation, transparency norms in the WTO legal context are directly and indirectly aimed at addressing issues within the domestic administrative legislation of its members.

Despite ongoing debates on whether Western liberal-democratic values conflict with Eastern cultural traditions in developing countries, Western transparency standards have recently gained both international and domestic recognition. They are now considered a key component of effective governance and public policy, applicable to both the public and private sectors. Christopher Hood and David Hild even described the recent emphasis on transparency as being "quasi-religious in nature."21. Transparency is an essential condition for democracy and is often seen as a panacea in the fight against corruption and poor governance. However, as with other "quasi-religious" phenomena, the nature and scope of transparency are not always clear. In this article, we will attempt to analyze the sources, adoption, and potential impact of transparency norms.

The demand for greater transparency is inevitably linked to what many commentators consider one of the fundamental human rights: the Freedom of Information (FOI). Article 19 of the Universal Declaration of Human Rights (UDHR), adopted by the United Nations General Assembly on December 10, 1948, collectively defines the basic rights of every person worldwide as follows: "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive, and impart information and ideas through any media and regardless of frontiers. "This establishes the international foundation for the connection between transparency and the free flow of information.22

Professor Anne Florini stated that Article 19 establishes a connection between the right to know and the right to speak. A free press is meaningless without the freedom to be informed. 23.

From a broader perspective, many scholars argue that the right to access documents held by government authorities should be recognized worldwide as a fundamental human right for several reasons, such as ensuring full participation in political activity and guaranteeing the functioning of democracy.24 More specifically, Mark Bovens (2002) emphasized that information rights should be regarded as an element of citizenship, part of constitutionally regulated civil rights, constituting a crucial step toward addressing existing accountability problems.25

Many scholars emphasize the role of the WTO as a "policy conduit."26

In the legal context, WTO transparency norms, ranging from Article X of the General Agreement on Tariffs and Trade (GATT) 1947 to Article X of GATT 1994, have been regularly

[21] TRANSPARENCY: THE KEY TO BETTER GOVERNANCE 135 (Christopher Hood & David Heald, eds., Proc. British Acad. Ser. 2006).

[22] G.A. Res. 217 (III) A, Всеобщая декларация прав человека (10 декабря 1948 г.), http://www.un.org/en/universal-declarati on-human-rights/index.html.

[23] Право знать: Transparency for an Open World (Ann Florini, ed. 2007).

[24] Toby Mendel, Freedom of Information: A Comparative Legal Survey (2d ed. 2008).

[25] Марк Бовенс, Информационные права, 10 J. POL. PHIL. 317, 341 (2002).

[26] Sudip Ranjan Basu, Does WTO accession affect domestic economic policies and institutions? (UN Conf. on Trade & Dev., Geneva, HEI Working Paper No: 03/2008, Feb. 14, 2008); Michael J. Ferrantino, Policy Anchors: Do Free Trade Agreements and WTO Accessions Serve as Vehicles for Developing-Country Policy Reform? (Off. Econ., U.S. Int'l Trade Comm'n, Working Paper No. 2006-04-A, Apr.

utilized by developed countries, whose strong economic power and reputation in the international community subsequently allowed them to impose their standardized policies on the WTO legal system.

The transition period at the beginning of WTO membership provides Uzbekistan with the opportunity to gradually implement legislative changes, minimizing negative impacts on domestic producers and entrepreneurs. During this period, the following measures are envisaged:

Elimination of subsidies and preferences: From January 1, 2025, subsidies and preferences provided to support exports, as well as low-efficiency tax and customs incentives, are planned to be abolished.

Unification of tax rates: Introduction of uniform VAT and excise tax rates for both the domestic market and imports.

Gradual liberalization of customs duties: Establishment of customs duties based on agreements with other WTO member states.

In addition, as part of its preparation for WTO accession, Uzbekistan is taking steps to improve consumer protection:

Simplification of certification procedures: Abolishing mandatory certification for certain goods, which reduces administrative barriers and increases the availability of products on the market.

Improvement of product labeling: Amending the labeling requirements for imported goods in the state language, which enhances consumer awareness.

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DEVELOPING THE PHYSICAL QUALITIES OF YOUNG WRESTLERS THROUGH ACTIVE GAMES

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Summary: *The article describes the theoretical and practical experiences of the development of physical qualities of wrestlers, the role of mobile games in the training of young wrestlers, and the technology of improving their technical and tactical skills.*

Keywords: *wrestling, active games, speed, selection, technical, tactical training, improvement, technology, sport, training, exercise.*

In recent years, consistent measures have been implemented in the republic to popularize physical education and sports, promote a healthy lifestyle among the population, create the necessary conditions for the physical rehabilitation of people with disabilities, and ensure the country's worthy participation in international sports arenas. [1]

The rapid development of children's and youth sports, the new tasks facing the training of young athletes, require more flexible coordination of the means and methods used by coaches. A game is a very physical activity, therefore it is of great importance in educational activities with children and youth. Open games are widespread among various types of children's and youth games. A distinctive feature of outdoor games is the specific role of actions within the game (running, jumping, throwing, shooting, passing and catching the ball, resistance, etc.). The movements of this tool are harmonized with the game plot (theme, idea). They are aimed at overcoming various difficulties and obstacles on the way to achieving the goal of the game. All players have an element of competition (each for themselves or each for their team), as well as mutual support and respect in the interests of achieving the goal. Collective games are characterized by a constantly changing situation in the game and require quick reaction from players. Therefore, relationships are constantly changing throughout the game: each child strives to create the most advantageous situations for themselves or the team compared to the "opponent." [2]

Open games contribute to the development and improvement of physical abilities. Furthermore, they develop and reinforce natural movements and individual skills acquired in gymnastics, track and field, basketball, volleyball, and other sports. When using outdoor games, it is important to remember that games serve as an auxiliary, supplementary exercise in the system of tools used in the learning process. Their importance should not be overestimated, and at the same time, their use for solving pedagogical problems at various stages of sports development should not be ignored.

In the long-term training process for highly qualified athletes, the continuous use of designated relay and game exercises not only creates opportunities for the effective development of speed, endurance, strength, agility, and speed qualities but also serves as the basis for mastering technical and tactical capabilities in a short time. [3]

Rooster fight

The game is played on the field, in the hall, or in the corridor.

Preparing for the game. A circle with a diameter of 2 meters is drawn on the ground. All players are divided into two teams and stand face-to-face in two rows near a circle. One leader is assigned to each team.



The characteristics of the game. The leader immediately separates the player from their team, and they enter the circle, holding their hands back and standing on one foot. As soon as a signal is given, they nudge each other with their shoulders and bodies, pushing and trying to get them out of the circle. The player who knocks their opponent out is considered the winner and earns one point for their team. Then, right in the middle, the next pair of "roosters" enter. The game continues until all the children have played the role of the rooster. The team with the most points is considered the winner.

Rules of the game.

1. If a player puts their other foot on the ground within the circle, they are considered lost.
2. If both players leave the circle when pushing each other, no one is considered the winner, and the next pair of roosters begins.
3. The roosters begin to fight only after each signal is given.
4. During fight, it is also forbidden to lower your hand.

Educational and upbringing value of the game. This game contributes to the growth of students' strength and helps them become quick-witted and comprehensible. The game cultivates the ability to give true recognition to one's own strength and the strength of one's peers, as well as the qualities of endurance to achieve the goal.

In this game, the players try to defend the honor of their teams. This, in turn, helps them develop a sense of responsibility to their team and the ability to correctly allocate the strength of the players in their team.

Resistance and struggle are the main actions in this game. These movements alternate with breathing. Each player participates in the game 1-2 times and watches the game for the rest of the time.

Methodological guidelines. This game cannot be divided into teams; players come to the center to compete voluntarily. The winning player remains on the field and competes with any new player who wants to fight them. As a result, the game continues. At the end of the game, the most successful players will be determined. If there are many players, they can be divided into four groups and play in two rounds. The manager must monitor the players' use of correct techniques. Sometimes the players nudge their opponents with their hands. This must not be allowed. During the "Rooster fight" game, attention should also be paid to maintaining roughly equal strength.

Pull over the line

The characteristics of the game. The players are divided into two equal teams. Both teams include players who are approximately equal in height and weight. A line is drawn through the center of the square or hall. The teams line up face-to-face from both sides of the line. Players of equal height and weight should be placed in front of each other. The scoring team stands 4-5 steps ahead of each team.

The game begins with the starter's signal. Each team tries to pull many of the other team's players over the line to their side. A pulled-over player must approach the accountant of the pulling-over team and touch their palm to their palm.

Only then will they have the right to cross the line and play for their team again. The accountants keep track of the players drawn. For each drawn player, the team receives one point. The team that scores the most points wins the game.



Rules of the game.

1. The player can only be pulled by holding their hand.

2. Several players can be drawn at once, in pairs, and simultaneously.

3. A player whose two legs are drawn across the line is considered to be drawn across.

4. It is forbidden to pull players by their clothes or feet.

Note. This game can be continued for up to a minute. After a short break, the game is repeated once more. Children with grown nails are not allowed to play.

Special movements of the game - holding and pulling, entering into a circle.

The characteristics of the game. Eight players are divided into 4-5 teams. Four circles are drawn on the ground, each with a diameter of 1-1.5 meters. Around each circle, two representatives of four teams, that is, 8 players, hold hands with each other. One counter (pointer) is assigned for each round.

The game begins with the leader's signal. Players walk in a circle, moving to the left or right (marked in advance) side, pulling and squeezing each other while keeping their hands in place, attempting to bring or stop the players within the circle. The player who steps into the circle loses 1 point. Those who let go of their hand while walking around the circle also lose points. After each mistake, the game is briefly stopped. Players who step into the circle are given the opportunity to step outside, while those who disengage their hands are given the opportunity to shake hands again. The team that receives fewer penalty points than the other team's players is considered the winner.

Rules of the game

1. After each break in the game, the direction of movement around the circle (right or left) is changed.

2. Rudeness in the game (blind nudge, kick, etc.) is prohibited.

The specific actions of the game are to hold hands and resist the "opponent's" strength.



Enclosing in a circle.

Game preparation: Students are divided into two equal teams. The players of the first team join hands to form a circle. The players of the second team take their places in the center.

The characteristics of the game. After the teacher's signal, the players standing in the center of the circle attempt to break out of the encirclement.

The players of the first team try to prevent them from escaping. The game continues for a set period of time. After that, the teams switch places. The team that manages to keep more players from the opposing team within the encirclement is considered the winner.

Rules of the game.

1. It is forbidden to tear off the players' hands and leave.
2. Jumping over hands is prohibited.
3. It is possible to crawl under the arm.

If the game is organized in an open area with soft soil, it is permitted to leave the enclosure in any way.

Conclusion: The physical qualities, tactical and technical preparation of young wrestlers are of particular importance for the results of athletes. A correctly constructed strategy allows for reliable execution during matches and provides the opportunity to defeat the opposing team. Without technical and tactical training, it is impossible to achieve high results. Without developing wrestlers' physical qualities (strength, speed, endurance, agility, flexibility), it becomes difficult for them to use these tactical and technical skills during their games.

In the training of young wrestlers, the parallel development of their psychological qualities is of paramount importance. It should be noted that achieving success in wrestling in certain situations requires not only the high development of all qualities, skills, and abilities, but also the development of quick thinking, analytical skills, the ability to differentiate, accurate assessment, attention, memory, anticipation, endurance, intelligence, and agility.

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Rezyume: *Maqalada gúresshilerdiń fizikalıq sapaların rawajlandırıw boyınsha teoriyalıq hám ámeliy tájiriybeler, jas palwanlardı tayarlawda ashıq hawada ótkeriletuǵın oyınlardıń áhmiyeti, olardıń texnikalıq-taktik sheberligin asırıw texnologiyaları kórsetilgen.*

Резюме: *В статье описаны теоретические и практические опыты развития физических качеств бор- цов, роль подвижных игр в подготовке юных борцов, технологии совершенствования их технико-тактических навыков.*

Kalit so‘zlar: *kurash, harakatli o‘yinlar, tezlik, tanlov, texnik, taktik o‘quv, takomillashtirish, texnalogiya, sport, trenirovka, mashq.*

Ключевые слова: *борьба, активные игры, скорость, отбор, техническая, тактическая подго- товка, совершенствование, техника, спорт, тренировка, упражнение.*

IMPROVING THE MANAGEMENT OF TOURISM DEVELOPMENT IN THE CONTEXT OF CROSS-BORDER TERRITORIES (USING THE EXAMPLE OF THE REPUBLIC OF KARAKALPAKSTAN)

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Summary. *In the Republic of Karakalpakstan, the tourism complex of the economy has unique cultural, historical and other potentials. Increasing the effectiveness of this activity requires taking into account regional peculiarities, including the cross-border nature of the territory. Based on the analysis of a number of studies, the article identifies sources of income from tourism activities and identifies some ways to improve industry performance management.*

Key words: *economic efficiency growth, regional tourism development, industry efficiency management.*

Tourism is a special branch of the modern economy. This industry is gaining the status of an industry and in many countries (USA, France, Italy, Great Britain, Greece, Spain, Egypt, etc.) is one of the most effective sectors of the economy.

Many studies have been devoted to the problem of economic efficiency of tourism. Thus, studying the modeling of the tourism potential of a regional entity, S.V. Zemlyak, O.M. Gusarova, E.V. Ganicheva, V.M. Kondrashov, "identified the factors constraining the development of the tourism industry of a regional entity, determined the influence of various types of trend models characterizing the dynamics of the incoming tourist flow of the region and its growth rates." In addition, they "performed an analysis of the quality of the constructed linear and nonlinear trend models. Recommendations have been formulated for the development of the tourism cluster of the regional entity." They noted that "Russian regions use various marketing mechanisms to promote regional tourism products based on their own understanding and awareness of the role and place of the tourism industry in the strategy of regional development"[1,4]. At the same time, the latter is assessed as a negative factor.

In their study, Kazybaikyzy A., Mukhanova A.E., Smagulova Zh.B. conducted a "brief analysis of the features of tourism development in the world", considered "the main functions of tourism as an industry (realization of value and consumer value contained in a tourist product, organization of the process of bringing a tourist product to the consumer (tourist), economic provision of material incentives to work); factors influencing the development of modern tourism; the positive and negative sides of the tourism industry (general economic factors, socio–demographic factors, cultural and socio-psychological factors, personality and behavioral factors)" [2, 6]. They also reviewed the prospects for the development of the tourism industry.

Gamidova A.E., and V.A. Plotnikov, studying the development and effectiveness of tourism as a type of economic activity, came to the conclusion "regarding the methods and expediency of state support for tourism in the future." [3, 5].

Considering the prospects of domestic tourism, Mamanabieva N.I., Muminova A.Z. note that "over the past few decades, there has been a significant surge in tourism development. This phenomenon has brought numerous benefits to the economy, culture and the population of the country, but it also creates a number of problems that need to be solved." They considered the prospects and problems of tourism development in Uzbekistan, highlighting the opportunities and obstacles faced by this sector" [4,3].

Exploring the socio-economic effectiveness of tourism, M. Morozova, based on an analysis of modern economic literature, shows "that the problem of researching the effectiveness of tourism activities is currently one of the debated and not fully developed. Distinguishing features of traditional and broad approaches, the expediency of using a new ("network") approach is substantiated, which differs from the existing ones in the following provisions reflecting modern ideas about the theory and methodology of research on the socio-economic effectiveness of tourism activities. He also notes

that at present "the content of the research object is expanding; the content is deepening and the nature of the research subject is becoming more complicated.... and the key task of performance management is changing" [5.6].

L. M. Shayakhmetova, exploring the issues of economic efficiency of investments in the tourism industry of the Republic of Kazakhstan, studied "mechanisms for attracting investments for the effective development of the tourism industry in the Republic of Kazakhstan and issues of consolidating investments in the industry" and identified "development prospects by analyzing the current situation." She "studied the indicators of the effectiveness of the investment process in the tourism industry and determined the prospects for development by analyzing the current situation." [6.3]

O. I. Kapustina, investigating the development of domestic tourism, believes that it is "necessary to replenish the budget, create new jobs, improve the lives of the population, and that public authorities need methodological tools to determine the most appropriate combination of forms and types of domestic tourism for a particular territory, as well as a mechanism for using the available resource base" [7. 9].

Researchers D.N. Shaikin, D.O. Abutalip, A.J. Bekmatova, considering the issues of assessing the dynamics of sustainable development of the tourism economy in the Republic of Kazakhstan, "supplemented the methods of assessing the dynamics of sustainable development of the tourism economy in modern conditions" [8.6].

Thus, these developments show the breadth of the geography of researchers, the complexity of the topic under consideration, and the availability of various approaches and methods of solutions.

The main feature negatively affecting the effectiveness of the tourism business in the region under study is the cross-border nature of the territory of Karakalpakstan.In the north and northeast, the Republic borders on sparsely populated areas of Kazakhstan, and on the south with sparsely populated areas of Turkmenistan. Karakalpakstan is located far from the industrial centers of Uzbekistan, such as the Ferghana Valley, Tashkent and Samarkand agglomerations with high population density. The region, with its unique masterpieces of cultural heritage, gets inadequate results as a result. According to an estimated estimate, as a result of such a dislocation, the tourism business of Karakalpakstan loses up to 40-45% of local tourism visits and up to 17-25% of foreign tourism, which must be taken into account in the strategic plans for the development of the industry.

It should be noted that over the years of independence, there has been a significant increase in the number and quality of facilities that make up the tourism infrastructure, and the human resources potential of the industry has grown. The task of the researchers is to find new ways to increase the efficiency of tourism, so that it becomes a powerful sector of the regional economy and ensures a multiple increase in employment due to the creation of new jobs with decent wages.

The literature notes that the development of tourism activities can play a crucial role in the rise of regions characterized by low indicators of economic development. Tourism has a multiplier effect, stimulating various sectors of the economy and creating new opportunities for local communities. In the context of depressed regions, tourism can become a powerful catalyst for:

1. Creating jobs and increasing incomes of the population:

Direct employment: The tourism industry provides a wide range of jobs, ranging from low-skilled positions (maids, waiters, drivers) to those requiring special training (guides, instructors, hotel managers). This is especially important for regions where traditional industries are in decline and where unemployment is high. By providing alternative sources of income, tourism helps to reduce social tensions and improve the quality of life of the population.

Indirect employment: The development of tourism stimulates the growth of related industries such as agriculture (food supplies for restaurants and hotels), transport (taxi services, bus transportation), handicrafts (production of souvenirs and traditional products), construction (construction of new accommodation facilities and infrastructure). This creates additional jobs and increases the incomes of the population employed in these related sectors.

Entrepreneurship: Tourism provides opportunities for the development of small and medium-sized businesses. Locals can open their own guest houses, restaurants, souvenir shops, organize

excursions and workshops. This contributes to the development of an entrepreneurial culture and the formation of a middle class, which is an important factor for sustainable economic development.

2. Stimulating economic growth and economic diversification:

Attracting investments: The tourism potential of the region can attract both domestic and foreign investments in infrastructure development, construction of hotels and other accommodation facilities, and the creation of entertainment complexes. Investments in tourism contribute to the modernization of the region's economy and increase its competitiveness.

Increase in tax revenues: The development of tourism activities increases tax revenues to local and regional budgets through income taxes, VAT, tourist tax and other taxes. These funds can be used to develop infrastructure, education, healthcare and other socially significant projects, improving the quality of life of the population.

Economic diversification: Tourism can become an alternative to traditional but declining sectors of the economy. By developing the tourism sector, the region reduces its dependence on one or more types of activities and becomes more resilient to economic shocks. This is especially important for regions where the economy is heavily dependent on mining or agriculture.

3. Preservation of cultural heritage and the environment:

Raising awareness of cultural heritage: Tourism promotes the cultural heritage of the region by drawing attention to historical monuments, traditions and customs of the local population. This stimulates interest in the preservation and restoration of cultural heritage sites, as well as supports the development of folk crafts and crafts.

Promoting environmental protection: The development of eco-tourism contributes to the conservation of the region's natural resources and biodiversity. Tourists who come to the region to enjoy its natural beauty are interested in preserving the purity of the environment. This creates incentives for the introduction of environmentally friendly technologies and farming methods, as well as to combat poaching and illegal logging.

Community Support: Tourism can be a tool to support local communities by providing them with access to new markets and opportunities.

The development of rural tourism allows farmers to sell their products directly to tourists, and the development of ethnographic tourism allows locals to share their culture and traditions with guests.

4. Infrastructure development and quality of life

improvement: Infrastructure construction and modernization: The development of transport, energy and communal infrastructure is necessary for the development of tourism. The construction of new roads, airports, power plants and water supply systems improve the quality of life not only for tourists, but also for local residents.

Improvement of services: Competition in the tourism industry stimulates the improvement of the quality of services. Hotels, restaurants, shops and other service businesses strive to provide their customers with the best possible service, which leads to higher standards of service and an improved quality of life in the region.

Improving the level of education and qualifications: Qualified personnel are needed to work in the tourism industry. The development of tourism stimulates the creation of new educational institutions and training programs for specialists in the field of tourism and hospitality. This increases the level of education and qualifications of the population, which contributes to its competitiveness in the labor market.

However, in order for tourism to truly become a catalyst for the economic development of a depressed region, a number of important factors must be taken into account.

Integrated approach: The development of tourism should be part of a comprehensive strategy for the development of the region, taking into account its specifics, resources and potential. It is necessary to take into account the interests of all stakeholders, including the local population, business, government and environmental organizations.

Sustainable development: Tourism should be developed in a sustainable manner, minimizing the negative impact on the environment and cultural heritage. It is necessary to introduce

environmentally friendly technologies and farming methods, as well as support the development of responsible tourism that benefits local communities.

Human capital development: It is necessary to invest in education and professional training for the tourism industry. It is important to train the local population in service, management and entrepreneurship skills so that they can successfully participate in the development of the tourism sector.

Marketing and promotion: It is necessary to effectively promote the region as a tourist destination using modern technologies and marketing strategies. It is important to create an attractive image of the region and attract the target audience of tourists.

Government support: The government should support the development of tourism in depressed regions by providing tax incentives, subsidies and grants for investors and entrepreneurs. It is important to create a favorable investment climate and stimulate the development of small and medium-sized businesses in the tourism sector.

In conclusion, the development of tourism activities can become a powerful tool for boosting the economic development of the region in question. However, this requires careful planning and management of tourism development, taking into account its social, economic and environmental impacts. With the right approach, tourism can become a catalyst for sustainable economic growth, improving the quality of life of the population and preserving cultural heritage and the environment. It must be remembered that tourism is not a panacea, and it must be developed in conjunction with other measures aimed at diversifying the economy and creating new opportunities for the local population. Consideration of potential sources of effectiveness of the tourist complex has shown that some of them are not actively used, further research should be conducted to increase the impact of these sources. Only in this case, tourism will be able to make a significant contribution to improving the socio-economic situation in the region.

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Rezyume: *Qoraqalpog‘iston Respublikasida iqtisodiyotning turizm kompleksi katta salohiyatga ega. Ushbu faoliyat samaradorligining o‘sishi mintaqaviy xususiyatlarni, shu jumladan hududning chegaralanishini hisobga olishni talab qiladi. Maqolada bir qator tadqiqotlar tahlili asosida turizm faoliyati natijasida daromad olish manbalari aniqlandi va sanoat samaradorligini boshqarishni takomillashtirishning ba’zi usullari aniqlandi.*

Резюме. *В Республике Каракалпакстан туристический комплекс экономики обладает уникальным культурно-историческим и иными потенциалами. Рост эффективности этой деятельности требует учета региональных особенностей, среди которых трансграничность территории. В статье на основе анализа ряда исследований определены источники получения доходов в результате туристической деятельности и выявлены некоторые пути совершенствования управления эффективностью отрасли.*

Kalit so‘zlar: *iqtisodiy samaradorlikni oshirish, mintaqaviy turizmni rivojlantirish, samaradorlikni boshqarish.*

Ключевые слова: *рост экономической эффективности, развитие регионального туризма, управление эффективностью.*

INFLUENCE OF EXOGENIC FACTORS ON ECONOMIC GROWTH (ON THE EXAMPLE OF THE REPUBLIC OF KARAKALPAKSTAN)

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Summary. *The article is based on the need to assess the impact of exogenous factors on economic growth. The impact of exogenous factors on economic growth in GRP growth was assessed based on statistical analysis. Based on the results, proposals and recommendations for the innovative development of the region have been developed.*

Key words: *economic growth, exogenous factors, endogenous factors, Solov model, innovation, investment, models of economic growth.*

Growth is an indicator of a country's economic situation. Economic growth is necessary for any country. Economic growth serves as the basis for solving socio-economic problems in the country, is the primary factor in the development of an innovation-based economy, and is the main result of scientific, technical, and institutional development. Economic growth is achieved through the sustainable development of the national economy.

Economic growth is a complex, multifaceted phenomenon studied by all theoretical schools of economists.

In the Address of the President of the Republic of Uzbekistan to the Oliy Majlis, "Ensuring macroeconomic stability and curbing inflation is the main task in the process of economic reforms..." was defined as a program and target task that needs to be implemented in the economic sphere in 2020 and subsequent years. In solving these tasks, the main directions were defined as "introducing an inflation targeting system," "reducing prices by ensuring healthy competition," "developing a strategy for creating a competitive environment in the economy," "further strengthening control over the targeted and rational spending of budget funds," "deep analysis of the factors of the emergence of the "shadow economy," and defining a program to combat it.[1]

The problem of choosing exogenous or endogenous models of economic growth is currently one of the central problems of economic growth theories. Recently, the theory of economic growth has become a separate, relatively separate part of economic theory. Nevertheless, this phenomenon is not yet complete for a final interpretation and drawing clear conclusions. Consequently, the main goal of the policy makers of each country should be the elimination of factors limiting economic growth and the correct use of economic laws for future development, having an understanding of the factors that caused previous development. These circumstances make it relevant to develop effective mechanisms for using exogenous and endogenous growth models of the economy.

Literature review. Despite the fact that the theory of economic growth as a separate branch of economic science was formed at the beginning of the 19th century, many fundamental ideas were expressed much earlier. For a historical and economic analysis of the development of modern growth theory, representatives of the classical political school, whose political ideas served as a starting point for 20th-century scholars, made a fundamental contribution.

Theories of exogenous and endogenous economic growth require factor analysis. The theory of exogenous growth helps to determine the possibilities of balanced growth in the country's economy[2] and to find the factors that determine long-term economic growth.[3]

Most studies conducted by world economists focus on approaches to determining economic growth in relation to factors in the production of products per capita.

The presence of the factor of exogenous technological development of economic growth, while allowing for continued growth in per capita income in the country, does not provide information about the reasons for the growth. Therefore, the policy of economic growth loses its essence, since the main growth factor of an exogenous nature cannot influence state policy. According to Solov's theories, by changing the internal factors of economic growth (in particular,

budget and tax mechanisms), the state cannot provide long-term growth opportunities for economic growth rates.

Romer sees technology as "endogenous," a central part of the economic system, and a key driver of growth. In his opinion, although any technological breakthrough is random, in general, the economy has determined through economic growth models that it develops in direct proportion to the funds spent on technologies. According to Solov, the technology is "exogenous," that is, random, and seems to have simply fallen from the sky.[5]

Scientists of our country, Makhmudov N.M., Khakimov Kh.A., classify new theories of endogenous growth into 4 groups, including new Keynesian theories of economic growth, new classical theories of economic growth, empirical theories of economic growth, new theories of endogenous growth.

From scientific sources and empirical research, it is clear that without studying all important models of exogenous growth, it is impossible to ensure sustainable growth. General conclusions on this matter have been proven in the scientific research of the following scientists: Harrod[7] and Domar[8], Solow[9], Swan[10], Barro[11] (1996), Alhassan[12], and others.

In general, the emergence of new economic systems in our republic in recent years requires an assessment of the factors ensuring macroeconomic stability and economic growth indicators based on exogenous system models.

Methodology. The increased attention to the problems of economic growth in the region is explained, on the one hand, by the need to equalize regional imbalances in their economic development, and on the other hand, by the interdependence of macroeconomic and regional processes: changes at the regional level sometimes lead to unexpected consequences at the macroeconomic level and radically change the trend of economic growth.

Taking into account scientific theoretical approaches, it is possible to build models of economic growth based on the methodology of ordering exogenous growth factors recommended by Russian scientists for building an economic growth model[14]. As the main dependent variable expressing economic growth, indicators of the growth of gross regional product (GRP) and foreign trade turnover over time per capita are used. Independent variables influencing economic growth include the following endogenous factors:

Expenses for technological innovations:

Investments in fixed capital;

Foreign direct investment;

Regression equations are obtained based on the SPSS package statistics.

Analysis and Results. Despite unfavorable environmental conditions, ensuring macroeconomic and social stability and implementing reforms in all sectors of the economy have positive trends. The region's economic growth rates were higher than the national average in 2005-2017 (3.0 times) [14].

In recent years, a number of positive shifts have occurred in macroeconomic indicators. Thus, the share of industry in the gross domestic product increased by 26.7 percent. The gross regional product has grown, and this trend can also be observed per capita.

It was calculated without foreign direct investment, which was chosen as an exogenous variable influencing economic growth. The main reason for this is the presence of foreign direct investment in the structure of total investments.

Model results for assessing the influence of selected exogenous factors on economic growth

Model		Non-standard coefficients		Standard coefficients	T	N
		B	Standard error	Beta		
1.	(Constant)	218,659	502,999		0.435	0.675
	Innovation costs	0.527	0.192	0.390	2.750	0.025
	Investments	0.822	0.246	0.367	3.340	0.010
	Export	11.108	3.851	0.339	2,884	0.020

The main results of the obtained model are reflected in the table, where the volume of GRP per capita increases by 0.527 thousand soums due to per capita expenditures on innovations. Also, due to investments per thousand soums per capita, the volume of GRP will increase by 0.822 thousand soums. The main factor ensuring economic growth is exports, and it was determined that due to the export of thousand soums per capita, the volume of GRP will increase by 11.108 thousand soums. From these facts, it is clear that economic growth is mainly associated with the volume of exports. This circumstance leads to the conclusion that economic growth relies more on the export of raw materials.

The results of the obtained model for assessing the impact of direct investment on economic growth as an exogenous factor are presented in the table below.

Model results for assessing the influence of selected exogenous factors on economic growth

Model		Non-standard coefficients		Standard coefficients	Non-standard coefficients	N
		B	Standard error	B		
1.	(Constant)	552.155	463.959		1.190	0.268
	Innovation costs	0.862	0.162	0.638	5.308	0.001
	Foreign direct investment	1.354	0.421	0.246	3,213	0.012
	Export	11.445	3.939	0.349	2,906	0.020

The data show that due to foreign direct investment per thousand soums per capita, there is an increase in GRP by 1.354 thousand soums, the coefficient of determination according to the selected statistics R^2 =0.976. This circumstance confirms that the impact of foreign investment on economic growth is higher than that of domestic investment.

Summary and recommendations. Based on the analysis results, it is necessary to accept growth theories in two main approaches. The first is the development of various approaches to the process of economic growth, its sources and main factors. In this case, it can be obtained mainly by analyzing and understanding the ideas of scientific schools in the field of economics and the opinions of representatives of economic sciences. The second approach involves creating models specific to each country based on economic growth theories.

The results of the analysis conducted to assess the influence of exogenous factors on economic growth made it possible to determine that the development of the region relies only on raw material exports. In turn, the role of innovations and investments in ensuring the possibilities of economic growth was practically not felt. Taking these circumstances into account, it is recommended to develop targeted strategic programs to increase the influence of the following exogenous factors on ensuring economic growth in the republic:

The low effectiveness of investments attracted to the region in relation to economic growth (excluding future investment returns), the lack of systematic attention to existing natural, environmental, and demographic factors in investment policy reflect the inefficient use of attracted investments. Taking this circumstance into account, the direction of investments in the region should be considered as a priority.

The study also revealed that the role of funds implemented in the region and spent on innovation in ensuring economic growth is not high. Most of the innovations being implemented in the republic are technological innovations, and it is recommended to direct the funds allocated for innovations to process and marketing innovations. The factor of entrepreneurship is considered as an important factor in the competitiveness of the region and national innovation systems. The development of education, science and technology, and the creation of favorable institutional conditions for innovative growth should be considered a priority.

Economic growth of the region, first of all, the recognition of human and intellectual capital as strategic resources, as well as their effective use for economic purposes, should be considered as the main strategic direction.

All of the above justifies the need to develop fundamentally new theoretical and methodological approaches to the formation of an innovative system. Expansion of the use of global intellectual property and information systems as an exogenous factor of economic growth also has a positive impact on economic growth.

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Резюме:. *Мақолада иқтисодий ўсишига экзоген омиллар таъсирини баҳолаш зарурияти асосланган. Иқтисодий ўсишга таъсир этувчи экзоген омилларнинг ЯҲМ хажмини ўсишига таъсири статистик таҳлиллар асосида бахоланган. Олинган натижаларга асосланиб, минтақани инновацион ривожлантиришга қаратилган таклиф ва тавсиялар ишлаб чиқилган.*

Резюме: *Статья основана на необходимости оценки влияния внешних факторов на экономический рост. Влияние внешних факторов на экономический рост прироста ВРП оценивалось на основе статистического анализа. На основании полученных результатов разработаны предложения и рекомендации по инновационному развитию региона.*

Калит сўзлар: *иқтисодий ўсиш, экзоген омиллар, эндоген омиллар, Солов модели, инновация, инвестиция, иқтисодий ўсиш моделлари.*

Ключевые слова*: экономический рост, экзогенные факторы, эндогенные факторы, модель Солова, инновации, инвестиции, модели экономического роста.*

COMPETENTIAL APPROACH TO THE DEVELOPMENT OF STUDENTS' CREATIVE ACTIVITY

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Summary: *The article presents information on some problems related to the competency-based approach in the development of creative activity of students of higher educational institutions and their solutions.*

Key words: *student, creativity, competence, creativity, competency-based approach, component, professional activity, creative activity.*

A number of scientific studies are being conducted on improving heuristic technologies for the development of students' creative competencies based on the priority of qualimetric aspects, clarifying the didactic principles of designing innovative models for preparing future teachers for problem-based social activity. In particular, in higher education, the improvement of the methodological system for the development of students' creative competence through the orientation of subjects towards professional fields, the expansion of pedagogical opportunities for enhancing students' creative abilities based on the design of problem-based learning technologies, and the development of methodological methods for forming students' thinking abilities are of particular relevance.

The theoretical foundations of the implementation of the competency-based approach in our country are reflected in the research works of U. Inoyatov, N. Muslimov, O. Musurmanova, B. Khodzhaev, and others.

In the countries of the Commonwealth of Independent States, the main content of the formation of students' creative abilities was studied by O.Butorin, E.Zeer, I.Sukhikh, N.Khryasheva.

In the scientific research of foreign scientists K. Rogers, R. Sternberg, P. Torrance, A. Maslow, practical and technological aspects of the development of creative thinking and creative abilities are reflected.

The concepts of "creativity" and "creative" come from the English language and mean the ability to create, creativity. Although the initial interpretations of these concepts were studied by D. Simpson, S. Kaplan, J. Renzulli, and other scientists, in our opinion, the views presented in their research are not sufficiently substantiated.

When comparing the definitions of "creativity" in the psychological dictionary and "creativity" according to P. Torrance, it was revealed that these two terms differ from each other: flexibility of thinking, the desire to seek new knowledge, the ability to go beyond existing "templates." When talking about creative activity, it is advisable to think about the nature of the combination of these two terms [4].

The process of developing students' creative activity based on a competency-based approach forms professional and creative competence in the specialist. Based on the analysis results, the following components of creative competence were identified within the framework of the study [2. P. 7-8]:

- motivational-personal component - the need for creative activity, awareness of the personal and social significance of creative activity, active manifestation of interest in the results of the creative process, awareness of the need for constant self-improvement;
- cognitive component - operations of creative thinking and cognitive methods (analysis and synthesis, comparison, generalization and classification, concretization, induction and deduction, abstraction, modeling); algorithms and strategies of creative activity;
- activity component - reliance on problem-research methods in the implementation of creative activity; personal readiness to apply algorithms and strategies of creative activity;
- reflexive - evaluative component - a person's readiness to assess their capabilities and make adjustments to subsequent actions in order to determine productive methods of creative activity.

Summarizing the results of studying the concept of "preparation for professional activity," reflected in psychological and pedagogical literature, I. Sukhikh established different levels of preparation for professional activity. Based on these levels, the levels of students' readiness for creative activity are designed according to the following table (Table 1) [3. P. 49].

Table 1.Levels of students' preparation for creative activity

Levels	Indicators
Personal-creative	Formation of personal abilities necessary for carrying out creative activity.
Functional-creative	The ability to use physical and mental resources necessary for creative activity.
Personal-activity-creative	A holistic manifestation of creative, personal qualities and skills that allow one to effectively perform assigned problematic tasks.

Thus, based on the analysis of creativity, creative activity, creative thinking processes, components of creative activity, as well as criteria, indicators, and levels, the following conclusions were made:

1) according to the methodological structure of creative activity, the following tasks of its formation can be distinguished:

- development of motivational and personal orientation of students towards the profession being mastered;
- equipping with technologies for organizing creative activity;
- formation of methods of reflection and objective self-assessment, skills of emotional and volitional management of creative activity.

2) From a socio-pedagogical point of view, the main task is the formation of creative activity in students at a level that provides them with effective educational and professional activity and develops the ability to acquire independent knowledge throughout life.

3) Clarification of the concept of "criteria for assessing the levels of development of creative activity" as a qualitative indicator of personality development, requiring a certain period and expressing various manifestations of creative activity [5. -142 p].

Further expansion of the development of students' creative and analytical thinking skills, the introduction of research into the educational process by research institutions, as well as in developed foreign countries

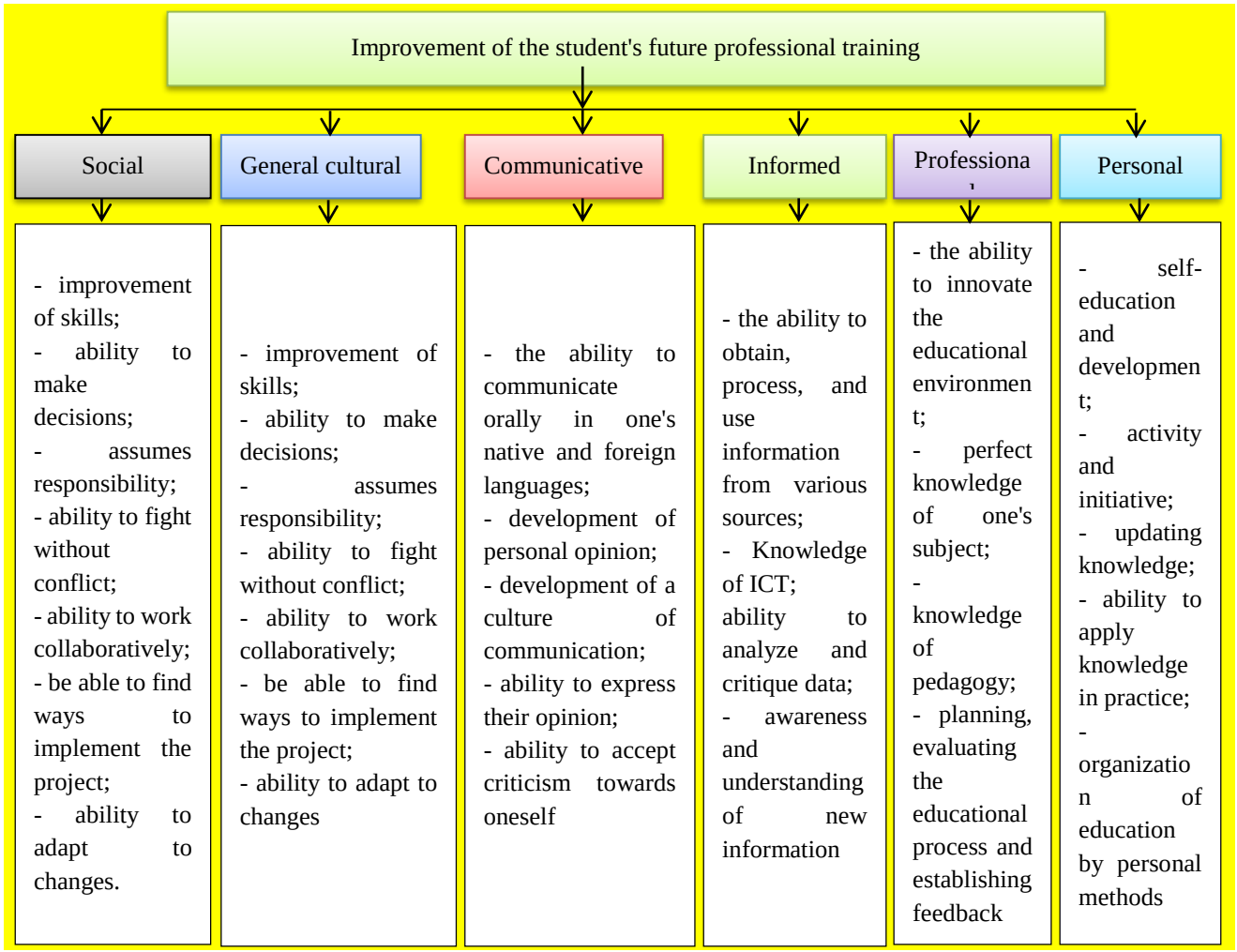


Figure 1. Mechanisms for improving the professional and methodological training of students

In conclusion, it should be noted that in the development of students' creativity: the student's attitude to the educational process, the subject, and the educational material; a clear definition of the educational goal; a thorough justification of the educational content; effective and interesting organization of the educational process; the teacher's creative approach to the organization of the educational process; the correct formation of the educational material in accordance with the students' theoretical knowledge and level of training; the appropriate, purposeful, and effective use of didactic, modern technical, and information and communication tools in the educational process; the correct choice of optimal methods for the teacher to fully reveal the essence of the educational material; the organization of an educational lesson in an effective form, based on the needs, desires, and interests of students; the teacher's sincere, trusting attitude towards students.; taking into account the individual and personal characteristics of each student, as well as their mental activity during the training process; clearly defining the expected result in accordance with the educational goal is extremely important. Therefore, when organizing the educational process, it is necessary to pay attention to this aspect of the issue.

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Rezyume: *Maqolada oliy ta’lim muassasalari talabalarining ijodiy faoliyatini rivojlantirishda kompetensiyaviy yondashuvga oid ayrim muammolar va ularning yechimlari haqida ma’lumotlar keltirilgan.*

Резюме: *В статье представлена информация о некоторых проблемах, связанных с компетентностным подходом в развитии творческой активности студентов высших учебных заведений и их решениях.*

Kalit so‘zlar: *talaba, kreativlik, kompetentlik, kreativlik, kompetensiyaviy yondashuv, komponent, kasbiy faoliyat, kreativ faoliyat.*

Ключевые слова: *студент, креативность, компетентность, креативность, компетентностный подход, компонент, профессиональная деятельность, творческая деятельность.*

COGNITIVE BASICS OF PROJECT EDUCATION IN THE TRAINING OF CIVIL ENGINEERS

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Summary: *This article examines the current state of project education in the engineering field, and in particular in civil engineering, and its role in shaping students' creative and cognitive skills. Despite the widespread introduction of the project method into educational programs, many approaches remain limited by the framework of traditional problem solving, without revealing the potential of design as an integrating learning mechanism. Special attention is paid to the cognitive basis of project activity, including constructivism, steady-state learning and the theory of cognitive flexibility, which contribute to students' ability to adapt knowledge to new contexts and conditions.*

Key words: *project, project education, cognitive flexibility, Ustoz-shogird system, scaffolding*

Introduction. Project-based education is widely promoted as a method for developing creative problem-solving skills. National education standards and qualification requirements for construction disciplines include in their criteria an integrative design experience, usually implemented as a core course, typically a thesis project, which is actually carried out during the final year of study [1]. In addition, many departments, faculties, and even universities in the field of engineering education pay special attention to the development of innovative project activities to improve the level of engineering training.

However, the considerable efforts of individual universities and even specialized councils do not address the cognitive basis of design and do not fully utilize design activities as a mechanism for integrating and consolidating the technical training that underpins engineering programs. Thus, the large volume of published works describing specific examples of design courses in civil engineering bachelor's degree programs suggests that design education, as it is currently implemented, may not address the fundamental questions of what it means to engage in engineering design and may not fully prepare students for real-world design work. In this article, we will examine not only the background of current work in the field of engineering design, but also the spectrum for understanding how design can be implemented to improve undergraduate programs, and discuss alternative models of engineering design.

There is a vast amount of material devoted to discussing engineering design and formulating theories about design, and this work will not present an exhaustive discussion of the many ideas about what design is, nor will it attempt to derive a comprehensive theory of engineering design.

We will also not describe theoretical work in the field of computer-aided design or design support here. However, we will present an overview of different perspectives on the nature of design and what design education should include. We will consider works on education in the field of engineering design, both in the form of final courses and in introductory courses, and make comparisons with education in the field of architectural design.

Project-based education as an integrative form of education. Design is a creative and integrative activity that combines higher-order cognitive skills, i.e., analysis, synthesis, and evaluation, to create an artifact that may be physical or otherwise. This broad definition encompasses the various perspectives with which specific disciplines view design activity. Computer design researchers often discuss routine, adaptive, and creative design. These descriptions embody varying levels of originality and innovation. For example, many computer scientists (and especially artificial intelligence researchers) characterize design as a problem-solving procedure that is best performed by searching a solution space (the range of possible solutions to a given problem) for the solution that best satisfies a given set of criteria. They usually refer to this type of design as routine. Routine design can also include simple detailing of structural elements, such as determining the cross-section of steel beams or calculating the required cross-section of reinforcement in reinforced concrete based on the

required resistance—something that many engineering educators consider to be mechanical problem solving.

Adaptive design involves accepting existing solutions and modifying them as necessary to meet a new set of criteria. In engineering, this may involve modifying designs to change support conditions and is often identified with research in the field of computer-aided reasoning based on specific cases. Viewing design in either of these ways may suit researchers who need to translate design decisions, rules, and procedures into computer code, but these perspectives ignore much of the design activity that relies more on innovation and creativity. Although routine and adaptive aspects are certainly part of design, this work will focus more on the creative aspect.

Creative design focuses on an original response to a specific situation, stimulus, or set of criteria, and although lessons learned from previous projects and prior experience may be incorporated into a new project, the designer must come up with a solution that is unique to that set of conditions. The more artistic qualities of design reach their peak at the other end of the design spectrum, starting with computer science, in the visual arts (painting, sculpture, and even, to some extent, architecture), where the more artistic, creative, and nonlinear diversity of design is embraced. It is in this creative dimension of design that the locus of real engineering also lies.

Theoretical schools of design. All these different points of view, generated by the context and practice of design in various fields, contribute significantly to differences of opinion both about design theory itself and about how design should be taught. The various schools of design theory can be divided into three groups. The first school is the traditionalist view that design is "empirical in nature" and that creativity cannot truly be taught, a view that also opposes scientific design theory. This group usually includes the traditional contingent of the visual arts. The second group, as a reaction to the first, consists mainly of engineering scientists and others, in general, analysts who see no real content in design education. This group argues that no meaningful design discipline can emerge until it can be expressed in mathematical terms. At this end of the spectrum, with this more rigid view of design, is the part of the computer science community that seeks to reduce the design process to a set of rules encoded on a computer. The third and final school represents a more modern view of design, which encompasses much of the traditional school but requires a degree of scientific approach to the study of design. The basic principle of this group is that design is a cognitive activity that can be studied by cognitive scientists.

Nevertheless, there is a widespread belief among engineering professors and students themselves that a "project" is something that is taught in a strictly limited task of solving higher-level classroom work, for example, in reinforced concrete or steel "design," which can truly be called detailing. Typical curricula tend to view engineering education as largely based on engineering disciplines and focused on analysis and clearly defined questions with specific answers. While some advanced educators have demonstrated a deeper understanding of the overall picture of design, the small number of projects that exist in most current curricula often simply take the form of more open-ended problems that have multiple alternative solutions. Some argue that design is more than just solving an open-ended problem, characterizing it as a highly integrated process that requires more time and effort to teach and learn.

Further evidence that engineering educators are beginning to pay more attention to design education can be seen in how some authors draw inspiration from resources such as Teaching Reflective Practice: Towards a New Design of Teaching and Learning Professions [2]. The book offers a look at how knowledge is structured differently in formal education and a guide to bringing this knowledge and real-world learning closer together, including teaching and practical activities. It proposes reflection in action as the key to engineering knowledge, implemented in a reflective workshop where students learn design not only by acquiring theoretical knowledge, but also by interacting with their teacher-trainers in problem-solving, formulating and rethinking questions, experiments, demonstrations, simulations, hypothesis testing, and frequent debates and discussions.

Reflexive practice in project-based learning. Reflective practice aligns with many ideas in cognitive theory about learning in the ustoz-shogird style and can lead to critical thinking and continuous learning. Recently, researchers and administrators have begun to call for a critical

evaluation of engineering education in terms of whether it prepares students to become engineers. The shortcoming of current curricula is that they teach engineering as problem solving rather than decision making, do not consider external influences on how a project should be evaluated, and do not consider uncertainty. Therefore, we must improve the curriculum by including the tools engineers need so that students become good designers. Project-based education has much to offer in equipping students with these tools. However, the culminating experience of designing may not be sufficient to teach students how to design, or perhaps more appropriately, to enable students to learn how to design. This thesis aligns with a view of design that is more closely aligned with the more traditional empirical version found in architecture schools, combined with a recognition of the cognitive skills and benefits provided by and inherent in design education.

Design activity is inherently constructive; designers actively outline, develop, and create an object or artifact. Therefore, many implications of constructionism can be applied here. As discussed earlier, many other cognitively oriented computer-based educational tools also use design as a constructive activity to organize student learning. It is important to note that design activities, even when embedded in a software environment, are much more than just using software. Students are actively involved in creating the artifact, provided and inherent in design learning.

Project development begins at the very beginning, as the designer must define the problem, a particularly important component of engineering design, since problems are usually not clearly defined, providing context for constructive activity to define the solution: literally, creating context for building the solution. The designer must also integrate the relevant knowledge necessary to create a solution; extract stored knowledge or learn new information as necessary. Using a combination of experience, trial and error, creativity, and heuristics, the designer creates or designs a product or solution that meets the project requirements.

Once a solution or set of alternatives has been generated, the designer can compare the available options to find the best solution and assess how well the chosen solution meets the design criteria. Successful design may require several iterations of these tasks. The above description is not a rigid definition of the design process, but rather a way of illustrating the constructive activity inherent in design.

The cognitive basis of project-based learning. The cognitive skills underlying these activities stem from higher levels of Bloom's taxonomy: analysis, synthesis, and evaluation. These activities are present in both students and practicing designers, but are performed at different levels of proficiency. Although these cognitive skills may be, and in fact often are, separated into distinct parts of the design process, an alternative and perhaps more accurate model is recognized as the internal interdependence that these skills imply in design activities. Although each of Bloom's levels includes skills that lie below, these cognitive skills become even more intertwined when carrying out a project [3]. This connection is due not only to the iterative nature of design (where evaluation occurs during reanalysis), but also because a project combines skills into a single stream of activity. During problem definition, which is often viewed as an analysis procedure, designers actually evaluate criteria, for example, by sorting them by importance, or synthesize the problem definition from previous experience.

Integration of project-based learning into engineering programs. Perhaps a more effective model of design activity, especially for such a complex and cognitively demanding field as civil engineering, is cognitive flexibility, which not only illustrates how constructive design activity is, but also provides a better understanding of the various possibilities that a designer must learn and have at their disposal in order to be successful. The theory of cognitive flexibility asserts that the traditional constructivist model of retrieving intact knowledge structures is incomplete and that instead, the designer must flexibly reconstruct relevant background knowledge into a useful set of information specifically tailored to the particular situation or task. This kind of knowledge reassembly is vital for effective problem solving in complex, poorly structured, and open-ended domains such as civil engineering, and for work above the elementary level of education. Furthermore, in helping students learn and engage in design, cognitive flexibility does not reduce problem solving to simplified

examples, but rather immerses the student in the complexity of the problems and then helps the student cope with that complexity.

Cognitive learning also offers some specific advantages for design education. The methods of ustoz-shogird and situational learning are evident in many aspects of design studio work. Through closer interaction with the studio instructor, who guides students' learning, authentic projects, and by offering a more comfortable learning environment and powerful assessment mechanisms through studio critiques and jury reviews, the studio effectively provides the benefits of cognitive learning and problem-based learning for design education. Scaffolding, built into the studio, also supports instructional design using a cognitive flexibility model. The cognitive basis of design is given special attention because, although it is not always explicitly discussed by practitioners and researchers in the field of design, the cognitive foundations of constructivism, especially the ideas of spatial cognition, cognitive learning, and cognitive flexibility, strongly influence both how a project is made and how it is studied.

Conclusion. Thus, project-based education, as currently implemented in most civil engineering departments, does not seem to be realizing its potential as a central organizing element of the engineering curriculum and educational model. The idea that design is an empirically acquired skill, the teaching of which can be based largely on cognitive science, raises further questions about whether design education in engineering schools is being considered in the proper context, because design is often viewed simply as the solution of open-ended problems. When used centrally, as in the architectural school model, the project can serve as the primary integrating tool and driving force behind the curriculum, helping students actively acquire and apply engineering knowledge, as well as laying the foundation for students to recognize the need for continuous learning skills and support their development.

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EXPERIENCE OF DEVELOPED COUNTRIES IN ASSESSING THE DIVERSITY OF BANK LOANS

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Summary: *This article presents a thorough analysis of foreign experience in assessing collateral for bank loans. Focusing on the examples of the USA, Germany, and Great Britain, the study reveals different approaches and strategies applied in these countries. The article examines the key principles and methods of valuation, their advantages and disadvantages, as well as current challenges and prospects in the field of collateral valuation.*

Key words: *collateral valuation, bank loans, foreign experience, USA, Germany, Great Britain, valuation methods, valuation challenges.*

Collateral valuation plays a vital role in bank lending operations by protecting financial institutions from potential credit risks. Although the collateral valuation process is gaining more attention in emerging markets, many of them have not yet fully adapted to modern valuation methods. At this time, foreign countries with developed financial markets, such as the US, UK and Germany, have already introduced modern and sophisticated collateral valuation methods. In this article, we provide an overview of foreign experience in the field of collateral valuation, which can serve as a model for emerging markets.

Collateral valuation is a critical element in the banking lending industry, as it provides protection to financial institutions from potential credit risks. Methodologies and practices used for valuation of collateral vary considerably from country to country, depending on the level of financial sector development and legal frameworks. Foreign experience in collateral valuation can provide valuable lessons for developing countries.

According to a 2022 World Bank report, approximately 40% of borrowers in developing countries have difficulty obtaining loans due to inefficient collateral scoring systems. In the same countries, the share of overdue loans averages 12%, which is three times higher than in developed countries. These findings highlight the importance of improving collateral valuation systems.

At the same time, developed countries with strong banking infrastructures, such as the US, UK and Germany, have implemented sophisticated and efficient collateral assessment systems to reduce risk and improve access to credit. For example, in the US, the share of overdue loans is only 2.7%, and in Germany this figure is even lower - 1.7%. This speaks to the high efficiency of collateral assessment systems in these countries.

The importance of collateral in the banking system cannot be overestimated. As part of lending, collateral is a guarantee of reimbursement of the bank's funds in the event of default by the borrower. As such, it serves as a powerful risk management tool for banking institutions. Proper collateral valuation is key to building an efficient and stable financial system.

The collateral appraisal process involves assessing the value of the assets that the borrower is willing to pledge as collateral. The assessment is carried out in order to determine their real market value and liquidity, as well as to exclude possible legal problems associated with the ownership of collateral assets.

Correct collateral assessment helps to manage risks, reduce the probability of losses from loan defaults, and also ensures the protection of the interests of all parties in the lending process. For the borrower, this is a guarantee that he will be able to get the loan he needs, and for the bank - that in case of non-payment, he will be able to return the borrowed funds by selling the collateral.

However, despite the importance of the collateral valuation process, many developing countries face problems in their valuation systems. Often these problems are associated with a lack of standards and regulations in this area, an imperfect legal system, as well as a lack of qualified appraisers and insufficient transparency of the appraisal process.

In this article, we review foreign experience in the field of collateral valuation and discuss its applicability in the context of developing countries.

Materials and Methods. Our research data is based on analysis of the banking sector and collateral valuation systems in the US, UK and Germany. We have used publicly available sources of information such as statistical reports, academic papers, reports from international financial institutions, and reports from government agencies. Based on the collected data, a comparative analysis of collateral assessment methods was carried out.

Many scholars and researchers have studied collateral assessment systems in various countries. The main areas of their work can be divided into the following categories: study of collateral valuation methodology, study of factors affecting the valuation, and study of foreign experience.

Levy and Schwartz (1999) deal with the issue of real estate valuation as collateral. The authors emphasize the importance of such aspects as market value, as well as the level of risk associated with the possibility of changes in real estate prices. They also offer a collateral valuation model that takes into account not only the current value of assets, but also the risk of impairment.

Gibler and Schwarzbach's (2004) research focuses on the impact of regulation and the legal system on the valuation of collateral. They conclude that a lack of clarity in legislation can seriously complicate the assessment process and increase risks for creditors.

A report by the International Monetary Fund (IMF, 2005) provides an overview of collateral valuation systems in developed countries. It includes an overview of the main assessment methods used in different countries, as well as their main advantages and disadvantages.

The work of Benton et al. (2007) is devoted to the study of the impact of financial crises on the valuation of collateral. The authors come to the conclusion that financial crises can significantly reduce the value of collateral assets and increase risks for creditors.

In general, the review of the literature shows that the valuation of collateral is a complex and multifaceted process that depends on many factors, including the state of the economy, the market situation, the legal system, and even global financial trends.

Duffie and Garleanu (2017) conducted a study of collateral valuation approaches in the context of financial innovation. They argue that in the era of digitalization and the use of artificial intelligence, new approaches to assessment are needed that can be more accurate and adaptive..

Tan and Stevenson (2018) researched the Australian real estate market and applied several collateral valuation methods. Their work highlights the importance of using multiple approaches to improve the accuracy of the estimate.

The book by Askari and Gonzalez (2019) provides a general overview of collateral valuation methods in different countries, including an analysis of new technologies and valuation algorithms. They highlight the importance of considering local market conditions and regulatory considerations when choosing a valuation approach.

The work of Hofmann and Santos (2021) is an analysis of the application of machine learning in collateral assessment. They argue that the use of artificial intelligence can significantly improve the accuracy of the estimate and reduce the cost of this process.

Results. The analysis showed that in developed countries, various methods of collateral valuation are used, including the market approach, the value approach and the income approach. In the USA, for example, the market approach is more often used, which is based on comparing the prices of similar assets in the market. In the UK and Germany, banks often use an income approach based on the expected return on the asset.

Table 1. Comparative analysis of foreign experience in the field of collateral assessment for bank loans.[27]

[27] Created by the author

Authors	Country/Region	Basic Approaches to Valuation	Features of the approach
Duffie and Garleanu	General review	Use of digital technologies	Emphasis on financial innovation and the use of AI
Tan and Stevenson	Australia	Multiple Approaches	Emphasis on the importance of using multiple methods
Askari and Gonzalez	International review	Use of technologies and algorithms	Emphasis on taking into account local market conditions and regulatory features
Hofmann and Santos	General review	Machine learning	Emphasis on the use of artificial intelligence to improve accuracy and reduce costs

Analyzing the information presented in Table 1, several important conclusions can be drawn.

First, all the countries studied have established detailed regulations and standards for valuation of collateral, confirming the importance of this process for the banking system. Note that most countries actively use the approach based on the assessment of market value.

Second, there is a difference in the degree of regulation of collateral valuation. In some countries, such as the US and the UK, the collateral valuation function is highly regulated and standardized, while in others, such as India and Australia, collateral valuation approaches can be more flexible and varied.

Thirdly, foreign experience emphasizes the importance of transparency and openness in the process of valuation of collateral. This includes not only a detailed description of the valuation methodology and assumptions used, but also the mandatory certification of appraisers and their independence from credit institutions.

Fourth, there are specialized institutions and organizations for valuation of collateral that provide training, certification and ongoing education of appraisers, which contributes to maintaining a high level of professionalism in the industry.

Finally, in practice, many countries have developed unique approaches and technologies for processing collateral transactions, including the use of digital technologies and automated valuation systems.

Comparing the experience of the US, Germany and the UK, one can see interesting differences and similarities in approaches to valuation of collateral.

Germany: In Germany, the field of collateral valuation is also highly regulated, but it is distinguished by a greater emphasis on manual valuation and expertise. In addition to assessing the market value, Germany also applies the principle of sustainable value (Beleihungswert), which provides for a more conservative assessment of the value of real estate, taking into account potential risks.

United Kingdom: In the UK, the approach to assessing collateral is flexible. The valuation of collateral is carried out by licensed appraisers in accordance with the standards of the Royal Institution of Chartered Surveyors (RICS). The collateral valuation system in the UK is notable for its openness to innovation, and digital and automated valuation is currently on the rise.

In general, it can be said that in all three countries the valuation of collateral attaches great importance to reliability and accuracy, although approaches to achieving these goals may differ significantly.

Discussion. Foreign experience in valuation of collateral emphasizes the importance of a diversified approach to the process. Different valuation methods may be applied depending on the type of collateral, its characteristics and market conditions. Based on this experience, developing countries can adapt these methods and customize them to their unique circumstances. However, institutional and regulatory considerations are also important to consider, as effective collateral valuation requires transparent and stable financial markets, reliable real estate and collateral data, and trained valuators.

Due to the significant differences in collateral valuation approaches in the US, Germany, and the UK, as well as the unique market characteristics of each of these countries, it is important to be careful when applying any of these approaches in other contexts.

However, certain conclusions and lessons can be learned:

1. Automation and digitalization: The US and UK are actively using automated valuation systems, which allows for fast and accurate collateral valuation. These aspirations may well be applied in other countries, given the global digitalization trends. At the same time, it is necessary to take into account the risks associated with automation, such as vulnerability to data manipulation and the unpredictability of artificial intelligence.
2. Balance between market and sustainable value: Germany offers an interesting approach using sustainable value in addition to market value. This may be of particular interest to countries with unstable property markets or high levels of economic uncertainty.
3. Strict regulation and professional standards: All three countries adhere to strict professional standards and regulation in the field of collateral valuation. This highlights the importance of having clear and transparent rules in this area.

Based on these findings, countries seeking to improve their collateral valuation systems can explore these different approaches and apply the relevant aspects in their own context, taking into account the specifics of their markets and economic conditions.

Conclusion. Valuation of collateral is a complex process that requires specific skills and knowledge. Foreign experience offers valuable lessons for developing countries seeking to improve their assessment systems. In doing so, it is important to remember that each country is unique and must adapt generally accepted assessment methods to its own conditions and circumstances.

Collateral valuation plays a critical role in bank lending and we can explore different approaches and strategies based on foreign experience in the US, Germany and the UK. Based on this experience, we can draw the following conclusions:

1. **Technology:** The use of new technologies, including automated valuation systems, can significantly improve the efficiency and accuracy of collateral valuation. However, it is important to consider the possible risks associated with this approach.
2. **Valuation sustainability:** Germany's approach to using sustainable value in addition to market valuation can be particularly useful in an environment of economic uncertainty and volatility in real estate markets.
3. **Regulation and standards:** Clear and transparent professional standards and regulation, as in the US, Germany and the UK, are key to maintaining trust and predictability in the collateral valuation industry.

In general, foreign experience offers many lessons and strategies that can be applied in other contexts. However, it is important to remember that each approach requires adaptation to the unique conditions and characteristics of a particular market. Critical analysis and understanding of foreign experience can significantly contribute to the development and improvement of the collateral assessment system in each country.

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Rezyume: *Ushbu maqolada bank kreditlari garovini baholash bo‘yicha xorij tajribasi chuqur tahlil qilingan. Tadqiqot AQSH, Germaniya va Buyuk Britaniya misollariga e’tibor qaratib, ushbu mamlakatlarda qo‘llanilayotgan turli yondashuvlar va strategiyalarni aniqlaydi. Maqolada*

baholashning asosiy tamoyillari va usullari, ularning afzalliklari va kamchiliklari, shuningdek, garovni baholash sohasidagi dolzarb muammolar va istiqbollar ko‘rib chiqiladi.

Резюме: *Эта статья представляет собой тщательный анализ зарубежного опыта в оценке залога для банковских кредитов. Сосредоточиваясь на примерах из США, Германии и Великобритании, исследование обнаруживает различные подходы и стратегии, применяемые в этих странах. Статья рассматривает ключевые принципы и методы оценки, их преимущества и недостатки, а также актуальные вызовы и перспективы в области оценки залога.*

Kalit so‘zlar: *garovni baholash, bank kreditlari, xorijiy tajriba, AQSH, Germaniya, Buyuk Britaniya, baholash usullari, baholash muammolari.*

Ключевые слова: *оценка залога, банковские кредиты, зарубежный опыт, США, Германия, Великобритания, методы оценки, вызовы оценки.*

FORMATION OF THE ECONOMY - THE BASIS OF SUSTAINABLE DEVELOPMENT

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Summary: *This article discusses the importance of new ideas and innovations as vital conditions for ensuring the competitiveness of entities to increase the share of export-oriented goods and the total factor productivity of resources (TFP) based on examples.*

Key words: *innovation, competition, market mechanism.*

Our state today is an integral part of the international community and the global financial and economic market. This is evidenced by the ever-expanding ties with the outside world, the implementation of programs for the development, modernization, technical and technological re-equipment of economic sectors with the support of leading developed countries, and the successful implementation of the five priority areas of the country's further development. In the context of globalization, increasing the country's competitiveness, enhancing its economic potential, widespread introduction of innovations, and, on this basis, the rational use of resources are the key to sustainable development and improving the living standards of the population. The purpose of the article is to study the state of development of the republic's economy, factors, efficiency of resource use, and opportunities for sustainable economic growth.

The essence, goals, factors, and process of formation of the economy were studied by domestic and foreign scientists D.Romer, Chen Derek, L.N.Orlova, T.Sh.Shodiyev, and others. In particular, D. Romer considers the formation of an intellectual economy, that is, the economy of knowledge, and the role and importance of innovations in it to improve the living standards of the population and ensure sustainable economic growth at the post-industrial stage of development. He proposed an endogenous model of economic growth and emphasized that intellectual potential, a complex of knowledge, new ideas, and innovations have become the main factors of development. Chen Derek, speaking about the innovative economy, that is, the four pillars of the knowledge economy in his definition: the economic external environment, the knowledge complex, the innovation system, and information and communication technologies, proposed a multifactorial econometric model of economic growth. L.N.Orlova studied the indicators of the innovation economy and the problems of ensuring competitiveness. T.Sh. Shodiev studied the state of creation, important scientific and methodological aspects of the formation and development of the knowledge economy and tried to create its econometric model. As a result of the research, a draft program for the innovative development of the national economy for 2012-2020 was developed at the UN Office in our country.

Methodological approaches to the study of the process of forming a new qualitative stage of innovative development, innovative developments, research on ensuring sustainable economic growth through the introduction of new technologies and products at enterprises are of both theoretical and practical importance. The level of formation of the knowledge economy or, in other words, the innovative economy, statistical indicators and factors, analysis through the combination of qualitative and quantitative methods of analysis, based on econometric models, have not been comprehensively studied. This problem has also escaped the attention of researchers.

The article notes that within the framework of the "2018 Year of Supporting Active Entrepreneurship, Innovative Ideas and Technologies," the intellectualization of economic activity requires increasing the role of intangible resources in production, ensuring the priority of the share of intellectual labor in the volume of goods, and the widespread use of market mechanisms in the liberalization and regulation of the economy. The development of a strategy for the innovative development of the national economy in the future is of great practical importance today. Therefore, in September 2018, the Strategy for Innovative Development of the Republic of Uzbekistan for 2019-2021 was adopted, and measures for its implementation were defined.

When studying the process of innovative development of the economy and the implementation of the Action Strategy, statistical data on the country's development in previous years, dynamic series,

averages, dispersion, variation, correlation, and regression equations were used in their comparison, analysis, and synthesis. Finally, when determining the factors and sources of economic growth, a two-factor model was created and the marginal efficiency of each factor (resource), the limits of resource exchange and optimal combinations were determined, the absolute and relative "net" impact of each factor on GDP was found, the coefficient of total efficiency (TFP) of capital and non-labor factors was determined, and the directions of sustainable economic innovation development were determined.

In the research process, such methods as a didactic approach, systematic and logical analysis, statistical observation, statistical summation, time series, correlation and regression analysis, and economic-mathematical modeling were used. The indicators of the State Statistics Committee's socio-economic development of the country in recent years were used as a database. In the form of a research hypothesis, it is assumed that the formation of an innovative economy is a means of ensuring sustainable development and competitiveness.

In the process of economic globalization, the competitive environment is changing rapidly, which requires companies and enterprises to create innovations and introduce innovations so as not to decline in market conditions. Currently, innovation occurs through the continuous introduction of new products, scientific developments, marketing, and management methods into practice in fundamental research, applied developments, and pilot sites. The logic of technological development and potential markets are equally valuable sources of innovative ideas. In other words, innovations can be created bypassing the stage of scientific research, where the idea arises, the concept is developed, and the development itself is carried out.

Innovation is not always about using a completely new product or process. Innovation is often the effective combination of previously known elements in a new compound. This does not diminish the importance of fundamental and applied research. However, they are addressed when difficulties arise, that is, first the results of practical work are analyzed. In the study of the process of intellectualization of the economy, first of all, the fulfillment of the tasks of the Action Strategy for the further development of the country requires further development and liberalization of the economy, reducing state intervention in the economy, using more market mechanisms in regulating the economy. In an in-depth study of this process, we use production functions.

Today, it is very necessary to develop the innovative potential of the national economy, including its reconstruction in the sphere of small business, to promote the unification of scientific organizations and science-intensive production enterprises in order to introduce high-tech developments and eliminate the consequences of the disconnection of science from production, which occurred during the period of reforms, to directly and indirectly support innovative activity and applied scientific research. Support for the innovative activity of small business entities should be one of the priority areas of state policy in the field of innovation. Small innovative business (SMB) is an integral link in the regional innovation system, a developer of effective innovations, their consumer, and an intermediary between science and production.

It is necessary to recognize the general understanding of the importance of information and knowledge in economic development, to recognize the importance of introducing innovations in ensuring competitiveness in political circles, businessmen, and enterprise managers. This direction cannot be ignored as a factor of development. Society and the economy are considered "reflexive systems," changing the perception of factors of economic growth automatically changes these systems and influences their development. Understanding the importance of knowledge and innovation forms modern management trends that determine, to a certain extent, the behavior of firms in markets and their development strategy. Understanding this at the state level encourages the development of state strategies and programs for the development of a knowledge-based economy. Today, one such strategy is the Action Strategy, which has been adopted and is being successfully implemented.

Intellectual activity testifies to the formation and development of innovative social production. "Innovative production is a production that forms the basis of technologies, know-how, new combinations of production factors, the use of new knowledge embodied in the structure of

organization and management of production, allowing to obtain intellectual income and an advantage over competition. In this case, the sources of innovation changed from traditional research institutes, design bureaus, and relevant departments of R&D to product consumers, marketing departments. At the macroeconomic level, the effectiveness of innovations is manifested in a decrease in the resource intensity of manufactured products per unit of output and an increase in the overall productivity of factors. In recent years, the dynamics of the overall effectiveness of factors in our republic averaged about 3 percent.

Currently, the share of new products and developments in the products manufactured in the country's industries and enterprises is increasing. In particular, the dynamics of innovative goods, works, and services in the sectors of our economy is as follows.

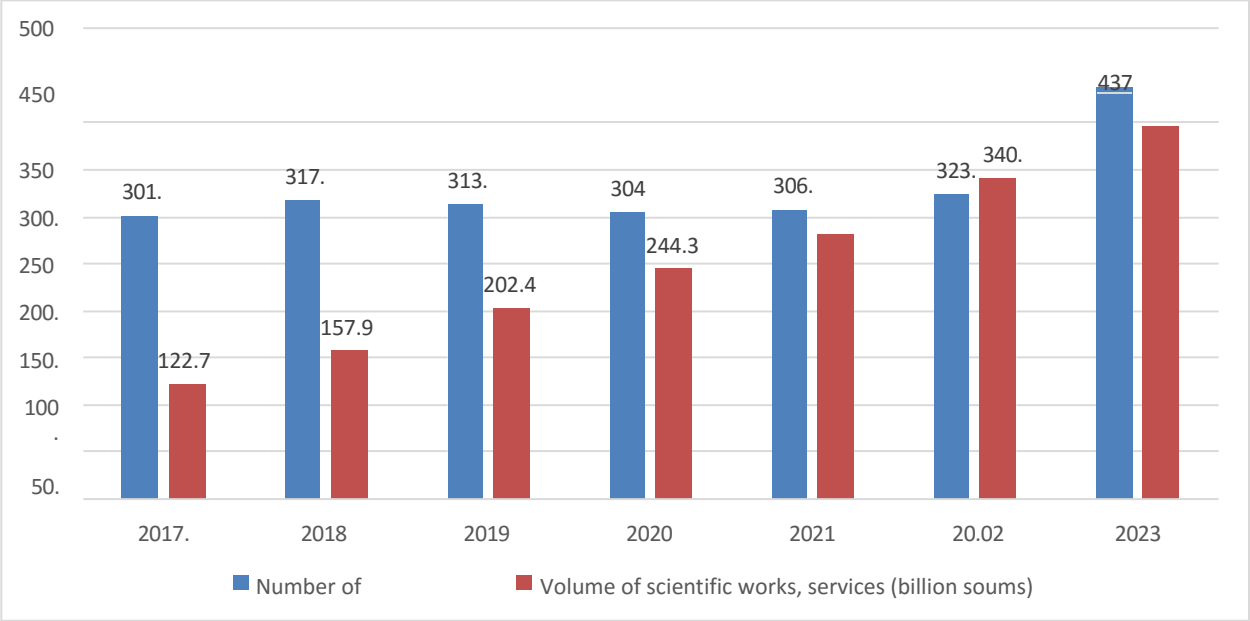


Figure. Dynamics of organizations carrying out research and development work (2020-2023)

It is gratifying that enterprises themselves are finding funds for innovative ideas and developments. If in 2023, innovations were financed mainly from the organizations' own funds (by 69.7%). In 2023, funding from organizations' own funds increased by 6.4 times compared to 2020. An increase in the share of innovative goods, works, and services produced in our country in economic sectors has been observed. The number of enterprises and organizations producing innovative products, works, and services has increased.

Objectively speaking, such laboratories as small business enterprises, startups, incubators are a natural and convenient sphere for the development of innovative processes.Therefore, it is necessary to continue the economic reforms being carried out in our country in terms of supporting innovative ideas and developments in small business and private entrepreneurship enterprises, paying great attention to saving resources at the macroeconomic level, especially the efficient use of intangible resources.

It is advisable to consider an innovative economy as a promising economy, which requires the continuation of the policy of structural transformations and accelerated development of modern industries and production areas based on high technologies, aimed at increasing competitiveness and strengthening positions in the world market, as the main priority. To achieve an innovative economy, it is necessary to: firstly, to establish cooperative relations between education, science, and production; secondly, to finance the production of innovative products by the enterprise based on cooperative relations; thirdly, to create the possibility of applying scientific and technological achievements to the production process of the enterprise; fourthly, to develop measures to create benefits for enterprises producing innovative products.

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Rezyume: *Maqolada milliy iqtisodiyotning barqaror rivojlanishi uchun yangi g‘oya va innovatsiyalarni ishlab chiqarishga keng joriy etish korxonalarning raqobatbardoshligini oshirishi, eksportbop mahsulotlar ulushini kengaytirish muhimligi va shu tariqasida resurslarning umumiy unumdorligini oshirish mumkinligi misollar orqali tahlil etilgan.*

Резюме: *В статье на примерах обосновывается значение внедрения в производство новых идей и инноваций как важного условия обеспечения конкурентоспособности предприятий, повышения доли экспорта ориентированных товаров и совокупной эффективности ресурсов (TFP).*

Kalit so‘zlar*: innovatsiya, raqobat, bozor mexanizmi*

Ключевые слова*: инновация, конкуренция, рыночный механизм*

THEORETICAL AND LEGAL BASIS OF DEPOSIT OPERATIONS

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Summary: *This article describes the concept and essence of savings operations, the concept of types of bank deposits, and an analysis of national legislation in the field of regulating savings operations. Also, the legal basis of bank deposits has been thoroughly studied.*

Key words: *Bank deposit operations, deposit operations, deposits of individuals and legal entities, banks and other credit institutions*

The concept of savings operations is defined differently in legislation and legal literature, i.e., in textbooks, study guides, and articles. For example, a deposit operation is the attraction of funds in the form of deposits from banks, credit organizations, their placement, as well as lending operations using attracted deposit funds.[1]. In addition, deposit operations are understood as operations consisting of attracting and placing funds in the form of deposits of individuals and legal entities.[2]. In our view, this definition is too narrow and does not fully reveal the concept of a savings operation.

At the same time, several definitions of the concept of savings operations have been given by scholars in the field of law, and they differ from each other. For example, according to T.E. Rozhdestvenskaya, a savings operation is understood as the attraction of funds by credit institutions from an indefinite circle of persons on the basis of various civil law transactions.[3].

In his scientific work, A.G. Bratko defines deposit operations as follows: "operations carried out to store deposits of individuals and legal entities in a bank are called deposit operations."4].

Some scholars have presented savings transactions in a very simple form. In these definitions, not all elements of savings operations are presented, but only the main ones are emphasized. In particular, according to D.A. Shevchuk, deposit operations are a type of banking operation related to attracting funds in the form of deposits of individuals.[5]. Since this definition represents a narrow range of characteristics, we cannot include it among the generally accepted definitions.

From this point of view, the efforts of some scientists to reveal the essence of savings operations are noteworthy, however, we can see that some features have been omitted in their definitions.

As can be seen from the above definition, a savings transaction mainly consists of the following elements:

Attraction of funds;

storage of funds for a certain period;

return of funds;

accrual and payment of interest for the use of funds.

Like any institution in the field of banking law, deposits are divided into several types.

Various classifications of bank deposits are given in the legal literature. We will consider them below.

Depending on the repayment period, a bank deposit is divided into two types: a demand deposit and a term deposit. In a demand deposit, a bank deposit agreement is concluded before the first demand deposit is received. Term deposits, on the contrary, are accepted by the bank with a fixed term.

Depending on the subjective composition, bank deposits can be divided into two types:

1) deposits of individuals;

2) deposits of legal entities.

In addition, a bank deposit can be divided into a deposit in favor of the depositor or a deposit in favor of a third party.

The types of bank deposits are also legally enshrined in the legislation of the Republic of Uzbekistan.

According to Article 762 of the Civil Code of the Republic of Uzbekistan, a bank deposit agreement is concluded on the condition of issuing the deposit on demand (demand deposit) or returning the deposit after the expiration of the term specified in the agreement (term deposit). In addition, this article stipulates that the bank deposit agreement may also provide for the placement of deposits on the basis of other conditions of repayment not contradicting the legislation.

Banks, in addition to the above-mentioned types of deposits, may accept other deposits that do not contradict the legislation.

Demand deposits of individuals are considered indefinite. The bank deposit agreement must contain conditions for the return of the deposit at the first request of the depositor and the payment of the established interest.

Savings deposits are understood as deposits accumulated under certain conditions and directed for specific purposes with the right to contribute additional funds to the amount of the initial deposit in the manner prescribed by the bank deposit agreement.

For savings deposits, a bank deposit agreement must be concluded between the bank and the depositor, and after the depositor concludes the agreement, the amount of the initial deposit specified in the bank deposit agreement must be deposited. Additional funds may be contributed to savings deposits in accordance with the bank deposit agreement. The procedure for making additional contributions must be clearly defined in the bank deposit agreement.

A distinctive feature of this type of deposit is that the deposit agreement is necessarily concluded and executed under certain conditions. For example, savings deposits can be of targeted, winning, conditional, and other types with specified conditions.

Deposits accumulated for a specific purpose and strictly directed towards this purpose are considered targeted savings deposits.

Deposits in which interest is paid to the depositor in the form of winnings are considered winning savings deposits. Winnings can be in the form of cash, accrual of additional interest on deposits, items, etc.

Deposits raised with the condition of repayment after the expiration of the term specified in the bank deposit agreement are considered term deposits.

For term deposits, a term bank deposit agreement is concluded between the bank and the depositor, and after the conclusion of the agreement, the depositor is obliged to deposit the amount of the deposit specified in the term bank deposit agreement. The procedure for making additional contributions must be defined in the term bank deposit agreement.

If the depositor wishes to demand the return of the term deposit before its expiration, they must notify the bank at least one month before the planned date of receipt of the deposit.

Term deposits can be short-term and long-term. In this case, deposits accepted for a term of one year or less are considered short-term deposits, and deposits accepted for a term of more than one year are considered long-term deposits.

In cases where the depositor does not demand the return of the amount of the term deposit after the expiration of the term, after the occurrence of the circumstances stipulated by the term bank deposit agreement, the agreement is considered extended on the terms of demand deposits, unless otherwise provided by the term bank deposit agreement.

For overdue time deposits, interest is accrued on the terms of the demand deposit, which must be specified in the deposit agreement.

A registered security confirming the right of the depositor (certificate holder) to receive the amount of the deposit made in the bank and the amount of the deposit, as well as the interest stipulated in the certificate, from the issuing bank or any branch of this bank after the expiration of the established period, is a deposit certificate. Savings certificates are issued in documentary form in the form of forms.

Another important feature of deposit certificates is that these certificates can be the object of transactions involving purchase and sale, donation, inheritance, contribution to the authorized capital, and other transactions leading to a change of ownership, as well as pledges.

However, a certificate cannot be used as a means of payment for the purchase and sale of goods or for settlements for services (works) rendered.

Based on the foregoing, it can be concluded that a deep study of the conceptof a savings operation and its types contributes to a sufficient understanding of theessence of savings operations by students, as well as employees working in the field of law enforcement, and the formation of the necessary skills for the practical application of legal norms related to savings operations.

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Резюме: *Ушбу мақолада омонат операциялари тушунчаси ва моҳияти, банк омонатининг турлари тушунчаси, омонат операцияларини тартибга солиш соҳасидаги миллий қонунчилик таҳлили ҳақида ёзилган. Шунингдек, банк омонатининг ҳуқуқий асослари атрофлича тадқиқ қилинган.*

Резюме: *В данной статье рассматриваются понятие и сущность сберегательных операций, виды банковских вкладов и анализ национального законодательства в области регулирования сберегательных операций. Также подробно исследованы правовые основы банковского вклада.*

Калит сузлар: *банк омонати операциялари, депозит операциялари, жисмоний ва юридик шахсларнинг омонатлари, банклар ва бошқа кредит муассасалари*

Ключевые слова: *банковские вкладные операции, депозитные операции, вклады физических и юридических лиц, банки и другие кредитные учреждения*

FORMATION OF NATIONAL OPERA AND BALLET SCENOGRAPHY IN KARAKALPAKSTAN

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Summary: *This article examines the main stages of the formation of national opera and ballet scenography in Karakalpakstan through the example of the Berdakh Karakalpak State Academic Musical Theatre. It also analyzes the performances, their thematic scope, and the sketches of stage decorations for operas and ballets.*

Key words: *opera, ballet, decoration, sketch, creativity, theatre, development, dramaturgy, artist-director.*

Opera and ballet are among the highest artistic forms of human culture, embodying musical performance, stage art, scenography, and dramaturgy. These art forms have developed over centuries, enriching both national traditions and the cultural heritage of the world.

When examining the development of Karakalpak opera art, the period before 1938 can be considered the "Initial" stage. This is associated with the establishment of the Karakalpak State Theatre in 1930, where only a small ensemble of folk instruments and a limited number of vocal performers were present. These circumstances define the artistic conditions of that time. In 1936, S. Majidov staged the first Karakalpak musical drama titled **"Bag'dagul".**

Between 1939 and 1973, musical drama performances became dominant on the Karakalpak stage, with around 120 productions being staged during this period. This, in turn, served as a significant impetus for the further development of opera art [1.119].

During the years 1974–1991, the first sparks of national opera art began to emerge in the Karakalpak theatre. This period is considered the **"Formation"** stage. The foundation of the first Karakalpak opera was laid with the work *"Ajiniyoz"*, based on the libretto by **I. Yusupov** and music composed by **N. Mukhammadinov**. Due to the lack of trained specialists, only one act of the opera was staged in 1974. However, by 1987, the complete version of *"Ajiniyoz"* was successfully staged by **O. Uzakov** and **N. Ansatbayev**.

In 1989, the opera *"Maysaraning ishi"* by **S. Yudakov**, directed by **N. Ansatbayev**, also gained significant public attention. This period as a whole is recognized as the stage during which Karakalpak national opera art took shape and developed [2.121].

The libretto of the opera *"Ajiniyoz"* was written by **Ibrohim Yusupov** in 1973. The opera was first staged by directors **O. Uzaqov** and **N. Ansatbayev**, with music composed by **N. Mukhammadinov**. The stage design was created by **Islam Alibekov**, an Honored Artist of Uzbekistan and Karakalpakstan.

After the premiere of the first act of *"Ajiniyoz"* in 1987, the opera was restaged three times. The production was based on the stage requirements of dramatic works and dramaturgy. In the libretto of *"Ajiniyoz"*, the protagonist is depicted as a figure whose life is intertwined with the destiny of his people — reflecting his wisdom and the tragic story of his love.

The events in the libretto take place around the 1860s in the region of **Qo'ng'irot**, particularly in **Bozatau.** The opera consists of **three acts and seven scenes**. The scenes within the acts are divided based on changes in the development of events, setting, and stage decorations.

he further development of opera scenography dates back to the years of Independence. During this period, attention was directed not only to opera, but also to ballet art. In 1996, the ballet *"Ayjamal"* composed by **N. Mukhammadinov** was staged by the ballet master **T. Khojasov**.

During the years of Independence, as all spheres of society developed, the demand for stage works embodying national values and traditions also increased. In this regard, the national opera and ballet arts experienced significant growth. This development can be clearly observed in the repertoire of the Karakalpak State Academic Musical Theatre, where a number of productions in these genres were staged.

The opera *"Aleko"* (1992) by **S. Rachmaninoff** was staged by director **K. Abdreymov** and stage designer **I. Alibekov**. The opera *"Ajiniyaz"* (1994), the ballet *"Ayjamal"* (1996) composed by **N. Mukhammadinov** and choreographed by **T. Khojasov**, with stage design by **I. Alibekov**, were also brought to the stage during this period. The opera *"Tumaris"* (2013) by **Q. Zaretdinov** was staged by directors **K. Abdreymov** and **J. Sultaboyev**, with stage design by **B. Aytmuratov**. The ballet *"Qirq Qiz"* (2015) by **Q. Zaretdinov** was staged by **A. Sharipov** and **Z. Nurimbetov**.

The ballet *"Ayjamal"* (2017) featured stage design by **Z. Soipov**, while the opera *"Gulayim"* (2019) by **N. Mukhammadinov** was staged by **B. Baymurzayev** and **M. Usenov**, with set design by **T. Shardemetov.** The opera *"For the People"* (2020) by **Q. Zaretdinov** was staged by **M. Usenov**, with set design by **T. Shardemetov**. The ballet *"The Star of Umrzoya"* (2021) by **Q. Zaretdinov** was staged by **A. Sharipov**, with set designers **Z. Soipov** and **R. Asqarov**.

The ballet *"The Nutcracker"* (2022) by **P. I. Tchaikovsky** was staged by **Z. Nurimbetov**, with sets by **Z. Soipov**. The opera *"Edige–Tokhtamish–Amir Temur"* (2023) by **Q. Zaretdinov** was staged by **M. Usenov**, with set design by **Z. Soipov**. The mono-opera *"My Aral"* (2024) by **Q. Zaretdinov** was staged by **M. Usenov**, with set design by **Z. Soipov** and costume design by **B. Serekeev.** The ballet *"Nazlimkhan Sulu"* (2025) by **Q. Zaretdinov**, with a libretto by **Z. Nurimbetov**, was staged with set design by **B. Aytmuratov** and **Z. Soipov**, and costume design by **B. Serekeev.** These productions marked the **period of flourishing** of national opera and ballet art.

During these years, the theatre repertoire included genres such as drama, historical drama, musical drama, psychological drama, fairy-tale drama, comedy, musical comedy, tragedy, opera, and ballet. The drama genre has traditionally been central to the theatre's artistic practice. At present, along with productions of various themes and genres, the theatre repertoire also includes theatrical show-concert performances.

In the decoration of opera and ballet performances, pictorial stage scenery is widely used. First of all, the stage designer works with a plane on which various visual compositions are drawn. These may represent landscapes or interior settings, and the designer may attempt to construct them in three dimensions. The scenery may also include stylized decorative motifs that serve as a visual background for stage action. Ultimately, the artist is capable of expressing the conceptual theme of the performance through painting or graphic language on the backdrop, curtain, or special scenic planes, thereby creating a broad visual metaphor. Scenic decoration provides the artist with numerous opportunities to develop diverse stage solutions. It is particularly common in opera and ballet productions, although it can also be used effectively in dramatic theatre [3.36].

Colorful panels are especially suitable for decorating ballet performances. Their conventionality is primarily based on presenting an open flat surface next to the live performers onstage, and this conventionality aligns well with the inherent stylization of the choreographic art. In ballet, it is usually the scenography that carries the narrative. Here, the stage space is primarily a symbolic environment in which dance images evolve freely, while the costumes contribute to creating visual expression through movement. The panel, instead of directly depicting a specific location, is intended to reveal the music and imagery of the performance through the means of visual art.

The formation of national opera and ballet scenography in Karakalpakstan is closely linked to the creative activity of the **Berdaq Karakalpak State Academic Musical Theatre**. The performances staged in this theatre have contributed not only to the broad promotion of the artistic heritage of national culture, but also to the development of contemporary scenographic art. The stage decorations, artistic sketches, and creative explorations of the set designers have played an important role in the rise of national theatre art. At the same time, scenographic innovations, harmoniously combined with national traditions, have contributed to the formation of modern theatrical aesthetics.

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Rezyume: *Mazkur maqolada Qoraqalpog'istonda milliy opera va balet ssenografiyasi shakllanishi Berdaq nomidagi Qoraqalpoq Davlat akademik musiqali teatri kesimida rivojlanishining asosiy boshqichlari va undagi spektakllar va ularning mavzu doirasi, opera va balet sahna dekoratsiyasi eskizlari haqida fikr mulohazalar yuritilgan.*

Резюме: *В данной статье рассматриваются основные этапы становления национальной оперной и балетной сценографии в Каракалпакстане на примере Каракалпакского государственного академического музыкального театра имени Бердаха, а также анализируются спектакли, их тематический диапазон, эскизы декораций к операм и балетам.*

Kalit so'zlar: *opera, balet, dekotasiya, eskiz, ijod, teatr, rivojlanish, dramaturgiya, rassom-rejissor.*

Ключевые слова: *опера, балет, декорация, эскиз, творчество, театр, развитие, драматургия, художник-режиссёр.*

CONCEPT AND FEATURES OF THE ACTIVITIES OF MICROCREDIT ORGANIZATIONS

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Summary: *This article describes the concept of civil law regulation of microcredit organizations, their specific features, the interpretation of the conclusion and execution of contracts for microfinance services, and their specific features. Also, the foundations of legal regulation of the activities of microcredit organizations have been comprehensively studied.*

Key words: *microcredit organizations, contractual and legal regulation, debt and credit, factoring, bank deposit, bank account, insurance, microleasing*

In the development of the country, a special place is occupied by the level of access to financial resources and the state of formation of financial infrastructure. Banks, which are the main subjects of this infrastructure, cannot meet all the needs of business entities and the population for financial resources. Therefore, in this area of activity, along with banks, the presence of non-banking structures is required. In Uzbekistan, microcredit organizations mainly operate as such structures. Such organizations usually include pawnshops, microcredit organizations created in various organizational and legal forms. Based on the latest legislative changes, banks now also provide microcredit and microloan services, which indicates that banks are also a type of microcredit organization. In turn, such diversity in the status of subjectivity of microcredit organizations is reflected in the legal regulation of their activities.

In the legal regulation of the activities of microcredit organizations, methods, mechanisms, and means of various branches of law are used, and this means the complexity of legal regulation of this area. For example, if the organization of the activities of microcredit organizations, the execution of relevant documents for carrying out activities, and the control of their activities are regulated by administrative and legal methods, then the grounds and procedure for the creation and liquidation of microcredit organizations, the services they provide, and contracts concluded by microcredit organizations fall under the scope of regulation of civil law. Therefore, in the legal regulation of the activities of microcredit organizations, civil law regulation occupies one of the central places.

In the context of market relations, the active participation of subjects in civil transactions is of particular importance for the economic development of each country. It should be noted that the share of service relations in the active participation of subjects in civil transactions is increasing. The expansion of types and methods of service provision as a result of the emergence of new economic relations requires their consistent legal regulation.

Financial services are also important in civil law as a specific type of service. Typically, financial services are understood as the provision of loans, credits, or other types of transactions to subjects of civil law by banks or persons licensed to provide such services in accordance with the law, on certain terms and for a fee. Microfinance services are a specific type of financial service. Usually, the terms "micro" and "macro" are used as indicators that determine the quantity of a particular state, thing, attitude, reality in terms of volume or significance, value. For example, A. Mukhammadiev proposes to divide the principles of civil law into macro and micro principles [1].

Microfinancing also means that financing is carried out in smaller indicators, and in this case, the part of the implemented loans that does not exceed a certain amount or amount is defined by the state as microfinancing.

As can be seen from this definition, microfinancing is the implementation of types of financing activities (microcredit, microloan, microleasing), expressed in legislation, in an amount not exceeding the established amount. The maximum amount for each type of microfinancing is established by law. For example, for a microloan, the maximum amount of service is one thousand times the minimum wage, and for a microloan, one hundred times the minimum wage. In this case, the amount of financing cannot exceed this amount. After all, microfinancing is not carried out in all financial

institutions. It is established by law that this type of activity is carried out by a financial organization, usually called a microfinance organization.

According to T.T. Madumarov, who studied the activities of microcredit organizations, a microcredit organization is understood as a legal entity established in any organizational and legal form, with the exception of prohibitions established by law, providing financial resources in the amount established by law, with or without the condition of providing security for small business entities and low-income segments of the population, providing services in the field of microcredit, microloan, microleasing and other financial services provided for by law[2].

A.V. Chirikov characterizes a microcredit organization as an entity carrying out activities that provides loans to citizens and small business entities in an amount limited by law for the purpose of obtaining profit or achieving a socially beneficial goal [3].

As can be seen, a microcredit organization is also a legal entity. As a legal entity, a microcredit organization operates with the aim of making a profit. After all, the services provided by him are always paid. For example, according to Article 744 of the Civil Code, the borrower undertakes to repay the loan amount and pay interest on it. The interest received is automatically the profit received by the microcredit organization. From this point of view, a microcredit organization can be classified as a commercial legal entity.

It is known that in the context of market relations, the legal capacity of legal entities is assessed as universal legal capacity. That is, in a market economy, the application of the principle of permissiveness (dispositiveness) for what is not prohibited by law allowed legal entities to operate in a wide range of economic relations [4]. However, it is important to remember that legislation regulating the activities of a specific legal entity or the charters of legal entities may also establish restrictions on the scope of their activities. Such restrictions usually imply the development of a certain sphere by the state. For example, the main activity of banks is the provision of financial services.

Based on this circumstance, the legislator, in order to develop microcredit relations in the Republic of Uzbekistan, establishes a norm defining the scope of the legal capacity of microcredit organizations. In accordance with the Law of the Republic of Uzbekistan dated April 20, 2022, No. ZRU-765 "On Non-Banking Credit Organizations and Microfinance Activities," a microcredit organization is not entitled to directly engage in production, insurance, trade intermediation, and other activities not provided for by this Law.

As can be seen, microcredit organizations cannot directly engage in activities not stipulated by law. This implies that the legal capacity of microcredit organizations is a special legal capacity and means the specifics of the direction of activity of microcredit organizations and the rights and obligations arising from it. This peculiarity is determined by the strict definition of the scope of activity of microcredit organizations and their focus only on a specific area.

It should be noted that microcredit organizations occupy a special place in the development of economic relations in our country. Indeed, by providing microloans, it is possible to develop the activities of small and medium-sized businesses and assist citizens in purchasing consumer goods. Microleasing by microcredit organizations plays an important role in the production activities of small businesses and the provision of equipment to farms.

A microcredit organization, like a bank, has the right to open bank accounts in the territory of the Republic of Uzbekistan in the prescribed manner. In this case, the microcredit organization must obtain the appropriate license.

It should be noted that a microcredit organization is not an organizational and legal form of a legal entity. A microcredit organization is an organization carrying out specific activities. It establishes a dispositive rule regarding the organizational and legal form of a microcredit organization. In accordance with the legislation, it can be created in any organizational and legal form. As such an organizational and legal form, one can include joint-stock companies, limited liability companies or additional liability companies, private enterprises, etc.

The circle of founders of a microcredit organization is limited by law. Although the Law of the Republic of Uzbekistan dated April 20, 2022 No. ZRU-765 "On Non-Banking Credit

Organizations and Microfinancing Activities" establishes that microcredit organizations may be created by legal entities and (or) individuals, part 2 of this article establishes that microcredit organizations cannot be created by state bodies, political parties, trade unions and religious organizations. This means that microcredit organizations can be created only on the basis of private property.

A microcredit organization must also have its own company name. The company name of a microcredit organization must contain the phrase "microcredit organization" and not be identical to the company name of other microcredit organizations. A legal entity that does not meet the requirements of this Law is not entitled to use the phrase "microcredit organization" in its name. A microcredit organization must have a seal with its full company name in the state language and an indication of its location. The seal may simultaneously indicate the company name in another language. A microcredit organization has the right to have stamps, forms, and its own emblem with its name.

These rules also apply to microcredit organizations. As a legal entity, a microcredit organization also operates on the basis of its constituent documents. The constituent documents of a microcredit organization are the charter, the founding agreement, and the founding decision. The constituent documents of microcredit organizations, along with the provisions provided for by Article 43 of the Civil Code for all types of legal entities, as well as the provisions established by legislative acts regulating the activities of legal entities of the organizational and legal form in which the microcredit organization is created, in relation to the constituent documents, must contain the following information:

- on activities for the provision of microcredits, microloans, microleasing and other microfinance services;
- on the structure and powers of governing bodies;
- on the sources of formation of funds for the provision of microloans, microloans, microleasing and other microfinance services;
- the audit procedure in the microcredit organization is correct.

When forming the authorized capital of a microcredit organization, the use of funds received on credit, as collateral, and other borrowed funds is not allowed.

The minimum amount of the authorized capital of a microcredit organization must be formed only from monetary funds on the date of application for a license.

In conclusion, it should be noted that the development of credit relations in the country regulates relations. At the same time, the study of the activities of microcredit organizations should be carried out in conjunction with the improvement of the mechanism for regulating the activities of credit organizations, which are considered a unique new entity. After all, the activities of microcredit organizations, the advantages and acceptability of the services they provide, should be demonstrated in practice.

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Резюме: *Ушбу мақолада микрокредит ташкилотлари фаолиятини фуқаролик-ҳуқуқий тартибга солиш тушунчаси, ўзига хос хусусиятлари, микромолиявий хизматларга оид шартномаларини тузиш ва бажаришни изоҳлаш ва ўзига хос хусусиятлари ҳақида ёзилган. Шунингдек, микрокредит ташкилотлари фаолиятини ҳуқуқий тартибга солиш асослари атрофлича тадқиқ қилинган.*

Резюме: *В данной статье рассматривается понятие гражданско-правового регулирования деятельности микрокредитных организаций, его особенности, толкование и особенности заключения и исполнения договоров, связанных с микрофинансовыми услугами. Также всесторонне исследованы основы правового регулирования деятельности микрокредитных организаций.*

Калит сўзлар: *микрокредит ташкилотлари, шартномавий-ҳуқуқий тартибга солиш, қарз ва кредит, факторинг, банк омонати, банк ҳисобварағи, суғурта, микролизнг*

Ключевые слова: *микрокредитные организации, договорно-правовое регулирование, долг и кредит, факторинг, банковский вклад, банковский счет, страхование, микролизинг*

REGIONAL CRIMINAL SECURITY LEVEL OF THE REPUBLIC OF KARAKALPAKSTAN

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Summary: *The dissertation examines regional differences in crime rates within the Republic of Karakalpakstan based on statistical data from 2014 to 2023, highlighting variations in criminal activity between different regions. The study also evaluates these differences using optimistic, realistic, and pessimistic scenarios. The research findings underscore the need for further refinement of regional security policies.*

Key words: *demographic and social factors, forecast, regional security policy, optimistic, realistic, pessimistic.*

Introduction. In the study of regional crime, determining the level of criminal security of regions is one of the important scientific tasks. The level of criminal safety is a criterion for assessing the danger of committing a crime in a certain territory and its social consequences, based on quantitative and qualitative indicators of the crime. It is closely related to the decrease in the level of crime in society, the sense of security of citizens, and the effective work of law enforcement agencies [1. p. 17-24).

The concept of criminal security has been formed as a separate scientific direction in modern socio-geographical research. Adolphe Quetelet was the founder of statistical analysis of crime, while André-Michel Guerry applied the method of territorial mapping of crime. Shaw and McKay (Chicago School) studied crime in connection with urbanization and the social environment. The decrease in the level of crime in society is directly related to the feeling of freedom and confidence of citizens in their life activities, as well as the effective activity of law enforcement agencies. In the context of the Republic of Karakalpakstan, the study of the level of criminal security is relevant, since this territory consists of administrative units with different socio-economic indicators, and the level of crime also differs significantly from region to region[6].

Results. The scientific significance of assessing regional crime lies in the fact that, by determining the level of security in the regions, it becomes possible to identify criminogenic territories, identify the factors influencing their formation, and develop practical measures. Analysis of the level of criminal security is an important foundation for reducing crime, improving the social environment, and effectively implementing state security policy at the regional level.

Adolphe Quetelet (Belgium 1833) - founder of the statistical analysis of crime. André-Michel Guerry (France 1833) - used the method of territorial mapping of crime. Shaw and McKay (USA, Chicago School 1942) - studied crime in connection with urbanization and the social environment. These experiments serve as a scientific basis for identifying regional differences in crime, using the example of Karakalpakstan [2].

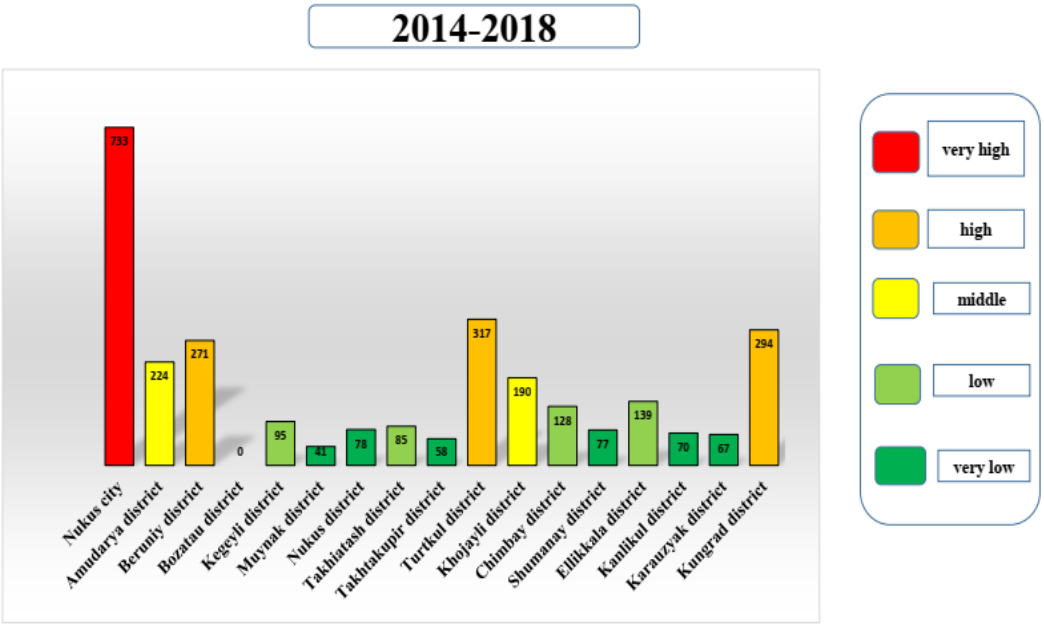


Figure 1. Territorial dynamics of crime rates registered in the Republic of Karakalpakstan in 2014-2018.

It reflects the average indicators of the number of registered crimes and their level in the administrative-territorial units of the Republic of Karakalpakstan in 2014-2018. Their reflected levels.

Territories with a very high level of crime: The region with a very high number of crimes in the republic is the city of Nukus. 733; this is due to the status of the capital, population density, and economic development.

High-level regions: Beruniy district. 271; Turtkul District 317; Kungrad district 294; these districts also have significantly higher crime rates than the national average.

Moderate regions: Amudarya district. 224; Khojeyli District 190; the crime rate in these districts is somewhat similar to the national average.

Low-Level Areas: Kegayli District. 95; Takhiatash District 85; Chimbay district 128; Ellikkala District 139; crime rates in these districts are below the national average.

Territories with a very low level: Muynak district. 41; Nukus District 78; Takhtakupyr District 58; Shumanay District 77; Kanlykul District 70; Karauzyak District 67; the crime rate in these districts is very low, which may indicate that crime prevention work is being carried out effectively in these areas. Bozatau District 0; This district was merged into Kegeyli District in 2004. Yangi Bozatau District was officially reorganized in August 2019 .

In the Republic of Karakalpakstan, crime rates differ significantly by region. The city of Nukus occupies a very high place in the absolute number of crimes, which is due to the urbanization and population concentration characteristic of urban areas. In a number of districts, for example, in Muynak, Takhtakupyr, Karauzyak, and Kanlykul, the crime rate is very low, which indicates that effective work is being carried out in these areas to maintain law and order. The zero indicator in the Bozatau district deserves special attention (Fig. 1).

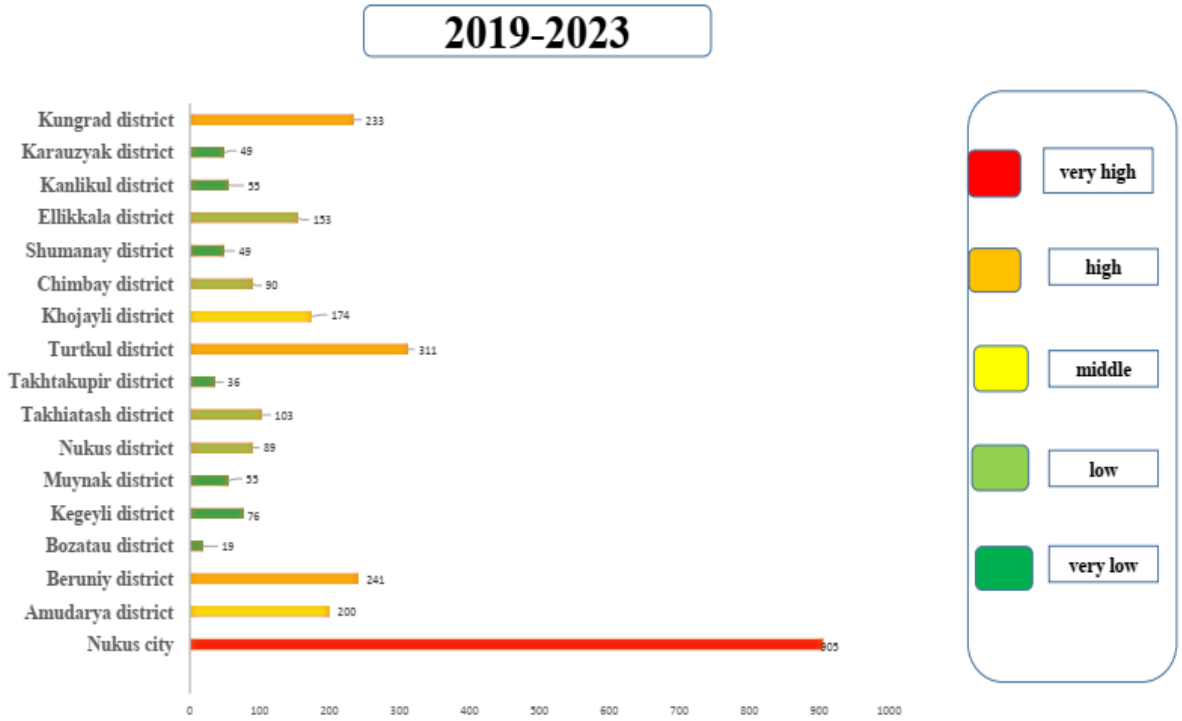


Figure 2. Territorial dynamics of crime rates registered in the Republic of Karakalpakstan in 2019-2023.

Provides average indicators of the number of registered crimes and their level by administrative-territorial units of the Republic of Karakalpakstan in 2019-2023. The average number of registered crimes in the Republic of Karakalpakstan is 167, which is assessed at the “average” level. This indicator shows that it has practically not changed from 166 in 2014-2018.

Very high-level regions: Nukus city. 905; As in the previous period, the republic remains a region with a very high crime rate. This indicator has significantly increased from 733 in 2014-2018, which indicates an increase in the dynamics of crime in the city.

High-level regions: Beruniy district. 241; Turtkul District 311; Kungrad district 233; the crime rate in these districts is also significantly higher than the national average. Compared to the previous period, the number of crimes in the Turtkul district practically did not change, while a slight decrease was observed in the Beruniy and Kungrad districts.

Moderate regions: Amudarya district. 200; Khojeyli District 174; the crime rate in these districts corresponds to the national average. A slight decrease compared to the previous period was observed in the Amudarya and Khojeyli districts.

Low-level regions: Nukus district. 89; - It has moved from a very low level in the previous period to a low level. Takhiatash District 103; - It remains at the low level of the previous period, but the number of crimes has increased. Chimbay district 90; - It remains at the low level of the previous period, but the number of crimes has decreased. Ellikkala District 153; - Remaining at the low level of the previous period, but the number of crimes has increased.

Territories with a very low level: Bozatau district. 19; - Although it increased by 19 compared to the previous period, it is still at a very low level. Kegeyli District 76; - Compared to the previous period, the number of crimes has decreased. Muynak district 55; - Compared to the previous period, the number of crimes has increased, but it is still very low. Takhtakupyr District 36; - Compared to the previous period, the number of crimes has decreased. Shumanay District 49; - Compared to the previous period, the number of crimes has decreased. Kanlykul District 55; - Compared to the previous period, the number of crimes has decreased. Karauzyak District 49; -

Compared to the previous period, the number of crimes has decreased. The crime rate in these districts remains very low (Figure 2).

In 2019-2023, the number of registered crimes in the city of Nukus increased significantly compared to the previous period, which indicates the need to pay special attention to the criminogenic situation in the capital. Stability of the average indicator for the republic: The average indicator for the republic as a whole 167 166 practically did not change from the previous period. This means that in some regions the number of crimes has increased, while in others it has decreased or remained stable.

Stability of districts with a very low level: Many districts of Kegeyli, Takhtakupyr, Shumanay, Kanlykul, Karauzyak maintained or even reduced the crime rate at a very low level.

Increase in crimes in some districts: In Nukus and Takhiatash districts, the number of crimes increased compared to the previous period.

In general, it is important to take into account regional characteristics in the fight against crime in the Republic of Karakalpakstan, especially in the city of Nukus, to strengthen measures for the prevention and prophylaxis of crimes.

Conclusion. Regional security level

- ✓ High-risk areas: Nukus city, Nukus district, Muynak district.
- ✓ Regions where a positive trend is observed: Takhiatash, Kungrad.
- ✓ Low-risk areas: Chimbay, Kegeyli, Ellikkala.Scenarios.

Optimistic scenario - economic growth will stabilize, crime will decrease by 10-12% by 2030. Realistic scenario - current conditions will remain, crime will decrease steadily or slowly. Pessimistic scenario - economic and environmental problems will intensify, crime will increase by 5-7%. When analyzing crime, it is important to consider geographical and demographic factors. In high-risk areas, enhanced preventive measures are necessary. Establishing monitoring of "hot spots" based on GIS will increase efficiency. Mitigating the consequences of migration and ensuring youth employment will remain the main direction in reducing crime.

Three scenarios (optimistic, pessimistic, and realistic) were developed for the prospective evolution of the criminogenic situation. Each scenario takes into account the impact of socio-economic changes and state policies (Fig. 3).

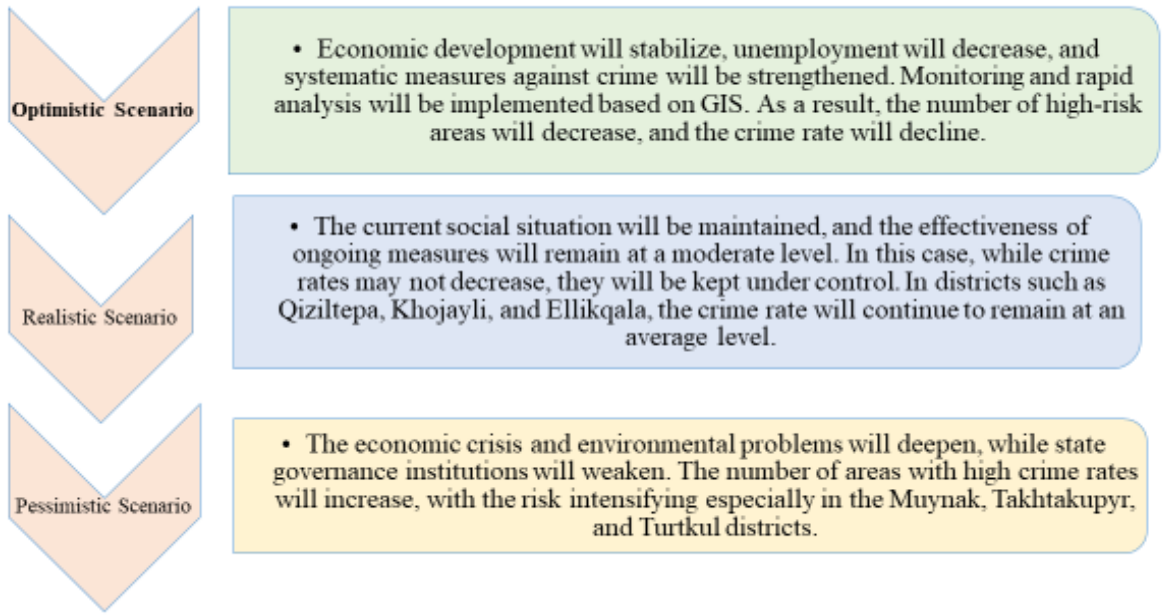


Figure 3. Three main development scenarios based on the assessment of the crime situation and identification of high-risk areas in the Republic of Karakalpakstan.

Each scenario serves as a foundation for shaping regional policy, developing security strategies, and efficiently allocating resources. In particular, the implementation of spatial crime monitoring and preventive analysis using GIS technologies enables the development of proactive strategies based on these scenarios[5].

An optimistic scenario is a forecast that expresses confidence in future social stability and a decrease in crime rates.

Expected positive outcomes. Reduction of regional risk zones. GIS identifies hazardous areas; Resources are directed specifically to regions in difficult situations; Crime prevention is carried out in a targeted manner; As a result, the number of high-risk districts decreases, for example, Muynak, Turtkul, and Beruniy districts gradually transition to “yellow” or “green” zones.

Decrease in crime rates. Employment is ensured → economic crimes are reduced; Rehabilitation and social programs are launched for youth and the unemployed; The reliability of the law enforcement system increases; Social trust between the population and the state is restored.

An environment for sustainable development is formed. Social balance is also restored in the ecological regions of the Aral Sea area; Internal migration flows decrease (people remain in their own territories); The types of crimes (diversification) narrow.

A realistic scenario allows consideration of crime and social stability issues based on the current real situation. This assumes the preservation of the existing economic, social, and institutional conditions in the current circumstances.

The essence of a realistic scenario. Although government and public sector actions are present, they are limited by moderate effectiveness, and while the risk of a sharp increase in crime is low, its stabilization is also slow.

Analysis of districts with moderate crime levels. Karauzyak District. There are industries and services, but stable jobs are still insufficient; Main types of crimes: theft, petty fraud, domestic violence; There is control, but social prevention is weak.

Khojeyli district. Due to its proximity to Nukus, the migration flow is high; Crimes include transport-related offenses, conflicts involving migrants, and fraud; The law enforcement system is active, but stable social infrastructure is insufficient.

Ellikkala District. A rapidly growing demographic region; Strong pressure on social services: education, healthcare, utilities; Crime rate is stable, but there are risk zones in newly developed areas.

A pessimistic scenario reflects a situation where negative factors leading to an increase in crime have intensified. It represents a state where the existing socio-economic and environmental conditions have sharply deteriorated, governance has been institutionally weakened, and crime is at risk of spiraling out of control.

Districts with a high probability of increasing crime rates.

Muynak District. At the epicenter of ecological disaster; Living conditions of the population are worsening → forced migration is intensifying; The labor market is disappearing, youth are becoming prone to crime; Crimes include: theft, vandalism, drug abuse, illegal migration.

Takhtakupyr District. Harsh climate and resource scarcity exacerbate social tensions; Problems with food and water supply cause discontent among the population; Crimes include: group attacks, confrontations, threat of social unrest.

Turtkul District. High population density and migration. Unemployment is the main factor of social risk. Crimes: petty crimes become widespread, organized crime types increase (smuggling, racketeering, fraud).

Visual results of the scenario. The number of "red zones" on the crime map increases. Risk zones identified by GIS are expanding. Population attempts to leave their territory → demographic depletion. Migration pressure shifts to other regions → secondary social instability [5].

Therefore, in conclusion,

An optimistic scenario allows for reducing crime through socio-economic reforms, increasing employment, strengthening security measures, and GIS-based governance.

This situation is reflected in the crime map of the Republic of Karakalpakstan: a decrease in "red" zones, stabilization of dangerous areas, a reduction in migration pressure, and the restoration of social balance.

A realistic scenario is a situation that occurs when existing social, economic, and institutional conditions remain unchanged. Under these circumstances, crime remains a priority threat but stays under state control. The number of high-risk areas will neither increase nor decrease. Karauzyak, Khojeyli, and Ellikkala districts are areas suited to this scenario, maintaining a moderate level of crime. If no additional measures are taken, the realistic scenario also includes the risk of transitioning to a pessimistic state in the long term.

A pessimistic scenario is a situation with a high probability of a crime surge due to economic crisis, environmental disaster, and weakening governance. Muynak, Takhtakupyr, and Turtkul districts are at the center of this dangerous scenario. To address this situation, emergency measures, social protection programs, and GIS-based monitoring are required.

The main objective was to conduct a comprehensive analysis of the crime situation in the Republic of Karakalpakstan based on geographical and statistical approaches, assess the current situation, forecast future changes, and develop development scenarios.

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Rezyume: *Mazkur maqolada 2014-2023 yillar oralig‘idagi statistik ma’lumotlarga asoslanib, Qoraqalpog‘iston Respublikasidagi jinoyatchilik darajasining hududiy farqlarini tahlil qiladi va turli hududlar o‘rtasidagi jinoyat ko‘rsatkichlarini yoritib beradi. Shuningdek, tadqiqot bu farqlarni optimistik, realistik va pessimistik stsenariylar asosida baholaydi. Tadqiqot natijalari mintaqaviy xavfsizlik siyosatini yanada takomillashtirish zarurligini ko‘rsatadi.*

Резюме: *В статье исследуются региональные различия в уровне преступности в Республике Каракалпакстан на основе статистических данных за период с 2014 по 2023 год, выявляя вариации криминальной активности между различными регионами. В работе также проводится оценка этих различий с использованием оптимистического, реалистичного и пессимистического сценариев. Результаты исследования подчеркивают необходимость дальнейшего совершенствования политики региональной безопасности.*

Kalit so‘zlar: *demografik va ijtimoiy omillar, prognoz, mintaqaviy xavfsizlik siyosati, optimistik, realistik, pessimistik.*

Ключевые слова: *демографические и социальные факторы, прогноз, политика региональной безопасности, оптимистический, реалистичный, пессимистический.*

TYPES OF INDEPENDENT CREATIVE WORK OF STUDENTS IN THE SUBJECT OF "PEDAGOGICAL TECHNOLOGY"

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Summary: *This article scientifically and analytically covers the types and pedagogical significance of students' independent creative activity in the subject of pedagogical technology. It discusses the types of independent work of students in independent education, such as problem analysis, information search, practical testing, and creative product creation. At the same time, the reflexive process and project presentation are also analyzed as important factors in improving independent creative activity. The results of the article provide an opportunity to use them as a practical guide in organizing and developing independent creative activity of students in higher educational institutions.*

Key words: *Pedagogical technology, independent work, creative activity, pedagogy students, practice, reflection.*

Introduction

Pedagogical technology is an innovative pedagogical creation that helps to increase the creative potential of students, improve their analytical and research skills. In all three technologies, the student is the main subject of his/her activity, actively participating in independent information search and problem solving. Design educational technology is the main mechanism for the effective development of this process. It orients the student to purposeful research, problem identification and creative solution. Therefore, independent creative work carried out on the basis of production technology strengthens the student's critical thinking, practical experience and problem solving. Research methodology. In the research methodology, the opportunity of using pedagogical technology in the educational environment to use the purpose, content, organizational forms, methods and means of independent learning of students was appropriately used. Designing the educational process is a process of developing a project (scheme) for the effective organization of a particular educational process, taking into account all factors. Literature review on the topic. The issue of forming independent creative activity of students in the system of teaching pedagogical technologies is at the center of modern pedagogical research. In primary scientific sources, independent creative activity is interpreted as a factor strengthening the student's position as a subject in the educational process and is indicated as one of the main tasks of pedagogical technology. In his work "Pedagogical Technologies and Pedagogical Skills" by Q.M. Ziyoyotov, he substantiates the central place of independent learning in the system of pedagogical technologies and emphasizes that the formation of creative competencies in students is directly related to the technological design of the educational process. The author shows that it is possible to develop reflective and creative thinking in students by setting clear goals in education, planning result-oriented tasks, and systematically organizing independently performed creative activities [1].

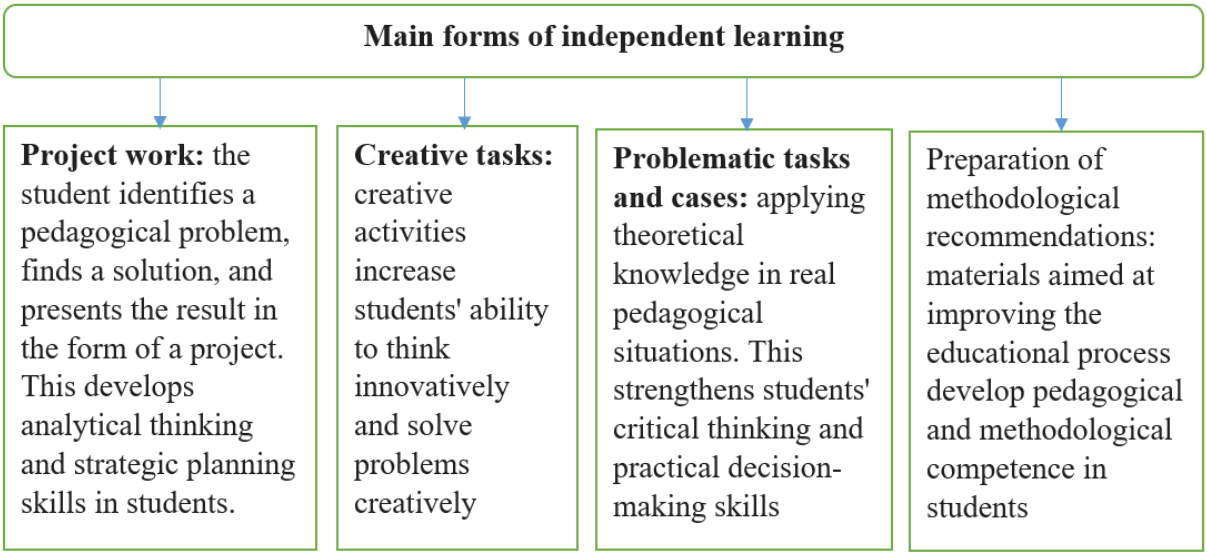
F.N. Turaqulov deeply analyzes the potential of innovative educational technologies to increase students' independent activity. In his opinion, the introduction of case technology, problem-based learning, and creative tasks based on ICT forms students' ability to independently search for information, analyze, draw scientific conclusions, and find creative solutions. The author substantiates the effectiveness of these technologies in practice with specific examples [2]. O.Sh. Sayfullayev analyzes the theoretical foundations of modern pedagogical technologies and recognizes the effectiveness of interactive methods, trainings, creative problem situations, and project activities in organizing students' creative independence. According to the author, these methods provide students with innovative thinking, independent decision-making and competent activity[3]. In the analysis of existing scientific articles, R.R. Abdullayev highlights the importance of innovative approaches to organizing independent learning in higher education and proposes to restructure

practical exercises and forms of control in a way that encourages independent learning. His research is significant in that it has developed a model of educational technologies that enhance independent thinking, critical approach and creative decision-making in students[4]. M.Y.

Tojiboyeva, studying the system of independent creative works in the field of pedagogical technology, divides them into such types as abstract, essay, project, practical creative task, problem assignment. The author scientifically substantiates that each of these types develops independent research, creative thinking, and practical application of scientific and theoretical knowledge in students[5]. B.B. Nurmatov, studying the methods of forming creative thinking in his article, emphasizes that creative tasks, analytical problems, and research-oriented tasks increase independent thinking and scientific creativity in students [6].

Analysis of research dissertations shows that scientific and methodological work in this area is continuously developing. N.S. Yuldasheva developed a model for the development of independent learning competencies and outlined its technological foundations[7]. J.T. Tursunov developed and tested a methodology for the formation of creative activity based on pedagogical technologies[8]. D.Kh. Abdurasulova identified the pedagogical conditions for organizing independent learning in the context of innovative technologies and suggested ways to increase the effectiveness of the educational process[9].

Analysis and results. Independent learning is the process of each student independently developing their own knowledge, skills and creative potential. This process is an important part of the pedagogical technology of transferring students from theoretical knowledge to practical competencies. The analysis revealed that the main forms of independent learning are project work, creative assignments, problem tasks and cases, preparation of methodological recommendations, etc., and constitute the following pedagogical content (see Figure 1).



Independent learning is one of the central components of the educational process, serving to form the student's personal educational activity, independently manage their own learning process, and develop creative thinking. Analysis of pedagogical theories shows that independent learning not only enriches the learning process, but also plays a decisive role in the formation of a person's professional competencies. Pedagogical competencies such as analytical thinking, independent problem solving, research, information processing, and analysis of results are formed precisely through independent learning tasks.

In the course of the research, the activities of students of the pedagogical direction on the types of independent educational tasks were evaluated using a comparative-experimental method. The criteria for evaluating independent education were: independent search and analysis of information, completion of creative and project tasks, preparation of methodological materials and development of recommendations, and reflection and self-assessment.

Initially, the independent educational work of students was analyzed to identify and find solutions to pedagogical issues on project tasks.

Result: 38% of students were able to effectively complete project work at the initial stage, but after the experiment this figure reached 73%.

Creative tasks. Educational task: Use new pedagogical methods, develop their own approaches.

Result: Initially, 35% of students showed high levels of creative work, after the experiment this figure increased to 70%.

Problem tasks and cases. Educational task: Combine theoretical knowledge with practical activities.

Result: Initially, 40% of students were able to fully complete problem tasks, after the experiment this figure increased to 75%.

Methodological recommendations and manuals. Educational task: Develop materials to improve the educational process.

Result: Initially, 25% of students prepared methodological materials, after the experiment this figure increased to 62%.

Analysis of pedagogical theories shows that independent learning is a decisive factor in the intellectual, professional and spiritual development of a person. It improves the educational process in accordance with the principles of person-centered, competency-based and active learning.

Conclusion and recommendations. The results of the study showed that independent learning plays an important role in the application of theoretical knowledge in practice, the development of creative and critical thinking, the formation of personal responsibility and self-management skills.

It is necessary to develop independent learning tasks in accordance with the level of complexity and creative requirements in the subjects, clearly define the assessment criteria and expected results. Instead of a recommendation, it can be said that monitoring and managing student activities through digital resources, electronic portfolios, virtual laboratories and online platforms will help to strengthen them. It is recommended to create methodological guides, sample tasks and assessment matrices for independent work, as well as constantly update them. Monitoring students' independent learning competencies and drawing up individual development plans each semester increases efficiency. Evaluating the results of students' independent work through rating and incentive mechanisms, linking them to real life and professional activities, increases motivation. Completing independent tasks in an integrated manner across several subjects develops students' systematic thinking.

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Rezyume: *Mazkur maqolada pedagogik texnologiyasi o‘quv fanida talabalarning mustaqil ijodiy faoliyatining turlari va pedagogik ahamiyati ilmiy-tahliliy jihatdan yoritilgan. Mustaqil*

ta’limda talabalarning muammolarni tahlil qilish, axborot izlash, amaliyotda sinovdan o‘tkazish va ijodiy mahsulot yaratish kabi mustaqil ish turlari haqida fikr bildirgan. Shu bilan birga, refleksiv jarayon va loyiha taqdimoti ham mustaqil ijodiy faollikni takomillashtirishda muhim omil sifatida tahlil qilingan. Maqola natijalari oliy ta’lim muassasalarida talabalarning mustaqil ijodiy ish faoliyatini tashkil etish va rivojlantirishda amaliy qo‘llanma sifatida foydalanish imkoniyatini beradi.

Резюме: *В данной статье научно и аналитически рассматриваются виды и педагогическое значение самостоятельной творческой деятельности студентов в рамках предмета «Педагогическая технология». Рассматриваются виды самостоятельной работы студентов в процессе самостоятельного обучения, такие как проблемный анализ, поиск информации, практическая апробация и создание творческого продукта. Анализируются рефлексивный процесс и презентация проекта как важные факторы совершенствования самостоятельной творческой деятельности. Результаты статьи позволяют использовать их в качестве практического руководства при организации и развитии самостоятельной творческой деятельности студентов в высших учебных заведениях.*

Kalit so‘zlar: *Pedagogik texnologiya, mustaqil ish, ijodiy faoliyat, pedagogika talabalari, amaliyot, refleksiya.*

Ключевые слова: *Педагогическая технология, самостоятельная работа, творческая деятельность, студенты педагогических вузов, практика, рефлексия.*

THE ROLE OF NATIONAL MUSIC ART IN SHAPING THE SPIRITUAL AND CULTURAL DEVELOPMENT OF YOUTH

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Summary: *Under the influence of musical art, students develop moral and aesthetic concepts such as the desire for beauty, decency, honesty, kindness, friendship, as well as such aesthetics as self-control, modesty, sweetness, cleanliness and elegance in clothing. The qualities of culture are formed, opinions are expressed on the role of national musical art in the formation of youth culture as a means of spiritual and cultural events.*

Key words: *music, culture, art, spiritual and educational, moral and aesthetic, musical culture.*

Since time immemorial, our wise people have considered music and song an integral part of their social and cultural life. Teaching a child to sing and play musical instruments was considered a family aspiration, and it was customary to keep a musical instrument in the home with benevolent intentions. It was no accident that a newborn would be soothed by a mother's plaintive lullaby during their first swaddling, that a melodious call to prayer (adhan) would be recited into the infant's ear at the naming ceremony, and that a boy's circumcision would take place to the mournful sounds of the surnay. Our great and wise ancestors deeply understood the ability of melodies and tunes to quickly find their way into an infant's heart, positively influence their emotional world, and lead them towards goodness.

Youth is the spring of a person’s life. All admirable traits as well as undesirable habits begin to form in youth. If a person is not drawn from an early age into the realm of refinement and is not raised in the spirit of the finest virtues, they will hesitate and falter later at life’s crossroads. For this reason, an important part of moral education should start in youth — in particular, systematic music instruction should be introduced from an early age.

We observe that great scholars of the East, such as Ibn Sina, Farabi, Beruni, Kawkabi, Hazrat Navoi, Omar Khayyam, and Jami, who gained worldwide renown, also devoted considerable attention to the science of music. We know that they unequivocally emphasized the significant role of music art in human upbringing and its paramount importance in an individual's culture and spiritual development in general.

Art is a form of social consciousness, and upon broader reflection, true art signifies an ideal ideology. It is not an exaggeration to suggest that art can positively resolve issues that even highly developed science and technology cannot, and achieve significant transformations in humanity's destiny. Particularly among the ancient arts, music holds a special position as an art inherently characteristic of humans, with unparalleled power of influence. Ample noteworthy ideas regarding music's high artistic-aesthetic value, its potent spiritual-moral impact, and its pedagogical significance can be found in scientific and literary works dating back to the Middle Ages. Our ancestors revered music for centuries as divine beauty and a delicate art. Furthermore, we ourselves cannot imagine our daily lives without music.

We know that pride, in general, is unequivocally emphasized as holding a paramount position in spirituality. In the words of Aristotle, "Music is capable of influencing the ethical-aesthetic aspects of the soul. Given that music possesses such characteristics, it must therefore be included among the means of educating youth."

Abu Ali ibn Sina, known worldwide as "Avicenna," was not only a physician but also a renowned musicologist. Even a legend associated with the creation of the rebek (ghijjak) is dedicated to Ibn Sina: it is said that the person who invented this instrument and played melodies on it was the great hakim. According to his work, "Kitab ash-Shifa" (The Book of Healing), music is one of the aesthetic tools that heals the human spirit and exerts a powerful influence on the human heart.

Alisher Navoi, possessing a refined taste and high intellect, loved to listen to music and derived profound joy from it. The poet always cared for talented artists and tirelessly concerned himself with the development of youth. He understood that benefiting from the art of music is one of the primary means for a person's attainment of perfection. A poet who does not love music is like an empty garden, a withered spring. Navoi states, "A poet who does not comprehend music, what kind of poet is he?"

Aristotle wrote: "If music has the power to influence the soul morally, then it must certainly be included among the manuals for the education of youth." The great scholar Farabi, who deeply researched the science of music and musicology, was also deeply convinced of the connection between music and morality: "This science balances the character of people who have lost their equilibrium, perfects a character that has not reached perfection, and maintains the equilibrium of those whose character is already balanced." Beethoven, who desired that music should ignite fire from the human heart, assessed it as follows: "....." (the sentence is incomplete).

Abdul Rahman Jami, in his "Treatise on Music," reflecting on maqams, stated with admiration: "Know that in addition to the general characteristic of providing pleasure to people, each of the 12 maqams, and each vocalization and branch thereof, possesses a specific power of influence. For example: Ushshoq, Navo, and Boʻsalik awaken power and courage in the listener, whereas the voice alone does not possess such an influential power."

The immortal works of Alisher Navoi, the sultan of the realm of words and a possessor of high culture, along with the scientific research written about him, attest not only to his being a highly intelligent, encyclopedic scholar of his era but also to his being a sensitive soul who deeply understood art and was profoundly affected by the magic of musical melodies. It is not inconceivable that A. Navoi was also a musicologist and composer of his time, for he was fully aware of the level of development of music art in his era, guided artists, and is known to have even written a special treatise, "Risolai Musiqa" (Treatise on Music), dedicated to music. He strived for his written poems and ghazals to possess an exceptionally musical resonance. Therefore, as Ogahiy puts it, "There is no greater benefit than Navoi's melody." In Navoi's opinion, every poet should know how to compose a melody to some extent; a poet who can play an instrument can write fluid musical verses, and the inability to produce sound on any instrument is a flaw in poets. Consequently, poetry and music should always be harmonious and mutually intertwined.

A person engaged in music "will not stain themselves with inappropriate actions, but rather will derive immense benefit and profit, performing useful deeds for themselves and their homeland."

Farabi, in addition to being an encyclopedic scholar, was also a great musicologist. His activities in the field of music science were not confined solely to theoretical perspectives but also found expression in his practical work. There are many accounts of Farabi having created a musical instrument, which was an innovation for his time, and being known as a skilled musician and composer.

When discussing the causes that give rise to the science of music, Farabi draws attention to the moral and educational aspects of music in general. "This science is useful in the sense that," writes Farabi in his work "Iḥṣāʾ al-ʿulūm" (The Enumeration of the Sciences), "it regulates the character of those who have lost their equilibrium, perfects a character that has not reached perfection, and maintains the equilibrium of those whose character is already balanced. This science is also beneficial for the health of the body, because if the body is sick, the soul also languishes; if the body encounters an obstacle, the soul also encounters an obstacle. Therefore, through the aid of restoring the soul's health by the influence of sounds, the body is also improved, and the soul is healed by the regulation of its powers and its adaptation to its circumstances."

It is said that al-Farabi himself was a skilled performer of the qanun, and a composer. According to legends, he invented a new instrument. In terms of his musical pedagogical views, al-Farabi was of the same opinion as the ancient Greek scholars. They considered music a necessary subject of education and upbringing. According to ancient Greek scholars, just as gymnastics shapes the bodies and physiques of people, music is considered a tool capable of shaping the human soul.

"Eastern music," said our first President I.A. Karimov in his speech at the opening ceremony of the "Sharq Taronalari" (Melodies of the Orient) International Music Festival, "is an integral part of Eastern philosophy and the Eastern world. The role of Eastern music in the global community is immensely great... This music has been purifying the hearts of people and spiritually uplifting them for thousands of years. With its delicate charm, it nourishes world culture and makes a worthy contribution to universal human values."

Music is an educational tool with immense expressive power. Music is a spiritual nourishment that can give life-giving strength to the human psyche. It helps people to enjoy, to revel, to relax, to find solace, to think, and to engage in philosophical reflection.

The educational significance of spiritual and educational events is also evident in promoting the idea of national independence. Since one of the crucial functions of the idea of national independence is the upbringing of youth, spiritual and educational events further enhance their pedagogical impact on young people by promoting this idea.

Instilling the idea of national independence in the minds of student-youth stands at the center of the educational work carried out within the educational system. Various methods and means of education are employed to achieve this goal. Our observations have shown that in some educational institutions, more attention is given to lectures, seminars, and colloquiums on the idea of national independence, while spiritual and educational events held after lessons are not given sufficient importance. However, such events hold immense significance in educating youth and instilling the idea of national independence in their consciousness.

Given the current emphasis on using interactive methods in our country's education system, the application of spiritual and educational events gains even greater importance. The experience of leading educators demonstrates that utilizing spiritual and educational events during lessons significantly increases the engagement of student-youth. Furthermore, forms of conducting classes such as role-playing and service games are, in their essence, cultural events. This is because they emerge from the integration of educational forms with elements of art. Introducing excerpts from literary works, expressive recitation of poems, and performing scenes from plays during lessons serves to sharply increase both the intellectual and emotional activity of students.

Therefore, music should not only be studied as a form of artistic creation and art, but also as a crucial component of spiritual culture.

The great composer Ludwig van Beethoven, speaking about melody, said: "Music is a declaration of the heart, higher than all wisdom and philosophy." We have been amazed, - says the famous musician Abdukhoshim Ismailov, - seeing how much our melodies, our songs and chants, have influenced peoples who do not understand our language, and how our melodies and ghazals have permeated the hearts of people in foreign lands.

Our observations conducted in general education schools, and the information we have gathered from studying the situation, show that students' interest and enthusiasm for art in general, and particularly for music lessons, has declined. The presence of a peculiar indifference to studying our national musical heritage, and the less-than-desirable state of matters concerning aesthetic emotion, aesthetic taste, and aesthetic needs, are clearly evident. These issues are implemented based on unwritten laws. In the land of Uzbekistan, the children of Uzbekistan have found themselves limited in the opportunity to comprehensively and deeply study the musical art of their ancestors, which has been ingrained in their blood and soul since their mother's lullaby.

- For various reasons, schools in our republic, and especially rural schools, have not been adequately supplied with highly knowledgeable and skilled personnel.

- Until now, general education schools have not been sufficiently provided with textbooks, manuals, methodological recommendations, and programs for music lessons.

- In many cases, due to the lack of professional and pedagogical skills among the subject teachers, this task is entrusted to non-specialists, resulting in poorly conducted lessons. The work of arousing aesthetic perception and aesthetic emotion in students through lessons, and of forming musical-aesthetic culture, is neglected, and so on.

In a word, the musical-aesthetic education being implemented in the general education schools of Uzbekistan clearly needs to be re-examined in its entirety and provided with scientific-theoretical foundations and modern methodological tools.

In nurturing students' musical and aesthetic development through lessons at school, extensively utilizing Uzbek folk music and revealing its educational potential plays a crucial role. Just as concepts like Mother Nature and Mother Earth, mother music, which begins with the cradle lullaby, is inherently close to a child's heart, feelings, and perception. The richness of our national musical art's content—be it lullabies, songs, melodies, chants, terma-lapars (folk couplets), yor-o'lan (love songs), katta ashula (grand song), or maqom (classical melodic system)—each genre, with its delightful melodies, lively and captivating rhythms, and elaborate embellishments, reflects the nature of the Uzbek people, their unique customs and traditions, in musical forms. It is natural for every student to understand it, perceive it with emotion, and derive profound joy from this process.

Organizing music lessons in school is carried out relying on important principles such as the interconnectedness of musical education and aesthetic upbringing, the scientific rigor of education, its consciousness, visual clarity, and comprehensibility, the solidity of acquired knowledge, involving all students in aesthetic activities during the educational process, connecting this activity with daily life, and achieving a synthesis of consciousness and emotion.

It is particularly important that during the process of musical education, students' interest in and appreciation for music art grow, their creative activity increases based on music lessons, and skills are formed for singing songs melodiously, listening to music with enthusiasm, perceiving and evaluating the pleasantness, melodiousness, and beauty in music through analyzing musical works.

It is particularly important that the teacher, under the influence of music art, fosters in students an aspiration for beauty, and develops ethical-aesthetic concepts such as politeness, honesty, kindness, and friendship. It is equally crucial for the formation of various qualities of aesthetic culture, such as self-control, modesty, pleasant speech, and neat and elegant attire.

Uzbekistan's independence places upon us the task of elevating the spirituality of youth, fostering high cultural qualities in them, restoring our national values, deeply studying the masterpieces of our national art, and fully and effectively utilizing the educational potential of music art within the school environment. It is with deep conviction that we must view this: musical-aesthetic education within schools, starting from the very first days children enter school, from the lower grades, must be implemented effectively, measured by the scales of reason, and scientifically well-founded. Indeed, a person's early childhood years are the most productive and unique for accumulating wisdom, gathering knowledge, learning discipline, and certainly for shaping qualities of high culture. Utilizing these years with wisdom and great effectiveness must be the sacred duty of every subject teacher.

In the song curriculum included in "Music Culture" lessons in general secondary schools, dozens of works can be found that express independence, our sovereignty, our identity, our holidays and traditions, and boundless feelings for our Motherland. These works serve to foster spirituality in students.

The primary task of musical education is to cultivate students' feelings of beauty and refinement, enrich their understanding and perceptions of the world, assist in the proper formation of their artistic taste, shape moral qualities in them, and, most importantly, nurture feelings of love for the Motherland in young students through art, thereby fostering their spirituality.

These tasks are entrusted to the music teacher. By what means are these serious, pedagogically, and psychologically complex tasks accomplished? There are many paths and tools. One of these is ensuring the development of students' spirituality. This may also seem complex at first glance. However, if the music teacher is sufficiently knowledgeable, loves their work, and derives pleasure from working with children, achieving the goal is certainly possible.

The following paths and tools have been proven to yield good results in fostering spirituality in children during music lessons:

- Starting each lesson with a positive mood. Creating a lively atmosphere in the classroom and among the students, generating interest.

- Selecting a logically sound repertoire for each lesson (the program indicates that the teacher is free to choose the lesson repertoire, and may also use additional sources besides the textbook).

- Judiciously applying new pedagogical technologies in the lesson that arouse the students' interest.

- Taking into account the age characteristics of students, using more creative games, musical riddles, musical rebus puzzles, and kinetic methods.

- Continuously applying diverse activities aimed at enriching students' musical imagination and impressions from lesson to lesson.

- Utilizing live performance more in the lesson. The teacher should provide a live, bright, and expressive performance of each song and musical piece for the young listeners.

- Organizing classroom concerts (once per quarter). In these concerts, students perform the songs they have learned in music lessons individually, in duets, or in small choirs, and they also invite parallel classroom students to these concerts. (Creative musical report concerts).

- Systematically organizing individual work with students who are slow learners (low aptitude) to ensure the clean and bright resonance of the classroom choir.

- Implementing activities that not only enrich the content of the lesson but also serve to foster the creative activity of students, such as taking students beyond the confines of the lesson to various clubs, concerts, and meetings outside the classroom and school.

- Conducting numerous spiritual-educational events (conversations, meetings, debates, Q&A sessions).

In conclusion, we, as mentors and educators, must pass on the essence of national music, inherited from our ancestors, to the younger generation without diminishing its luster. Let us strive to raise music teachers who serve the interests of independent Uzbekistan, who possess a high level of knowledge of its language, religion, historical culture, literature, and art, and who are capable of living in harmony with its joys and concerns.

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Rezyume: *O‘qituvchi o‘quvchilarda musiqa san’ati ta’sirida go‘zallikka intilish, odob, rostgo‘ylik, yaxshilik, do‘stlik kabi axloqiy-estetik tushunchalarni tarkib toptira borish, o‘zini tuta bilish, kamtarlik, shirinsuxanlik, toza va chiroyli kiyinish kabi estetik madaniyatning qator sifatlari shakllana borishida, ma’naviy-madaniy tadbirlar vositasida milliy musiqa san’atining yoshlar madaniyatini shakllantirishda tutgan o‘rni haqidagi fikr-mulohazalar bildiriladi.*

Резюме: *Под влиянием музыкального искусства у учащихся формируются нравственно-эстетические понятия, такие как стремление к красоте, порядочности, честности, доброте, дружбе, а также такие эстетики, как самообладание, скромность, сладость, чистота и элегантность в одежде. формируются качества культуры, высказываются мнения о роли национального музыкального искусства в формировании молодежной культуры как средства духовно-культурных мероприятий.*

Kalit so‘zlar: *musiqa, madaniyat, san’at, ma’naviy-tarbiya, axloqiy-estetik, musiqa madaniyati.*

Ключевые слова: *музыка, культура, искусство, духовно-воспитательная, нравственноэстетическая, музыкальная культура.*

COMPARATIVE ANALYSIS OF LEVELS OF FORMING STUDENTS' PROBLEM-SOLVING AND EXERCISE-SOLVING SKILLS IN BIOLOGY TEACHING

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Summary:. *This article focuses on the formation and development of problem-solving and exercise-solving skills among students in biology education. It examines the issue of improving the methodological basis for developing these skills. Specifically, the article conducts a comparative analysis of various levels or approaches for enhancing this methodological basis, scientifically and methodologically justifying the effectiveness, shortcomings, and ways to overcome them for existing approaches. The analysis identifies the most effective methodological approaches that contribute to strengthening students' practical and theoretical knowledge, and enhancing their logical thinking abilities. The article will be useful for biology teachers, methodologists, education researchers, and all specialists interested in improving the effectiveness of biology education.*

Keywords: *Problem-solving skills, exercise-solving skills, methodological basis, improvement, comparative analysis, teaching methodology, students' skills, logical thinking, didactics.*

Introduction. The educational reforms carried out in our country aim to adapt teaching to modern requirements and modernize it based on advanced foreign experiences. In connection with the modernization of school biology education, it is intended to develop students' subject-specific knowledge, skills, and competencies; generalized methods of cognitive, communicative, practical, and creative activities; and to strengthen teachers' focus on gaining experience in this process. As President Sh. M. Mirziyoyev emphasized: "We will mobilize all the power and capabilities of our state and society so that our youth grow into individuals with high intellectual and spiritual potential who can confidently compete with their peers around the world in any field" [1]. Creating a modern learning environment for students in every subject, directing them toward independent and logical thinking, and fostering their scientific worldview are considered among the main tasks of the continuous education system. In fulfilling these tasks, special attention is paid to ensuring high-quality education in general secondary schools and developing students' ideological immunity and intellectual potential in biology classes, as in other subjects. The National Curriculum for developing school education places particular emphasis on forming students' knowledge and skills and educating them in the spirit of loyalty to national and universal values [2].

Review of Related Literature. The decrees, resolutions, laws concerning teacher training and development adopted by the President of Uzbekistan, the Action Strategy for the Development of the Republic of Uzbekistan, and the new edition of the "Law on Education" form the methodological basis of this research. In general secondary schools and academic lyceums of the republic, the pedagogical features of solving biological problems and exercises are being studied scientifically and methodologically based on innovative and integrative approaches. The development of students' skills in solving problems and exercises in biology has long been one of the leading research directions among scholars of Uzbekistan and CIS countries. Analysis of the existing literature shows that biological problems are regarded as an important tool for developing students' reasoning skills, the ability to solve problem situations, functional literacy, and competencies in natural sciences.

A.T.G'ofurov, in his work *"Methods of Teaching Biology"* and other studies devoted to the gradual formation of biological knowledge, provides sufficient scientific-theoretical foundations for constructing biological problems and exercises and using them in teaching. The author interprets biological problems as didactic tools that activate learning activity. His approach shows that problem-solving develops important cognitive processes such as forming logical sequences, understanding cause-and-effect relationships, modeling natural phenomena, and analyzing experimental results. G'ofurov classifies problems into reproductive, constructive, comparative, problematic, ecological, and research types, emphasizing that each type cultivates specific cognitive skills. He particularly

notes that problematic and ecological problems develop students' independent thinking and attitudes toward nature [3].

S.Fayzullayev thoroughly studied the psychological-pedagogical and methodological foundations of using problems and exercises in biology education. He considers problems as a systemic tool for developing students' thinking and presents the following conclusions: biological problems allow modeling natural phenomena, understanding relationships at species and population levels, and applying genetic, ecological, and physiological laws; the problem-solving process develops reflective thinking and prompts the student to ask meaningful questions such as "why?", "how?", and "for what reason?" [4]. Rahmatov states that problem-solving develops students' functional literacy and analytical decision-making skills required by PISA standards [5].

A.Jumanov and N.Jumonova classify types of biological problems on a scientific basis and explain models of their use at various stages of the lesson. They argue that descriptive, comparative, functional, and ecological problems activate analytical thinking differently and serve to create problem-based situations during learning. According to the authors, problem-solving enriches students' understanding of biological concepts and the ability to apply them in practice [6].

R.Q.Qodirov proposes a model for constructing problems and exercises, distributing them according to difficulty levels, and adapting them to students' individual abilities. He argues that the problem-solving process consists of three stages—reproductive, algorithmic-constructive, and creative—each corresponding to a student's cognitive development. His research highlights the possibilities of implementing problems through a step-by-step methodological system [7].

B.Abdullayev substantiates that laboratory and practical classes serve as an important source for developing biological problem-solving skills. He emphasizes that experimental-practical tasks lead students to think like researchers and teach them to analyze situational problems. His studies strengthen the practical aspect of problem-solving [8]. D.Toshpo'latova analyzes problem-solving models based on competence-based approaches and PISA requirements. She provides scientific evidence that applying real-life cases in biology lessons develops students' functional literacy and enhances their ability to think actively based on natural sciences [9]. I.Ya.Lerner and M.N.Skatkin emphasize the creative nature of problem-solving and its role as a key mechanism leading students to intellectual activity. They consider problems as the most effective tool for creating problem-based situations. These studies conclude that problem-solving is the main means for processing, generalizing, and applying knowledge in new situations [10]. N.Deryabin and V.Polyakov developed a model of biological problems based on the theory of problem-based learning. They interpret problem-solving as a chain of scientific reasoning operations such as forming hypotheses, finding evidence, analyzing, and drawing conclusions [11]. Analysis of the works of CIS scholars shows that problem-solving is the most effective mechanism for transitioning from passive learning to active intellectual activity.

Research Methodology. The research methodology was based on the appropriate use of the goals, content, organizational forms, methods, and tools aimed at developing students' skills in solving biological problems and exercises. It consisted of integrating the specific methodological approaches of problem-solving and exercise-solving in biological education into the content of lesson plans.

Analysis and Results. Within the study, a total of 741 students from general secondary schools (5th–11th grades) were selected, with 372 in the experimental group and 369 in the control group. Students' attitudes toward solving biological problems and exercises were analyzed. During the experimental period, tasks were provided according to difficulty levels: reproductive (easy) in the 1st quarter, productive (medium) in the 2nd quarter, partially investigative (difficult) in the 3rd quarter, and creative (most difficult) in the 4th quarter. The results differed according to the difficulty levels.

Analysis of the experimental results showed that the students in the experimental group demonstrated higher knowledge, skills, and competencies than those in the control group. To objectively evaluate this, statistical analysis was conducted, confirming that the experimental work was scientifically, pedagogically, technologically, and methodologically effective.

The final stage determined the students' levels of mastering the processes of forming problem-solving skills using the criteria mentioned above.

Table 1.

Analysis of the initial results of the experiment on improving the formation of students' problem-solving skills in biology education (in numbers and percentages)

Classes	Number of students	Mastery results (in %)		
		High (%)	Medium (%	Low (%)
Experimental	372	86 23	141 38	145 39
Control	369	77 21	133 36	159 43

The initial results indicated that the differences between the experimental and control groups were not significant. Statistical analysis (Student's t-test and Pearson's methods) was used to objectively evaluate the results. For accurate assessment, the statistical indicators of both groups were considered as samples and variation series were formed.

The diagram below illustrates the obtained results:

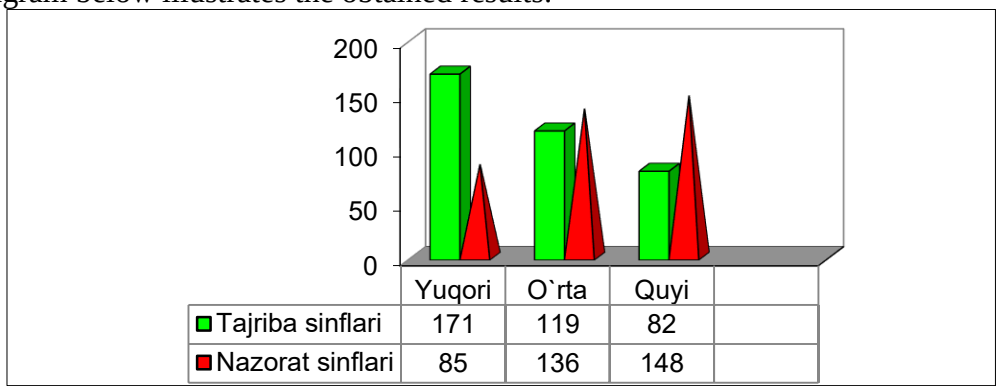


Figure 1. Diagram of forming students' problem-solving skills in biology teaching

The statistical results show that the effectiveness index of teaching is greater than 1, and the cognitive level index is greater than 0. The analysis revealed that the experimental group's learning outcomes were 13.7% higher than those of the control group.

Conclusion and Recommendations. Thus, the conducted experimental work confirmed that improving the methodological basis for developing students' skills in solving problems and exercises in biology increases teaching effectiveness.

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Rezyume. *Ushbu maqola biologiya ta'limida o'quvchilarning masala va mashq yechish ko'nikmalarini shakllantirish va rivojlantirishga qaratilgan. Unda mazkur ko'nikmalarni tarkib*

toptirishning metodik asosini takomillashtirish masalasi ko‘rib chiqiladi. Xususan, maqolada ushbu metodik asosni takomillashtirish bo‘yicha turli darajalarning qiyosiy tahlili amalga oshirilgan bo‘lib, bunda mavjud yondashuvlarning samaradorligi, kamchiliklari va ularni bartaraf etish yo‘llari ilmiy-metodik jihatdan asoslab beriladi. Tahlil natijasida o‘quvchilarda amaliy va nazariy bilimlarini mustahkamlashga, ularning mantiqiy fikrlash qobiliyatini oshirishga xizmat qiladigan eng samarali metodik yondashuvlar aniqlangan. Maqola biologiya o‘qituvchilari, metodistlar, ta'lim sohasi tadqiqotchilari hamda biologiya ta'limi samaradorligini oshirishga qiziquvchi barcha mutaxassislar uchun foydali bo‘ladi.

Резюме. *Данная статья посвящена формированию и развитию у учащихся навыков решения задач и выполнения упражнений в процессе преподавания биологии. В ней рассматривается вопрос совершенствования методической основы формирования данных навыков. В частности, в статье проведен сравнительный анализ различных уровней (или подходов) по усовершенствованию данной методической основы, при этом научно-методически обосновываются эффективность, недостатки и пути их устранения для существующих подходов. В результате анализа выявлены наиболее эффективные методические подходы, способствующие укреплению практических и теоретических знаний учащихся, а также повышению их способности к логическому мышлению. Статья будет полезна учителям биологии, методистам, исследователям в области образования и всем специалистам, заинтересованным в повышении эффективности биологического образования.*

Kalit so‘zlar: *Masala yechish ko‘nikmalari, mashq yechish ko‘nikmalari, metodik asos, takomillashtirish, qiyosiy tahlil, o‘qitish metodikasi, o‘quvchilar ko‘nikmalari, mantiqiy fikrlash, didaktika.*

Ключевые слова*: Навыки решения проблем, навыки решения упражнений, методологическая основа, совершенствование, сравнительный анализ, методика преподавания, навыки студентов, логическое мышление, дидактика*

FORMATION OF STUDENTS' CREATIVE STYLE BASED ON THE ANALYSIS OF NATIONAL KOLORIT AND COLOR HARMONY IN THE WORKS OF ARTISTS FROM THE UZBEKISTAN SCHOOL OF PAINTING

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Summary*: This scientific and methodological article addresses the issue of forming a national creative style among students in the system of higher art education. The primary goal of the research is to develop an effective methodology for teaching color harmony, based on the systematic analysis of the unique national color palette (Kolorit) found in the works of masters of the Uzbekistan Painting School (A. Volkov, P. Benkov, U. Tansykbaev). The article proposes the "Master-Student" Kolorit Analysis method, which focuses on applying solutions like color contrast, aerial perspective, and emotional color gamma from the masters' works directly into student studio practice. It is concluded that this methodology ensures the formation of a distinctive creative style imbued with a deep national spirit alongside technical proficiency in young artists' work.*

Key words*: National Kolorit, Painting School, Visual Analysis, Color Harmony, Masters' Works.*

In the modern system of art education, alongside providing students with fundamental knowledge, it is crucial to instill in them a unique **creative style** and **national identity**. The Uzbekistan School of Painting is directly connected with its historically formed bright **kolorit** (color palette), the unique qualities of colors influenced by the Central Asian sun, and artistic images characteristic of the Uzbek people's life. Studying the works of national art masters is the most effective way to form the foundation of a creative style for young artists. It is precisely through this approach that students become professionals capable of uniquely showcasing the art of Uzbekistan on the global artistic stage. Therefore, developing methodological foundations for forming a creative style through the analysis of national kolorit is an **extremely urgent task** for higher education.

The main problem of the research is that general academic kolorit rules often prevail in contemporary Painting classes. Consequently, although students may execute technically correct work, their artworks often fail to reflect the unique brightness of the national kolorit, the warm color gamma, and the specific local **aerial perspective**. This leads to a homogenization of color solutions in the graduates' works, making the formation of a personal, nationally distinct creative style difficult. Resolving this issue requires combining the methodological experience of national painting masters with contemporary pedagogical approaches to consciously form the skill of applying the kolorit characteristic of national painting in students.

The Uzbekistan School of Painting was formed at the beginning of the 20th century as a result of the synthesis of the cultural environment of Central Asia and the achievements of European art. Art critics who analyzed the main characteristics of the national kolorit, including researchers such as **H. Sulaymonov** and **N. Abdullayev**, specifically emphasize aspects like **brightness, a warm color gamma**, and the **originality of aerial perspective** in Uzbek painting. This bright and optimistic kolorit originated from Uzbekistan's geographical conditions and the national mentality, and it is the first fundamental concept that should be taught to students.

The artists involved in the formation of the national painting school used various color solutions. To establish a creative style in students, these color solutions need to be analyzed methodologically:

1. **A. Volkov's School:** The artist's kolorit in his works is primarily based on the active use of **contrasts** and the principle of **colors dissolving into the environment**. His bright, pure colors serve as an excellent example for teaching students how to correctly utilize the emotional power of colors.

2. **Works by P. Benkov and U. Tansykbaev:** The works of these creators reflect unique methods of conveying the influence of the Central Asian nature's **aerial perspective** and **sunlight**

through color. Benkov's airy, light colors and Tansykbaev's deep, opulent kolorit serve as a key tool for explaining to students the **interrelation of kolorit with the atmospheric environment**.

Methodological Gap and Scientific Novelty Existing studies show that while theoretical information about these masters is provided in higher education, the methodology for directly applying their color solutions to the étude process is not systematized. For instance, specific types of practical exercises have not been clearly developed for teaching how to use Volkov's colors in a student's étude or how to teach Benkov's method of rendering light. This methodological gap precisely defines the scientific novelty of the current research.

The main goal of this research is to develop scientific and methodological solutions for forming a unique creative style based on national art traditions in higher education students, through the systematic analysis of the unique national kolorit and color harmony in the works of masters from the Uzbekistan School of Painting.

To achieve the stated goal, the following objectives are implemented:

1. **Strengthening the Theoretical Foundation:** Re-analyzing the concept of **national kolorit** put forth in the works of Uzbek art critics (H. Sulaymonov, N. Abdullayev) within the context of contemporary colorimetry theories (warm-cold, light-dark contrast).
2. **Developing Analysis Methodology:** Proposing a **complex visual analysis methodology** aimed at determining the technical methods (e.g., paint texture, color contrast, rendering of light) used to achieve the national kolorit in the works of Uzbekistan's masters (A. Volkov, P. Benkov, U. Tansykbaev).
3. **Proposing a System of Practical Exercises:** Introducing a special system of **"Stylistic Études"** based on the analysis results, designed to help students apply the color solutions characteristic of national painting to their own études and compositions.
4. **Substantiating Effectiveness:** Theoretically substantiating the positive impact of the proposed methodology on the formation of students' **creative style** and the degree of **national originality** in their artworks.

Systematically analyzing the color solutions in the works of the masters of the Uzbekistan School of Painting is crucial, not merely for theoretical study, but for their direct application to the student's **étude** process.

A. Volkov's Color Contrast:

1. **Analysis:** The bright, pure color application in Volkov's works is analyzed, especially the sharp **contrast of complementary colors** (in works like "Pomegranate Atelier," "Under the Crescent Moon"). He demonstrated the maximum brilliance achieved through the transparency of the white gesso ground.
2. **Application to the Student:** Students are tasked to find not the local color of objects during the étude, but their **maximum brilliance under sunlight**, and to avoid darkening (soiling) these colors. This encourages them to feel the **Volkov-style bright kolorit**.

P. Benkov's Light and Aerial Kolorit:

1. **Analysis:** The kolorit in Benkov's works is characterized by the **airy lightness** shaped by his landscapes of Fergana and Bukhara. He rendered deep **aerial perspective** by using soft and smooth transitions between warm and cool hues when mixing colors.
2. **Application to the Student:** Students are assigned to complete one **étude** under bright sunlight and a second one in cool shadow. The objective is to learn how to **model color with air and light** characteristic of Benkov's style, by feeling how much the colors cool down in the shadow and warm up in the light.

U. Tansykbaev's Emotional Color Gamma:

1. **Analysis:** The color gamma in the artist's landscape and figural compositions is deep, opulent, warm, and romantic in spirit. By using closely related hues (analogous harmony) on large surfaces, he imparted grandeur and stability to the artwork.
2. **Application to the Student:** Students are assigned the task of determining an **emotional kolorit** appropriate for the subject of their artwork. They are taught, like Tansykbaev, to select not

just the color seen in the étude, but the **dominant (main) color** that creates the overall mood of the work.

To systematically form the students' creative style, it is recommended to introduce a special type of practical exercise:

Assignment: Based on the analysis of the masters' works, students are required to consciously integrate three national kolorit elements into their own **études**, rather than simply working on a standard study:

1. **Warm-Cool Contrast:** Intensifying the warm light characteristic of the Uzbek sun with cool shadows (Benkov's method).
2. **Luminosity of Local Color:** Preserving the brightness of objects regardless of their placement (Volkov's method).
3. **Depth of Dark Kolorit:** Achieving depth in dark kolorit by adding complementary colors (e.g., reddish hues to green) instead of darkening the colors (Tansykbaev's method).

As a result of this methodology, the student learns not only to see colors correctly but also to understand them within a **cultural-national context**. The knowledge gained through analyzing the masters' works creates the foundation for forming the student's creative style. This, in turn, facilitates the emergence of a **professional style** in young artists' works—a style that is unique, possesses local **kolorit**, and is based on the traditions of the national school.

Conclusion

The conducted research demonstrated that forming students' **unique national creative style** in teaching the Painting discipline in higher education primarily requires the systematic study of the rich heritage of the masters from the Uzbekistan School of Painting through a structured methodology.

Through the **"Master-Student" Kolorit Analysis** and **"National Kolorit Elements" Étude** methodologies proposed in the article, unique solutions such as **color contrast, aerial perspective**, and **emotional color gamma** were identified in the works of masters (A. Volkov, P. Benkov, U. Tansykbaev) and the pathways for their practical application in the students' artistic process were substantiated.

As a result:

1. Students learn to consciously select colors based not only on academic rules, but also through the kolorit shaped by the **national cultural spirit** and geographical conditions (the Central Asian sun).
2. This approach prevents superficial imitation in the student's works and creates the foundation for the emergence of a unique, **deep creative style** based on national kolorit.
3. Analyzing the creative work of national masters serves to develop the creative thinking of young artists.

In order to increase the effectiveness of Painting classes in higher education and form a national creative style, the following practical recommendations are put forward:

1. **Improvement of Textbooks:** Mandatory inclusion of **kolorit analysis diagrams** and practical exercise examples derived from the artworks of Uzbekistan's artists into the educational and methodological manuals for Painting.
2. **Special Courses:** Organizing specialized seminars and practical courses for students on the topic **"Analysis of National Kolorit in the Works of Masters."**
3. **Practical Application:** Requiring students, during their academic **études**, to consciously apply at least two distinctive **kolorit elements** of Uzbek painting in each of their works (for example, Benkov's method of rendering light + Tansykbaev's deep color gamma).

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ADVANCING FINE ARTS TEACHER EDUCATION THROUGH MASTER CLASSES

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Summary: *This study provides a comprehensive scientific analysis of the methodology for enhancing pre-service fine arts teachers' methodological preparation through the integration of master classes. Methodological training constitutes a fundamental component in shaping the pedagogical and didactic competencies essential for a teacher's professional performance. The research explores the potential of master classes in fostering creative thinking, strengthening pedagogical mastery, and bridging theoretical understanding with practical application. Furthermore, it offers evidence-based conclusions regarding the systematic organization of master classes, their incorporation into teacher education curricula, and their impact on professional development. The proposed framework possesses both theoretical and practical significance for preparing future fine arts educators in alignment with contemporary educational standards and innovations.*

Keywords*: Pre-service fine arts teacher, methodological training, master class, pedagogical mastery, creative approach, educational effectiveness, professional competence, learning process, methodology, innovative approach.*

In the current stage of educational reform, enhancing the quality of teacher training remains one of the most critical priorities in pedagogy. The preparation of fine arts educators, in particular, extends beyond theoretical instruction to include practice-oriented methodological frameworks that cultivate creativity and pedagogical mastery. In Uzbekistan, significant attention is being directed toward education reform. For example, while 5.6% of the national budget was allocated to education in 2019, this figure increased to 6.2% by 2021. Despite this, the fine arts discipline continues to face financial and institutional challenges that restrict its developmental potential.

Moreover, according to recent statistics, approximately 61% of fine arts teachers report insufficient time to fulfill their pedagogical and creative duties effectively. Such constraints hinder the advancement of methodological training, as the development of artistic pedagogy requires substantial time, mentorship, and creative experimentation. Forecasts for the next three to five years predict that methodological innovations in teacher education will intensify, particularly with the expansion of STEAM (Science, Technology, Engineering, Arts, Mathematics) approaches that integrate artistic creativity with scientific and technological literacy.

This article seeks to substantiate and refine a methodological system aimed at improving pre-service fine arts teachers' professional preparedness through structured master classes. It focuses on identifying effective pedagogical strategies, evaluating empirical data, and aligning best practices with the demands of modern teacher education.

Literature Review

1.1 Methodological Approaches to Art-Based Teacher Training

Art-based pedagogical models have proven to significantly enhance pre-service teachers' instructional competence and creativity. Experimental data indicate that students engaged in art-based learning models scored an average of 100.41 on post-tests compared to 94.90 in control groups, demonstrating the superiority of experiential, practice-oriented teaching methods. These findings reinforce the importance of integrating creative methodologies into teacher education.

STEAM pedagogy, which unites artistic and scientific disciplines, further promotes critical thinking, interdisciplinary collaboration, and innovation. However, effective implementation of STEAM in teacher education requires systemic structural changes, continuous teacher professional development, and a reevaluation of traditional curricula.

1.2 Active Learning and Microteaching

Active learning transforms students from passive recipients of information into active participants in the construction of knowledge. A meta-analysis encompassing 225 studies revealed

that active learning reduced failure rates from 32% (traditional lectures) to 21%, alongside a 0.47 standard deviation improvement in conceptual understanding.

Microteaching, a reflective and iterative instructional technique in which pre-service teachers deliver short, recorded lessons and receive peer feedback, ranks among the most effective pedagogical tools. According to John Hattie's Visible Learning (2009), microteaching is the sixth most impactful instructional strategy in improving teacher effectiveness.

1.3 Direct Instruction and Mentorship

Direct instruction remains a highly validated pedagogical approach, supported by meta-analyses of over 42,000 students that revealed an average effect size of 0.59—a statistically significant advantage over other instructional models.

Mentorship and instructional coaching also play pivotal roles in developing pedagogical expertise. Studies conducted at the Pennsylvania Institute for Instructional Coaching indicated that 91% of mentored teachers demonstrated a deeper understanding of new instructional methods, while 79% substantially improved the quality of their teaching practices.

Practical Applications

1. Art-Based Learning through Microteaching: The Mask-Making Experiment

Zakaria et al. (2019) conducted a quasi-experimental study that divided pre-service fine arts teachers into experimental (art-based microteaching) and control (traditional teaching) groups. The experimental group achieved a mean score of 100.41, compared to 94.90 in the control group, yielding a statistically significant improvement of 5.51 points ($p = 0.029$). These results affirm that art-based microteaching enhances both creative engagement and instructional competence.

2. The Impact of Arts Programs on Academic Achievement

Egana-delSol (2023) demonstrated that participation in arts-based seminars with professional artists significantly improved academic outcomes: $+0.61\sigma$ in language, $+0.36\sigma$ in mathematics, $+0.33\sigma$ in the arts, and $+0.55\sigma$ in overall GPA. These students also displayed heightened motivation for higher education and artistic excellence.

3. Teachers' Perceptions and Socio-Emotional Impact

Fahy (2023) reported that 26% of teachers identified positive socio-emotional outcomes when engaging with professional artists in schools. Such collaborations fostered empathy, broadened perspectives, and enhanced communication and reflective skills among students and educators alike.

Challenges and Limitations

Despite the proven effectiveness of art-based learning and microteaching, their large-scale implementation faces infrastructural and resource-based constraints. Microteaching requires advanced technological tools, qualified mentors, and institutional support, all of which may be limited in resource-constrained educational settings. Addressing these challenges demands policy-level investment, teacher professionalization, and institutional innovation.

Forecast and Expected Outcomes

If art-based methodologies, microteaching, STEAM integration, and collaborative pedagogical practices are systematically implemented, the following outcomes are projected within the next three to five years:

Methodological competence among pre-service fine arts teachers will improve by an estimated 30–40%, particularly through reflective and evidence-based feedback mechanisms.

Student creativity, engagement, and interdisciplinary understanding will increase by 20–30% as a result of STEAM-based instruction.

Classroom communication, critical thinking, and pedagogical reflection will improve through structured dialogue and active learning environments.

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Rezyume: *Ushbu maqolada bo'lajak tasviriy san'at o'qituvchilarining metodik tayyorgarligini takomillashtirishda mahorat darslarining (master class) o'rni va ahamiyati ilmiy jihatdan tahlil qilinadi. Tadqiqotda metodik tayyorgarlik o'qituvchining kasbiy faoliyatida zarur bo'lgan pedagogik va didaktik kompetensiyalarni shakllantirishdagi asosiy omil sifatida ko'riladi. Maqolada mahorat darslarining ijodiy yondashuvni rivojlantirish, nazariy bilimlarni amaliyot bilan uyg'unlashtirish hamda metodik ko'nikmalarni mustahkamlashdagi roli yoritilgan.*

Shuningdek, tadqiqotda art-based learning, microteaching, STEAM integratsiyasi va mentorlash kabi zamonaviy pedagogik yondashuvlarning samaradorligi tahlil qilingan. Ularning ta'lim jarayoniga tizimli tatbiqi orqali bo'lajak o'qituvchilarning kasbiy kompetensiyasi 30–40% gacha, talabalar ijodkorligi esa 20–30% gacha oshishi mumkin

Резюме: *В данной статье научно анализируются роль и значение мастер-классов в совершенствовании методической подготовки будущих учителей изобразительного искусства. Методическая подготовка рассматривается как ключевой фактор формирования педагогических и дидактических компетенций, необходимых для профессиональной деятельности учителя. Подчеркивается роль мастер-классов в развитии творческого подхода, сочетании теоретических знаний с практикой и закреплении методических навыков.*

В исследовании также анализируется эффективность современных педагогических подходов, таких как арт-ориентированное обучение, микрообучение, интеграция STEAM и наставничество. Благодаря их системному внедрению в образовательный процесс профессиональная компетентность будущих учителей может повыситься на 30–40%, а креативность студентов – на 20–30%.

Kalit so'zlar*: bo'lajak tasviriy san'at o'qituvchisi, metodik tayyorgarlik, mahorat darsi, pedagogik mahorat, ijodiy yondashuv, STEAM, mikro-o'qitish, kasbiy kompetensiya, innovatsion metodika.*

Ключевые слова: *будущий учитель изобразительного искусства, методическая подготовка, мастер-класс, педагогическое мастерство, творческий подход, STEAM, микрообучение, профессиональная компетентность, инновационная методика.*

POPULATION GROWTH OF THE REPUBLIC OF UZBEKISTAN

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Summary: *This article examines the territorial and periodic characteristics of population growth in the Republic of Uzbekistan. Regions are grouped by population growth rate.*

Key words: *population, population growth, average population, natural increase, migration increase, urban population, rural population*

The demographic situation is a complex social, economic, geographical and political process that reflects the growth of a country's population and its sources, including natural increase and migration, as well as the settlement of the population, urbanization, its national and social composition, family, labor resources and the level of employment [2]. This process has been constantly changing in the world over the past decades. In Uzbekistan, as a result of socio-economic and political processes taking place since the 1990s, a new demographic situation has emerged.

Uzbekistan is the largest among Central Asian countries in terms of population (45.5 %). According to statistical data, as of January 1, 2024, its number reached 36,799.8 thousand people. This indicator amounted to 24,487.7 thousand people in 2000, and over the past 24 years it has increased by almost 12,312.1 thousand people or 150.3%. This indicator was 114.3 % in 2000-2010 and 121.1 % in 2010-2020. So, in recent years, population growth in our country has accelerated significantly.

As of January 1, 2024, the share of the urban population in our country is slightly higher, at 51.0 %, and in rural areas - 49.0 %. During the study period, the rate of population growth is significantly different in urban and rural areas. In particular, between 2000 and 2024, the population in cities increased from 9,165.5 thousand to 18,771.1 thousand people (more than twice), and in rural areas from 15,322.2 thousand to 18,028.7 thousand people (117.7%). Usually, the rate of population growth in rural areas, that is, natural increase, was much higher than in cities. However, this was due to the fact that 966 large villages in our country were granted town status in accordance with the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 68 dated March 13, 2009, "On measures to further improve the administrative-territorial structure of settlements" [1].

Table 1. The population of Uzbekistan and its periodic growth

Years	Population (1000 per)		From that:			
			Urban population		Rural population	
	Total population	Growth	Total population	Grouth	Total population	Growth
2000	24487,7	-	9165,5	-	15322,2	-
2010	28001,4	3513,7	14425,9	5260,4	13575,5	-1746,7
2020	33905,2	5903,8	17144,1	2718,2	16761,1	3185,6
2024	36799,8	2894,6	18771,1	1627,0	18028,7	1267,6

The table was compiled based on the information of the National Statistics Committee of the Republic of Uzbekistan

According to the table, the population increased by 3,513.7 thousand people in 2000-2010, by 5,903.8 thousand people in 2010-2020, and by 2,894.6 thousand people in 2020-2024. As mentioned above, the number of urban populations increased from 9165.5 thousand people to 18771.1 thousand people, and the rural population increased from 15322.2 thousand people to 18028.7 thousand people. It should be noted that, according to the above-mentioned decision, the urban population increased from 9698.2 thousand to 14236.0 thousand in 2009, while the rural population decreased from 17374.0 thousand to 13297.4 thousand (Figure 1).

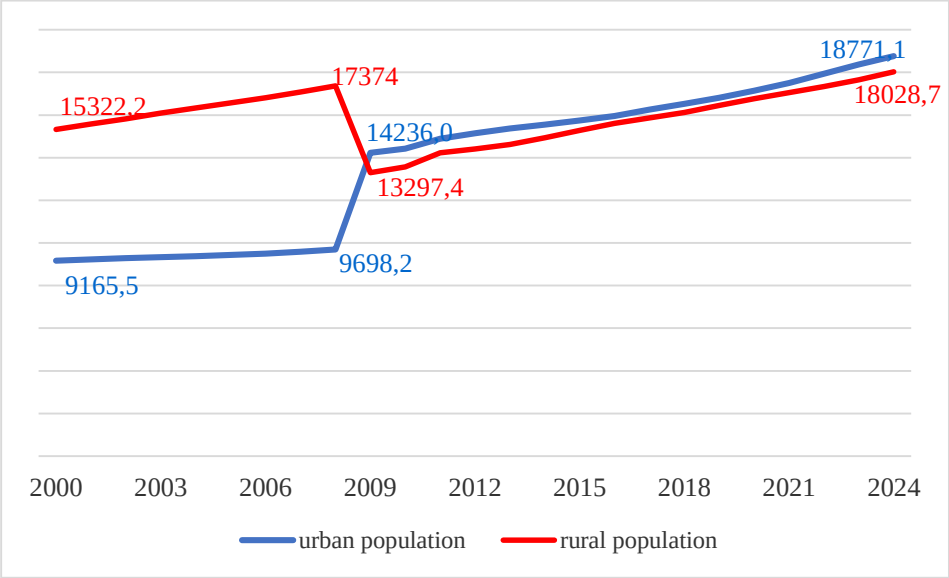


Figure 1. Population growth rate in Uzbekistan by urban and rural areas (thousand people)

It was compiled based on the information of the National Statistics Committee of the Republic of Uzbekistan

In our republic, demographic processes, as well as regional characteristics of the level of socio-economic development, have caused periodic changes in population growth and regional differences. In Uzbekistan, there were sharp changes in population growth during the period 2000-2024, which amounted to 150.3 %. This indicator was 114.3 % in 2000-2010 and 121.1 % in 2010-2020. In cities, this indicator was 157.4 and 118.8 %, respectively, while in rural areas it was 88.6 and 123.5 % (Figure 2). In recent years, we can observe an increase in the level of population growth in Uzbekistan. This can be attributed to an increase in the level of natural increase.

Population growth during the study period had regional characteristics. For example, population growth was significantly higher in Kashkadarya and Surkhandarya regions than in other regions. This situation was low in the Republic of Karakalpakstan, Tashkent and Navoi regions, and moderate in the remaining regions.

When analyzing population growth by period, the average level in our country in 2000-2010 was 114.3 %, higher than this indicator in Andijan, Jizzakh, Kashkadarya, Namangan, Samarkand, Surkhandarya, Fergana and Khorezm regions, and lower in Bukhara, Navoi, Syrdarya, Tashkent regions, Tashkent city and the Republic of Karakalpakstan.

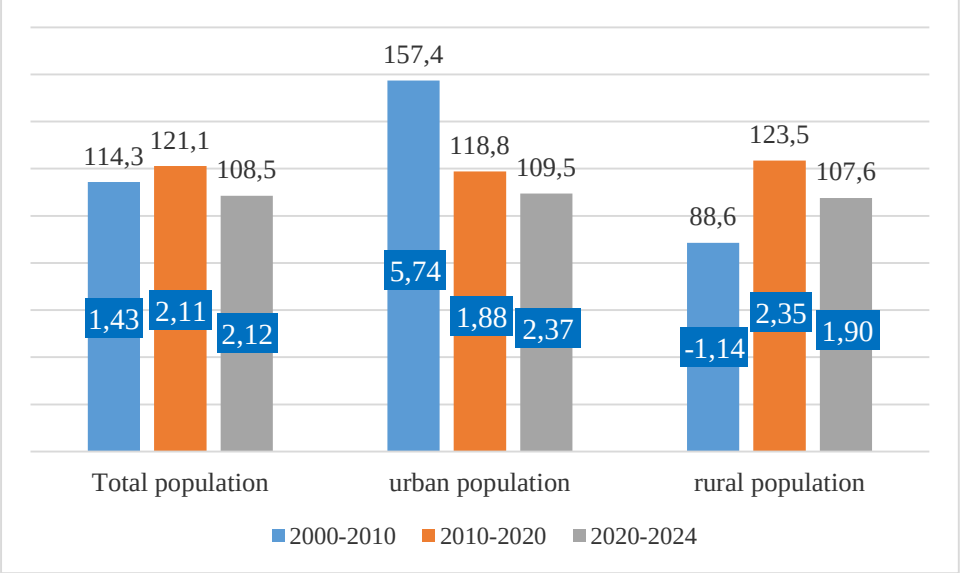


Figure 2. Periodic growth rate of the population of Uzbekistan (in %)

It was compiled based on the information of the National Statistics Committee of the Republic of Uzbekistan

This situation amounted to 121.1 % in 2010-2020. During this period, the above situation was observed across the administrative units of our country, with only the Khorezm region, where population growth was slightly lower than the average for our country, ranking in the second group.

Table 2 shows the administrative units of Uzbekistan divided into three groups according to population growth rates. The first group consists of regions with a rapidly growing population, with a total area of 48.7 thousand sq. km (10.8 % of the territory of our republic). During the period under review, the population increased from 3,903.5 thousand to 6,437.7 thousand people (164.9 %), and its share in the population of our country increased from 15.9 to 17.5 %.

The regions of the second group occupy 24.0 % of the country's territory (107.5 thousand sq. km). During this period, the population in this group increased from 15,947.7 thousand to 24,232.3 thousand people (151.9 %), and its share increased from 65.2 to 65.8 %. The second group has the largest number of administrative units, including 8 regions and the capital city of Tashkent. The third group, divided by population growth rate, is the largest in terms of territory, accounting for 65.2 % of the country's territory (292.8 thousand sq. km). During the research period, its population grew from 4636.5 thousand to 6129.8 thousand people (132.2 %). During this period, the share of the population due to the low level of population growth decreased from 18.9 to 16.7 %. Therefore, it should be concluded that the main change in the location of the population during the research period, that is, the demographic capacity is being observed in the direction of the south (Surkhandarya and Kashkadarya regions) and the "shift" of the urbanized area to the east.

Table 2. Grouping of regions of Uzbekistan by population growth (2000-2024)

№	Groups	Administrative units	Area		Population share (%)	
			1000 sq. km	%	2000 y.	2024 y.
1	Population growth is high (160.0 % and more)	Kashkadarya and Surkhandarya regions	48.67	10.8	15.9	17.5
2	Average population growth (140.0-159.9 %)	Andijan, Bukhara, Jizzakh, Namangan, Samarkand, Syrdarya, Fergana, Khorezm regions and Tashkent city	107.48	24.0	65.2	65.8
3	Population growth is low (139.9 % and more)	Republic of Karakalpakstan, Navoi and Tashkent regions	292.83	65.2	18.9	16.7
	Total:	**14**	**448.98**	**100.0**	**100.0**	**100.0**

The table was compiled based on the information of the National Statistics Committee of the Republic of Uzbekistan.

The specific regional characteristics of population growth are greatly influenced by the national and ethnic composition. The indigenous peoples of the republic have traditionally been large families, the main part of which is made up of Uzbeks. In addition, the urbanization process also has a significant impact on population growth. To date, the level of urbanization in our country has reached 51.0 %. As we have already noted, this high indicator was strongly influenced by the urban policy pursued in our country. In 2000-2008, the level of urbanization in Uzbekistan decreased from 37.4 to 35.8 %.

During the period 2000-2024, the level of urbanization increased from 23.0 to 39.8 % in the first group, from 39.4 to 54.4 % in the second group, and from 42.9 to 49.5 % in the third group. Tashkent city is of great importance in the growth of the urbanization process in the second group.

It should be noted that, in addition to the above factors, the ecological situation also has a significant impact on the growth and distribution of the population. For example, our republic has a variety of natural conditions. At the same time, a number of environmental problems have arisen in Uzbekistan due to anthropogenic factors. This is illustrated by the pollution of the environment in large cities by automobile, industrial and household waste, and the pollution of land and water

resources by various chemical fertilizers and waste. The population growth and settlement have also been caused by the ecological situation created by the drying up of the Aral Sea. The existing problem is most clearly visible in the northwestern part of our country.

For example, the Republic of Karakalpakstan and the Navoi region in the third group identified above are located in areas with poor environmental conditions, while the Tashkent region is located in an area with heavy industrial development. Therefore, factors affecting population growth and settlement, such as mortality, especially infant and maternal mortality, and population migration, are likely to be slightly higher in this region than in other places.

During the years under study, regional differences in population growth between urban and rural areas of Uzbekistan are also noticeable. Some sectors of agriculture are characterized by manual labor, and the need for labor has always been high. Due to these factors, the birth rate in rural areas is somewhat higher. However, the birth rate in rural areas is decreasing faster than in urban areas, and in this respect, they are getting closer to each other.

The population of Uzbekistan has grown mainly due to natural increase. Although this process slowed down significantly in the first years of independence, its indicators have increased slightly in recent years. However, it has not only compensated for population growth, but also for the negative balance of external migration. During the period under study, the effects of external migration in Uzbekistan were negative, as a result of which the population growth rate was lower than the indicator of its natural increase.

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Резюме: *Ушбу мақолада Ўзбекистон Республикаси аҳолиси ўсишининг ҳудудий ва даврий хусусиятлари ўрганилган. Минтақалар аҳоли сонининг ўсиш даражаси бўйича гуруҳлаштирилган.*

Резюме: *В статье рассматриваются территориальные и периодические особенности роста населения Республики Узбекистан. Регионы сгруппированы по темпам роста населения.*

Калит сўзлар: *аҳоли сони, аҳоли сонининг ўсиши, ўртача аҳоли сони, табиий кўпайиш, миграцион кўпайиш, шаҳар аҳолиси, қишлоқ аҳолиси*

Ключевые слова: *население, прирост населения, средняя численность населения, естественный прирост, миграционный прирост, городское население, сельское население*

PORTRAIT AND FIGURATIVE PAINTING: TECHNICAL AND AESTHETIC ISSUES OF EXPRESSING PSYCHOLOGICAL STATE THROUGH COLOR

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Summary: *This scientific and methodological article addresses the core challenges in teaching the* ***Painting discipline*** *within portrait and figure genres in the higher education system. The main objective of the research is to develop a* ***complex methodological approach*** *necessary for students to effectively convey the* ***psychological state of a person through color****. The article proposes methods such as the* ***"Emotional Palette" analysis*** *and* ***conveying condition through paint texture****, which integrate the technical (color, texture) and aesthetic (symbolism) aspects of color in expressing psychological state. It is concluded that the proposed methodology enhances both students' psychological perception and technical-creative mastery, ultimately increasing the emotional impact of their artworks.*

Keywords: *Portrait painting, Figurative composition, Psychological state, Color texture, Color palette, Emotional expression, Color psychology, Teaching methodology.*

Painting (or **The art of painting**) is one of the oldest and most complex ways of expressing human inner feelings (or **experiences**) through visual means. The portrait and figurative composition genres of painting serve to reflect not only the human figure, but also their psychological state, spiritual world, and character. In higher education, it is crucial to integrate the technical skills of the students (color application) with psychological analysis in preparing future artists. A work created without this integration cannot go beyond a superficial (or **shallow**) appearance. Therefore, studying the theoretical and practical aspects of expressing human psychology through color is extremely relevant for forming highly qualified, creatively thinking specialists.

The **main problem of the research** is that during the process of teaching painting, students often focus more on technical aspects (drawing, rendering/coloring) and find it difficult to use colors as an aesthetic and symbolic tool for expressing a psychological state. Subtle issues arise, such as the psychology of colors and their individual impact on each person (for example: red — not only anger, but also power; green — not only peace, but also sickness). This leads to superficial color solutions and unemotional depictions in portrait and figurative works. Overcoming this gap — that is, building a solid bridge between the technical application of colors (texture, color palette/scheme) and their aesthetic-psychological meaning — is a scientific and methodological problem that must be solved in higher education.

The main goal of this research is to develop scientific and methodological foundations and pedagogical recommendations aimed at enabling higher education students to effectively express a person’s psychological state in the portrait and figurative genres of painting by utilizing color texture and color scheme (or **palette**).

The following **tasks** (or **objectives**) will be implemented to achieve the set goal:

1. **Determine the Theoretical Basis:** To study the theories of Color Psychology (Kandinsky, Luscher), color contrasts (Itten), and the theory of creating a psychological portrait, and to develop a model for their application in higher education.
2. **Analyze Technical Issues:** To identify the main technical difficulties encountered in expressing psychological states in portrait and figurative painting (e.g., color texture, reliability of the color scheme/palette) and to substantiate ways to overcome them.
3. **Propose a System of Practical Exercises:** To introduce a system of special color analysis and *étude* (sketch) exercises (e.g., "Palette of Emotions") aimed at transmitting psychological state through color to students.
4. **Substantiate Effectiveness:** To theoretically substantiate how the proposed methodological approach positively affects students' psychological perception abilities and the emotional impact of the artwork's color scheme.

The main objective is to teach students to choose colors that reflect the **inner state**, not just the colors they see.

1. **Explanation (or Instruction):** The instructor requires students to identify not the superficial emotion of the model (or the character of the figurative composition), but their inner, hidden psychological state (e.g., aspiration, melancholy, determination).
2. **Practice (or Application):** Students are assigned "Palette of Emotions" exercises (similar to the Lüscher theory). In this exercise, they first select the dominant colors (color scheme/palette) and complementary (contrasting) colors corresponding to the state being studied, first on paper and then in the background of the artwork.
3. **Example:** If the character's inner state is sorrow/anger, the goal is not to render the skin itself in reddish-brown tones, but to increase the emotional power of the artwork by using a sharp contrast between a cool-green or grey background and red tones.

In transmitting the psychological state, not only the color tone but also the method of application — the **texture** (paint layer or *factura*) — plays an important role.

1. **Technical Problem:** Students often apply the paint smoothly (flatly), which reduces the "vitality" (or **liveliness**) of the image.
2. **Methodological Solution:** It is recommended to teach students the types of textures that correspond to the psychological state of the model:
3. **Anxiety/Nervousness:** The use of fast, sharp, dense, and thick brushstrokes (**impasto**).
4. **Peace/Gentleness:** Ensuring delicate (smooth) transitions of color through soft, semi-transparent brushstrokes (**glazing**).
5. **Application in Figurative Work:** In a figurative composition, the psychological emphasis is enhanced by rendering the main character's face and hands (centers of emotion) in a bright and thicker texture, while the background and secondary elements are handled with a muted (glazing) texture.

It is recommended to introduce the following **special exercise** into the educational process:

1. **Assignment:** Students are assigned to complete a Portrait (or Figure) *étude* (sketch) within a short period, setting the primary task not as achieving anatomical likeness, but as finding the **emotional color scheme** (Psychological Color Scheme/Palette).
2. **Goal:** This exercise sharply increases the student's ability for psychological perception of colors and encourages them to use color not merely as paint, but as a means of expression.

Conclusion

This research, conducted on the subject of Painting in higher education, was aimed at overcoming the technical and aesthetic issues encountered in expressing the human psychological state, particularly in the portrait and figurative genres. The research results demonstrated that mere anatomical accuracy and superficially correct color rendering do not fully develop the professional skills of students.

The Complex Psycho-Painting approach advanced in this article (specifically, the "Emotional Palette" analysis and the methodology of transmitting state through color texture) integrated theoretical knowledge (Kandinsky, Luscher) with the practical creative process.

As a result, the proposed methodological solutions allow for achieving the following:

1. Developing students' ability to perceive colors not only visually but also psychologically.
2. Adapting the artwork's color scheme to the model's inner feelings/experiences and thereby increasing the emotional impact of the work.
3. Conscious use of paint texture (the method and thickness of application) as a means of expressing the psychological state.

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A METHOD OF EFFECTIVE ORGANIZATION OF INDEPENDENT LEARNING OF THEACHING THEORY USING DIGITAL EDUCATIONAL TECHNOLOGIES

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Summary: *This article examines the methodological foundations for effectively organizing students' independent learning activities in higher education institutions and improving their effectiveness. It analyzes developed approaches to optimizing independent learning activities, using digital educational technologies in the educational process, planning individual student educational trajectories, and mechanisms for supporting self-assessment and reflective activity. The effectiveness of pedagogical tools, adaptive learning platforms, differentiated assignments, and methods that activate students' cognitive activity and facilitate the optimization of independent learning activities is experimentally confirmed. The results of the study contribute to the systematic organization of independent learning activities, enhancing students' motivation for learning, and developing their professional competencies.*

Keywords: *independent learning, optimization, pedagogical model, student engagement, digital technologies, adaptive learning, individual learning trajectory, self-assessment, reflective approach, monitoring, improving the quality of education.*

The reform of higher education in Uzbekistan directly led to the implementation of a multi-stage personnel training model, radically changing the requirements for graduating students in terms of the level and content of competencies formed in the educational process. Today, the most needed person in society is a creative, flexible person with a constructive, conscious attitude and able to adapt to all changes.

The methodology for effectively organizing and optimizing students' independent educational activities based on the credit-module system in the process of teaching the theory of education is aimed at increasing the efficiency of the educational process and developing students' skills of self-education and independent learning.

Today, in the context of the modernization of the education system and its adaptation to the digital environment, the effective organization of students' independent education is one of the pressing issues. The organization of independent educational activities within the framework of the theory of education is not only a component of the educational process, but also an important factor in the formation of a person's self-development, creative thinking, and professional competence. Through independent learning, the student becomes the subject of his own learning activity, he independently searches, analyzes and learns to apply his knowledge in practice.

Effective organization of independent work in the educational process develops students' self-management skills, directs them to scientific research, analytical thinking and a reflexive approach. At the same time, the use of digital educational technologies allows for the optimization of independent learning, that is, its implementation in a systematic, effective and tailored to individual needs.

A modern specialist is distinguished by his abilities, that is, he must be ahead of the current requirements for knowledge at any time through his knowledge, activities and the ability to use available resources. Therefore, the interest of researchers in the issues of improving independent work and increasing its efficiency does not decrease: the essence of independent work, its purpose, features, tasks and structure have been studied in sufficient detail by such scientists as S.I. Arkhangelsky, G.S. Leonova, E.Ya. Golant, N.G., A.S., Nilson; forms of organizing independent work and approaches to its classification have been studied by such scientists as A.S. Belkin, I.Ya. Lerner, I.I. Malkin, P.I. Pidkasisti, I.E. Unt; the issues of organizing independent work and its improvement have been covered by M.G. Garunov, I.I. Ilyasov, V.Ya. Lyaudis, R.A. Nizomov and others; the concept of self-education was developed by V.I. Andreev, A.K. Gromtseva, G.N. Serikov, M.N. Skatkin and others;

Variants of organizing independent work of students in the conditions of using modern pedagogical and information technologies, features of the relationship between management of independent work of students and self-management N.V. Grishina, M.A. Petrova, I.G. Shirokova, G.N. Yushko and others; various systems of organizing independent work of students, methods of its management and increasing efficiency were proposed by L.G. Vyatkin, P.Ya. Galperin, E.K. Osipyants, N.S. Sarro, N.F. Talizina, T.I. Shamova and other scientists.

The study analyzes the scientific and methodological foundations of organizing independent learning in teaching the discipline of educational theory, pedagogical approaches, assessment criteria and the possibilities of using digital platforms. Also, innovative technologies aimed at optimizing independent learning and their role in improving students' professional training are highlighted. The purpose of the study is to identify ways to effectively organize independent learning in the discipline of educational theory and improve it based on an innovative approach.

In the current educational process, independent learning activities often take on a formal character, and their effectiveness is not sufficiently ensured. The implementation of independent tasks by students is often carried out in a controlled manner, not aimed at developing analytical thinking and creativity. Therefore, there is a need to develop new methodological approaches to organizing independent learning, introduce digital technologies, and optimize the educational process.

The relevance of the issue is that today the quality of education in higher educational institutions largely depends on the culture and competence of students to work independently. Therefore, the systematic organization of independent studies in the field of educational theory, the development of clear criteria for their evaluation, and optimization using innovative technologies are considered a problem of scientific and practical importance.

The amount of information that a student absorbs is constantly increasing. According to the calculations of computer science specialists, the amount of information in a specific area of human knowledge doubles in the 5th-6th year. This is supported not only by quantity, but also by quality. The teacher, familiarizing himself with the latest literature in the subject, selects and recommends literature that is within the scope of the course he is studying and at the same time stimulates the development of his intellectual abilities. It is a rather difficult task to put forward a personal opinion among many scientifically based facts, numbers, and ideas. The teacher's task is to warn the student about such difficulties and to avoid them. The teacher, together with the students, created new knowledge and interesting information about science from related subjects, in addition to existing knowledge about science.

Studies have shown that effective organization of independent learning activities in the field of educational theory has a positive effect on the formation of students' learning motivation, reflective thinking skills, and professional competence. As a result of experimental analysis, a significant difference was observed between traditional forms of independent work and independent learning activities organized using digital technologies.

In particular, it was found that student activity increased by 35–40% in activities organized using interactive learning platforms (Google Classroom, Moodle, Edmodo, etc.), online testing systems, and digital project assignments. At the same time, the implementation of an individual approach to planning independent learning, time-management skills, and self-assessment criteria increased the effectiveness of the learning process.

The most effective methods for optimizing independent work are analyzed below.

1. Managing the learning process through digital platforms. Using platforms such as Google Classroom, Moodle, Edmodo, and Microsoft Teams, students' independent work is organized electronically.

2. Visualizing independent work. Using tools such as Canva, Genially, Prezi, and PowerPoint, students prepare their independent work in the form of infographics, video presentations, or interactive slides.

3. Automating analytical activities using SPSS and Excel programs. SPSS (Statistical Package for the Social Sciences) allows for statistical analysis in independent research.

4. Using learning tools based on artificial intelligence. Tools such as ChatGPT, Grammarly, Quillbot, Copilot, and Mendeley play an important role in improving the quality of students' independent work.

5. Enabling independent learning through gamification. Interactive tools such as Kahoot, Quizizz, and Mentimeter enhance competition, motivation, and game-based learning in students. The table below lists some independent works in the field of educational theory.

Table 3.5.1

Independent works in the field of educational theory

№	Topic	Assignment	Tools	Result
1.	"Basic Laws and Principles of the Pedagogical Process"	Analytical Independent Work The student independently studies the content of the concept of "principles of education", explaining each principle using the example of modern education	Google Classroom	Each student prepares a 1–2 page analytical essay and submits it via Google Classroom
2.	"Designing the educational process based on innovative pedagogical technologies"	Practical project assignment Students are divided into small groups and develop a project to teach one educational topic (for example, "Theories of Motivation") using one of the modern methods - cluster, brainstorming, gamification	Canva, PowerPoint or Prezi platform	The student prepares a project presentation and defends it in front of the class
3.	"The role of digital technologies in the organization of independent learning" Research assignment	The student observes how independent learning is organized in his faculty or group, conducts a survey of 5–10 students, and analyzes the results	Quizizz or Google Forms platform	Writes a mini-research report (with diagrams).
4.	Main areas of the discipline of educational theory	Independent literature analysis. The student selects 3–5 scientific articles or monographs and, analyzing their content, identifies current trends in the development of educational theory	Google Scholar, ResearchGate, Mendeley	The student writes a bibliographic review (1–2 pages) and presents the most important theoretical conclusions in the form of a presentation
5.	"Designing a Modern Educational Model"	Developing an Educational Model The student develops his or her "ideal educational model" - which outlines the roles of the teacher and student, educational tools, methods, assessment system, and the role of **the digital environment**	Via Canva, MindMeister, or Lucidchart	Visual presentation in the form of infographics or diagrams

During the discussion, it was found that the following factors play an important role in optimizing independent learning:

- The correct choice of pedagogical design - logical sequence of learning tasks and gradual increase in the level of complexity;
- Integration of digital technologies - use of educational platforms, visualization tools and gamification elements;
- Openness and transparency of assessment - combining student self-assessment and feedback provided by the teacher;
- Development of reflection and analytical thinking - the student learns to evaluate his own activities and analyze his results.

Also, during the study, it was found that in order to effectively organize independent learning sessions in the discipline of educational theory, it is necessary to develop the methodological training of teachers, develop their digital competence and continuous professional development in the use of modern educational technologies.

In general, the results obtained show that the optimization of independent learning is not limited to organizational changes, but requires updating all components of the educational process - goals, content, methods and tools. This allows creating an educational environment that ensures the personal development of the student based on an innovative approach.

In the process of optimizing independent learning, the systematic application of pedagogical approaches, the integration of digital educational technologies and the methodological training of the teacher are of decisive importance.

Also, the study revealed that the following conditions must be created for the effective organization of independent learning:

Development of pedagogical and digital infrastructure - creation of a convenient online environment and digital resources for independent learning;

1. Development of methodological manuals - preparation of methodological recommendations that determine the criteria for planning, performing and evaluating students' independent work;

2. Improving the skills of teachers - development of professional competence of teachers in the areas of modern educational technologies, gamification, distance learning and digital pedagogy;

3. Implementation of innovative approaches - introduction of project-based learning, problem-based learning, and adaptive learning elements in the educational process;

4. Formation of self-management skills in students - development of skills for independent planning, monitoring of one's own activities and analysis of results.

The following methods were used in developing the methodology:

1) Analysis of existing curricula organized on the basis of the credit-module system;

2) Identification of problems and needs in the organization of independent learning through a survey among students and teachers;

3) Study of the experience of leading higher education institutions and innovative educational approaches;

4) Development of structural recommendations for planning and effective organization of students' independent learning activities;

5) Analysis and comparison of student learning indicators in order to assess the effectiveness of the proposed methodology.

The research identified the following key aspects of organizing independent learning:

1. The need to develop self-organization skills. The credit-module system gives students greater independence, which requires them to have the skills to plan and manage their own learning.

2. Effective use of information and communication technologies. Modern digital technologies and online educational resources allow students to deepen the process of independent learning, master new knowledge, and develop themselves.

3. Strengthening learning motivation. Proper organization of independent learning develops responsibility, creativity, and the ability to analyze their own knowledge in students.

In the context of the credit-module system, the teacher now acts not only as a source of knowledge, but also as a consultant and guiding coach. He provides students with methodological assistance in properly organizing the independent learning process, setting learning goals, managing time and monitoring their own activities. Under the guidance of the teacher, students develop self-study and analysis skills. One of the most important problems in organizing independent learning is the lack of students' motivation for learning. To eliminate this problem, it is necessary to improve the incentive and assessment systems. In this regard, it is important to introduce mechanisms that encourage students to actively, creatively and effectively work independently. Studies have shown that the introduction of clearly structured methodological guidelines and recommendations for organizing independent learning improves students' learning performance, develops their critical thinking, independent decision-making and self-control skills.

In the context of the credit-module system, students are required to demonstrate a high level of independence and responsibility. Therefore, the effective organization of independent learning is one of the main factors determining the success of the educational process. The introduction of

methodologies aimed at developing students' self-management, planning of the educational process and the active use of modern educational technologies allows us to significantly improve the quality of higher education.

In conclusion, the optimization of independent learning activities in the field of educational theory serves to individualize the educational process, increase the learning activity of students, and prepare them as specialists with digital competence, independent thinkers, and those who meet the requirements of modern education.

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Rezyume: *Ushbu maqolada oliy ta'lim muassasalarida talabalarning mustaqil ta'lim faoliyatini samarali tashkil etish va uning natijadorligini oshirishning metodik asoslari yoritilgan. Mustaqil ta'limni optimallashtirish bo'yicha shakllangan yondashuvlar, o'quv jarayonida raqamli ta'lim texnologiyalaridan foydalanish, talabalarning shaxsiy o'quv trajektoriyalarini rejalashtirish, o'z-o'zini baholash va refleksiv faoliyatni qo'llab-quvvatlash mexanizmlari tahlil qilingan. Shuningdek, mustaqil ta'limni optimallashtirishga xizmat qiluvchi pedagogik vositalar, adaptiv ta'lim platformalari, differensiallashgan topshiriqlar hamda talabalarning kognitiv faolligini oshiruvchi metodlar samaradorligi eksperimental tarzda tasdiqlangan. Tadqiqot natijalari mustaqil ta'limni tizimli tashkil etish, talabalarning o'quv motivatsiyasini kuchaytirish va kasbiy kompetensiyalarini rivojlantirishga xizmat qiladi.*

Резюме: *В статье рассматриваются методические основы эффективной организации самостоятельной учебной деятельности студентов в высших учебных заведениях и повышения её результативности. Анализируются разработанные подходы к оптимизации самостоятельной учебной деятельности, использованию цифровых образовательных технологий в образовательном процессе, планированию индивидуальных образовательных траекторий студентов, механизмы поддержки самооценки и рефлексивной деятельности. Экспериментально подтверждена эффективность педагогических инструментов, адаптивных обучающих платформ, дифференцированных заданий и методов, активизирующих познавательную активность студентов, способствующих оптимизации самостоятельной учебной деятельности. Результаты исследования способствуют системной организации самостоятельной учебной деятельности, усилению мотивации студентов к обучению и развитию их профессиональных компетенций.*

Kalit so'zlar: *mustaqil ta'lim, optimallashtirish, pedagogik model, talaba faolligi, raqamli texnologiyalar, adaptiv o'qitish, individual ta'lim trayektoriyasi, o'z-o'zini baholash, refleksiv yondashuv, monitoring, ta'lim sifatini oshirish.*

Ключевые слова: *самостоятельное обучение, оптимизация, педагогическая модель, вовлеченность студентов, цифровые технологии, адаптивное обучение, индивидуальная траектория обучения, самооценка, рефлексивный подход, мониторинг, повышение качества образования.*

COMPARATIVE ANALYSIS OF TEMPORAL ADVERBS IN EXPRESSING ASPECTUAL SEMANTICS OF THE PREDICATE IN ENGLISH AND UZBEK LANGUAGES

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Summary:*This article is dedicated to the comparative study of the aspectual Aktionsart (mode of action) significance of verbs in English and Uzbek languages. Since grammatical aspect is not a full category in either language, the expression of aspectual meanings is analyzed primarily through morphological, semantic, and syntactic features, as well as temporal adverbs (adverbials).*
Key words:*Aspectuality, temporal adverbs, iterativity, durativity, quantitative indicator*

A comparative study of the aspectual (actional content) significance of predicates in English and Uzbek languages focuses attention on the manifestation of aspectual semantics at the language level. Since the role of grammatical aspect as a category is not fully formed in either language, aspectual meanings are expressed using the predicate's morphological, semantic, and syntactic features, as well as through adverbs and temporal devices within the text. It is precisely these characteristics that take a central place in the comparative analysis. The Russian aspectologist A. Kholodovich arrived at an important conclusion following his comparative research on the semantics of action repetition in various languages: he emphasizes that the "composition and structure of the quantitative indicator of action is extremely diverse." Kholodovich defines the functional-semantic macro-field of the quantitative indicator of reality in European languages as follows: The Quantity Macro-field is divided into two secondary fields: Linguistic means with a definite quantitative indicator. Linguistic means with an indefinite quantitative indicator.

Another important researcher on the classification of quantitative indicators is B. Toshovich. He divides the composition of quantitativity into the micro-fields of numerality and singularity. He also groups the micro-fields of plurality and indefinite quantity into a separate group. In Toshovich's classification, the macro-field of indefinite quantity includes two poles: Infinitely large quantity (the micro-field of multiplicity). Infinitely small quantity (the micro-field of singularity).

According to B. Toshovich, this approach is not limited merely to the theory of the functional-semantic field, but also encompasses quantitative complexes in describing linguistic quantitativity. He distinguishes a total of 8 such complexes: 1. Count: plurality, singularity, duality, pairing; 2. Completeness/Fragmentation: entirety, segmentation, collectivity, integrality, uniqueness, concreteness, abstractness; 3. Mode of Expression: explicitness (clear, understandable meaning), implicitness (hidden meaning); 4. Definite and Measurable: definiteness, linearity; 5. Type of Action: dynamicity, extremality, iterativity (repetition), durativity (continuation), recurrence, accumulativity, intensivity (rapid development); 6. Comparison and Growth: gradation, step-by-step nature, minimality, multiplication (growth), dimensionality, comparability, correlativity; 7. Interruption: discreteness; 8. Order and Limit: countability, enumeration, separation, precision, proximity, infinity, stability, sequentiality.

Neither of the two languages' researchers considers the aspect category to be a full-fledged category. In the domain of aspectuality in both English and Uzbek languages, some similar areas adhere to the specific rules of each language. Therefore, when the aspectual meanings in these languages are comparatively analyzed, primary attention is paid to morphological, semantic, syntactic, actional features, and temporal devices. In many cases, the morphological feature is not crucial for the analysis of aspectual meanings in English and Uzbek languages. Accordingly, in the comparative analysis of aspectual meanings, it is important to focus on identifying the place of lexical, syntactic means, time forms, and other temporal devices (apart from analytical combinations), and determining the lexical units of separately used words. For instance, it is significant to determine the influence of adverbs such as seldom, rarely, often, sometimes, frequently, from time to time, for 2 hours, in two hours, during, at the moment in English, and expressions like juda (very), to‘laligicha (completely), ozgina (a little), kamroq (less), gohida (sometimes), aynipaytda (at the moment),

paytida (during), mobaynida (in the course of), davomida (during/for), 2 soatichida (in 2 hours), kamdankam (rarely/seldom) in Uzbek on the aspectual semantics of the predicate. All these form the basis for determining the functional aspects of adverbs in English and Uzbek languages. It is evident that their semantic and syntactic features, and their influence on the predicate, are effective for classifying the predicate's semantics from an aspectual point of view.

It is considered that aspectual adverbials should be distinguished from actional-type (Aktionsart) adverbials by the following categorical features. While aspectual adverbials serve to differentiate the perfective/imperfective feature of the predicate in the sentence, actional-type adverbials clarify characteristics of the predicate such as processual, durative (continuative), resultative, and iterative (repetitive) nature.

The observations noted above pertain to the English language, where continuous and indefinitely frequent adverbials require the imperfective feature in the verb, while adverbials indicating quantitative indicators (complements), definite frequency, and those pointing to completion usually require perfectivity. This refers to the sensitivity of aspectual adverbials to the Perfective - Imperfective distinction, meaning their ability to determine one or the other aspectual feature in the verb.For example: *His wife had decorated it all up with hollyhocks and poison ivy, and it looked real festal and bowery* [O‘Henry, p. 102].

However, if the quantitative indicator is accompanied by another factor that creates imperfectivity, such as "yiligaikkimarta" or "twice a year," they are evaluated as an imperfective situation. For example:*'Once or twice even I, myself, have fancied that the Chaldean Chiroscope has availed* [O‘Henry, p. 278]. The adverbial 'Once or twice' in this example is viewed as expressing a completed meaning. In this case, individual situations of the same appearance are recognized as units performing a certain function.

Aspectual features are important in describing verbs based on the type of event they express in both English and Uzbek languages. This involves whether the verbs are dynamic or non-dynamic, whether they are bounded (possessing a specific endpoint) or unbounded, and whether they describe momentary actions or situations with sequential stages. Their dependency on non-predicators in the context is observed. These features are important and crucial in determining the aspectual semantics of predicates.

Some scholars suggest that the syntactic potential of adverbials is much broader in English. They can be used both as part of the sentence (in ancillary and non-verbal processes) and outside the sentence structure. In contrast to English, additional lexemes (often auxiliary verbs) play an important role in Uzbek. They convey supplementary aspectual meanings to the meaning expressed by the main verb, such as repetition, continuation (durativity), intensity, inception, accidental inception, and the like.

If the position of adverbials in English is of fundamental importance, being related to the principles of actual sentence division and the sentence's intonational structure, then in Uzbek, adverbials are observed to adapt to the meaning expressed by the auxiliary verb or the analytical form. Therefore, the syntactic potential of additional lexemes in the Uzbek language is noticeable for its high degree of grammaticalization and its dependence on a number of other factors. Forexample:*“He’s unconscious!” “Oh, not for long.” Hopefully, he poked Hiram with his toe, drawing no response. “Probably not for long,” he amended* [Susan Law, p. 17]; *Ikkovi ham bir nafas jim qolishdi. So‘fimis va giniqinidan chiqarib yana sekingina solib qo‘ydi* [A.Cho‘lpon “Kecha va kunduz”, b. 14].

In these examples, the quantitative indicators for long and birnafas (a moment/one breath) served to show the event's movement within a certain time interval, the sequence of situations, and their countability. This indicates that these adverbials are important linguistic devices implemented not only within the sentence but also during the process of text analysis. They serve to realize the main parameters of the text's quantitative features and its temporal structure. Example: *On business errands on La Salle Street, zooming or plunging in swift elevators, every time I felt a check in the electrical speed and the door was about to open, my heart spoke up* [Saul Bellow “Humboldt’s Gift”,

p. 100]*; Zo‘rg‘a-zo‘rg‘a qayrilib yoniga qaradi: sevimli bulbuli, sochlarini to‘zdirib, shirin uyquda rohat qilmoqda edi!* [A.Cho‘lpon “Kecha va kunduz”, b. 261].

It is evident that temporal units are one of the main components of speech. In both Uzbek and English languages, temporal adverbs are considered the main lexical means for directly expressing tense and aspectual semantics. They are actively observed to participate in conveying meanings such as the durativity, continuation, sequence, iterativity (multiplicity), repetition, and habituality of an event or action.

Based on the above considerations and analyses, two types of temporal adverbs can be distinguished. One type serves to illuminate the general time of the expression, situation, or event, while the second refers to the time and course of events expressed through verbs with a specific (particular) meaning. Temporal adverbs participating in sentences with a particular meaning are used to reveal and indicate the quantitative feature of the action. Furthermore, they become active in the sentence as referentials to tense. We can include always, never, usually in the category of these temporal adverbs. They give rise to a general habitual semantics. Temporal adverbs that form a part of this composition can include seldom, often, rarely.

Temporal adverbs of this type are considered from a different perspective by A.I. Mel’chuk using the Russian language as an example. He divides similar adverbs in Russian into the types: iterative (*часто, редко, изредка*, *иногда*), and durative/continuous (*всегда*, *всевремя*, *постоянно*). Example: “*That whore with fat tits”—was what Denise regularly called her. She spoke of beautiful Renata always as a gross tough broad. The trend of her epithets, it seemed, was to make a man of Renata and a woman of me* [Saul Bellow “Humboldt’s Gift”, p. 29]. Muallif birinchi turga tegishli temporal ravishlarni kengroq komunikativ mazmunga ega deb hisoblaydi. Ikkinchi tur esa zamon bilan bog‘liq vaqtlarni yoritishni qayd etadi.

Temporal adverbs in English such as always, seldom, sometimes, usually, often, never, rarely are used not only for habitual semantics but also to express the iterativity (repetition) of events within the same system. The iterative semantics of certain types of events is also expressed through quantitative-meaning phrases like again and again and every time. Example: *He stood plucking and eating, spitting out stones and skins, his gaze fixed beyond me. He wiped at his Acheson mustache from time to time. Arrogant, haggard, he was filled with incommunicable thoughts. These were written dense and small on every inch of his inner surface* [Saul Bellow “Humboldt’s Gift”, p. 201]; - *Yana birmartaaytingshugapingizni, Polvon aka* **[Said Ahmad “Ufq”, b.** 52].

In general, adverbs and adverbials, especially temporal adverbials, play an important role in the formation of the aspectual semantics of the predicate in the compared English and Uzbek languages. However, it cannot be said that (equivalent) adverbs and adverbials in English and Uzbek languages always give rise to the same type of aspectual meaning. This is clearly related to the differences in the morphological, syntactic, and analytical features of the verb systems in these languages.

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Rezyume:*Ushbu maqlada ingliz va o‘zbek tillarida fe’l aspektual harakat tarzini ahamiyatini qiyosiy o‘rganishga bag‘ishlangan. Har ikki tilda ham grammatik aspekt to‘liq kategoriya emasligi sababli, aspektual ma’nolar asosan morfologik, semantik va sintaktik xususiyatlar, shuningdek, temporal ravishlar (adverbiallar) orqali ifodalanishi tahlil qilinadi.*

Резюме:*Данная статья посвящена сравнительному изучению значимости видового способа действия глагола в английском и узбекском языках. Поскольку грамматический вид не является полноценной категорией в обоих языках, видовые значения выражаются преимущественно посредством морфологических, семантических и синтаксических признаков, а также наречий времени (адвербиалов).*

Kalit so‘zlar:*Aspektuallik, temporal ravishlar, iterativlik, durativlik, miqdoriyko‘rsatkich*

Ключевые слова:*Аспектуальность, временные наречия, итеративность, длительность, количественный показатель*

CULTURAL DEVELOPMENT OF CHILDREN AND YOUTH WITH SPECIAL NEEDS THROUGH CREATIVE ACTIVITIES

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Summary: *The article examines the features of cultural development in children and youth with special educational needs through the lens of creative activity. Various forms of creativity are analyzed as means of socialization, self-expression, and cultural integration for children with disabilities. Particular attention is given to art therapy methods, inclusive cultural practices, and their impact on personal development. The paper provides an overview of modern approaches to organizing creative activities for children with different developmental disorders and substantiates the need to create an accessible cultural environment and develop inclusive creative programs.*

Key words: *children with special needs, inclusive education, creative activity, art therapy, cultural socialization, adaptive creativity, rehabilitation through art, cultural integration, sociocultural development.*

Cultural development is an integral part of every child's personal formation, regardless of physical or mental characteristics. For children and youth with special educational needs, creative activity acquires particular importance as a powerful tool of communication, self-expression, and social adaptation. In modern society, increasing attention is given to inclusion and equal opportunities for all children in the sphere of culture and the arts. For children with special needs, creativity is not only a form of leisure but also a crucial means of rehabilitation, cognitive development, emotional intelligence formation, and social skills enhancement.

The category of children with special needs includes individuals with disabilities such as hearing, visual, and motor impairments, intellectual disabilities, autism spectrum disorders, as well as gifted children requiring special educational approaches. Each of these groups has specific needs in the field of cultural development that must be considered when organizing creative activities. Creativity performs multiple functions—compensatory, corrective, therapeutic, socializing, and self-actualizing. It enables the child to express feelings and thoughts through alternative means, which is particularly important in the presence of speech or communication difficulties.

Visual art contributes to the development of fine motor skills, spatial thinking, color perception, and imagination. For children with speech disorders, drawing becomes a means of communication, while working with various materials stimulates sensory development—especially significant for children with autism and intellectual disabilities. Musical creativity and music therapy positively influence auditory perception, rhythm, coordination, and emotional balance. Theater activities promote socialization, communication, empathy, self-control, and confidence. Inclusive theater studios, where children with different developmental characteristics work alongside their neurotypical peers, have proven effective in fostering a tolerant society.

Dance and choreography serve as powerful tools for physical and emotional development. Adapted wheelchair dance programs have been created for children with motor impairments, while simple rhythmic movements are used for those with intellectual disabilities. Dance therapy helps build body awareness, improves coordination, and encourages emotional expression. Literary creativity—writing stories, poems, and journals—develops speech, imagination, and reflection. The use of digital technologies allows participation for children with dysgraphia or motor limitations, while bibliotherapy helps address emotional difficulties through identification with literary characters.

Art therapy integrates artistic expression and psychocorrective techniques, based on the idea of the healing power of the creative process itself. Its principles include nonjudgmental acceptance, focus on process rather than product, and the creation of a safe environment for self-expression. Among the most effective techniques are finger painting, clay modeling, collage, and the creation of

mandalas and masks. Each technique is selected individually, depending on the child's characteristics and therapeutic goals.

Cultural inclusion presupposes the creation of conditions under which children with special needs have equal access to cultural values and full participation in the cultural life of society. This involves program adaptation, use of assistive technologies, and development of a friendly sensory environment. Joint creative activity among children with different abilities fosters tolerance, empathy, and social responsibility. Cultural institutions such as museums, theaters, and libraries actively develop special programs—tactile tours, performances with sign language interpretation, workshops with art therapists, and sensory rooms for children with autism.

Creative activity has a multifaceted impact on the development of children with special needs. It contributes to cognitive growth by stimulating attention, memory, imagination, and thinking. The emotional sphere is enriched through safe emotional expression, reduced anxiety, and increased self-esteem. Group creativity develops cooperation, mutual assistance, and communication skills. Physical development is supported through active forms of creativity—dance, theater, sculpture, and painting—that strengthen coordination and motor function.

Modern digital technologies open new opportunities for cultural development. Graphic tablets, music and animation programs make creativity accessible for children with physical disabilities. Virtual and augmented reality enable special-needs children to visit museums, participate in exhibitions, and immerse themselves in the world of art. Online platforms allow participation in creative workshops and events, which is especially valuable for children with severe physical limitations or those living in remote areas.

Working with children with special needs requires high professional competence and personal readiness from specialists. It demands knowledge in special pedagogy, psychology, and adaptive creativity, along with empathy, patience, and creativity. The family plays a key role in the cultural development of the child by creating a supportive home environment and engaging in joint creative activities. Parental initiatives and clubs are becoming important elements of inclusive cultural infrastructure.

Both domestic and international experiences confirm the effectiveness of inclusive cultural practices. In Russia, successful projects include *Osoby Vzglyad* ("A Special View"), *Anton's Right Here*, and the *Accessible Museum* programs at the Hermitage and Tretyakov Gallery. Abroad, notable examples are *VSA Arts* (USA), *Sense* (UK), and multisensory museum initiatives in France. These examples demonstrate that when provided with appropriate conditions, children with special needs can achieve significant creative results.

Cultural development of children and youth with special needs through creativity is an important direction in modern special pedagogy and social practice. It promotes rehabilitation, self-realization, and social integration. Analysis of theoretical foundations and practical experience shows that participation in creative activities positively influences cognitive, emotional, social, and physical development. The expansion of inclusive cultural practices, environmental adaptation, and the use of digital technologies create conditions for the full participation of special-needs children in society's cultural life. Successful implementation of such programs requires a comprehensive approach involving professional training, family engagement, cooperation between educational and cultural institutions, and governmental support.

Future prospects include expanding access to cultural programs, developing new adaptive creativity methods, and creating an inclusive cultural environment. Cultural development through creativity provides children with special needs an opportunity to unlock their potential, gain confidence, and take a worthy place in society. This contributes not only to the future of individual children but also to the creation of a humane and inclusive society.

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Rezyume: *Мақолада махсус таълим эҳтиёжларига эга болалар ва ёшларнинг маданий ривожланиши ижодий фаолият призмасидан келиб чиқиб кўриб чиқилади. Ижоднинг турли шакллари махсус эҳтиёжли болаларнинг ижтимоийлашуви, ўзини ифода этиши ва маданий интеграциясининг воситаси сифатида таҳлил қилинади. Арт-терапевтик усуллар, инклюзив маданий амалиётлар ва уларнинг шахсий ривожланишга таъсирига алоҳида эътибор қаратилган.*

Резюме: *В статье рассматриваются особенности культурного развития детей и молодёжи с особыми образовательными потребностями через призму творческой деятельности. Анализируются различные формы творчества как средство социализации, самовыражения и культурной интеграции особых детей. Особое внимание уделяется арт-терапевтическим методам, инклюзивным культурным практикам и их влиянию на личностное развитие.*

Kalit so'zlar: *махсус эҳтиёжли болалар, инклюзив таълим, ижодий фаолият, арт-терапия, маданий ижтимоийлашув, адаптив ижод, санъат орқали реабилитация, маданий интеграция, ижтимоий-маданий ривожланиш.*

Ключевые слова: *особые дети, инклюзивное образование, творческая деятельность, арт-терапия, культурная социализация, адаптивное творчество, реабилитация через искусство, культурная интеграция, социокультурное развитие.*

GADGET TECHNOLOGIES AND THEIR IMPACT ON THE DEVELOPMENT OF CHILDREN'S SPEECH

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Summary: *This article explores the influence of modern gadget technologies on the speech development of young children. The study emphasizes that gadgets such as smartphones, tablets, and computers have become an integral part of childhood, shaping the way children learn and communicate. While interactive educational applications and digital speech therapy tools can enrich vocabulary, improve pronunciation, and support inclusive learning, excessive and unsupervised screen time often leads to speech delays, limited articulation skills, and reduced social interaction. The author highlights the importance of maintaining a balance between digital learning and live human communication. Parental guidance, moderate use of technology, and the inclusion of traditional activities such as storytelling and dialogue are essential for healthy speech and cognitive development. The paper concludes that technology should serve as a supportive tool rather than a replacement for real communication, ensuring that children's speech develops naturally through emotional contact and social interaction.*

Keywords: *gadget, communication, linguistic, dialogue,* ***articulation, speech***

The rapid development of modern digital technology has transformed the daily life of people across the world. Today, even young children are surrounded by gadgets such as smartphones, tablets, computers, televisions, and smart toys. These devices, while providing opportunities for learning and entertainment, also play a crucial role in shaping the psychological and linguistic development of children.

Speech is one of the most important indicators of a child's intellectual and emotional growth. It serves as the foundation of communication, learning, and thinking. During the preschool period, speech develops most intensively through live interaction with adults, imitation, and dialogue. However, the overuse of gadgets may disrupt this natural communication process and affect how children acquire and use language. This article explores how gadget technologies influence the development of children's speech, examining both their positive and negative impacts, and offering recommendations for parents and educators to create a balanced digital environment.

Gadgets have become an integral part of children's upbringing. Many parents use tablets and smartphones to occupy their children during meals, travels, or while performing household chores. Digital devices attract children's attention because of their colorful graphics, sound effects, and interactive features. From a developmental perspective, gadgets can serve both educational and recreational purposes. There are thousands of applications designed to teach letters, numbers, words, and even foreign languages. These programs, when used correctly, can expand a child's vocabulary, improve pronunciation, and stimulate curiosity. However, the efficiency of such tools depends on how they are used and how much time children spend with them. Excessive exposure to digital media, especially passive content such as cartoons or videos, can lead to reduced social communication and limited verbal interaction. Unlike real conversation, screens cannot provide emotional feedback, gestures, or tone of voice that are essential for the development of communicative competence.

Positive Effects of Gadget use

When used under parental guidance and moderation, gadget technologies can bring certain benefits to children's speech development:

1. **Vocabulary Expansion:** Educational apps and programs often introduce new words with pictures and sounds. Interactive games that involve naming objects or answering questions can strengthen vocabulary and word association.
2. **Phonetic Awareness:** Some speech therapy applications help children learn how to pronounce difficult sounds correctly. By listening and repeating after digital models, children can practice articulation in a playful way.

3. **Multisensory Learning:** Gadgets combine visual, auditory, and kinesthetic experiences. This combination helps children with different learning styles to perceive and remember information more effectively.

4. **Access to Speech Therapy Resources:** For children with speech delays or articulation problems, gadgets offer valuable tools such as digital exercises, pronunciation videos, and online therapy sessions that can complement professional work.

Therefore, if properly selected and used within recommended limits, gadgets can support speech development rather than harm it.

Negative Effects of Gadget Overuse

Despite their potential advantages, uncontrolled gadget use can have numerous negative consequences for a child's speech development.

First, **lack of live communication** is the most critical problem. When children spend too much time with gadgets, they have fewer opportunities to interact with adults and peers. This leads to reduced speech imitation, poor conversational skills, and delayed language formation. Speech develops in the context of dialogue, where the child receives immediate feedback, facial expressions, and emotional responses—none of which can be fully replaced by a screen.

Second, **delayed speech onset** has become a common issue among toddlers who are exposed to gadgets too early. Research shows that children under three years old who regularly watch videos or play with mobile phones tend to start speaking later than their peers. Their vocabulary remains limited because they passively consume language rather than actively use it.

Third, **articulation and pronunciation disorders** may appear due to a lack of oral motor practice. Speech organs, such as the tongue and lips, develop properly only through active speech and dialogue. When communication is replaced by tapping screens or watching cartoons, these skills remain underdeveloped.

Fourth, **attention and memory problems** may arise. Constantly changing images and sounds on screens reduce a child's ability to concentrate and listen carefully. This can make it difficult for them to follow longer sentences or remember new words.

Lastly, overuse of gadgets can lead to **social isolation**, where the child becomes emotionally attached to devices rather than to people. Such children often prefer solitary play and may have difficulty expressing their feelings or understanding others. The role of parents and teachers is fundamental in managing children's relationship with gadgets. It is unrealistic to completely ban technology, but it is essential to teach children how to use it wisely.

Parents should:

Set clear time limits for screen use (for preschoolers, no more than 1 hour per day).

Watch and discuss content together with their children to develop comprehension and speech.

Encourage live conversation, storytelling, and reading aloud as daily activities.

Choose educational and age-appropriate content rather than passive entertainment.

Educators and speech therapists should integrate digital tools into learning processes carefully. Interactive boards, speech games, and visual learning programs can enrich lessons, but they should never replace real communication between teacher and child. In speech therapy, gadgets can be used to motivate children through play, but corrective work must include face-to-face exercises, articulation training, and dialogue practice. The human voice, emotional tone, and empathy remain the most powerful stimulants for speech growth.

The impact of gadget technologies on children's speech cannot be studied in isolation from their emotional and social development. A child's desire to speak arises from a need to communicate and express feelings. If emotional contact with adults is replaced by digital interaction, this motivation weakens. Moreover, speech development is connected with play. Traditional games that involve imagination, storytelling, and role-playing naturally stimulate dialogue. When children spend most of their time with gadgets, they lose interest in imaginative play and prefer passive consumption of information. This affects not only their speech but also their creativity and social intelligence.

Therefore, it is important to strike a balance between digital learning and traditional play activities that involve movement, communication, and cooperation.

Gadget technologies are an inseparable part of modern childhood. They offer valuable educational opportunities and can assist in speech development when used wisely. However, uncontrolled or excessive use can negatively affect verbal communication, articulation, and emotional interaction. The key principle is moderation and active adult participation. Parents and teachers should not rely solely on gadgets for learning or entertainment. Instead, they should combine digital tools with rich verbal interaction, storytelling, reading, and creative play. Speech develops through living language, emotional contact, and shared experiences. No technology, however advanced, can replace the warmth of a parent's voice or the joy of real conversation. Therefore, in shaping the digital childhood of the 21st century, it is vital to ensure that technology supports — not replaces — the natural process of human communication.

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Rezyume: *Ushbu maqolada zamonaviy gadjet texnologiyalarining yosh bolalar nutqining rivojlanishiga ta'siri o'rganiladi. Tadqiqotda smartfon, planshet va kompyuter kabi gadjetlar bolalik davrining ajralmas qismiga aylangani, ular bolalarning o'rganishi va muloqot qilish tarziga ta'sir ko'rsatayotgani ta'kidlanadi. Interfaol o'quv dasturlari va raqamli nutq terapiyasi vositalari so'z boyligini kengaytirishi, talaffuzni yaxshilashi hamda inklyuziv ta'limni qo'llab-quvvatlashi mumkin. Biroq, gadjetlardan ortiqcha va nazoratsiz foydalanish nutqning kechikishi, talaffuzdagi muammolar hamda ijtimoiy muloqotning kamayishiga olib keladi. Muallif raqamli ta'lim bilan jonli insoniy muloqot o'rtasida muvozanatni saqlash zarurligini ta'kidlaydi. Ota-onalar nazorati, texnologiyadan me'yorida foydalanish va ertak aytish, suhbatlashish kabi an'anaviy mashg'ulotlarni qo'shish sog'lom nutq va kognitiv rivojlanish uchun muhimdir. Maqolada texnologiya haqiqiy muloqotni almashtirmasdan, balki uni qo'llab-quvvatlovchi vosita sifatida xizmat qilishi lozimligi qayd etiladi; bolalar nutqi esa hissiy aloqa va ijtimoiy muloqot orqali tabiiy shakllanishi kerakligi ta'kidlanadi.*

Резюме: *В данной статье рассматривается влияние современных гаджет-технологий на развитие речи у маленьких детей. В исследовании подчеркивается, что такие устройства, как смартфоны, планшеты и компьютеры, стали неотъемлемой частью детства, формируя способы обучения и общения детей. Интерактивные образовательные приложения и цифровые логопедические программы могут обогащать словарный запас, улучшать произношение и способствовать инклюзивному обучению. Однако чрезмерное и неконтролируемое использование гаджетов часто приводит к задержке речевого развития, нарушению артикуляции и снижению социальной активности. Автор акцентирует внимание на необходимости поддержания баланса между цифровым обучением и живым человеческим общением. Родительский контроль, умеренное использование технологий и включение традиционных занятий, таких как рассказывание сказок и диалог, являются важными условиями для здорового речевого и когнитивного развития. В статье делается вывод, что технологии должны служить вспомогательным инструментом, а не заменой реальному общению, обеспечивая естественное развитие речи детей через эмоциональный контакт и социальное взаимодействие.*

Kalit so'zlar: *gadjet, muloqot, tilshunoslik, suhbat, artikulyatsiya, nutq*
Ключевые слова: *гаджет, общение, лингвистика, диалог, артикуляция, речь*

CAUSES OF SPEECH DISORDERS

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Summary: *This article examines the main causes of speech disorders among children and adults, highlighting biological, psychological, and social factors that affect normal speech development. It emphasizes the importance of early diagnosis, speech therapy, and interdisciplinary cooperation in preventing and correcting speech impairments. The paper provides a scientific analysis of genetic predispositions, neurological dysfunctions, and environmental influences as key determinants of speech pathology.*

Keywords: *speech disorder, communication, psychology, neurology, development, therapy, articulation*

Speech is one of the most important components of human communication and mental development. It not only allows individuals to express their thoughts and emotions but also shapes their identity and cognitive growth. However, speech disorders — such as stuttering, dysarthria, and delayed speech development — affect millions of people worldwide. Understanding their origins is essential for developing effective intervention programs. Speech impairments may result from multiple interacting factors — biological, psychological, and environmental — that disrupt the normal process of speech formation.

Biological Factors

Biological causes of speech disorders include **genetic abnormalities**, **neurological impairments**, and **physiological defects**.

Genetic predisposition: Some speech disorders, such as stuttering and dysarthria, may have hereditary components that influence neural connectivity in speech areas of the brain.

Neurological dysfunctions: Injuries to the central nervous system (CNS), cerebral palsy, brain trauma, or infections like meningitis can disrupt the coordination of speech muscles and auditory processing.

Physiological anomalies: Structural problems such as cleft palate, hearing loss, or malformations of the speech organs (tongue, lips, jaw) significantly interfere with articulation and phonation.

Physiological and emotional factors

Emotional and psychological states strongly influence speech. Children exposed to chronic stress, anxiety, or emotional neglect may develop selective mutism or delayed speech. Psychological traumas such as parental separation, bullying, or excessive fear can lead to communication avoidance or stuttering.

Moreover, neurodevelopmental disorders such as **autism spectrum disorder (ASD)** or **attention-deficit/hyperactivity disorder (ADHD)** often involve atypical communication patterns and difficulties in language processing.

Healthy emotional attachment and supportive relationships between parents and children are crucial for building the foundation of expressive and receptive language skills.

Social and Environmental factors

The **environment** plays a major role in shaping a child's language and speech. Lack of communication, limited verbal stimulation, and insufficient parental attention can delay speech development. In modern society, overreliance on **digital gadgets** often reduces face-to-face interaction, which is essential for natural speech acquisition. Social neglect, bilingual confusion, or improper teaching methods can also contribute to speech irregularities.

Preventive and Corrective Approaches

Effective prevention of speech disorders requires early screening, parental education, and collaboration between **speech therapists**, **psychologists**, and **medical specialists**. Speech therapy sessions, combined with motor exercises, breathing control, and auditory training, can help improve

articulation and fluency. The use of play-based learning and storytelling also enhances communicative motivation and emotional expression.

Speech disorders are complex conditions arising from a combination of biological, psychological, and social causes. Each individual case demands careful assessment to determine the underlying factors. Early diagnosis, supportive family environments, and consistent therapy can significantly improve speech outcomes.

Technology, when used appropriately, can assist speech development, but it should never replace live human communication. The ultimate goal of speech therapy is to help individuals express their thoughts freely, confidently, and effectively in both social and educational contexts.

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Rezyume: *Ushbu maqolada bolalar va kattalarda uchraydigan nutq buzilishlarining asosiy sabablari tahlil qilinadi. Maqolada nutqning normal rivojlanishiga ta'sir etuvchi biologik, psixologik va ijtimoiy omillar yoritilgan. Erta tashxis, nutq terapiyasi va turli soha mutaxassislari hamkorligining ahamiyati ta'kidlanadi. Tadqiqotda genetik moyillik, nevrologik buzilishlar va atrof-muhit omillari nutq patologiyasining asosiy omillari sifatida ilmiy jihatdan tahlil qilinadi.*

Резюме: *В данной статье рассматриваются основные причины речевых нарушений у детей и взрослых. Подчеркивается влияние биологических, психологических и социальных факторов на нормальное развитие речи. Особое внимание уделяется важности ранней диагностики, логопедической терапии и междисциплинарного сотрудничества в профилактике и коррекции речевых расстройств. В работе представлен научный анализ генетической предрасположенности, неврологических дисфункций и факторов окружающей среды как ключевых детерминант речевой патологии.*

Kalit so'zlar: *nutq buzilishi, muloqot, psixologiya, nevrologiya, rivojlanish, terapiya, artikulyatsiya*

Ключевые слова: *речевое расстройство, коммуникация, психология, неврология, развитие, терапия, артикуляция*

THE CONTENT AND SIGNIFICANCE OF NEWLY ADOPTED LAWS (ON THE EXAMPLE OF TAX LEGISLATION)

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Summary: *The article examines the elements of taxation by their content, the principles and methods of their organization, as well as the essence of concepts such as subject, object, source, rate, tax unit, benefit, tax burden.*

Keywords: *tax, taxation, tax elements, functions, principles of organization, methods, tax subject, object, source, rate, tax unit, benefit, tax burden.*

First of all, it is necessary to distinguish between the system of taxes and the system of taxation. The tax system represents a set of homogeneous, interconnected types of taxes that are received into the centralized monetary fund and other state funds.

The set of methods, elements, and principles for organizing taxes, established by legislative bodies and levied by executive bodies, is called the tax system.

The tax system of Uzbekistan, in its content, teaches the elements of taxation, the principles and methods of their organization. The elements of tax include concepts such as subject, object, source, rate, tax unit, benefit, tax burden.

1. The subject of tax is the taxpayers participating in tax relations. They are subdivided into legal entities and individuals. In tax relations, not only taxpayers but also tax authorities participate. The tax is levied by the state. A special organization acts on its behalf, meaning this work is carried out by state tax service bodies. The responsibility for the correct calculation and completeness of tax payment is assigned to the taxpayer entity.

2. The object of taxation is the taxable income, expenditure, turnover, or property. There are such types as profit, wages, added value, land, building, and total expenses. The object is always connected with the subject, belongs to the subject. Without a subject, there is no object. For example, in VAT, the object is the turnover of shipped products (performed work and services), in income tax - profit, in property tax - property value, in land tax - land area, etc.

3. The source of tax is the income of the entity. In some taxes, income and profit are both the object of taxation and the source of taxation. However, in other taxes, the objects are different, and the source is income. There is such a law of taxes that they should never exceed the amount of the source. Otherwise, the source will be lost.

4. The unit of taxation here is the unit of measurement of the object. These are sums in profit taxes, sq.m in property taxes, cubic meters in water taxes, etc.

5. The tax rate is the rate set by the state for each unit of the object, that is, the state's share in the object. The tax rate is expressed in two ways: fixed rates (in sums) and relative rates - in percentages. In the context of transition to a market economy and inflation, it is advisable to apply relative rates. In such cases, the budget doesn't lose much money due to inflation. If the rate is taken into account in sums, then budget revenues from taxes may cease to have any economic significance by the end of the year. There are proportional, progressive, and regressive types of tax rates.

6. Tax benefits are understood as the partial, temporary, and full exemption of taxpayers from paying taxes and fees, as well as the reduction of the tax base.

Currently, there are 3 types of tax benefits:

- Fully exempting from taxes;
- partially and temporarily exempt from tax;
- Taxes deducted from the taxable base.

7. The tax burden is the sum of all taxes and fees paid by the payer to the budget. The tax burden is levied on profit or aggregate income. On a national scale, the share of all paid taxes and fees in the gross domestic product also expresses the tax burden. However, the tax burden is the share of all taxes and payments paid by a specific payer in relation to their income.

If the taxpayer paid the taxes correctly, the tax burden corresponds to it. However, although some enterprises have indirect taxes, and their legal payers are enterprises, the tax burden falls on the consumer, that is, the population. The final consumers are the population. Here, due to indirect taxes, there is a slight decrease in the real incomes of the population. The tax burden can be determined at the macro level, by industry, and at the micro level.

The functions of taxes show their essence and action in practice. Consequently, the function must constantly exist and reflect the essence of tax. Situations that appear today and disappear tomorrow cannot be a tax function. Thus, the function of a category expresses a constant, strictly repeating reality. Based on this methodological approach, it is necessary to define the function of taxes. It is necessary to distinguish between function and task. The function is constant, and the problem is transient.

There are many disputes regarding the functions of taxes, but there is no consensus. Many economists define taxes as having fiscal, managing, stimulating, and controlling functions. Today, taxes have fiscal, distribution, and control functions.

In the fiscal function of taxes, taxes actually go to the treasury. Since this reality is obvious, practicing specialists cling to this function, that is, if we think more deeply, there can be no situation where the value of the created gross domestic product or the enterprise's income is directly transferred to the budget without prior distribution. First of all, it is necessary to ensure the interest of producers in production, and then to take part of the income into the treasury. Therefore, it would be more correct to call the treasury function the distribution function in the full and broad sense.

The control function of taxes is indeed in constant motion. However, this function, along with the distribution function, theoretically controls the correct distribution of income and the timely receipt of taxes. The control function is the basis for the development of the work of tax authorities.

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Резюме: *Мақолада солиққа тортиш тизими ўз мазмунига кўра солиқ элементлари, уларни ташкил қилиш тамойиллари ва усуллари, шунингдек, солиқ элементларига солиқ субъекти, объекти, манбаи, ставкаси, солиқ бирлиги, имтиёзи, солиқ оғирлиги (солиқ юки) каби тушунчаларнинг мазмун-моҳияти еритилган.*

Резюме: *В статье рассматриваются элементы налогообложения по своему содержанию, принципы и методы их организации, а также суть таких понятий, как субъект, объект, источник, ставка, налоговая единица, льгота, налоговая нагрузка.*

Калит сўзлар: *солиқ, солиққа тортиш, солиқ элементлари, функциялари, ташкил қилиш тамойиллари, усуллар, солиқ субъекти, объекти, манбаи, ставкаси, солиқ бирлиги, имтиёзи, солиқ оғирлиги.*

Ключевые слова: *налог, налогообложение, элементы налога, функции, принципы организации, методы, субъект налога, объект, источник, ставка, налоговая единица, льгота, налоговая нагрузка.*

IMPROVEMENT OF ACCOUNTING POLICY BASED ON IFRS IN JOINT-STOCK COMPANIES IN THE ENERGY SECTOR

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Summary: *The article discusses the issues of improving accounting policy based on IFRS in order to improve the quality of financial reporting of joint stock companies. The specific features of energy sector enterprises are analyzed and practical recommendations are developed based on the experience of JSC "Thermal Power Plants". The study examines in detail modern methods of accounting for fixed assets, lease operations and reserves. The advantages and complexities of the IFRS transition process are revealed.*

Key words: *accounting policy, IFRS, joint stock company, energy sector, financial reporting, fixed assets, lease*

ENTRANCE

In the context of the modern economy, the quality and transparency of financial reporting are becoming the main factor determining the investment attractiveness of the enterprise. The integration of global financial markets and the development of multinational enterprises are increasing the need for a unified accounting system. International Financial Reporting Standards (IFRS), which have become such a system, are currently used in more than 140 countries.

The liberalization of the economy of the Republic of Uzbekistan and the deepening of market relations place new demands on national enterprises. In particular, for large joint-stock companies operating in strategic sectors such as the energy sector, the need to maintain financial reporting in accordance with international standards is on the agenda. This is due to the fact that energy enterprises are characterized by high capital intensity, a long investment cycle, and complex technological processes.

JSC "Thermal Power Plants" was created in 2019 on the basis of the reorganization of JSC "Uzbekenergo." The company was established in accordance with the Decree of the President of the Republic of Uzbekistan dated March 27, 2019 No. PP-4249 as part of the comprehensive reform of the electric power industry and occupies a central place in the system of electricity and heat generation of the republic. The enterprise's activities include such important tasks as ensuring the country's energy security, uninterrupted energy supply to industry and the population.

The relevance of this research lies in the fact that the issues of forming and implementing an accounting policy based on IFRS in the energy sector have not been sufficiently studied. In particular, the practical aspects of applying international standards in the context of the national economy, methodological approaches that take into account the specifics of the industry, and the organizational and methodological foundations of the implementation process need detailed analysis.

LITERATURE REVIEW

Issues of accounting policy have been one of the central themes of the theory and practice of accounting for many years. With the formation of the system of international financial reporting standards, scientific research in this area has become even more relevant.

IFRS (IAS) No. 8 "Accounting Policies, Changes in Accounting Estimates, and Errors," developed by the International Accounting Standards Board (IASB), defines the basic principles for choosing and changing accounting policies. According to this standard, accounting policy refers to the specific principles, foundations, rules, and practices applied by an organization in the preparation and submission of financial statements.

In their research, foreign scientists D. Alexander and A. Britton examined in detail the conceptual foundations of IFRS and the national features of their application in different countries. They emphasize that the process of transitioning to international standards requires not only technical, but also cultural and institutional changes.

A. Jorissen substantiated the need to simplify IFRS for small and medium-sized businesses.

Issues of the influence of the choice of accounting policy on the quality of financial reporting are widely covered in the works of W. Beattie, S. Brown, and M. Manson. Based on empirical research, they revealed what motives the management of the enterprise chooses for certain accounting methods and how this choice affects financial indicators.

Russian scientists V.G. Getman and Ya.V. Sokolov analyzed the specific problems of the transition to IFRS in the CIS countries. They indicated ways to eliminate the differences between the traditions of national accounting schools and the requirements of international standards. V.F. Paliy developed special methods for accounting for fixed assets in capital-intensive industries such as energy and metallurgy.

In Uzbekistan, scientific research on MHHS issues has been actively developing in recent years. In their works, Sh.M. Musaev and A.A. Abdugafforov studied in detail the theoretical and practical aspects of the process of transitioning national enterprises to international standards. N.R. Karomatov paid attention to the issues of qualitative characteristics of financial statements. Z.N. Abdullaeva and D.Kh. Sotiboldiyeva considered methodological issues of applying individual standards of IFRS.

Economists A. Karimov, I. Kuziev, and M. Rakhimov noted that the transition to international financial reporting standards will allow for the expansion of future activities, the search for external financial sources, and the attraction of capital from international financial institutions through a comparative study and objective assessment of the economic, property, and financial condition of enterprises and organizations, as well as their financial results in previous periods.

Economist I. Ismanov, in his scientific article, cites the following: IFRS is a set of rules adopted in the public interest for the preparation and submission of financial statements. This is an internationally valid accounting system.

However, the analysis of the available scientific literature showed that a comprehensive study of the improvement of accounting policies at enterprises of the energy sector in accordance with IFRS is insufficient. Especially in the context of the renewing national economy, the methods, stages of implementation, and practical impact of accounting for fixed assets, lease operations, and reserves, taking into account the industry's specifics, have not been sufficiently studied.

RESEARCH METHODOLOGY

The complexity and multifaceted nature of the research problem necessitated the application of a comprehensive methodological approach. In the scientific work, general scientific and special research methods were used comprehensively.

The method of theoretical analysis was applied at the initial stage of the research. International literature on IFRS, texts of official standards, commentaries, and explanatory notes were systematically studied. The legislative base of the Republic of Uzbekistan, Presidential decrees, resolutions of the Cabinet of Ministers, and industry regulatory documents were analyzed. This method made it possible to determine the theoretical foundations of the concept of accounting policy and systematize various approaches.

The comparative analysis method was used to identify differences between national and international standards. The requirements set forth in different IFRS standards were compared, and alternative methods for accounting for identical transactions were evaluated. In particular, the advantages and disadvantages of accounting for fixed assets at initial cost and revaluation models were compared. The experience of accounting policies of leading foreign energy companies (companies in the energy sector) was also studied, and the possibilities of adaptation to the conditions of Uzbekistan were assessed..

The systematic approach formed the methodological basis of the research. Accounting policy was considered as an integral part of the enterprise management system. Its interrelationship with other systems, such as financial planning, budgeting, internal control, and risk management, was analyzed. Technological processes, organizational structure, financial condition, and environmental factors of energy enterprises were comprehensively studied.

The case study method formed the empirical basis of the research. The activities of JSC "Thermal Power Plants" for the period 2022-2025 were thoroughly analyzed. The company's financial statements, accounting policy rules, internal regulatory documents, and audit opinions were studied in detail. The practical problems that arose during the transition to IFRS, ways to solve them, and the results obtained were systematized. This method allowed for the verification of the practical application of theoretical conclusions and the development of practical recommendations.

The following sources served as the information base of the study: annual reports of JSC "Thermal Power Plants" for 2022-2025, accounting policy documents of the company, conclusions of international audit companies, official data of the Ministry of Energy and the Ministry of Finance, reports of international financial institutions (World Bank, Asian Development Bank).

ANALYSIS AND DISCUSSION OF RESULTS

The accounting policy for IFRS and its formation are based on the principles provided for by international standards. However, it is precisely these that require the enterprise to choose its own methods of accounting, which are carried out in accordance with the specifics of its activities and a certain economic status. When choosing accounting methods, the company also determines the procedure for their application.

The development and implementation of accounting policies in accordance with international standards, despite being based on them, implies the free choice and preparation by the enterprise of its accounting policy provisions. At the same time, it is necessary to take into account not only the current needs of the company in creating and implementing an effective accounting policy, but also the future consequences of using its components.

Accounting policy is the specific principles, foundations, generally accepted conditions, rules, and practical approaches applied by an organization in the preparation and submission of financial statements.

Accounting policy in accordance with the requirements of IFRS is one of the most relevant topics for companies that have begun to apply international financial reporting standards (IFRS). To assist companies in choosing and changing accounting policies, the IAS Board has developed IFRS 8 "Accounting Policies, Changes in Accounting Estimates, and Errors."

The basic principle of accounting policy selection in accordance with IFRS is that the accounting policy should be selected and applied in accordance with each applicable standard or review.

It should be noted that IAS 8 focuses on the fact that accounting policy defines a global approach to the selection and evaluation of existing accounting methods, for example, the choice of a model for accounting for fixed assets at their initial cost or revalued value, or the choice of a method for accounting for reserves at FIFO or weighted average cost.

In practice, in order to choose an accounting policy for a company, taking into account the specifics of the industry and the specifics of the operations carried out, it is first necessary to determine whether there is an appropriate international standard (IAS, IFRS) or an appropriate explanation for a specific operation or object (SIC, IFRIC).

Let's consider how to change the accounting policy. Accounting policy change is the transition from one accepted accounting principle to another acceptable accounting principle, including the methods of applying these principles. (for example, changing the inventory accounting method from the average value to FIFO). According to IFRS, companies can change their accounting policies in two cases:

1) if a new standard has been adopted or changes have been made to the existing one. In this case, a review of the accounting policy is mandatory. As a rule, the new standard establishes special rules for the transition stage. They provide detailed instructions for accounting for changes made to the standard. If the new standard does not contain transition provisions, a retrospective revision is applied, i.e., the new standard should be applied in the report as always in effect;

2) voluntary change of accounting policy, but only if there is a clear and justified need. Account policies can only be modified independently to enhance their relevance and reliability for users. If a company decides to voluntarily change its accounting policy, it must do so retrospectively.

In such a retrospective transition, the initial balance of retained earnings corresponding to the earliest periods presented in the report is also adjusted. This adjustment amount is the difference between the retained earnings balance at the beginning of the period and the retained earnings resulting from the application of the new accounting policy for all previous periods.

If a company cannot, through reasonable efforts, determine both the impact of applying a new accounting policy during the change period and the cumulative impact, then IAS 8 allows reflecting changes in the earliest possible period, which is practically feasible for it.

However, international standards exclude retrospective changes in accounting policies in cases where the management of the company decides to account for fixed assets or intangible assets in the future using a revaluation model instead of a cost model. This transition is not retrospective, but rather promising as a reassessment.

Also, in accordance with IAS 8, the following actions are not considered changes in accounting policies:

- adoption of a new accounting policy for an event or transaction that has not occurred before or is insignificant;
- adoption of an accounting policy for an event or transaction that differs in essence from previously occurred events and transactions.

The development and implementation of accounting policies is a step-by-step process, which includes: studying the company's activities, during which the objects of accounting (for which the policy is formed), as well as factors influencing the choice of accounting methods, are identified.

Based on the analysis and evaluation of the obtained data, the initial principles (rules) for creating an accounting policy are selected and substantiated.

Improvement of accounting policy based on IFRS implies bringing the organization's accounting procedures into compliance with the requirements of International Financial Reporting Standards (IFRS). This includes selecting the best accounting methods, developing rules and procedures that ensure reliable and appropriate presentation of financial information in accordance with IFRS.

The improvement process should be systematic and take into account the specifics of a particular organization (Table 1).

Table 1.

Main aspects of improving accounting policy based on IFRS

№	The main aspects of improving accounting policy based on IFRS are:	
1.	Analyze current account policy	It is necessary to assess the compliance of the current accounting policy with the requirements of IFRS and identify areas requiring changes.
2.	Study of IFRS requirements	Careful consideration of the relevant IFRS (especially IAS 8 "Accounting Policies, Changes in Accounting Estimates, and Errors") will help determine what changes should be made to the accounting policy.
3.	Select accounting methods	IFRS often provides several accounting options for specific transactions. To ensure the reliable and appropriate presentation of financial information, it is necessary to choose the most appropriate methods.
4.	Development of rules and procedures	The accounting policy should contain clear and understandable rules and procedures for all aspects of accounting reflected in the financial statements in accordance with the chosen accounting methods.
5.	Personnel training	Personnel responsible for accounting should be trained in new methods and procedures to ensure the correct application of accounting policies.
6.	Implementation and control	After the new accounting policy is developed and approved, it is necessary to ensure its implementation and monitor compliance with it.
7.	Documentation of changes	All changes in accounting policies, including the justification for changes and their impact on the financial statements, must be documented.

The advantages of improving accounting policy based on IFRS include the following (Fig. 1).

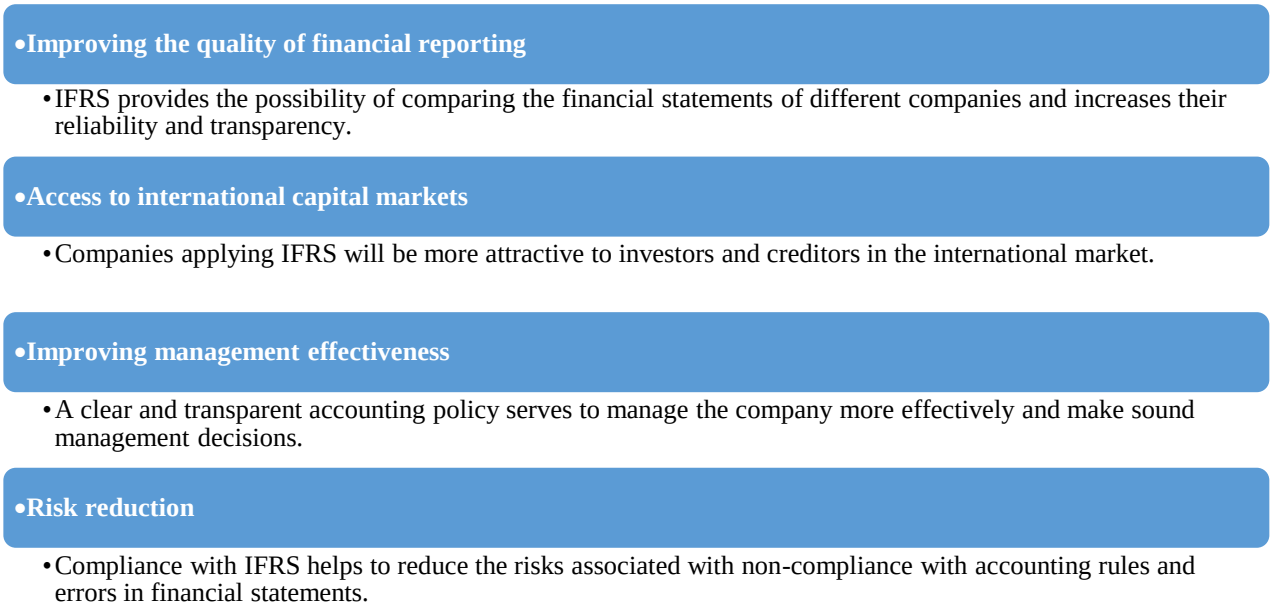


Figure 1. Improvement of accounting policy based on IFRS

The advantages of improving accounting policies based on IFRS include improving the quality of financial reporting by ensuring comparability and transparency; entering international capital markets by increasing attractiveness for investors; increasing the efficiency of company management; reducing the risks associated with discrepancies in accounting rules and errors in financial reporting.

The joint-stock company "Thermal Power Plants" is the largest state energy company in the Republic of Uzbekistan and was created in 2019 as part of the comprehensive structural reform of the electric power industry. In accordance with the Decree of the President of the Republic of Uzbekistan

The reform of JSC "Uzbekenergo" through its reorganization in accordance with Resolution No. PP-4249 dated March 27 demonstrates the state's strategic approach to modernizing the energy sector and increasing the efficiency of effective management of industry assets.

The company manages thermal power plants and power plants in the republic and provides electricity and heat generation for industrial, municipal, and domestic consumers. The scale of the company's activities is determined by its decisive role in ensuring the country's energy security and sustainable energy supply to the national economy.

In accordance with the International Financial Reporting Standards, adopted in 2022 and updated on May 2, 2025, the accounting policy is a comprehensive document covering all aspects of financial accounting and reporting that meets modern international requirements. The document reflects not only the current state of the regulatory framework, but also prospective changes in the system of international standards, demonstrating a professional approach to planning the development of the accounting system.

The theoretical basis of accounting policy is the conceptual basis of financial reporting, which defines the basic principles of presenting financial information. The purpose of financial reporting is to provide existing and potential investors, creditors, and other lenders with useful financial information for making decisions about providing the company with resources. Such a formulation of the goal fully corresponds to the modern concept of financial reporting as a means of communication between the company and external users.

The principle of temporary certainty, called the calculation principle, forms the basis of the company's accounting system. According to this principle, the facts of economic activity are reflected in accounting records at the time of their occurrence, regardless of the actual movement of funds. Applying the calculation principle ensures a more accurate reflection of the company's financial condition and activities, as it allows linking income and expenses with economically related periods.

The continuity assumption implies that the company will continue to operate in the near future and has no intention or need to terminate it or significantly reduce the scope of operations. For a strategic energy company, this assumption plays a special role, since energy infrastructure is an important asset with a long service life and high social significance.

Quality indicators of financial data include the fundamental features of relevance and fair presentation, as well as features that improve comparability, verification, timeliness, and accessibility. The relevance of information is determined by its ability to influence users' economic decisions, helping them evaluate past, present, and future events or confirm or correct previous calculations. Fair presentation is ensured by completeness, impartiality, and the absence of serious errors in the financial statements.

The principle of materiality permeates the entire financial reporting system and defines the boundaries between information that needs to be disclosed and secondary details. If omission or misrepresentation of data can influence the economic decisions of users of financial statements, then it is considered important. The company has developed a detailed system of quantitative significance criteria, adapted to the specifics and scale of the energy sector.

The internal control system ensures the reliability of financial statements, the effectiveness of activities, and compliance with current laws and regulations. The main elements of the system are the control environment, risk assessment, control procedures, information systems, and monitoring. Control procedures include the allocation of responsibilities, authorization of operations, document flow, physical safety of assets, and independent audits.

The accounting policy of JSC "Thermal Power Plants" is a comprehensive and modern system of principles and procedures for financial reporting that fully complies with the requirements of International Financial Reporting Standards. The document demonstrates a deep understanding of the specifics of the energy sector and the successful adaptation of international standards to the conditions of the national economy and regulatory environment of the Republic of Uzbekistan.

A very active approach to the implementation of new standards, including the preparation for the application of IFRS No. 18, testifies to the high level of professionalism of management teams and their desire to align with best international practices. Detailed development of methodological issues, clear criteria of materiality, and a comprehensive system of internal control ensure high quality of financial reporting and its compliance with the needs of various user groups.

The accounting policy can serve as a model for other energy companies in the region, demonstrating the possibilities of successful application of IFRS in the context of developing markets and state ownership. The constant improvement of accounting policies in accordance with changes in international standards and the development of the company's business ensures high-quality financial reporting, which strengthens the confidence of stakeholders in the company's financial information.

CONCLUSIONS AND PROPOSALS

The conducted research showed that improving accounting policies based on IFRS in joint-stock companies is an important way to improve the quality of financial reporting. The specifics of the energy sector - high capital intensity, a long investment cycle, complex technological processes - require a special approach to the formation of accounting policies.

The experience of JSC "Thermal Power Plants" has shown that a number of conditions must be met for a successful transition to NPS. Firstly, strong support from senior management is necessary, as the changes are very comprehensive and will affect the entire company. Secondly, the support of a team of qualified personnel and international consultants is important. Thirdly, modern information systems and sufficient financial resources are required. Fourthly, the phased implementation and advanced training of permanent personnel will increase efficiency.

Based on the research results, the following proposals were developed. Government agencies are recommended to develop programs to encourage energy companies to transition to IFRS, provide tax benefits, and reduce the gap between national and international standards. It is advisable to prepare special methodological guidelines for the energy sector.

Energy companies are recommended to form special project teams, attract international consultants and auditors, and systematically train personnel for the transition to IFRS. It is important to invest in information systems and exchange experience with other companies. It would be useful to create platforms for disseminating best practices in the application of IFRS within the framework of industry associations.

Scientific organizations are recommended to thoroughly study the methodological issues of applying IFRS in the energy sector and develop methodological recommendations adapted to the conditions of the region. It is necessary to develop special courses on IFRS in higher educational institutions, prepare manuals and case studies for practitioners.

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Резюме: *Мақолада акциядорлик жамиятларининг молиявий ҳисобот сифатини ошириш мақсадида МҲҲС асосида ҳисоб сиёсатини такомиллаштириш масалалари кўриб чиқилган. Энергетика тармоғи корхоналарининг ўзига хос хусусиятлари таҳлил қилинган ҳамда "Иссиқлик электр станциялари" АЖ тажрибаси асосида амалий таклифлар ишлаб чиқилган. Тадқиқотда асосий воситалар, ижара операциялари ва захираларни ҳисобга олишнинг замонавий усуллари батафсил ўрганилган. МҲҲСга ўтиш жараёнининг афзалликлари ва мураккабликлари очиб берилган.*

Резюме: *В статье рассматриваются вопросы совершенствования учетной политики на основе МСФО с целью повышения качества финансовой отчетности акционерных обществ. Проанализированы специфические особенности предприятий энергетической отрасли и разработаны практические рекомендации на основе опыта АО "Тепловые электростанции". В исследовании подробно изучены современные методы учета основных средств, операций аренды и резервов. Раскрыты преимущества и сложности процесса перехода на МСФО.*

Калит сўзлар: *ҳисоб сиёсати, МҲҲС, акциядорлик жамияти, энергетика, молиявий ҳисобот, асосий воситалар, ижара*

Ключевые слова: *учетная политика, МСФО, акционерное общество, энергетика, финансовая отчетность, основные средства, аренда*

WAYS TO IMPROVE THE PRODUCTION STRATEGY OF ENTERPRISES IN OUR COUNTRY

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Summary: *In this article, the current state of state support for the innovative activities of agricultural enterprises in our country has been analyzed, and scientific and practical recommendations for its improvement have been developed.*

Key words: *agricultural enterprise, innovative activity, state, support, international standards, international certificates, subsidy.*

Agriculture is one of the most important sectors of our country's economy. According to the results of 2023, agricultural products accounted for **38 percent of the country's gross domestic product**, that is, **more than one-third** of the total [1].

In today's competitive environment, where conquering the market with new products and services — that is, through innovations — is required under the conditions of a **digital economy**, supporting such an important sector of our national economy has become one of the most **urgent and significant tasks**.

As our President **Shavkat Mirziyoyev** emphasized: "In the *Uzbekistan – 2030* strategy, we have defined important tasks in all areas, including agriculture. In particular, we aim to reduce the cost of production by 30–35 percent through resource-saving innovative technologies, to expand the areas where water-saving technologies are introduced to **1.5 million hectares**, to increase the production of high-quality and high-yield varieties and pedigree livestock, and to prioritize the cultivation of **environmentally clean products**." [2]

As can be seen from the President's statement, **state support for the innovative activities of agricultural enterprises** is of great importance. This can lead to **positive changes not only in the agricultural sector but also in the entire national economy**.

Since the agricultural sector is one of the key branches of our economy (see Figure 1), under the conditions of a **highly competitive digital economy**, the **development of innovative activities in agricultural enterprises** is emerging as one of the most urgent and priority tasks. This, in turn, gives rise to the necessity of **state support** for this sector.

Before evaluating the current state of government support for the innovative activities of agricultural enterprises in our country, let us briefly analyze the data presented in **Figure 1**.

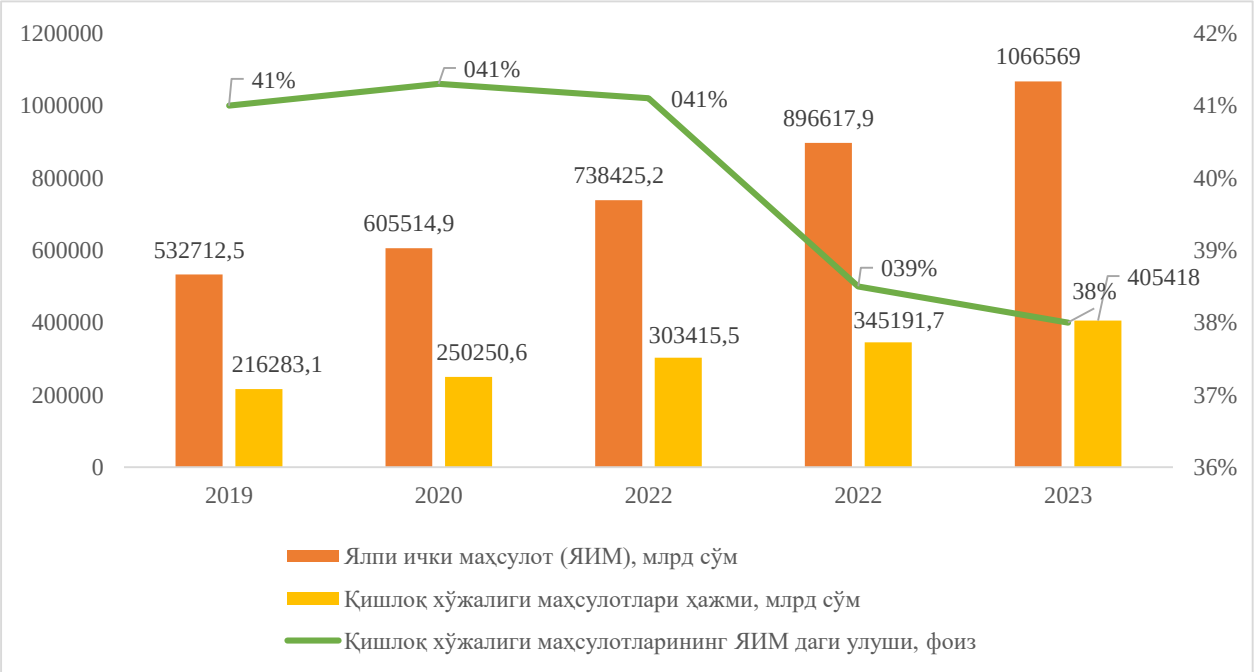


Figure 1. Dynamics of the Share of Agricultural Products in the Gross Domestic Product for 2019–2023 [3]

As can be seen from the data in **Figure 1**, during 2019–2023 both the **gross domestic product (GDP)** of the country and the **volume of agricultural products** were characterized by a steady growth trend. Although the share of agricultural products in GDP began to decline starting from **2021**, it still remains at a **relatively high level**.

At this point, let us briefly discuss the **main factors** that influenced this decline:

- The **growth rate of agricultural output** began to lag behind the **growth rate of GDP** compared to the previous year. For instance, in **2019**, the GDP growth rate compared to the previous year was **125.0 percent** [4], while the growth rate of agricultural products was **115.5 percent** [5]. Accordingly, in 2020 these rates were **114.0 – 115.7 percent**, in 2021 **122.0 – 121.2 percent**, in 2022 **121.4 – 114.0 percent**, and finally in 2023 **118.9 – 117.4 percent**.
- The **share of other sectors of the economy** in the country's GDP has not decreased. For example, if we look at the **volume of industrial production**, its share in GDP remained stable at **62.0 percent annually** during **2021–2023** [6].
- As mentioned earlier, under the conditions of **intensifying competition**, agricultural enterprises have **not been able to sufficiently develop their innovative activities**, which may also have contributed to the decline in their share of GDP in recent years.

In fact, identifying this **last factor** constitutes the **main focus of this article**. So, could one of the factors influencing the **decline in the share of agricultural products in GDP** indeed be the **insufficient development of innovative activities in agricultural enterprises**?

Figure 2. The Number of Agricultural Enterprises that Obtained the International "Global G.A.P." and "Organic" Certificates [7]

To find an exact answer to the above question, let us turn our attention to the **analytical data**. Figure 2 provides information on the **number of agricultural enterprises** that managed to obtain international **"Global G.A.P."** and **"Organic"** certificates during **2021–2023** as a result of implementing **innovative activities**.

Before analyzing the data presented in Figure 2, it is recommended to review **Table 1**, which explains the **content and essence** of the "Global G.A.P." and "Organic" international certificates, as well as their **advantages** for agricultural enterprises in our country.

As can be seen from **Table 1**, both certificates are **similar in nature** — they are aimed at **organizing agricultural production based on innovative methods** to **increase the sales and export volume** of products to **international markets**. However, the **"Global G.A.P." certificate** has a **relatively higher status**, which can be clearly observed from the following data: in **2021**, agricultural enterprises in our country obtained **39 "Global G.A.P."** and **5 "Organic"** certificates [8], whereas by **2023**, these numbers increased to **252 "Global G.A.P."** and **32 "Organic"** certificates.

The main reason why **"Global G.A.P."** has become more widespread than **"Organic"** certification in our country lies in the fact that "Global G.A.P." is recognized as a **top standard** — that is, the **number one global standard** in the **international agricultural products market**.

Turning to the analysis of the data in **Figure 2**, in **2021**, the total number of agricultural enterprises possessing either of the two certificates amounted to **44**. In **2022**, a significant **"leap"** was observed in this indicator, and the **growth trend continued** into **2023**.

Such positive progress can rightly be attributed to the **state policy** of the **Government of Uzbekistan**, aimed at supporting the **innovative activities of agricultural enterprises** and thereby **increasing the export volume** of agricultural products to **world markets**.

This **support** can be observed in the following areas:

- In accordance with the **Decree of the President of the Republic of Uzbekistan No. PF-5742 dated June 17, 2019, "On Measures to Ensure the Efficient Use of Land and Water Resources in Agriculture,"** the task was set to **gradually introduce and develop certification in agriculture** based on **international experience**, including the **"Organic"** and **"Global G.A.P."** standards [9];
- The **Decree of the President of the Republic of Uzbekistan No. PF-5853 dated October 23, 2019, "On Approval of the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020–2030,"** established **target indicators** to **increase the number of farms applying good agricultural and environmental practices (Global G.A.P. standard)** by **10 percent by 2025** and **20 percent by 2030** [10];
- The **Resolution of the President of the Republic of Uzbekistan No. PQ-4575 dated January 28, 2020, "On Measures to Implement the Tasks Defined in the Strategy for the Development of Agriculture of the Republic of Uzbekistan for 2020–2030 in 2020,"** set the task of **developing mechanisms to promote the introduction of internationally recognized quality and compliance standards**, including **"Global G.A.P."** and **"Organic"** [11];

Table 1Brief Information on the International "Global G.A.P." and "Organic" Certificates Awarded to Agricultural Enterprises for Implementing Innovative Activities [11]

Criteria	Global G.A.P.	Organic
Content and Essence of the International Certificates	This is a standard aimed at applying **good agricultural and environmental practices**. It certifies that agricultural products comply with the **required level of safety and quality**, that **environmental regulations** were observed during their cultivation or production, and that **special attention** was given to the **health and safety of workers**, as well as to the **state of the environment and livestock welfare**.	This certificate confirms that an agricultural product has been **grown or produced in accordance with the requirements of organic production**. The "**Organic**" label on agricultural products guarantees that **no chemical substances or synthetic additives** were used during cultivation or production.
Advantages for Agricultural Enterprises	• Enables enterprises to produce or grow safe products **in compliance with international standards and principles**; • Introduces **modern systems for risk management** and for improving the efficiency of production process management to ensure product	• Expands **market opportunities** and facilitates **access to international markets**; • Increases the opportunity to export to **countries with strict ecological safety requirements**; • Provides a **competitive advantage** over rivals not only in domestic but

Criteria	Global G.A.P.	Organic
	safety and quality; • Expands **market opportunities** and facilitates **access to international markets**; • Provides the opportunity to demonstrate to **partners and consumers** the enterprise's commitment to producing safe products, etc.	also in international markets; • Expands sales volume by offering **guarantees of product quality and safety** to consumers, etc.

These important **regulatory and legal documents** constitute a crucial part of the **state support system for the innovative activities of agricultural enterprises** in our country, and their effectiveness is clearly reflected in the data presented in **Figures 1 and 2**.

In general, the **state support for the innovative activities** of agricultural enterprises in Uzbekistan is being implemented in many other areas as well — including the **expansion of irrigated agricultural lands** where **water-saving technologies** have been introduced, the **gradual increase in state budget expenditures** for agricultural research, and other similar measures. These issues will be discussed in more detail in our **subsequent research**.

It should also be noted that a number of other international standards — such as **HACCP**, **ISO**, and **Halal** — are also being applied in our country. However, since the **"Global G.A.P."** and **"Organic"** certificates are specifically focused on the **innovative activities of agricultural enterprises**, this article has primarily concentrated on them. Naturally, in our future studies, we plan to examine **other international certification systems** as well as **other forms of state support** for innovation.

Conclusion and Recommendations

Based on the above, it can be concluded that in order to increase the **competitiveness of the agricultural sector** — one of the key branches of the national economy — not only in the **domestic** but also in the **international market**, it is extremely important to **strengthen state support** for the **innovative activities of agricultural enterprises**.

In this regard, we would like to present the following **scientific and practical recommendations**:

- **Enhance the efficiency of the state subsidy system** for supporting the innovative activities of agricultural enterprises, taking into account **international experience**. It is important to differentiate the allocation of subsidies based on the **type, characteristics, and scale** of enterprises (for example, **private enterprises** are generally more inclined to organize innovative activities than state-owned ones), and to establish an **effective control mechanism** over the use of subsidies. Otherwise, enterprises with a **low level of investment in innovation** may fail to use them effectively.
- Introduce **training and educational programs** for representatives of agricultural enterprises on the implementation of **"R&D" (Research and Development)** systems, which ensure the effectiveness of innovative activities in enterprises worldwide. For this purpose, it would be useful to create a **dedicated website** and organize **online training courses** accessible to all interested participants, similar to international practice.
- Continue to develop the **transition system of agricultural enterprises** to **international standards and certifications**, as this will contribute to the development of **"green tourism," "sustainable tourism," ecotourism, and agrotourism** in Uzbekistan. This, in turn, will increase not only the **share of agriculture** but also that of **tourism** in the **country's GDP**.
- Ensure the **quality and transparency** of **statistical data** regarding agricultural enterprises that have obtained international certificates. During the preparation of this article, we observed a **lack of sufficient open data** in this area. Ensuring data accessibility will not only **facilitate research** but also **increase foreign consumers' interest** in Uzbek agricultural products and **boost export volumes**.

In conclusion, the **further development** of the **state support system for the innovative activities of agricultural enterprises** in Uzbekistan will, in the future, lead to the **growth of these**

enterprises into large-scale producers. Moreover, it will enhance their ability to **sell competitive products** in both domestic and international markets by applying **high-quality technological innovations**.

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Резюме: *Ушбу мақолада мамлакатимизда корхоналари инновацион фаолиятини давлат томонидан қўллаб-қувватлашнинг амалдаги ҳолати таҳлил қилинган ва уни такомиллаштириш бўйича илмий-амалий тавсиялар ишлаб чиқилган.*

Резюме: *В данной статье осуществлен анализ современного состояния государственной поддержки инновационной деятельности сельскохозяйственных предприятий в нашей страны и разработаны научно-практические рекомендации по ее совершенствованию.*

Калит сўзлар: *корхоналар , инновацион фаолият, давлат, қўллаб-қувватлаш, халқаро стандартлар, халқаро сертификатлар, субсидия.*

Ключевые слова: *предприятие, инновационная деятельность, государство, поддержка, международные стандарты, международные сертификаты, субсидия.*

WAYS TO ENHANCE THE INNOVATIVE ACTIVITY OF BUSINESS ENTITIES THROUGH FINANCIAL SUPPORT

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Summary: *In the article, the issue of financing the innovative activities of business entities is examined, and this problem has become increasingly relevant under the conditions of ensuring the innovative development of the national economy. To address this issue, three main research methods were applied: scientific-theoretical, theoretical-practical, and economic-statistical analysis. The results of the study substantiate the significant role of the state in financing the innovative activities of business entities. Through scientific-theoretical investigation, analysis of the current situation, and the development of scientific and practical recommendations, the author has made a meaningful scientific and practical contribution to addressing the research problem.*

Key words: *entrepreneurship, business entities, innovative activity, innovative project, financing, grant, subsidy, state support.*

Introduction

The role of business entities in the economy of our country has been steadily increasing. According to the results of 2024, their share in the national gross domestic product amounted to 54.3%, in industrial output — 32.4%, in investments in fixed capital — 51.8%, in trade turnover — 84.0%, in the volume of provided services — 57.0%, and in the export of goods (works and services) — 33.3% [1]. As these figures illustrate, creating even more favorable conditions for the development of business entities—which hold a critically important place in the national economy—is one of the priority tasks before the government. In this regard, financing their innovative activities plays a particularly significant role.

The innovative development of the national economy, characterized by rapid changes in the competitive environment, requires business entities to introduce and expand innovative activity. Since the implementation of such activity requires financial resources, this article discusses issues related to financing the innovative activity of business entities.

Literature review

Financing the innovative activity of business entities is one of the issues widely researched by both foreign and local scholars. Below, we briefly analyze the approaches and views presented in this field. In addition, we also provide an example from the experience of the Russian Federation.

A group of foreign scholars — Anabela M. Santos from Spain, Michel Sincera from Belgium, and Giovanni Cerulli from Italy — in their scientific research highlight eight sources of financing for the innovative activity of business entities. These include: internal funds, bank loans, credit lines, trade credit, private equity, grants or subsidies, leasing, and factoring. According to the researchers, not all of these financing sources have an equal impact on the development of innovative activity. However, combined use of these sources not only contributes to the development of innovation within business entities, but also creates opportunities for their overall growth.

Table 1 presents these financing sources and the degree of their impact on the development of innovative activity.

Table 1

Sources of Financing the Innovative Activity of Business Entities [2]

№	Sources	Description	Degree of Impact on Innovative Activity
1	Internal funds	Cash funds generated as a result of savings, undistributed profit, or sale of assets and their equivalents	Medium
2	Bank loans	Long-term loans provided under repayment terms and their financing cost (interest rate)	Low

3	Credit lines	Short-term credit lines that may be used fully or partially at the borrower's discretion within the pre-approved limit	Low
4	Trade credit	Deferred payments for goods, services, or equipment provided by the supplier, carried out under mutual agreement	Low
5	Private equity	Cash raised by selling a share in a business entity	Medium
6	Grants or subsidies	Non-repayable funds provided by the government, often offered on a non-reimbursable basis	High
7	Leasing	Acquisition and use of fixed assets on a long-term lease for business purposes	Low
8	Factoring	Selling accounts receivable to a factoring company at a discount to accelerate cash flow	Medium

In the Russian Federation, the federal project "Takeoff – from Startup to IPO" is being implemented with the aim of financing the innovative activity of business entities. Within the framework of this project, the Innovation Assistance Fund, in cooperation with the Ministry of Economic Development, regularly conducts a competition called "Business Start."

The purpose of this competition is to select innovative projects aimed at creating, expanding, and/or modernizing the production necessary for serial manufacturing and commercialization of innovative products.

According to Deputy Minister of Economic Development Maksim Kolesnikov, under the federal project "Takeoff – from Startup to IPO," startups receive government support at every stage of their development — from business expansion to improving their products according to the requirements of large customers and entering the stock market.

One of the most important tools supporting product improvement and increasing production capacity is grants.

Based on the results of the 2024 "Business Start" competition, 33 small enterprises obtained financial support totaling 372 million rubles. Their innovative projects cover areas such as 3D printing technologies, biometric and information security systems, development of medical devices, as well as the creation of new equipment for various sectors of industry and agriculture.

The Deputy Minister also noted that priority is given to business entities that have the status of small technological companies: they receive additional points during the evaluation of their innovative projects. As a result, every second winner of the competition is a business entity with such status.

According to Sergey Polyakov, Director General of the Innovation Assistance Fund, each winner of the competition may receive a grant of up to 12 million rubles, which allows them to allocate funds for marketing services, industrial design, and the purchase of equipment, components, and software — in other words, to carry out all the necessary work to bring a new or improved product to the market [3].

A local researcher, Sh. A. Atamuradov, studied the role and importance of venture capital in financing the innovative activity of business entities. According to him, international experience shows that venture capital plays a significant role in financing practical innovative ideas.

The experience of the USA, Japan, Singapore, Finland, and India demonstrates that financing through venture capital can fundamentally transform the quality of an innovation-driven economic development model, provide investment resources, foster economic growth, and eliminate investment shortages.

Atamuradov adds that in this case, the innovative activity of business entities is financed through private investment. The goal of such investments is to obtain future profit if the innovative activity of the business entity proves successful. Venture financing is characterized by its high risk and long-term nature, typically ranging from three to seven years [4].

Overall, an analysis of the literature on financing the innovative activity of business entities shows that the role of the state in this sphere is extremely significant. Government support — primarily through grants and subsidies — provides a crucial impetus for the development of innovative activity.

Research Methodology

This article has been prepared in accordance with the requirements of the international IMRAD structure, and three main research methods were applied: the scientific–theoretical analysis method, the theoretical–practical analysis method, and the economic–statistical analysis method.

The scientific–theoretical analysis method was mainly used to examine the data collected for the "Literature Review" section, while the economic–statistical analysis method was applied in analyzing the data collected for the "Analysis and Results" section. The theoretical–practical analysis method, in turn, was used in both sections of the article.

During the process of collecting information for the "Literature Review", search engines such as Google, Google Scholar, and Yandex, as well as the Elsevier international scientific journal database, were primarily used. Special attention was given to reviewing online and printed literature published mainly from 2019 to the present. In studying the scientific-theoretical views of foreign scholars and researchers on the topic, literature in English was utilized; in analyzing the practical experience of Russia, literature in Russian was used; and in examining the opinions of local scholars and researchers, literature in Uzbek and Russian was employed.

In the process of gathering information for the "Analysis and Results", both primary and secondary research sources were used. As part of the primary data collection, interviews were conducted with local scholars, researchers, and specialists related to the financing of the innovative activity of business entities. For the secondary data collection, search engines such as Google and Yandex, local online news platforms, as well as reports and statistical bulletins of relevant organizations, were consulted.

Overall, in preparing this article, efforts were made to make maximum use of available information and data, maintain logical consistency and coherence, and avoid the "copy–paste" approach that may lead to plagiarism. This, in turn, helped achieve the main goal of the research — developing scientific and practical recommendations on financing the innovative activity of business entities.

Analysis and results

As in many countries around the world, increasing attention is being paid in our country to the issues of financing the innovative activity of business entities. The purpose of these efforts is to expand the production of import-substituting and export-oriented goods, increase employment and income sources for the population, promote the development of national brands capable of competing in the global market, and foster the formation of digital, green, and sustainable economies. Indeed, in achieving these objectives, business entities that successfully develop innovative activity serve as key "drivers."

In this section of the article, we examine the current state of financing the innovative activity of business entities in the country based on analytical data.

We would like to draw your attention to Table 2, which presents the number of innovations introduced by small and private business entities in Uzbekistan over the past three years:

Table 2

The Number of Innovations Introduced by Small and Private Business Entities in Uzbekistan in 2022–2024 [5]

№	Types of Innovations	2022	2023	2024
1	**Technological innovations**	2,778	1,541	1,815
2	**Marketing innovations**	129	40	45
3	**Organizational innovations**	33	54	278
Total:		**2,940**	**1,635**	**2,138**

Before analyzing the data presented in Table 2, we would like to draw your attention to Figure 1 below, which provides brief information on the types of innovations — technological innovations, marketing innovations, and organizational innovations.

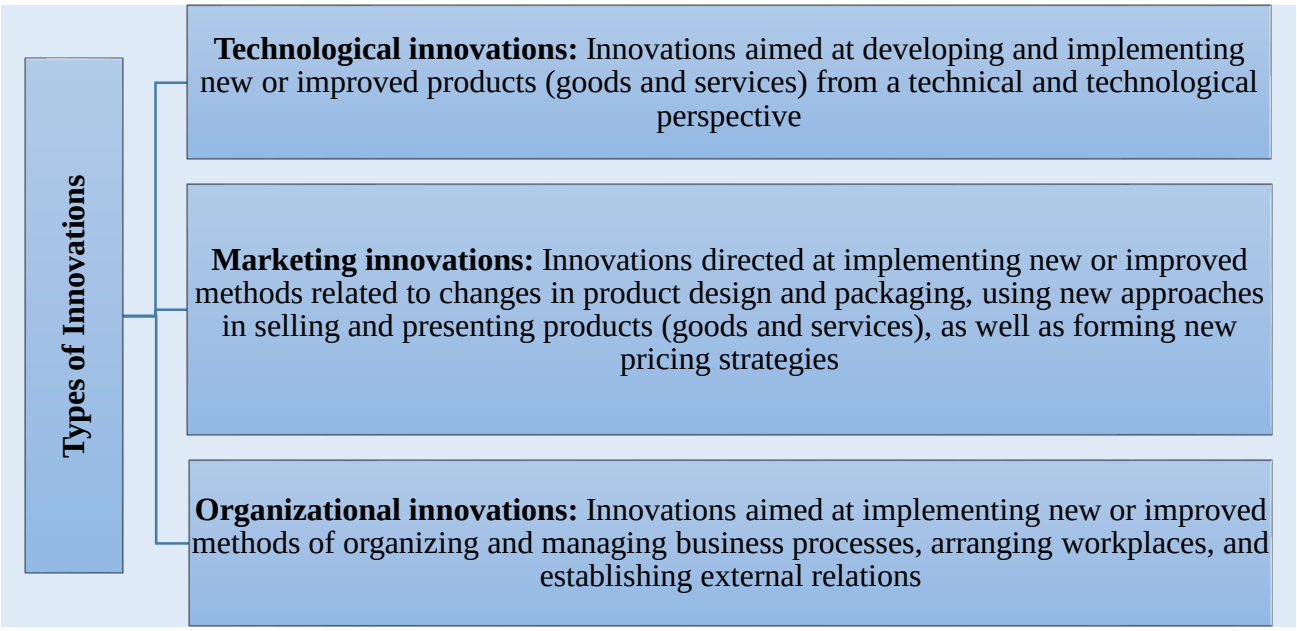


Figure 1. Types of Innovations [6]

Returning to the analysis of the data presented in Table 2, the number of innovations introduced by small and private business entities in 2023 — especially technological and marketing innovations — sharply decreased compared to 2022, but began to grow again in 2024. However, the number of organizational innovations continued to increase steadily and even demonstrated an exceptionally high result by 2024.

If we pay attention to the description of organizational innovations shown in Figure 1, we can identify two main reasons for such growth:

First, according to Presidential Decree No. PF-93 dated June 12, 2023, “On measures aimed at establishing mutually beneficial cooperation with business entities in reducing poverty”, business entities that create from 51 to 200 or more new jobs are provided with various benefits and preferences in the areas of “financing,” “taxation,” “providing necessary funds and infrastructure for business activities,” “simplifying tax and customs administration,” and “strengthening legal protection of business entities.”

These measures significantly accelerated the introduction of organizational innovations. Indeed, in the description of organizational innovations in Figure 1, the phrase “innovations aimed at implementing new or improved methods of organizing workplaces” is used, which aligns with the objectives set in this Presidential Decree.

According to this Decree, such business entities are included in the program “20 thousand entrepreneurs – 500 thousand qualified specialists” and are granted differentiated benefits and preferences in the above-mentioned areas. Since our research is focused on financing, in Figure 2 we present only the data on benefits and preferences provided in the field of financing.

As shown in Figure 2, in accordance with Presidential Decree No. PF-93 dated June 12, 2023, business entities creating:

— 51 to 100 new jobs are provided with loans of 5 billion soums,

— 101 to 200 new jobs — 10 billion soums,

— more than 200 new jobs — 15 billion soums,

for up to 7 years at an interest rate of 14 percent.

Undoubtedly, this created strong conditions for the sharp increase in the number of organizational innovations introduced in 2023 by small and private business entities.

Second, Presidential Decree No. PF-228 dated September 30, 2022, “On measures to further expand the export potential of business entities,” allowed the allocation of financial resources from the Export Support Fund for pre-export and export-related trade operations, based on the volume of

exports carried out during the last 12 months. This also played an important role in the increase in the number of organizational innovations.

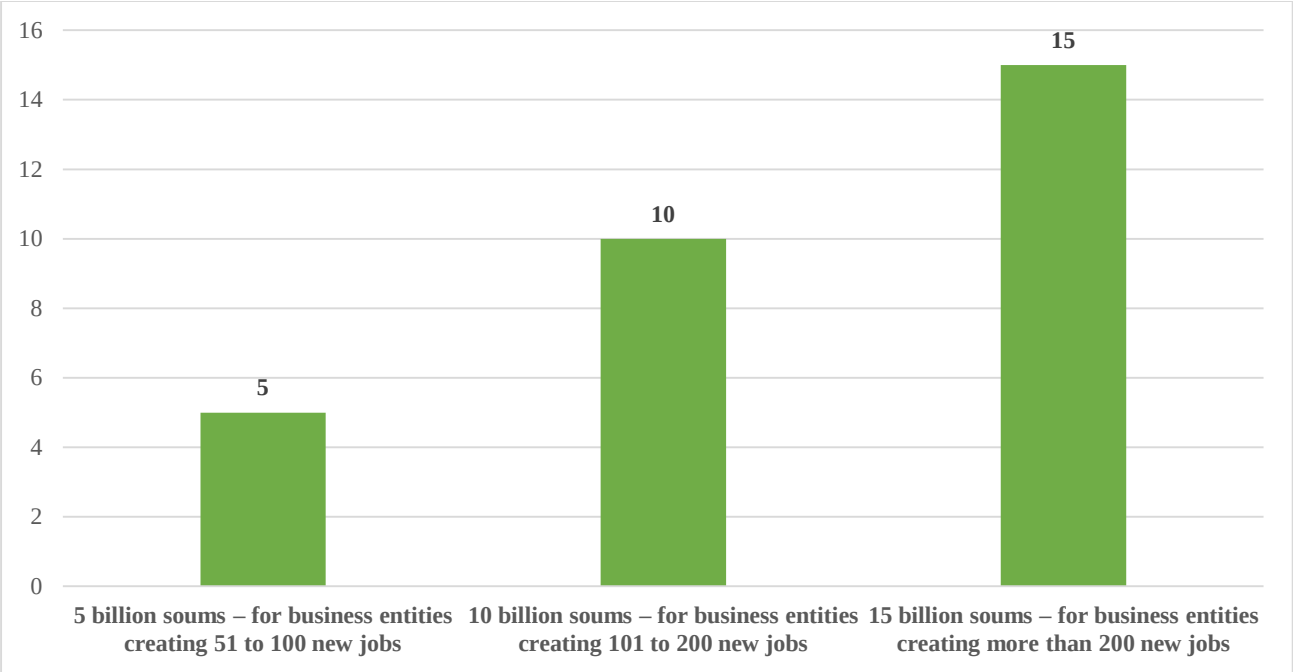


Figure 2. Maximum loan amounts (in billion soums) allocated at a 14% interest rate for up to 7 years for the implementation of business projects [9]

If we pay attention to the description of organizational innovations in Figure 1, we can see a statement that reads "innovations aimed at introducing new or improved methods of establishing external relations." In essence, the financing of export activities of business entities reflects the financing of organizational innovations.

Figure 3 presents information regarding the financing of export activities of business entities as established by Presidential Decree No. PF-228 dated September 30, 2022.

As seen in Figure 3, if a business entity's export volume over the past 12 months ranges from 1 million USD to 5 million USD, it may receive up to 1 million USD; if from 5 million USD to 10 million USD – up to 2 million USD; if from 10 million USD to 15 million USD – up to 3 million USD; if from 15 million USD to 20 million USD – up to 4 million USD; and if exceeding 20 million USD – up to 5 million USD. These financial resources are allocated from the Export Support Fund.

Additionally, if business entities that meet these criteria implement and obtain certification for at least one international standard, they are also provided with financial assistance not exceeding 30,000 USD.

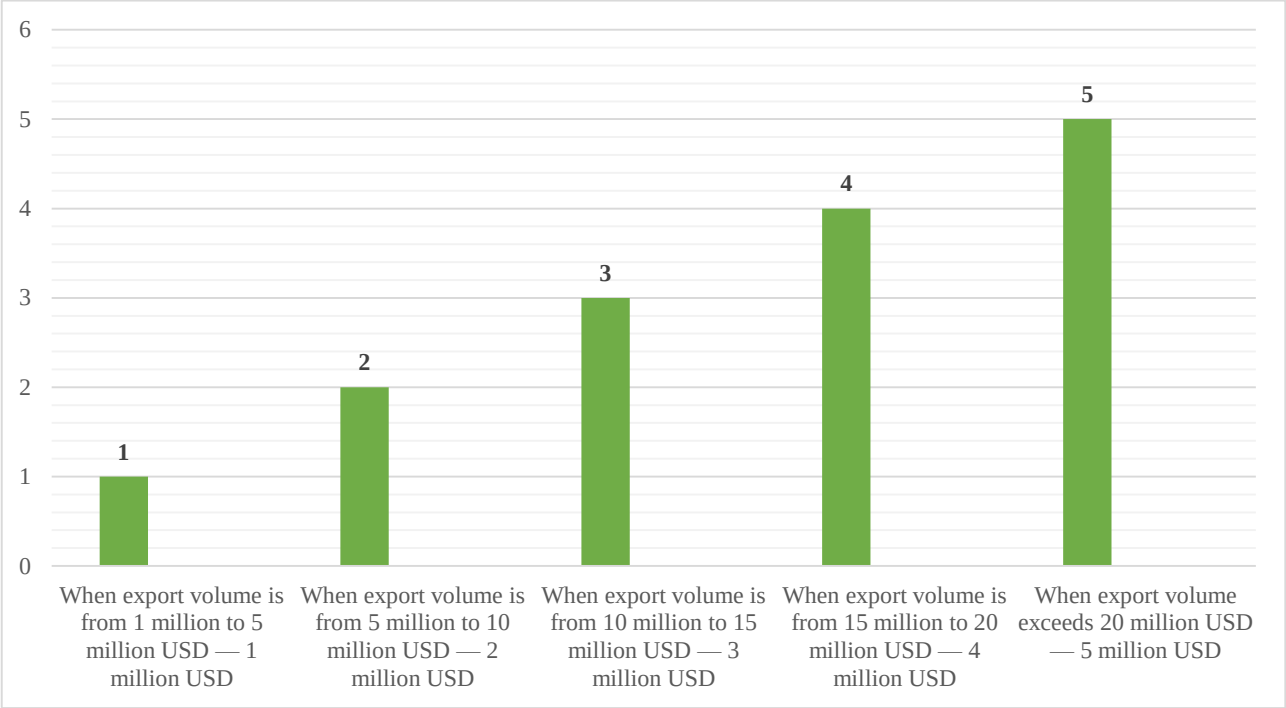


Figure 3. Financial resources allocated to business entities from the Export Support Fund based on their export volume, million USD [10]

From this, we can conclude that, under Presidential Decree No. PF-228, the support for the export activities of entrepreneurial entities has enabled a steady, and even sharp by 2024, increase in the number of organizational innovations introduced by them.

In general, as mentioned above, in addition to organizational innovations by small and private entrepreneurial entities, there are also technological and marketing innovations, which we will attempt to address in our future research. However, we can state with certainty that the main reason for the observed growth trend in these types of innovations in 2024 can also be attributed to the reforms carried out by the state aimed at financing them (similar to organizational innovations). This is because the role of the state in financing the innovative activities of entrepreneurial entities in our country is of utmost importance.

Conclusion/Recommendations

In conclusion, it can be stated that significant attention is being given to financing the innovative activities of entrepreneurial entities in our country, which is evident from the analytical data presented above as well as the reviewed regulatory and legal documents. At this point, we would like to reiterate that the state remains the main driving force in financing the innovative activities of entrepreneurial entities.

Based on this, we would like to present the following scientific and practical recommendations:

- It is necessary to further expand the sources of financing for the innovative activities of entrepreneurial entities. As can be seen from the analyses above, in our country such financing sources mainly consist of loans provided by commercial banks (most of which have state participation) and subsidies allocated by various state funds. In addition, it would be appropriate to make full use of other sources such as leasing, factoring, credit lines, trade credit, private equity, internal funds, grants, and similar instruments. The more diverse the financing sources used, the greater the opportunity for entrepreneurial entities to implement and develop innovative activities.
- It is necessary to increase the number of competitions that provide grants for financing the innovative activities of entrepreneurial entities. In our country, such competitions are not sufficiently widespread, which may contribute to the low interest of entrepreneurs in implementing innovations. During the research, we only obtained information about a competition for startup

projects carried out in cooperation with the Russian Federation under the Innovation Development Agency of the Ministry of Higher Education, Science, and Innovation of the Republic of Uzbekistan. We believe that holding many more such competitions without limitation would contribute to the further development of the innovative activities of entrepreneurial entities.

- It is necessary to improve the statistics on startups, which occupy an important place in the topic of "Innovative Activities of Entrepreneurial Entities." During our research, due to the lack of precise statistics, we decided to leave the investigation of this issue for our future studies. The insufficient quality of statistics may hinder the attraction of international venture investors willing to invest in startups. We believe that the time has come to create a website in our country that contains comprehensive statistical information on all startups.

Overall, many initiatives with significant positive impact are being implemented in our country to finance the innovative activities of entrepreneurial entities. In the future, these efforts will contribute not only to the development of entrepreneurship at the national level but also to the formation of a successful class of entrepreneurs at the international level. We hope that the scientific and practical recommendations developed as a result of our research will make a meaningful contribution to this process.

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THE IMPORTANCE OF LOGISTICS IN THE FORMATION AND IMPROVEMENT OF INTERNATIONAL CARGO TRANSPORTATION IN KARAKALPAKSTAN

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Summary: *The improvement of logistics mechanisms contributes to the integration of Karakalpakstan into global trade networks, the expansion of foreign economic relations, and the formation of a sustainable transport and economic system of the region.*

Key words*: export flows, logistics, customs warehouse, international transportation, interstate regulation, international trade, international communication, cooperation, agreement*.

Introduction

Logistics plays a key role in the development and effective organization of international cargo transportation in Karakalpakstan, as it ensures the rational movement of goods, optimization of transport flows, and cost reduction in the region's foreign economic activity. Karakalpakstan is capable of becoming an important transport and logistics link between Central Asia, Russia, the Caucasus, and European countries [1].

The role of logistics in international transportation of Karakalpakstan

In Uzbekistan, the Strategy for the Social and Economic Development of the Republic of Karakalpakstan until 2035 has been adopted. The document will be implemented in stages based on five-year detailed programs [7].



Figure 1:Republic of Karakalpakstan

It is planned to increase the growth of the gross regional product to 6-6.5%, increase the volume of industrial production by 5-6%, and the service market by 15-17%.

To finance the program, it is planned to attract 150-200 million dollars of foreign investment as part of the results-based financing system.

In order to further improve the level of transport and logistics services in the Republic of Karakalpakstan and create additional conveniences for entrepreneurs, a new open customs warehouse with a total area of 1110 sq. meters was commissioned on the territory of the Nukus Logistics Center, belonging to JSC "Uztemiryulkonteyner."

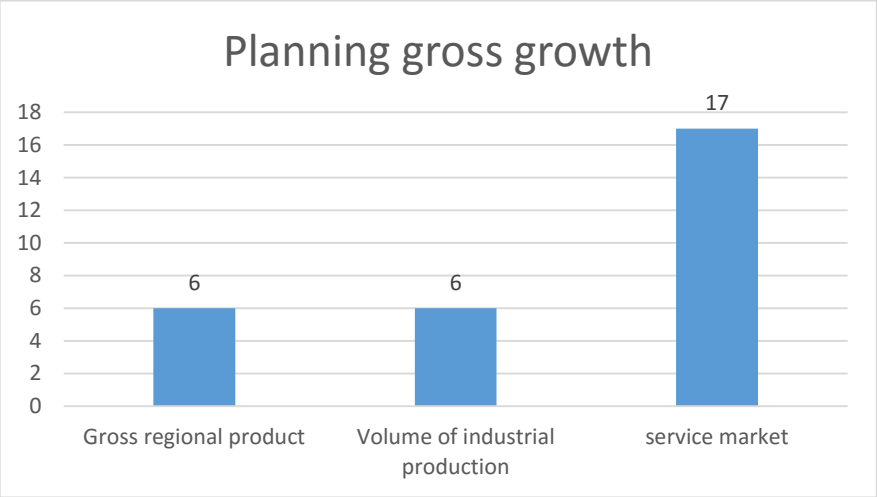


Figure 2:Diagram of planning gross growth

This warehouse was established with the support of regional customs representatives and is equipped with modern infrastructure and security systems [8].

The warehouse not only provides the possibility of temporary storage of goods, but also performs customs operations and multimodal transportation.

Logistics in modern conditions is a key element of the effective functioning of international cargo transportation. For Karakalpakstan, which has a favorable geographical location at the intersection of transport routes of Central Asia, logistics plays a strategic role in the development of foreign economic activity, exports, and transit links [5].

Logistics ensures the organization, coordination, and optimization of all processes related to the movement of goods - from the producer to the final consumer. In the context of international transportation in Karakalpakstan, logistics performs the following functions:

- rational management of cargo flows within the region and outside it;
- integration of transport types (railway, automobile, air, and pipeline) into a single system;
- reduction of transportation and time costs during export-import operations;
- expansion of foreign trade relations and increasing the competitiveness of domestic products in world markets.

Karakalpakstan is located along Central Asian transit routes, including the A-380 highway and railway branches connecting Tashkent, Nukus, Beyneu, Turkmenbashi, and further - with the ports of the Caspian Sea.

The region has the potential for developing multimodal transportation, logistics centers, and transport hubs.

The development of logistics contributes to the integration of Karakalpakstan into international transport networks, including within the framework of the "Central Asian Transport Corridors" initiative.

Karakalpakstan is located in the northwest of Uzbekistan and has transport links:

- with Kazakhstan (through Khojeyli and Kungrad);
- with Central Uzbekistan (via Nukus and Bukhara);
- with Turkmenistan and the Caspian region (through the Amu Darya bridge and further along the "TRACECA" corridor).

This arrangement makes the region a natural transit bridge between the countries of Central Asia, Russia, the Caucasus, and Europe. Effective logistics enhances this potential [6].

The economic potential of Karakalpakstan is rich in natural resources:

- oil, natural gas, construction materials, as well as fertile soils in the lower reaches of the Amu Darya;
- agriculture (cotton growing, livestock farming, melon growing), food and light industries are developing here;

- free economic zones are being created in the region, which contribute to attracting investments and developing production.

The development of logistics and transport infrastructure strengthens trade ties with other regions of Uzbekistan and neighboring states.

The socio-economic role of the development of industry, agriculture, and transport contributes to job creation, improving the living standards of the population, and the sustainable development of the region.

The restoration of the Aral Sea region's ecosystem and the implementation of UN and Uzbekistan programs to support the region are creating new opportunities for a green economy.

The strategic importance of Karakalpakstan is an important element of Uzbekistan's national security and economic stability.

Control over the transport flows and resources of the region is important for regional cooperation and integration in Central Asia.

Thanks to its position, the region can become a center for international logistics routes and energy projects.

Logistical role in the export flows of Karakalpakstan

Logistics is a key element in successfully managing Karakalpakstan's export flows. Thanks to the effective organization of transport, warehousing, and information processes, the region is capable of optimizing the supply of goods to international markets, reducing costs, and increasing the competitiveness of its products [7].

Features of export flows Karakalpakstan has a strategic geographical position in the northwest of Uzbekistan, borders with Kazakhstan, Turkmenistan, and has access to the transport corridors of Central Asia. Main export goods of the region:

- agricultural products: cotton, grain, melons;
- mineral resources: salt, mineral fertilizers, raw materials for the chemical industry;
- textile and light industry.

Export flows require organizing transit routes, multimodal delivery, and optimizing warehouse operations.

Logistics infrastructure for exports

1. Transport network:

- railway: Kungrad-Beyneu-Atyrau stations, connection with Kazakhstan and further with Russia;
- highways: routes through Nukus-Khojeyli-Turkmenistan, ensuring the delivery of products to the markets of Iran and the Caspian region;
- possibilities of multimodal transportation: railway + road, railway + seaport (Black Sea through Kazakhstan and the Caspian Sea).

2. Logistics Centers and Terminals:

- warehouse complexes in Nukus ensure the consolidation, storage, and preparation of cargo for international shipment;
- customs terminals accelerate the processing of export documents and simplify border crossing.

3.Information systems

- electronic cargo tracking systems (GPS, e-TIR, e-CMR);
-platforms for planning and monitoring export deliveries.

In Karakalpakstan, which has a strategic geographical position in the northwest of Uzbekistan, it is possible to optimize export flows, reduce transport costs, and accelerate the delivery of goods to international markets.

Optimization of export flows involves the rational management of all stages of cargo movement:

- route planning - selection of the most economical and fastest transport corridors;
- choice of transport and its combinations - multimodal transportation (railway + road, railway + seaport);

- organizing warehouse and customs operations - minimizing storage time and accelerating the processing of export documents;

- cargo control and information technology - use of GPS, electronic tracking systems (e-CMR, e-TIR) for monitoring the movement of goods.

These measures will reduce costs, increase the speed and reliability of deliveries, and enhance the competitiveness of Karakalpakstan's products in foreign markets.

Conclusion

Logistics in Karakalpakstan plays a key role in optimizing export flows and developing the region's foreign economic activity. The development of modern logistics systems ensures:

- reducing the time and costs of transporting export goods through the introduction of efficient transport routes and digital solutions;

- increasing the reliability and safety of transportation, which is especially important in international deliveries;

- increasing the competitiveness of regional products by reducing costs and improving the quality of logistics services;

- integration of the region into international transport and trade networks, which opens access to new sales markets and investment opportunities.

Thanks to these factors, effective logistics transforms Karakalpakstan into a strategic transit and export hub of Central Asia, contributing to sustainable economic growth, industrial development, and strengthening the region's position in international trade.

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Rezyume: *Logistika mexanizmlarini takomillashtirish Qoraqalpog‘istonning global savdo tarmoqlariga integratsiyalashuviga, tashqi iqtisodiy aloqalarni kengaytirishga va mintaqaning barqaror transport-iqtisodiy tizimini shakllantirishga xizmat qiladi.*

Резюме: *Совершенствование логистических механизмов способствует интеграции Каракалпакстана в глобальные торговые сети, расширению внешнеэкономических связей и формированию устойчивой транспортно-экономической системы региона.*

Kalit so‘zlar: *eksport oqimlari, logistika, bojxona ombori, xalqaro tashishlar, davlatlararo tartibga solish, xalqaro savdo, xalqaro aloqa, hamkorlik, kelishuv.*

Ключевые слова: *экспортных потоков, логистика, таможенный склад, международные перевозки, межгосударственное регулирование, международная торговля, международное сообщение, сотрудничество, соглашение.*

PREVENTING DAMAGE (DELICT) CAUSED TO BUSINESS ENTITIES BY TAX AUTHORITIES: A CIVIL LAW ANALYSIS

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Summary: *This article provides a civil law analysis of preventing damage (delict) caused to business entities by tax authorities. It is highlighted that tax relations, despite their public legal nature, also possess civil law foundations, particularly concerning the calculation and compensation of damages. The methods of protecting civil rights, such as compensation for damages, are examined based on Article 11 of the Civil Code of the Republic of Uzbekistan. The paper reveals the growing importance of civil law protection in disputes arising between business entities and state bodies in public law relations, focusing on defending the property and non-property rights of taxpayers against the unlawful actions of tax collection authorities.*

Key words: *Tax delict, business entity, tax authority, civil law protection, compensation for damages, Civil Code, civil liability.*

Tax relations are complex legal relations between the state and the taxpayer, in which the rights and obligations of both parties are firmly established. A tax-related delict is considered a violation of tax obligations or tax legislation by a taxpayer or a tax authority. This situation not only has a public character but also possesses civil law foundations, particularly concerning the calculation and compensation of damages.

According to Article 11 of the Civil Code of the Republic of Uzbekistan, the restoration of the situation that existed before the violation of a right, the prevention of actions that violate a right or create a threat of its violation, the recognition by a state body or a self-governing body of citizens that a document is invalid, and compensation for damages are among the methods of protecting civil rights.

According to the authors' emphasis, the civil law procedure for the protection of rights is understood as being carried out on the basis of civil law protection means aimed at protecting against obstacles to the violation of property and non-property rights reflected in civil law norms, eliminating offenses, and restoring rights. Particularly, the importance of civil law protection is growing in disputes arising between business entities and state bodies in public-legal relations. This is because civil law protection involves the use of civil law methods and means to ensure the full realization of interests related to ensuring unimpeded entrepreneurial activity, which does not violate the legally established rights, does not contradict the interests of other persons, and does not harm their rights, as well as protection from the actions (inactions) of a state body, its official, any obstacles, and compensation for damage caused[1].

A document of a state body that is not in accordance with legislation and violates the civil rights and legally protected interests of citizens or legal entities may be declared invalid by a court. Unless the law or contract provides for compensation in a lesser amount, the person whose right has been violated may demand full compensation for the damages caused to them.

According to sources, all measures, methods, and forms of protection aimed at protecting rights directly and indirectly incorporate civil law protection means. Improving the measures and means aimed at ensuring the effective civil law protection mechanisms of civil legislation, as well as their conscientious and proper implementation, is of great importance[2].

The issue of compensation for damage is not a public-legal relation, but a private-legal relation. This is because the issue of calculating and collecting the amount of damage is studied within the scope of the subject of private law. Specifically, the damage caused by tax authorities to the person whose right is violated – the taxpayer – will be related to the expenses incurred or to be incurred to restore the violated right, the loss of his property, as well as the income that this person could have received under ordinary civil turnover conditions if his rights had not been violated (lost profit).

According to Article 15 of the Civil Code of the Republic of Uzbekistan, damage caused to a citizen or legal entity as a result of the adoption by a state body or a self-governing body of citizens of a document not in accordance with legislation, as well as illegal actions (inaction) of their officials, must be compensated by the state or the self-governing body of citizens. Such damage is compensated from the extra-budgetary funds of the state body or the funds of the self-governing body of citizens.

In general, the possibilities for using civil law protection methods are expanding, acquiring a universal character, and this allows business entities to use several methods of protection simultaneously when providing civil law protection against illegal actions of tax authorities. This is because the protection of private property rights by business entities has its own characteristics[3].

As a state body, if tax authorities are abolished, their funds are insufficient, or if there are no extra-budgetary funds of the state body, compensation for damage caused to a taxpayer citizen or legal entity is made from the funds of the State Budget of the Republic of Uzbekistan. If the damage was caused through the fault of officials of the tax authority, the court may, by its decision, impose the obligation to compensate the damage on these officials.

In civil law, a delict related to tax relations mainly arises from the illegal actions of a tax-collecting person – a tax official, and illegal decisions (documents) of a tax authority also give rise to a delict. Usually, in tax relations, most problems are related to business entities. This naturally covers areas ranging from large business entities to small business subjects. Although the tax relations of business entities are usually public relations, the issue of delict is considered a civil law relation.

According to paragraphs 26-27 of the Regulation on the State Tax Committee, "officials of state tax service bodies exceeding their official powers, as well as failure to perform their official duties, shall entail disciplinary, administrative, or criminal liability as established by legal documents. Damages caused as a result of illegal actions (inaction) of officials of state tax service bodies in the exercise of tax control are compensated in accordance with the procedure established by law"[4].

Disputes arising from public-legal relations between business entities and state bodies are specific[5]. However, in modern development conditions, taking into account the doctrinal theoretical teachings emerging in scientific approaches in public and private law, conceptual requirements in administrative reforms, the issues of defining clear boundaries from the point of view of public and private law, developing civil law mechanisms, and ensuring the priority of applying civil law norms in relation to damages caused as a result of illegal actions of state bodies are gaining significant importance[6].

In civil law, a tax-related delict has a number of characteristics:

first, the occurrence of material damage as a result of tax authority decisions;

second, the illegality of tax authority decisions or violations in the actions of a tax official;

third, a legal connection between the damage and the action;

fourth, the degree of fault (intent or negligence).

These circumstances make it expedient to consider a number of measures to increase the effectiveness of the institution of civil law protection of entrepreneurs from illegal actions of tax authorities.

The Strategy for the Development of Small and Medium Business for 2025–2030, approved by Decree of the President of the Republic of Uzbekistan No. PF-50 dated March 19, 2025, "On measures to increase the role of small and medium business in the economy," defines a number of tasks regarding strengthening the institutional foundations of business regulation (Goal 17).

In particular, taking into account the tasks defined in the strategy, as well as modern support measures and mechanisms provided by the state to business entities in recent years, and envisaging the designation of an authorized body implementing a unified state policy in this area, it is planned to adopt a new version of the Law of the Republic of Uzbekistan "On Guarantees of Freedom of Entrepreneurial Activity."

If material damage is caused to a citizen or organization as a result of illegal actions of an official, an obligation to compensate it arises. This is reflected in Article 15 of the Civil Code[7]. Damage caused to a citizen or legal entity as a result of the adoption of an illegal document by a state body, illegal actions (inaction) of officials is compensated from the extra-budgetary funds of the state

body. If these funds are insufficient, it is compensated from the State Budget of the Republic. According to some sources, "even if the state does not commit an illegal act, if an official acts on behalf of the state, performs a specific function of the state, the state will be liable for his illegal act"[8]. If the damage was caused through the fault of a specific official, the court may impose the obligation to compensate the damage on that official. According to some literature, the court may also target the personal funds of the offending official when compensating damage caused to the budget[9].

In our opinion, it is expedient to introduce a number of innovations for the prevention and full compensation of damages caused to business entities, including damages related to tax relations.

Based on Resolution No. PQ-300 of the President of the Republic of Uzbekistan dated September 11, 2023, "On measures for the qualitative and timely implementation of the 'Uzbekistan – 2030' strategy in 2023," with the aim of further liberalizing liability in the field of entrepreneurship, starting from January 1, 2024, a procedure has been introduced to exempt from liability a person who has committed a criminal offense for the first time, provided that he fully compensates the damage caused to the state in the form of taxes and fees, including penalties and other financial sanctions, before entering the court consultation room. This issue certainly needs to be reflected in the law as a guarantee of the rights of business entities.

Furthermore, in our opinion, "the legal measures applied by tax authorities and other state bodies in relation to business entities must be proportional to the nature of the violation of mandatory requirements, the material and non-material assets protected by law that have been or could be harmed (damaged).

In the territory of Uzbekistan, civil liability for tax delicts usually arises as a result of damage caused to the state budget by the taxpayer, as well as damages caused to the taxpayer by tax-collecting authorities and officials.

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Резюме: *Ушбу мақола солиқ органлари ва тадбиркорлик субъектлари ўртасидаги муносабатларда юзага келадиган деликт (зарар етказиш) ҳолатларини фуқаролик ҳуқуқи нуқтаи назаридан таҳлил қилади. Солиқ муносабатлари оммавий-ҳуқуқий хусусиятга эга бўлишига қарамай, етказилган зарарни ҳисоблаш ва қоплашда фуқаролик ҳуқуқи асослари муҳим аҳамият касб этиши таъкидланган. Ўзбекистон Республикаси Фуқаролик кодексининг 11-моддасига мувофиқ, фуқаролик ҳуқуқларини ҳимоя қилиш усуллари, хусусан, зарарни қоплаш механизми кўриб чиқилган. Мақолада солиқ органларининг ноқонуний ҳаракатларидан тадбиркорлик субъектларининг мулкий ва номулкий ҳуқуқларини ҳимоя қилишда фуқаролик-ҳуқуқий ҳимоя воситаларининг аҳамияти очиб берилади.*

Резюме: *Данная статья посвящена гражданско-правовому анализу предотвращения причинения вреда (деликта) субъектам предпринимательства со стороны налоговых органов.*

Подчеркивается, что налоговые отношения, хотя и носят публично-правовой характер, обладают также гражданско-правовыми основаниями, особенно в части расчета и возмещения убытков. Рассматриваются способы защиты гражданских прав согласно статье 11 Гражданского кодекса Республики Узбекистан, в частности, механизм возмещения убытков. В работе обосновывается возрастающая роль гражданско-правовых средств защиты в спорах, возникающих между субъектами предпринимательства и государственными органами в публично-правовых отношениях, с акцентом на защиту имущественных и неимущественных прав налогоплательщиков от неправомерных действий налоговых органов.

Калит сўзлар: *Солиқ деликти, тадбиркорлик субъекти, солиқ органи, фуқаролик-ҳуқуқий ҳимоя, зарарни қоплаш, Фуқаролик кодекси, мулкий жавобгарлик.*

Ключевые слова: *Налоговый деликт, субъект предпринимательства, налоговый орган, гражданско-правовая защита, возмещение убытков, Гражданский кодекс, имущественная ответственность.*

THE SIGNIFICANCE OF SOMATOTYPE INDICATORS IN INCREASING SPORTS RESULTS OF SWIMMERS AT THE AGE OF 14-15 YEARS

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Summary: *The purpose of the study is to assess the importance of somatotype indicators in increasing sports performance of swimmers aged 14-15 years. The work used such scientific methods as theoretical analysis and generalization of scientific and methodological literature; morphofunctional research methods; anthropometry; mathematical-statistical analysis of research results.*

Key words: *sprint swimmers, body composition, somatotypes, results prediction, body fat, skeletal muscle mass.*

A sports training system represents a long-lasting and multicomplex process in which programmed training loads are applied. It is well documented in scientific literature that has examined long-term athlete development that selected athletes need eight to twelve years of systematic sports training with approximately two or three hours of daily practice to achieve an elite level with full performance potential (Balyi, 2001).

The improvement of the sports training system has led to better sport achievements with the help of increased athlete performance. The same phenomena were established in swimming in the last 50 years, regardless of swimmers' age and gender (Vavrek et al., 2012).

Biologically, development of athletes as a specifically selected and highly trained population, is constantly subjected to adaptation. It is well known that there are many extraneous factors (genetics, anatomical, neurological, hormonal, psychological, cognitive etc.) that must be incorporated within the planning of any specific form of physical training. All these systems are influenced by the hetero-chronic phenomenon, that is, they are time independent in their biological development, but all of them affect the physiological systems of the body (Norton et al., 2001).

American scientists Heath and Carter, based on certain anthropometric parameters, determined a somatotype by applying a formula, table and nomogram. The somatotype was defined as the quantification of the current shape and composition of the human body expressed in the form of three numbers which shown the endomorphic, mesomorphic an ectomorphic component, always following the same order (Carter, 2002). The endomorphic component is connected to the amount of fat tissue, the mesomorphic with muscle mass, and the ectomorphic with the relations between body height and weight. When one of the components is dominant, then we are dealing with "clean types".

An analysis of elite swimmers shows that the mesomorphic somatotype is present, and that there are also differences in the swimming styles [4]. The somatotype of the boys is mesomorphic with a tendency towards the ectomorphic component, and the intense training process changes the somatotype in around 50% of the boys in favor of the mesomorphic component and decreases endomorphism (Bagnall et al., 1977). A difference in the somatotypes among swimming styles was also determined, as was the fact that young swimmers have a tendency of being less mesomorphic and more ectomorphic [18, 19]. What was also determined were differences between boys and girls freestyle sprinters, but only in % fat (boys = 9.40 ± 5.35 % fat; girls = 12.73 ± 6.19 % fat) and the endomorphic component (boys = 2.87 ± 0.96; girls = 4.29 ± 1.22) [20]. In addition, it was determined that swimmers with top results are central somatotypes with a tendency of decreasing the endomorphic and increasing in the ectomorphic component, and that somatotypes are included in the selection process of potential elite swimmers (Babington et al., 2000).

Currently, medical and pharmacological means, various drugs and simulators are used in the development of physical training of swimmers in world sports. This creates a number of negative consequences for the health of swimmers. As a result, there is a need for methods of organizing scientifically based training conducted on the basis of a comprehensive experiment aimed at

developing swimmers' training, which can be used not only for highly qualified athletes, but also in the training of young swimmers (Ganchar, et al., 2012).

Follows from this that one of the important research works is to identify the features of the training of 14-15-year-old swimmers, taking into account the characteristics of their somatotype from the point of view of the concept of their long-term training.

Based on the aforementioned, the aim of the research is to assess the importance of somatotype indicators in increasing sports performance of swimmers aged 14-15 years.

Materials and Methods

The educational and training process of swimmers involved in the educational and training stage of the Nukus City Sports School No. 1 was chosen as the object of the study, and the following tasks were set:

- Analysis of the processes of organizing physical training of swimmers aged 14-15;
- Substantiation of the methodological support for the training of swimmers aged 14-15, as well as the development of a predictive model to achieve promising results.

Research work was carried out on 32 swimmers aged 14-15 years. In the course of the research work, the dynamics of the development of physical qualities, sports results, anthropometric indicators, functional test indices, initial exercises and rotation speed were analyzed. Significance of differences in changes was assessed according to Student's t-test. Differences were considered significant at $p<0.05$. Correlation analysis was carried out using Pearson's correlation coefficient. The research work was carried out on the basis of the sports school No. 1 of the city of Nukus.

Results and discussion

A characteristic feature of long-term sports training occurs in adolescence. During this period, it is possible to observe the heterochrony of the formation of the functional and somatic systems of the athlete. Particular attention to the planning of physical activity in adolescents during morphofunctional changes is associated with changes in the endocrine state. It is necessary to pay attention to the coordinated work of the cardiovascular system. In particular, when preparing young athletes, much attention should be paid to the degree of variability of physical loads (Goncharova, 2005). In accordance with modern trends in the development of teenage sports, many experts consider it expedient to carry out selection only after the onset of puberty (Petrovich, 2009).

In this regard, there was a need to study the dynamics of sports performance of children aged 14-15 years engaged in swimming. To carry out the research work, the study of sports results at different distances in the competitive and preparatory periods of the annual training cycle of athletes of this age category was determined.

When carrying out the study, first of all, we determined the anthropometric indicators of the test subjects. Also, we conducted a comparative analysis of these indicators at the beginning and at the end of the experiment (Table 1).

Table 1

Anthropometric indicators of swimmers aged 14-15 years

Control data	Boys (n=32)				Girls (n=32)			
	BE		AE		BE		AE	
	$\bar{x}$	м±	$\bar{x}$	м±	$\bar{x}$	м±	$\bar{x}$	м±
Height (cm)	169,4	±1,5	172,6	±0,85	165	±2,6	167,6	±3
Weight, (kg	56	±1,7	58,8	±1,93	49,8	±3,6	53	±3,43
Vital lung volume (ml)	3460	±64,4	4040	±64,37	3280	±236,1	3580	±236,06
Chest circumference (cm)	71,6	±1,3	72,6	±1,28	68	±2,1	69,2	±2,14

Note: BE - before the experiment, AE - after the experiment.

The study was conducted in the 2021/2022 academic year. The study recorded a high rate of characteristics of puberty and body growth in 32 boys aged 14-15 years in the first group (n_1-9) - 17±2.9%, while 16 athletes in the second group (n_2 -16) showed a moderate increase in body length

and limbs during puberty - 10.7±1.9%, and 7 teenagers in the third group (n_3-7) had slow growth rates. The change in growth rates was - 4.2±0.9%.

According to the analysis of the dynamics of efficiency when overcoming a distance of 50 m freestyle, it was found that the time of swimming in a straight line among adolescents of the group (N1-9) increased significantly: the speed of passing the first 25 m changed from 14.57 ± 0.38 s to 13.00 ±0.11 s, and the second 25 m from 16.20±0.24 s to 15.33±0.12 s.

When swimming in a straight line at a distance of 100 meters at the beginning of the study, the following indicators were recorded: 14.27 ± 0.44 seconds in the first 25 meters, 16.50 ± 0.37 seconds in the second 25 meters, 17.49 ± 0.44 seconds on the third 25 meters. The final distance of 25 meters is 16.00±0.28 seconds.

According to the final reports at the end of the academic year, the indicators were as follows: at the first distance 14.01±0.35s ($p<0.005$), at the second distance 16.00±0.23s ($p<0.005$), at the third distance 16.32± 0.39 s ($p<0.005$) and 14.44±0.30 s in the last 25 m ($p<0.005$). At the same time, in high-speed turns, spatial characteristics of body position errors, movement instability and shock intensity were revealed. in the group (n2-16) the results at a distance of 100 m changed from 1:12.35±0.24 s to 10.31±0.19 s ($p<0.005$), at a distance of 800 m from 12:30±1 :09 s to 11:00 ± 0.45 s ($p<0.005$), and no significant changes were found at distances of 50 and 1500 m. The most stable sports results among the athletes of the group (n3-7) were recorded at a distance of 800 m, while the result improved from 12:33.7±0.5-5.4 s ($p<0.005$) to 10:45.4± 0.4-7.2 s ($p<0.005$). While at a distance of 1500 meters the result improved from 24:10.3±1:31.3 seconds to 20:05.2±1:02.5 s ($p<0.005$), significant changes in this group of athletes in short and medium distances did not happen.

As a result of tests for coordination, there were no significant changes compared to the results of 8.93±0.47 at the end of the academic year in the shuttle run for 4 × 9 meters in groups (n1-9) and (n1-16). At the same time, the results of the swimmers of the group (n3-7) in this exercise improved from 9.29±0.48 to 8.74±0.32s. This significantly increased the results in swimming ($p<0.005$).

Based on the results of statistical analysis, we determined the correlation dependence of body mass index and the results of control at freestyle distances. Based on the body mass index (BMI), it was found that the first group has a statistically significant correlation with the results at short distances p1 = 16.2±0.35 p=0.477. In the second group, athletes with body mass index r2=17.9±1.4 were mainly associated with average distance indices p=0.539. At short distances, the interaction is less pronounced p=0.315. In the third group with body mass index r3=18.3±1.4, the correlation with the results for long distances was p=0.575.

Conclusions. The conducted studies show that in children aged 14-15, the period of puberty has its own characteristics. This should be taken into account when planning training sessions and distributing competitive distances depending on the characteristics of the somatotype. The experimentally determined ratio of the effectiveness of the distance traveled to the body mass index corresponds to the data of leading experts in this field. However, despite this, rapid morphological and functional changes in the body during the study period require constant medical and pedagogical control.

The current study presents several important and significant correlations between body composition variables and sprint swimming performance in sprint swimmers. Generally, quantifying body composition is beneficial for sprint swimmers in order to control the process of training to improve performance. Body composition measurement procedures may be helpful to determine optimal training modalities (methods, volume, and intensity) for continuous improvement of sprint performance.

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Rezyume: *Maqolada 14-15 yoshli suzuvchilarning sport natijalarini oshirishda somatotipik ko‘rsatkichlarning roli baholangan. Tadqiqotda ilmiy-uslubiy adabiyotlarni nazariy tahlil qilish va umumlashtirish; morfofunksional tadqiqot usullari; antropometriya; tadqiqot natijalarini matematik-statistik tahlil qilish kabi ilmiy usullardan foydalanilgan.*

Резюме: *В статье представлена оценка роли соматотипических показателей в повышении спортивных результатов пловцов 14-15 лет. В работе использованы такие научные методы, как теоретический анализ и обобщение научно-методической литературы; морфофункциональные методы исследования; антропометрия; математико-статистический анализ результатов исследований.*

Kalit so‘zlar: *sprint suzuvchilari, tana tuzilishi, somatotiplar, natijalarni bashorat qilish, tana yog‘i, skelet mushaklari massasi.*

Ключевые слова: *спринтерские пловцы, состав тела, соматотипы, прогноз результатов, жир тела, масса скелетных мышц.*

CORPORATE GOVERNANCE AND SUSTAINABLE TOURISM IN CENTRAL ASIAN COUNTRIES

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Summary**:** *Sustainable tourism is emerging as a strategic development priority across Central Asian countries, which seek to diversify their economies and improve global competitiveness. However, achieving sustainability depends on effective corporate governance that ensures transparency, accountability, ethical management, and stakeholder engagement. This study examines the relationship between corporate governance and sustainable tourism in Central Asia, analyzing the progress and challenges faced by Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan. Through a review of policy frameworks, institutional reforms, and best practices, the article identifies how good governance can serve as a foundation for sustainable tourism and inclusive economic growth in the region*.

Key words: C*orporate governance, sustainable tourism, Central Asia, ESG, transparency*

The tourism industry in Central Asia has gained increasing attention in recent years as governments recognize its potential for economic diversification, employment generation, and cultural exchange. The region's strategic location along the historic Silk Road, combined with its unique landscapes and heritage sites, provides strong foundations for tourism development. However, tourism growth also brings environmental, social, and management challenges that require sound governance to ensure long-term sustainability. Corporate governance—the system by which organizations are directed and controlled—plays a crucial role in shaping sustainable tourism. It encompasses principles of transparency, accountability, responsibility, and fairness, ensuring that decisions in both the public and private sectors are ethical and inclusive. In the context of tourism, corporate governance affects how enterprises manage resources, engage with local communities, and adhere to environmental standards. This study explores how corporate governance frameworks influence sustainable tourism development in Central Asian countries. It aims to identify institutional gaps, analyze reform efforts, and provide recommendations for improving governance mechanisms that support sustainable tourism.

The concept of corporate governance first appeared in 1932 and has since developed into a well-defined theoretical framework. Corporate governance has traditionally focused on mechanisms designed to align managerial behavior with shareholders' interests, as articulated in agency theory (Jensen & Meckling, 1976). Over time, however, the concept has expanded to include broader Environmental, Social, and Governance (ESG) dimensions, emphasizing firms' responsibilities beyond financial performance (Eccles, Ioannou & Serafeim, 2014). ESG-oriented governance integrates environmental stewardship and social responsibility alongside conventional governance structures (Elkington, 1997). Consequently, sustainable corporate governance has evolved into a comprehensive framework in which firms are accountable not only to investors but also to communities, ecosystems, and other stakeholders affected by their activities (Freeman, 1984; Aguilera et al., 2008).

Sustainable tourism is broadly defined as an approach that seeks to balance economic development with environmental protection and socio-cultural preservation (UNWTO, 2004). Within tourism scholarship, governance is viewed as a key determinant of sustainable outcomes because it shapes coordination between public authorities, private businesses, and local communities (Bramwell & Lane, 2011). Effective tourism governance involves policy-making, multi-stakeholder participation, institutional oversight, and capacity-building among residents (Hall, 2011). Thus, governance in tourism extends beyond regulatory enforcement to include fostering trust, enabling stakeholder collaboration, and developing institutional frameworks capable of supporting long-term sustainability goals (Bramwell & Lane, 2015).

Within the tourism field, several Uzbek researchers have addressed issues related to sustainable development and governance structures. Ruzmanov (2025) provides a comprehensive analysis of sustainable tourism resources in Uzbekistan, identifying weaknesses in policy coordination, environmental management, and institutional capacity that hinder sustainable tourism growth. His findings resonate with studies by Urokova (2024), who evaluates management strategies for sustainable tourism in Samarkand and underscores the need for stronger governance mechanisms to support heritage conservation, community engagement, and long-term planning. Moreover, Tashpulatov (2023) investigates sustainable financing for tourism development, showing that governance of investment decisions—particularly those relating to green infrastructure—plays a critical role in advancing sustainable tourism outcomes. While these studies address sustainability from various perspectives, they collectively indicate that governance quality, institutional coordination, and corporate responsibility are central to achieving sustainable tourism development in Uzbekistan. Despite these contributions, research directly linking corporate governance structures within tourism enterprises to sustainable tourism performance remains limited. Existing studies tend to examine ESG or CSR in general business contexts, or sustainability issues in tourism separately. Therefore, there is a clear gap in integrating corporate governance theory—particularly ESG governance—with empirical analyses of tourism organizations in Uzbekistan. Addressing this gap is essential for understanding how tourism firms can align managerial decisions with sustainability priorities and how governance reforms can support the country's broader goals for responsible tourism development.

This research is based on a qualitative comparative analysis of corporate governance and tourism policy frameworks in the five Central Asian countries—Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, and Turkmenistan. Data were collected from official government documents, national tourism strategies, World Bank and UNWTO reports, corporate sustainability disclosures, and academic publications from 2015–2024.

The analysis focused on three dimensions of governance in relation to sustainable tourism:

-Transparency and accountability – availability of sustainability reporting, open data, and oversight mechanisms;

-Stakeholder engagement – participation of local communities, NGOs, and private sector actors in tourism planning;

-Ethical and environmental responsibility – adoption of ESG principles, codes of conduct, and compliance with international sustainability standards. Each country was assessed qualitatively based on its policies, institutional reforms, and practical initiatives linking governance and tourism sustainability.

In the result:

1. Kazakhstan

Kazakhstan has positioned tourism as a pillar of economic diversification under its Kazakhstan 2050 Strategy. The country established "Kazakh Tourism" National Company, which promotes ESG principles in public–private tourism projects. The government introduced corporate reporting standards and environmental codes requiring tourism enterprises to disclose sustainability data. Despite progress, the sector still faces challenges such as limited stakeholder involvement in local tourism planning and insufficient independent auditing mechanisms.

2. Uzbekistan

Uzbekistan's Strategy for Tourism Development 2030 emphasizes sustainable and inclusive tourism, with governance reforms promoting transparency, simplification of licensing, and community-based tourism (CBT). The government actively partners with international institutions to train tourism managers in corporate ethics and sustainability reporting. However, private sector governance remains weak, with many enterprises lacking formal ESG reporting or independent oversight structures.

3. Kyrgyzstan

Kyrgyzstan promotes mountain and ecotourism as key economic sectors. The government and NGOs have implemented community-based governance models, allowing local communities to

participate in decision-making. The "Tourism Code" introduces basic corporate accountability requirements for tourism operators. However, the absence of formal ESG frameworks and low financial transparency among small tourism businesses remain key barriers.

4. Tajikistan

Tajikistan has developed a National Tourism Development Strategy 2030, focusing on sustainable mountain tourism. Corporate governance is evolving, supported by donor-funded projects encouraging responsible investment and local participation. Nevertheless, weak institutional enforcement, limited access to information, and underdeveloped corporate accountability mechanisms continue to restrict progress.

5. Turkmenistan

Turkmenistan's tourism sector remains largely state-controlled. While national programs highlight sustainable tourism and heritage protection, corporate governance practices are not yet institutionalized. Transparency, stakeholder engagement, and environmental accountability remain limited due to centralized management structures and restricted private sector participation.

Linking Governance and Sustainability

The analysis demonstrates that corporate governance and sustainable tourism are mutually reinforcing. Countries with more advanced governance frameworks, such as Kazakhstan and Uzbekistan, show greater progress in implementing sustainability initiatives and attracting responsible investment. Transparent governance fosters investor trust, while accountability mechanisms ensure that tourism development benefits local communities and protects the environment.

Common Challenges

Despite policy advances, several structural challenges persist across the region:

Limited transparency: Few tourism enterprises publicly report on ESG or sustainability indicators.

Weak stakeholder engagement: Local communities and NGOs are rarely integrated into formal decision-making processes.

Regulatory gaps: Sustainability requirements often lack enforcement or independent auditing.

Capacity constraints: There is a shortage of trained professionals in corporate governance and sustainability management.

These weaknesses hinder the transition from short-term, profit-oriented tourism to a sustainable, long-term model that aligns with global ESG standards.

Opportunities for Improvement

Central Asian countries have strong potential to leverage corporate governance reforms for sustainable tourism development. Key opportunities include:

Institutionalizing ESG standards within national tourism policies;

Creating public–private sustainability councils to enhance accountability and coordination

Developing regional governance frameworks to harmonize standards and facilitate cross-border Silk Road tourism routes;

Promoting digital governance tools for transparency, data sharing, and public monitoring.

International cooperation, particularly with the EU, UNWTO, and EBRD, can provide technical expertise and funding for governance capacity-building in the tourism sector.

Country	Transparency& Accountability	Stakeholder Engagement	Ethical&Environmental Responsibility (ESG)	Overall governance for sustainable tourism
Kazakhstan	**3 (High)** – Strong reporting standards; environmental code requires disclosures	**2 (Moderate)** – Inconsistent local involvement	**3 (High)** – National tourism company promotes ESG	**3 (High)**
Uzbekistan	**2 (Moderate)** – Improved transparency, but weak private-sector reporting	**2 (Moderate)** – CBT growing but	**2 (Moderate)** – ESG adoption limited among enterprises	**2 (Moderate)**

		not institutionalized		
Kyrgyzstan	**2 (Moderate)** – Basic accountability rules, but transparency still low	**3 (High)** – Strong NGO and community participation	**1 (Low)** – No formal ESG frameworks	**2 (Moderate)**
Tajikistan	**1 (Low)** – Weak enforcement; limited access to information	**2 (Moderate)** – Donor-supported participation	**1 (Low)** – ESG adoption minimal	**1 (Low)**
Turkmenistan	**1 (Low)** – Transparency extremely limited	**1 (Low)** – Minimal stakeholder participation	**1 (Low)** – ESG not institutionalized	**1 (Low)**

Table 1. (by the author according to the results of research)

Corporate governance serves as the backbone of sustainable tourism in Central Asia. Strengthening transparency, accountability, and stakeholder engagement will ensure that tourism contributes not only to economic growth but also to social inclusion and environmental preservation. Kazakhstan and Uzbekistan are taking promising steps by aligning their policies with ESG principles, while Kyrgyzstan demonstrates how local participation can enhance governance. For Tajikistan and Turkmenistan, progress depends on greater openness, decentralization, and institutional reform. Ultimately, embedding good governance in the tourism sector will help Central Asian countries transform their vast cultural and natural heritage into a sustainable development asset. By adopting international corporate governance standards, encouraging ethical leadership, and promoting inclusive tourism models, the region can position itself as a responsible and competitive destination on the global stage.

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Rezyume: *Markaziy Osiyo davlatlarida barqaror turizm iqtisodiyotni diversifikatsiya qilish va global raqobatbardoshlikni oshirish yo‘lida strategik rivojlanish ustuvor yo‘nalishiga aylanib bormoqda. Biroq, barqarorlikka erishish shaffoflik, hisobdorlik, etik boshqaruv va manfaatdor tomonlar ishtirokini ta’minlaydigan samarali korporativ boshqaruvga bog‘liq. Ushbu tadqiqot Qozog‘iston, O‘zbekiston, Qirg‘iziston, Tojikiston va Turkmanistonda korporativ boshqaruv va barqaror turizm o‘rtasidagi munosabatni o‘rganib, ularning erishgan yutuqlari va duch kelayotgan muammolarini tahlil qiladi. Siyosat doiralari, institutsional islohotlar va ilg‘or tajribalarni ko‘rib*

chiqish orqali maqola yaxshi boshqaruv Markaziy Osiyoda barqaror turizm va inklyuziv iqtisodiy o‘sish uchun qanday poydevor bo‘lishi mumkinligini aniqlaydi.

Резюме: *В странах Центральной Азии устойчивый туризм становится стратегическим приоритетом развития, направленным на диверсификацию экономики и повышение глобальной конкурентоспособности. Однако достижение устойчивости зависит от эффективного корпоративного управления, обеспечивающего прозрачность, подотчётность, этичное руководство и участие заинтересованных сторон. Данное исследование рассматривает взаимосвязь между корпоративным управлением и устойчивым туризмом в Казахстане, Узбекистане, Кыргызстане, Таджикистане и Туркменистане, анализируя достижения и существующие вызовы. На основе обзора политических рамок, институциональных реформ и передового опыта статья определяет, каким образом качественное управление может стать основой устойчивого туризма и инклюзивного экономического роста в регионе.*

Kalit so‘zlar: *Korporativ boshqaruv, barqaror turizm, Markaziy Osiyo, ESG, shaffoflik, hisobdorlik*

Ключевые слова: *Корпоративное управление, устойчивый туризм, Центральная Азия, ESG, прозрачность, подотчётность*

ASSESSING OF THE INFLUENCE OF PASTURES AND HAY LANDS ON LIVESTOCK PRODUCTION (ON THE EXAMPLE OF KONGRAD DISTRICT OF THE REPUBLIC OF KARAKALPAKSTAN)

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Summary*: In this article, the impact of changes in the area of pastures and hayfields on livestock production in the Kungrad district was assessed using econometric methods, in particular, correlation and regression analysis. The study confirms that intensive methods are mainly used in the development of livestock farming and shows the need to increase the efficiency of pasture use.*

Key words: *pastures, hayfields, regression analysis, correlation analysis, coefficient of determination, elasticity coefficient, agriculture, livestock products, MAPE indicator, Durbin-Watson criterion.*

Livestock farming is one of the most important sectors in the development of agriculture, and in recent years, an increase in the share of this sector in the gross agricultural output has been ensured. Because animal husbandry is more adaptable to various natural and ecological changes than agriculture. In addition, the increase in real incomes of the population leads to an increase in demand for livestock products with a relatively high feed unit and an increase in the price of livestock products in the market. This, in turn, leads to a higher efficiency of the industry for the manufacturer. In such conditions, it is important to study the possibilities of livestock development using quantitative methods and assess the effectiveness of the use of available resources.[1]. According to the results of our research, the development of livestock farming has two forms, that is, there are cases when households grow and purchase the necessary fodder at home or graze livestock farmers using pastures.

In our previous scientific work, we presented the results of a correlation analysis to assess the impact of changes in the area of pastures and hayfields on the number of livestock and the volume of livestock production in the Kungrad district.[2].

In this scientific article, the regression analysis method was used to quantitatively assess the impact of changes in the land fund on the development of animal husbandry. According to the obtained results, the following relationship was revealed between the total volume of livestock products created in the Kungrad district and the land area at the disposal of land users engaged in agricultural production.

$$lnY = 12{,}19 - 0{,}40 * lnTL$$
$$se = (1{,}76)\ \ (0{,}13) \qquad (1)$$
$$t = (6{,}95)\ \ (-2{,}99) \qquad R^2 = 0{,}24$$

Here: Y - real value of the volume of livestock products grown in the Kungrad district (in million soums); TL - land area (hectares) at the disposal of land users engaged in agricultural production.

We have provided the necessary data to justify the adequacy of the developed model. According to them, each coefficient is adequate according to Student's t-test[3], but the coefficient of determination has a small value. The MAPE indicator[4], which represents the reliability of the model, is 4.8. Based on the presented data, it can be noted that there is no sufficient correlation between the change in the total land fund and the production of livestock products, since, according to the results of the coefficient of determination, only 24 percent of the change in production is related to the change in the land fund. In addition, according to the results of the developed model, the elasticity coefficient between the two indicators is -0.4. That is, it is substantiated that the growth in livestock production is mainly the result of measures taken to intensify the industry.

The article focused on assessing the impact of changes in the area of pastures and hayfields on production volumes. Since the results of assessing the impact of pastures and hayfields on the total

livestock production are not at the required level, other lands were also included as an additional factor, and the following results were achieved.

$$lnY = 11{,}12 + 0{,}85 * lnPAS - 1{,}16 lnOTH$$
$$se = (1{,}00) \quad (0{,}15) \qquad (0{,}14) \qquad (2)$$
$$t = (11{,}07) \quad (5{,}84) \qquad (-8{,}13) \qquad R^2 = 0{,}71$$

Where: PAS - area of hayfields and pastures (hectares); OTH - other lands (hectares).

The obtained results indicate a significant improvement in the criteria justifying the adequacy of the model. In particular, it was established that the factors selected by the coefficient of determination represent 71% of the changes in the resulting factor. With an increase in the reliability of the model, it was found that the MAPE indicator is equal to 2.6.

The results of the model show that changes in the area of cultivated pastures and hayfields have a positive impact on the volume of livestock products, that is, an increase in the area of pastures and hayfields by one percent increases the volume of gross livestock products by 0.85 percent. However, changes in the area of other lands have the opposite effect.

The results of the correlation analysis show that[2] pastures and hayfields have varying degrees of correlation with different livestock products. In this regard, the impact of changes in the area of pastures and hayfields on the production of meat, milk, wool, and karakul pelts, which are important livestock products, was assessed. In the process of developing the models, due to the fact that the Durbin-Watson indicator [5], which indicates the presence of autocorrelation, is not at the required level, lags of the resulting factor were used, and the autocorrelation problem was eliminated (Table 1).

Table 1

Results of a regression analysis to assess the impact of changes in the area of pastures and hayfields at the disposal of agricultural organizations on the volume of production of important livestock products in the Kungrad district.

№	Model	Student's criteria	R^2	MAPE
1.	$lnMT_t = -0.06 * \ln PAS + 1{,}1 * lnMT_{t-1}$	b_1 = -2,3 b_2 = 26,31	0,99	1,1
2.	$lnWOOL_t = 1{,}24 - 0.14 * \ln PAS + 1{,}08 * lnWOOL_{t-1}$	b_0 = 5,13 b_1 = -5,09 b_2 = 22,63	0,96	1,15
3.	$lnLEA_t = 0{,}96 + 0.09 * \ln PAS + 0{,}76 * lnLEA_{t-1}$	b_0 = 3,97 b_1 = 2,87 b_2 = 14,57	0,97	0,43

All criteria justify the adequacy and reliability of the developed models. The results show that the importance of pastures and hayfields in the production of livestock products is very low, and the coefficients of elasticity of meat and wool production for pastures and hayfields are -0.06 and -0.14, respectively, which justifies an inverse relationship. The main thing is that the results of regression analysis also showed that dairy production has no connection with the area of pastures and hayfields. Due to the inadequacy of the developed model according to the criteria, it was not considered appropriate to present it in Table 1.

In the production of livestock products, the composition of livestock is of great importance, in particular, sheep breeding is important in the production of wool and karakul pelts, while cattle breeding is of great importance in the production of milk and meat. At the same time, improving the livestock composition of pastures and hay-fields will serve to increase the production of these products. Therefore, the influence of hay-fields and pastures on the development of livestock types was also assessed using the regression analysis method (Table 2).

Table 2

Results of a regression analysis to assess the impact of changes in the area of pastures and hayfields at the disposal of agricultural organizations on livestock types in the Kungrad district.

	Model	Student's criteria	R^2	MAPE
1.	$lnL_t = -0.59 - 0{,}03 * \ln PAS + 1{,}09 * lnL_{t-1}$	b_0 = -1,99 b_1 = -3,17 b_2 = 40,37	0,98	0,2
2.	$lnLL_t = -0{,}03 * \ln PAS + 1{,}04 * lnLL_{t-1}$	b_1 = -2,989 b_2 = 91,37	0,99	0,26
3.	$lnLSHG_t = -0{,}88 - 0{,}04 * \ln PAS + 1{,}12 * lnLSHG_{t-1}$	b_0 = -2,30 b_1 = -3,44 b_2 = 28,54	0,97	0,23
4.	$lnLH_t = 0{,}80 + 0{,}09 * \ln PAS + 0{,}73 * lnLH_{t-1}$	b_0 = 1,85 b_1 = 5,61 b_2 = 11,47	0,90	0,47
5.	$lnLCA_t = 0{,}05 * \ln PAS + 0{,}91 * lnLCA_{t-1}$	b_1 = 3,18 b_2 = 30,69	0,99	0,52

The same analysis was carried out for livestock types, and according to the results of determining the influence of pastures and hayfields on the number of cattle, an increase in the area by one percent leads to a decrease in the number of heads by 0.03 percent. That is, although the area has decreased, an increase in livestock numbers has been ensured. However, it was found that there is no correlation between the number of cows and the area of pastures and hayfields, in other words, the coefficient expressing the relationship between them is not adequate according to existing criteria.

The same situation can be observed in the results of assessing the impact on the number of sheep and goats. From the results of the correlation analysis, it is known that the relationship between the number of horses in the district and the area of pastures and hayfields has the highest value. According to the results of regression analysis, it can be seen that the change in the area of pastures and hayfields has a positive effect on the number of horses, but the coefficient is very small. The same situation can be observed in relation to the number of camels.

Based on the results of the correlation[2] and regression analysis, it can be noted that the use of the existing pasture fund in the district is not at the required level, in other words, there is no significant correlation between the change in the pasture fund and the number of livestock, the volume of livestock products.

In conclusion, it can be said that, in our opinion, the proper organization of pasture use, the expansion of the number of livestock farmers, ensuring the optimal ratio of the number and composition of livestock at their disposal serve to increase the efficiency of pasture and hayfield use. Therefore, in order to organize the effective use of available resources, it is advisable to develop a special platform for farmers and dehkan farms engaged in livestock breeding on pastures.

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ANALYSIS OF A STUDY ON ADOLESCENTS' EXPERIENCE OF AN AGE-RELATED CRISIS

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Summary: *The article is devoted to the analysis of experimental research on the individual psychological characteristics of adolescents experiencing age-related crisis. The conducted experimental methodology was analyzed and conclusions were drawn.*

Key words: *individuality, crisis, age, personality, problem, character, abilities, level, correction.*

The change in the state-political and socio-economic system in Uzbekistan and in all countries of the world has created a fundamentally new situation in the field of education. A new approach to the education system and youth education is being formed in society. The problem of educating is coming to the forefront in recent years. Firstly, Uzbekistan is a country of youth. Therefore, one of the most important issues today related to the formation of a new state and society, the implementation of youth policy, which has become an objective necessity, is that more than 60 percent of the population of Uzbekistan is youth [5].

During childhood and adolescence, the emotional-personal sphere is the most vulnerable. This is due to the rapid maturation of the individual, on the one hand, and the challenges of adapting to interpersonal relationships and activities, on the other.

During the period of character development, typological traits, referred to, as "character accentuations," are particularly prominent. These are extreme variants of the norm in which certain character traits are excessively exaggerated, resulting in selective vulnerability to certain types of psychogenic influences.

In the history of Uzbekistan, the first study of adolescent mental health was conducted in 2020-2022. Conducted by UNICEF in collaboration with partner organizations, the study involved 22,854 students from 299 schools across all 14 regions of Uzbekistan.

We conducted a study to identify the individual psychological characteristics of adolescents experiencing age crisis. The following research methods were used:

1) The Self-Attitude Questionnaire (V.V. Stolin) – to determine the characteristics of adolescents' self-attitudes during a personal crisis;

2) The Emotional Orientation Questionnaire (B.I. Dodonov) – to determine the general emotional orientation of an individual in the process of adolescents experiencing age-related crisis;

3) F. Zimbardo's Time Perspective Method – to determine the characteristics of adolescents' time perspective [1].

The study was conducted on the basis of Secondary School No. 28 in Nukus. The sample included learners in grades 7-8. The total sample consisted of 40 learners: 20 learners in grade 7 and 20 learners in grade 8. The work was conducted by third-year students in the Department of Practical Psychology of Karakalpak State University.

Based on the results of the analysis of the data obtained during the empirical study, the following conclusions can be drawn: our hypothesis about the existence of differences in the experience of an age crisis depending on the degree of expression of individual components of self-attitude, orientations, and the general emotional orientation of the personality - was partially confirmed. Based on the analysis of psychodiagnostic data, we were able to identify differences in the experience of adolescence crisis in younger adolescents (12-13 years old) and adolescents (14-15 years old) according to the following indicators:

1. Significant differences in the degree of expression of individual components of self-esteem exist on the scales "Self-confidence," "Internal conflict," "Self-blame," on the scales "Communicative" and "Gedonistic orientation";

2. Using F. Zimbardo's time perspective method, no significant differences were found between the two groups of respondents.

On the "Self-Confidence" scale, adolescents aged 12-13 are predominantly characterized by low or moderate levels of self-confidence, while adolescents aged 14-15 are most often characterized by high levels of self-confidence. This may be due to the fact that adolescents aged 14-15 have more experience making independent decisions, as well as the fact that parents perceive 14-15-year-olds as more mature, while younger adolescents (12-13) are more often perceived as children.

Internal conflict, a component of self-perception identified by V.V. Stolin, is also more common among younger adolescents, which may be due, among other things, to the results on the "Self-Confidence" scale [3].

Self-blame is most pronounced in the younger adolescent group, which, combined with low self-confidence and a high level of internal conflict, allows us to present a general picture of the adolescent crisis in the context of an individual's self-perception [2].

It can be concluded that by the age of 14-15, the experience of the adolescent crisis in the structure of self-perception no longer exhibits such pronounced manifestations of problematic behavior. On the contrary, it can be assumed that by this age, adolescents have already developed a fairly strong sense of adulthood. However, it is not possible to substantiate this assumption, as the study of the sense of adulthood, as a component of the adolescent crisis was not included in the structure of our study.

Emotional orientation—as a drive for any activity—is a very important indicator in relation to the adolescent crisis. Thus, a communicative orientation and the desire for pleasure (hedonic orientation) are characteristic of all 12-13-year-old adolescents who participated in the study. The pronounced communicative orientation of the individual in early adolescence, in our opinion, is due to the adolescence zone (intimate and personal communication) [4]. However, for 14-15-year-old adolescents, the degree of communicative orientation is reduced almost by half – this can be considered one of the individual psychological consequences of the adolescent crisis.

We obtained similar results on the "hedonic orientation" scale—the pursuit of pleasure. This was also characteristic of all early adolescent subjects in the study. A high level of internal conflict and a pronounced desire for pleasure correspond to the descriptions of the characteristics of adolescent crisis by foreign psychologists (e.g., A. Freud). Naturally, the desire to satisfy communicative needs or the desire for pleasure do not disappear in 14-15-year-old adolescents. In fact, if we examine the results of the study on the 14-15-year-old group separately, it becomes clear that virtually all scales and indicators tend toward average values, that is, there is no conventionally referred to "preponderance" of any emotional orientation [3].

A study of the temporal orientations (time perspectives) of adolescents experiencing age-related crisis revealed no significant differences between early adolescence and adolescence. This suggests that adolescence is characterized by a typical attitude toward time perspectives (regardless of the stage of the crisis).

As a result of our empirical study, we identified individual psychological characteristics of the midlife crisis experienced by modern adolescents, depending on the adolescent's age. Based on the results obtained during the study, it can be concluded that there are differences in the experience of an age-related crisis among adolescents of different ages – 12-13 and 14-15 years old. Theoretically and empirically confirmed data on these differences will allow educational psychologists and teachers to optimize their interactions with adolescents, as teachers (including educational psychologists) gain insight into the specific characteristics of how modern adolescents experience of an age-related crisis.

We found differences in adolescents' experiences of an age-related crisis, depending on their individual typological characteristics, namely, the severity of individual components of self-esteem: self-confidence, internal conflict, and self-blame; and the overall emotional orientation of the individual.

We found no differences in temporal orientations (specifically, time perspectives). These results may be due to the fact that time perspectives do not change with age in adolescents experiencing midlife crisis, but remain stable throughout the entire process of overcoming the crisis.

Therefore, in both groups (1 and 2), the results of the study of temporal orientations of the subjects did not reveal significant differences.

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Rezyume: *maqola o‘smirlarning yoshga oid inqiroz tajribasini boshdan kechirishdagi individual-psixologik xususiyatlarini tajriba-eksperimental tadqiqotini tahlil qilishga bag‘ishlangan. O‘tkazilgan tajriba metodikasi tahlil qilindi va xulosalar chiqarildi.*

Резюме: *статья посвящена анализу опытно-экспериментального исследования индивидуально-психологических особенностей переживания подростками возрастного кризиса. Дан анализ проведенной методики эксперимента и сделаны выводы.*

Kalit so‘zlar: *shaxsiyat, inqiroz, yosh, shaxs, muammo, xarakter, qobiliyatlar, daraja, tuzatish.*

Ключевые слова: *индивидуальность, кризис, возраст, личность, проблема, характер, способности, уровень, коррекция.*

THE ROLE OF OLYMPIC EDUCATION IN GENDER EQUALITY AND INCLUSIVENESS

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Summary: *This article analyzes the role of Olympic education in promoting gender equality and inclusivity. The author examines issues of equal rights, tolerance, and the creation of opportunities in sports for people with disabilities through the lens of Olympic values. The article also substantiates the positive impact of Olympic education on shaping socially responsible, humane, and active citizens among the younger generation. Additionally, it includes practical proposals to ensure gender equality and inclusivity in educational institutions.*

Key words: *Olympic education, gender equality, inclusivity, sports upbringing, Olympic values, women's sports, Paralympic movement, equal opportunities, youth education, social equality.*

In modern society, sport is considered not only as physical activity, but also as an expression of social equality, solidarity, and human rights. From this point of view, the Olympic movement and its integral component, Olympic education, play an important role in promoting gender equality and inclusiveness. This type of education instills in the younger generation the ideas of finding their place in society through sports, respecting others, and achieving equal opportunities. The philosophy of Olympism underlies Olympic education. It is aimed at the harmonious development of physical, mental, and moral qualities of a person. This philosophy promotes human rights, peace, friendship, mutual respect, and justice through sports. In particular, the International Olympic Committee has defined gender equality and inclusivity as a strategic goal. The Olympic movement strives to create equal opportunities for women and men in sports. Through the strategies developed by the International Olympic Committee:

- women are encouraged to actively participate in sports,
- women's sports are increasingly being included in Olympic programs,
- programs for training women for leadership positions in sports are being implemented.

Through Olympic education, students develop a spirit of eliminating gender stereotypes, appreciating equal rights in sports, and recognizing women's achievements. The equalization of the number of women and men at the Olympic Games, the organization of the Paralympic Games for athletes with disabilities are clear examples of this.

Through Olympic education, girls and boys are equally involved in sports in schools and sports institutions. This serves to break gender stereotypes. For example, sports (wrestling, football), traditionally considered exclusively male, are becoming widespread among girls today. Through this, the younger generation develops the skills of equality, freedom of expression, and active participation in society.

Historically, sport has been viewed as a more masculine activity. However, decisions and policies adopted by the Olympic Committee in recent decades have encouraged women's participation in sports. Through Olympic education, students are formed an understanding of women's achievements in sports, their place in public life, and their equality. This encourages girls to engage in sports, increase self-confidence, and be active in society.

Another important area of Olympic education is inclusivity. Olympic values - respect, stability, friendship - demonstrate that everyone has the right to participate in sports. Inclusivity:

- expanding sports opportunities for people with disabilities,
-supporting the Paralympic movement,
- by creating an open and fair sports environment for representatives of different nationalities, races, and social groups. Olympic education encourages youth towards tolerance, kindness, solidarity, and mutual understanding. Olympic education is aimed not only at gender equality, but also at creating opportunities for people with disabilities to express themselves through sports. The Paralympic movement, special Olympics are developing directions of sports based on the ideas of

inclusiveness. Through Olympic education in educational institutions, children understand that disability is not a limitation, but a specific feature. People of any nationality, age, or disability should have the opportunity to participate in sports. This educational model strengthens solidarity and mutual respect between different segments of society.

The Tokyo 2020 Olympic Games (held in 2021 due to COVID) became the most gender-equal Olympics in history: Women constituted 48.8% of the participants. This figure was only 2.2% at the 1900 Paris Olympics. At the Paris 2024 Olympic Games, the International Olympic Committee for the first time aimed to achieve 100% gender equality. In mixed teams, each country represents equal numbers of female and male athletes. Paralympic Games for athletes with disabilities have been held since 1960. More than 4,400 athletes from 162 countries participated in the Tokyo 2020 Paralympic Games, of which 42% were women. As of 2021, more than 200 countries have inclusive physical education programs based on Olympic values. Various master classes and seminars are held among children and adolescents on gender issues and people with disabilities. Inclusive Olympic festivals are held in more than 100 countries. In preparation for the Paris 2024 Olympics, projects promoting gender equality are being implemented. According to 2023 data, the share of female athletes in high sports reserve schools in Uzbekistan reached 34%.

Olympic education is not only the development of knowledge and skills in sports, but also a means of establishing equality, justice, and tolerance in society. By ensuring gender equality and inclusivity, Olympic values encourage the active participation of all young people in public life. This is one of the important factors in building a healthy, harmonious, and just society.

Suggestions:

1. Individual subjects or modules based on Olympic values should be introduced in educational institutions.
2. Athletes' achievements should be actively promoted in the mass media.
3. It is necessary to increase the number of sports clubs for students with disabilities and provide them with special methodological assistance.
4. It is advisable to organize advanced training courses for teachers on gender equality and inclusivity.

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Rezyume: *Maqolada Olimpiya ta’limining gender tengligi va inklyuzivlikni rivojlantirishdagi o‘rni tahlil qilinadi. Muallif Olimpiya qadriyatlari orqali jamiyatda teng huquqlilik, bag‘rikenglik va imkoniyati cheklangan insonlar uchun sportda sharoit yaratish masalalarini ko‘rib chiqadi. Shuningdek, Olimpiya ta’limining yosh avlodni ijtimoiy mas’uliyatli, insonparvar va faol fuqarolar etib tarbiyalashdagi ijobiy ta’siri asoslab beriladi. Maqola ta’lim muassasalarida gender tengligi va inklyuzivlikni ta’minlashga oid amaliy takliflarni ham o‘z ichiga oladi.*

Резюме: *В статье анализируется роль олимпийского образования в развитии гендерного равенства и инклюзивности. Автор рассматривает вопросы обеспечения равных прав, толерантности и создания условий для участия людей с ограниченными возможностями в спорте через призму олимпийских ценностей. Также обосновывается положительное влияние олимпийского образования на воспитание молодого поколения как социально ответственных, гуманистически настроенных и активных граждан. В статье представлены практические предложения по обеспечению гендерного равенства и инклюзивности в образовательных учреждениях.*

Kalit so‘zlar: *Olimpiya ta’limi, gender tengligi, inklyuzivlik, sport tarbiyasi, Olimpiya qadriyatlari, ayollar sporti, Paralimpiya harakati, teng imkoniyatlar, yoshlar tarbiyasi, ijtimoiy tenglik.*

Ключевые слова: *Олимпийское образование, гендерное равенство, инклюзивность, спортивное воспитание, Олимпийские ценности, женский спорт, Паралимпийское движение, равные возможности, воспитание молодежи, социальное равенство.*

TYPES OF NON-CUSTODIAL CRIMINAL PENALTIES FOR MINORS IN FOREIGN COUNTRIES

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Summary: *The article analyzes the liability of minors in the criminal legislation of many foreign countries and the punishments imposed on them. Today, many countries devote a significant part of their criminal legislation to the responsibility and punishment of minors. In some countries, the responsibility and punishment of minors is allocated to a separate section or chapter of the Criminal Code, while in others it is not.*

Key words: *Law, crime, criminal law, juvenile delinquency, juvenile delinquency, criminal liability, punishment, fine, community service, detention, imprisonment, foreign country.*

Today, many countries devote a significant part of their criminal legislation to the responsibility and punishment of minors. In some countries, the responsibility and punishment of minors is allocated to a separate section or chapter of the Criminal Code, while in others it is not.

For example, the Criminal Code of the Republic of Uzbekistan (Chapter Six. Peculiarities of Liability of Minors), the Criminal Code of the Republic of Azerbaijan (Chapter 14. Peculiarities of Liability and Punishment of Minors) [1]; the Criminal Code of the Republic of Belarus (Chapter Five. Peculiarities of Criminal Liability of Persons Who Committed Crimes at the Age of Under Eighteen) [2]; the Criminal Code of the Russian Federation (Chapter Five. Criminal Liability of Minors) [3]; the Criminal Code of Georgia (Chapter Five. Criminal Liability of Minors) [4]; Almost identical provisions can be observed in the Criminal Code of the Republic of Tajikistan (Chapter Five. Criminal Liability of Minors) [5] and other CIS countries.

In our opinion, an important role in ensuring the principle of humanism, which is considered one of the basic principles of criminal law, is played by the fact that in the criminal legislation of the CIS countries, issues of criminal liability and punishment of minors are given a particularly wide place.

At the same time, if we look at the criminal legislation of foreign countries, the Criminal Code of the Republic of Bulgaria (Chapter 6) [6]; In the Criminal Code of Sweden (Chapter 30, Section 5 "Choice of Punishment") [7] the issue of liability of minors is considered as a separate chapter, while in the Criminal Code of the Republic of Albania (Articles 51, 52) [8], the Criminal Code of the Republic of Korea (Articles 9, 52) [9] and the Criminal Code of the People's Republic of China (Article 17) [10] this issue is also considered as separate articles. In our opinion, the fact that the criminal legislation of the CIS countries is specifically devoted to issues of liability of minors differs from the legislation of foreign countries in a number of positions.

In particular, many differences can be observed in the systems of punishments assigned to minors. Article 81 of the Criminal Code of the Republic of Uzbekistan does not establish a special type of punishment for minors, but limits the type of punishment established by Article 43 of the Criminal Code. This article lists a system of punishments from the lightest to the most severe, namely: a fine, correctional labor, arrest and imprisonment. If we turn to the criminal legislation of the CIS countries in this regard, the following can be noted: Article 88 of the Criminal Code of the Russian Federation (fine, deprivation of the right to engage in certain activities, compulsory work, correctional labor, arrest, imprisonment for a certain period) [11]; Article 85 of the Criminal Code of the Republic of Azerbaijan (fine, community service, correctional labor, imprisonment for a certain period) [12]; Article 109 of the Criminal Code of the Republic of Belarus (community service, fine, deprivation of the right to engage in certain activities, correctional labor, arrest, restriction of freedom, imprisonment) [13]; Article 82 of the Criminal Code of Georgia (fine, deprivation of the right to engage in activities, community service, arrest, imprisonment for a certain period) [14]; Article 87 of

the Criminal Code of the Republic of Tajikistan (fine, deprivation of the right to engage in certain activities, correctional labor, arrest, imprisonment for a certain period) [15].

From the above, it can be concluded that, with the exception of some differences in the types of punishments, such as compulsory work in the Criminal Code of the Russian Federation [16], community service in the Criminal Code of the Republic of Azerbaijan [17] , community service and restriction of freedom in the Criminal Code of the Republic of Belarus [18] and socially useful work in the Criminal Code of Georgia [19], the remaining types of punishments for minors in the criminal legislation of the CIS countries are practically identical.

In particular, according to Article 88 of the Criminal Code of the Russian Federation, compulsory work is defined as work that a minor is capable of performing in his free time from school or main work, and is assigned for a period of 40 to 160 hours [20]. The duration of this type of punishment for persons under 15 years of age should not exceed two hours a day, and for persons aged 15 to 16 years - four hours a day. This type of punishment in the Republic of Azerbaijan is called community service and is applied in the same manner.

According to Article 110 of the Criminal Code of the Republic of Belarus, community service for minors is assigned to a convicted person who has reached the age of sixteen by the day of sentencing, for a period of thirty to one hundred and eighty hours and consists of performing work that the minor can perform in his free time from school or main work [21]. The duration of this type of punishment should not exceed two hours a day, four hours a week or three days a week. In accordance with Article 114.1 The Criminal Code of the Republic of Ukraine imposes a restriction of freedom for a period of six months to three years on a person who has reached the age of eighteen at the time of sentencing. According to Article 85 of the Criminal Code of Georgia [22], community service as a form of punishment is imposed for a period of 20 to 160 hours and consists of performing work that a minor is capable of performing in his or her free time from school or main work [23]. The other types of punishment listed above do not have significant differences in the criminal legislation of the CIS countries; the only difference we see is the duration of the types of punishment.

If we turn to the legislation of foreign countries on this issue, we can note, among other things, the following: Articles 33-34 of the Criminal Code of the People's Republic of China (the main types of punishment: supervision, short-term arrest, fixed-term imprisonment, life imprisonment, death penalty [24]; additional types of punishment: fine, deprivation of political rights, confiscation of property); Article 41 of the Criminal Code of the Republic of Korea (death penalty, hard labor, imprisonment, disqualification, suspension of qualifications, fine, arrest, small fine, confiscation) [25]; Article 62 of the Criminal Code of the Republic of Bulgaria (imprisonment, public censure, deprivation of the right to practice a certain activity or profession) [26]; Article 9 of the Criminal Code of Japan (death penalty, imprisonment with the right to work, imprisonment without the right to work, fine, short-term imprisonment, small fine, confiscation) [27] Swedish Penal Code [28], Chapters 25-26 (fine, imprisonment); Article 29 of the Criminal Code of the Republic of Albania [29] (main penalties: death penalty or life imprisonment, imprisonment, fine; additional penalties: deprivation of the right to work as a civil servant or in public service, confiscation of funds and benefits obtained as a result of committing a crime, prohibition to drive a vehicle, deprivation of honorary titles, deprivation of the right to practice a profession or activity, deprivation of the right to hold leadership positions related to legal activity, deprivation of the right to reside in one or more administrative units, expulsion from the country, forced announcement of the court sentence) provides for the following types of punishment: However, the criminal legislation of these countries does not provide for specific types of punishment for minors, with the exception of the Criminal Code of the Republic of Bulgaria [30].

In all the other listed countries, the criminal legislation contains only a few articles containing instructions on the appointment of punishments for minors.

Analyzing the above types of punishments and sentencing of minors in the criminal legislation of the CIS countries and far abroad, we can draw the following conclusions:

Firstly , it would not be wrong to say that paying special attention to issues of responsibility of minors in the criminal legislation of our country is one of the most important achievements in the creation of a civil society and a state based on the rule of law in the Republic of Uzbekistan;

Secondly , in our opinion, it would be advisable to additionally include in the criminal legislation certain types of punishment for minors, including community service. This can be justified by several factors: on the one hand, assigning a fine to a minor creates certain problems related to his financial situation, and assigning correctional labor deprives him of the opportunity to receive an education or master a certain profession on an equal basis with his peers. Community service, without interrupting his studies or main working hours, would play an important role in the moral rehabilitation and education of a minor;

Thirdly , the criminal code of our country does not provide for punishment in the form of deprivation of certain rights for minors. Considering the modern development of information technologies, the fact that most of their users are minors, and it is they who directly commit crimes in the field of computer information, we believe it is appropriate to introduce as an additional type of punishment for minors the punishment in the form of deprivation of certain rights. Because the fairest punishment for a minor is the one that ensures his correction.

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Rezyume: *Maqolada ko‘plab xorijiy davlatlar jinoyat qonunchiligida voyaga yetmaganlarning javobgarligi va ularga qo‘llaniladigan jazolar tahlil qilingan. Bugungi kunda ko‘plab mamlakatlar jinoyat qonunchiligining katta qismini voyaga yetmaganlarning javobgarligi va jazosiga bag‘ishlaydi. Ba’zi mamlakatlarda voyaga yetmaganlarning javobgarligi va jazosi Jinoyat kodeksining alohida bo‘limi yoki bobiga ajratilgan bo‘lsa, boshqalarida bunday emas.*

Резюме: *В статье анализируется ответственность несовершеннолетних и применяемые к ним наказания в уголовном законодательстве многих зарубежных стран. Сегодня многие страны посвящают большую часть уголовного законодательства ответственности и наказанию несовершеннолетних. В некоторых странах ответственность и наказание несовершеннолетних выделены в отдельный раздел или главу Уголовного кодекса, в других - нет.*

Kalit so‘zlar: *Huquq, jinoyat, jinoyat qonunchiligi, voyaga yetmaganlar, voyaga yetmaganlar jinoyatchiligi, jinoiy javobgarlik, jazo, jarima, jamoat ishlari, qamoq, ozodlikdan mahrum qilish, xorijiy davlat.*

Ключевые слова: *Право, преступление, уголовное законодательство, несовершеннолетние, преступность несовершеннолетних, уголовная ответственность, наказание, штраф, общественные работы, тюремное заключение, лишение свободы, иностранное государство*

ECONOMIC ADVANTAGES OF EFFICIENT RESOURCE UTILIZATION IN SUNFLOWER CULTIVATION

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Summary: *This article examines the economic benefits of efficient resource utilization in sunflower cultivation under modern agricultural conditions. Sunflower is an important oilseed crop that plays a significant role in ensuring food security, supplying raw materials to the oil-processing industry, and supporting rural livelihoods. The study focuses on the optimization of land, water, fertilizers, machinery, and labor resources and evaluates how resource-saving technologies-including drip irrigation, minimal soil tillage, fertigation, and high-yielding varieties-enhance productivity and profitability. Comparative economic indicators demonstrate that efficient resource use significantly reduces production costs, increases profit margins, and improves farm sustainability. The article concludes that implementing innovative agricultural practices is essential for increasing the competitiveness of sunflower production and ensuring long-term economic stability for farming enterprises.*

Key words: *Sunflower cultivation, resource efficiency, economic effectiveness, cost reduction, drip irrigation, fertigation, yield improvement, sustainable agriculture, profitability, input optimization.*

Introduction. Sunflower is one of the principal oilseed crops cultivated worldwide and is gaining particular importance in arid and semi-arid regions where climate-resilient crops are increasingly needed. Its versatility-serving as a primary source of vegetable oil, a valuable component of livestock feed, and a raw material for a variety of processed products-has resulted in steadily rising demand at both the domestic and international levels. This growing demand has encouraged farmers not only to expand cultivation areas but also to adopt modern agricultural techniques that can improve productivity and ensure consistent supply.

Despite these opportunities, sunflower production faces considerable challenges. Agricultural resources such as land, water, fertilizers, and energy are becoming progressively scarce and more expensive due to population growth, environmental degradation, and global market fluctuations. Water shortages, in particular, pose a serious risk in regions characterized by irregular rainfall and limited irrigation infrastructure. Meanwhile, rising fertilizer prices and fuel costs increase the financial burden on farmers, reducing their profit margins and threatening the long-term viability of production systems. Under these increasingly constrained conditions, the economic success of sunflower-growing farms depends heavily on the efficiency with which they manage and allocate available resources.

Efficient resource utilization is therefore not simply a technical requirement-it is an economic imperative. By adopting resource-saving technologies, farmers can significantly reduce unnecessary expenditures, improve input-use efficiency, and achieve higher yields with fewer resources. These technologies also foster greater environmental sustainability by minimizing soil degradation, conserving water, and reducing greenhouse gas emissions associated with excessive fuel and chemical use. In an era of intensifying climate stress and shrinking natural resources, such environmentally responsible practices are essential for maintaining productive agricultural systems.

Modern agriculture, shaped by global market pressures and rapidly evolving technological advancements, increasingly encourages farmers to implement innovative production strategies. Precision agriculture tools, improved seed varieties, and advanced irrigation systems enable producers to lower production costs, enhance crop performance, and maintain high levels of profitability. As a result, assessing the economic outcomes of resource-efficient sunflower cultivation has become a critical area of interest not only for farmers but also for agricultural economists,

policymakers, and researchers. Understanding the economic implications of adopting resource-saving technologies provides valuable insights that can guide future investments, support policy development, and promote more sustainable and profitable sunflower production systems.

Main Part. Concept of Efficient Resource Utilization in Sunflower Cultivation. Efficient resource utilization in sunflower cultivation refers to the strategic, rational, and balanced use of all essential agricultural inputs to achieve the highest possible output while maintaining or reducing production costs. In the context of modern agriculture-where climate change, soil degradation, rising input prices, and resource scarcity have become pressing global challenges-the efficient management of resources is not simply a recommended practice but a fundamental requirement for sustainable crop production. Sunflower, being one of the most important oilseed crops, requires a well-coordinated system of water, nutrients, mechanical energy, and labor to attain optimal growth and yield. Therefore, the degree to which these inputs are utilized directly affects farm productivity, economic viability, and long-term sustainability.

The main resources involved in sunflower production include [1]:

- **Water,** which is especially limited in arid and semi-arid regions. Efficient water management is essential to prevent wastage and ensure the uniform and adequate hydration of crops throughout their growth cycle. Improved irrigation practices contribute to higher yield stability and better water-use efficiency.
- **Land and soil fertility**, which determine the crop's access to nutrients and influence its physiological development. Sustainable soil management techniques-such as crop rotation, organic matter incorporation, and conservation tillage-help preserve long-term soil health, increase biological activity, and enhance the resilience of sunflower plants to environmental stress.
- **Fertilizers and plant protection materials**, which must be applied with precision to avoid unnecessary costs and environmental damage. Over-application can lead to nutrient runoff and reduced soil quality, while under-application can limit growth. Balanced nutrient management ensures stronger plants, higher yield, and improved oil content.
- **Mechanical power and energy**, which are required for land preparation, planting, irrigation, weed control, and harvesting. Efficient use of machinery reduces fuel consumption, minimizes greenhouse gas emissions, and lowers operational costs.
- **Labor resources**, which need to be organized effectively to guarantee timely agricultural operations. Efficient labor management increases productivity and prevents delays that could negatively impact crop development.

When these resources are managed according to scientific principles and supported by modern agro-technologies, farms can achieve higher yield stability, avoid unnecessary losses, and significantly improve economic returns [2]. Moreover, the application of precision agriculture tools enables farmers to apply inputs at the right time, in the right amount, and at the right place-resulting in improved productivity, reduced environmental impacts, and more sustainable long-term farming practices.

Economic Benefits of Resource-Saving Technologies:

a) Drip Irrigation. Drip irrigation is one of the most effective and widely adopted resource-saving technologies in sunflower cultivation. By delivering water directly to the root zone, drip irrigation minimizes evaporation, runoff, and deep percolation, making it exceptionally efficient in water-limited environments. Studies have shown that this method can reduce water consumption by **35-50%**, enabling farmers to use scarce water resources more effectively. In addition to conserving water, drip irrigation enhances nutrient uptake, as fertilizers delivered through the irrigation system reach the roots more efficiently. Improved moisture management reduces plant stress, promotes uniform growth, and increases both yield and oil content. These combined effects make drip irrigation a powerful tool for improving both productivity and profitability.

b) Minimal or Reduced Soil Tillage. Minimal or reduced tillage conserves soil structure, protects organic matter, and minimizes erosion caused by wind and water. Since reduced tillage requires fewer field operations, it significantly cuts down on the fuel used by tractors-often by 20-30%. This reduction in fuel use directly lowers production costs and helps minimize carbon emissions. Additionally, reduced tillage retains soil moisture, enhances soil biodiversity, and prevents compaction. These benefits collectively support a more sustainable farming system while improving long-term soil fertility and productivity.

c) Fertigation and Precise Fertilizer Application. Fertigation involves applying fertilizers through irrigation water, allowing for precise delivery of nutrients directly to the plant roots. This method improves nutrient-use efficiency by ensuring that plants receive essential nutrients exactly when they are needed. Fertigation can reduce fertilizer consumption by **15-20%**, cutting input costs while maintaining or improving crop performance. Precise nutrient application reduces environmental pollution risks associated with nutrient leaching and runoff [3]. As a result, fertigation promotes uniform crop growth, enhances crop quality, and contributes to higher yield potential.

d) Use of High-Yielding and Disease-Resistant Varieties. The adoption of high-yielding, drought-tolerant, and disease-resistant sunflower varieties plays a crucial role in improving production efficiency. These improved varieties are designed to withstand common diseases, pests, and environmental stresses, reducing the need for chemical treatments and minimizing yield losses. Many high-performing varieties can increase yields by **20-35%** compared with traditional cultivars. Additionally, these varieties often possess superior oil content and better market quality, resulting in higher income for farmers. The stability and reliability offered by improved genetics are particularly valuable in regions affected by climate variability.

Economic Performance Comparison: Traditional vs. Resource-Saving Technologies. The economic performance of sunflower cultivation is profoundly influenced by the choice of production technology implemented by farmers. Traditional farming methods, which have been practiced for decades, often rely heavily on large volumes of water, repeated and intensive soil tillage, and non-precision application of fertilizers and pesticides. These practices, although familiar and simple to apply, frequently result in excessive input consumption, higher fuel requirements, and increased labor needs. As a consequence, production costs rise, resource-use efficiency decreases, and yields become more vulnerable to fluctuations in weather conditions and soil fertility. Moreover, traditional methods tend to degrade soil structure over time, reduce soil organic matter, and contribute to environmental challenges such as erosion and nutrient leaching, which further undermine long-term productivity.

In contrast, **resource-saving technologies**-including drip irrigation, minimal tillage, fertigation, precision fertilization systems, advanced mechanization, and high-yielding seed varieties-are designed to minimize input wastage while maximizing crop performance [4]. These technologies operate on the principles of targeted input delivery, energy efficiency, and ecological sustainability. For example, drip irrigation provides water directly to the plant root zone, significantly reducing water loss, while minimal tillage preserves soil integrity and reduces energy consumption. Additionally, fertigation ensures that nutrients are delivered in appropriate quantities at critical growth stages, enhancing nutrient uptake efficiency and minimizing environmental pollution. High-yielding and disease-resistant varieties further strengthen production systems by improving resilience to pests, diseases, and climatic stresses.

The adoption of these modern technologies results not only in lower production expenses but also in improved environmental outcomes, such as reduced soil degradation, better water-use efficiency, and decreased greenhouse gas emissions. These benefits make resource-saving technologies highly suitable for sustainable agricultural development, especially in regions facing increasing resource constraints and climate instability.

A **comparative economic analysis** between traditional and resource-efficient production systems serves as a valuable tool for assessing their performance. By examining key indicators such as water consumption, fertilizer requirements, fuel and energy use, labor intensity, input costs, yield levels, net profit, and overall profitability, researchers and decision-makers can clearly identify the

relative advantages and limitations of each approach. Such analyses also help farmers understand how modern technologies can impact both short-term profitability and long-term farm viability.

The illustrative data presented in the comparison table highlight the practical economic benefits of adopting resource-saving technologies. The results demonstrate that these technologies significantly reduce the cost of water, fertilizers, fuel, and labor, thereby minimizing total production costs. At the same time, they enhance yield quantity and quality, increase oil content, and ultimately generate higher revenue per hectare. The combined effect of reduced costs and increased output leads to substantially higher net profits and improved profitability ratios.

Furthermore, the implementation of resource-efficient technologies strengthens the **economic resilience** of farming operations. Farms that adopt modern techniques are better equipped to withstand market fluctuations, rising input prices, and the impacts of climate change [5]. They tend to experience more stable yields, lower production risks, and improved long-term sustainability.

In summary, this expanded analysis emphasizes the critical importance of transitioning from traditional production methods to innovative agricultural practices. By improving resource efficiency, reducing costs, and enhancing economic returns, resource-saving technologies play a pivotal role in promoting sustainable development, increasing farm income, and enhancing the competitiveness of sunflower production in both domestic and international markets.

Table 1

Economic comparison between traditional and resource-saving technologies in sunflower cultivation (illustrative data)

Indicators	Traditional Technology	Resource-Saving Technology
Average yield (t/ha)	1.8	2.5
Water consumption (m^3/ha)	4500	2600
Fertilizer use (kg/ha)	180	140
Fuel consumption (L/ha)	70	45
Cost price (USD/kg)	0.52	0.38
Gross revenue (USD/ha)	1,260	1,950
Net profit (USD/ha)	420	1,050
Profitability (%)	33%	54%

The comparative analysis clearly demonstrates that the adoption of resource-saving technologies substantially enhances the overall economic efficiency of sunflower production. The data reveal several noteworthy improvements across all major performance indicators.

- Yield increased by 39%, showing that efficient technologies not only optimize resource use but also stimulate healthier plant growth and greater productivity. This significant rise in yield directly contributes to higher revenue for farmers and strengthens the reliability of sunflower as a profitable crop.
- Water use decreased by 42%, which reflects a major shift toward sustainable irrigation practices. Such a reduction in water consumption not only lowers irrigation costs but also helps farmers adapt to water scarcity-one of the most pressing challenges in modern agriculture.
- Cost price decreased by 27%, largely due to more efficient use of production inputs such as fuel, fertilizers, and water. Lower production costs translate into a more competitive product in the market and allow producers to achieve better financial outcomes even under fluctuating market conditions.
- Net profit more than doubled, rising from 420 USD/ha to 1,050 USD/ha. This substantial increase highlights the strong economic incentives for adopting resource-saving technologies and demonstrates how technological upgrades can transform farm profitability within a short period.
- Profitability increased from 33% to 54%, indicating improved economic resilience and stronger financial stability. A higher profitability margin means that farms are better positioned to invest in future innovations, expand production, and withstand external economic pressures.

➢ Overall, these results clearly show that investing in resource-saving technologies generates substantial long-term financial benefits. In addition to improving economic performance, these technologies also contribute to environmental sustainability by reducing resource depletion, minimizing waste, and promoting more responsible agricultural practices [6]. Together, these advantages underline the critical importance of transitioning from traditional methods to modern, efficiency-oriented approaches in sunflower cultivation.

Conclusion. Efficient resource utilization is a critical determinant of the economic performance and long-term sustainability of sunflower cultivation. By strategically managing essential inputs-such as water, fertilizers, energy, and labor-farmers can achieve higher productivity while minimizing waste and production costs. In recent years, the integration of resource-saving technologies has emerged as a vital approach to achieving these goals. Techniques such as drip irrigation, fertigation, minimal or reduced tillage, precision fertilization, and high-yielding or disease-resistant seed varieties not only optimize the use of agricultural resources but also enhance crop resilience, quality, and overall yield. As global challenges such as water scarcity, rising input costs, and climate variability intensify, the adoption of modern, resource-efficient technologies becomes increasingly necessary. Farmers who embrace these solutions are better positioned to maintain competitiveness in both domestic and international markets, ensuring stable and sustainable income streams. Moreover, resource-efficient practices support environmental sustainability by reducing soil degradation, conserving water resources, and minimizing greenhouse gas emissions.

To promote wider adoption of such technologies, policymakers, agricultural extension services, and research institutions must actively support farmers through training, financial incentives, and access to modern equipment and high-yielding seed varieties. Encouraging knowledge exchange, field demonstrations, and collaborative research can further facilitate the implementation of innovative agricultural practices. Ultimately, the systematic integration of resource-saving technologies in sunflower production not only enhances economic performance but also contributes to sustainable growth, food security, and the long-term resilience of agricultural systems.

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Rezyume: *Ushbu maqolada zamonaviy qishloq xo‘jaligi sharoitida kungaboqar yetishtirishda resurslardan samarali foydalanishning iqtisodiy afzalliklari tahlil qilinadi. Kungaboqar oziq-ovqat xavfsizligini ta’minlash, yog‘-moy sanoatini xomashyo bilan ta’minlash va qishloq hududlarida aholi turmush darajasini yaxshilashda muhim o‘rin tutadigan asosiy moyli ekin hisoblanadi. Tadqiqotda yer, suv, o‘g‘it, texnika va mehnat resurslaridan samarali foydalanish, shuningdek, tomchilatib sug‘orish, minimal ishlov berish, fertigasiyadan foydalanish va yuqori hosilli navlarni joriy etish kabi resurs tejamkor texnologiyalarning hosildorlik va rentabellikka ta’siri o‘rganilgan. Taqqoslovchi iqtisodiy ko‘rsatkichlar samarali resurs boshqaruvi ishlab chiqarish tannarxini sezilarli darajada kamaytirishini, foyda marjasini oshirishini va xo‘jalik barqarorligini mustahkamlashini ko‘rsatadi. Maqola innovatsion agrotexnologiyalarni joriy etish kungaboqar yetishtirishning raqobatbardoshligini oshirish va uzoq muddatli iqtisodiy barqarorlikni ta’minlash uchun zarurligini ta’kidlaydi.*

Резюме: *В данной статье рассматриваются экономические преимущества*

эффективного использования ресурсов при выращивании подсолнечника в современных условиях сельского хозяйства. Подсолнечник является важной масличной культурой, играющей значительную роль в обеспечении продовольственной безопасности, снабжении перерабатывающей промышленности сырьём и поддержке уровня жизни сельского населения. Исследование направлено на оптимизацию использования земли, воды, удобрений, техники и трудовых ресурсов, а также на оценку того, как ресурсосберегающие технологии - включая капельное орошение, минимальную обработку почвы, фертигацию и использование высокоурожайных сортов - повышают продуктивность и рентабельность. Сравнительные экономические показатели показывают, что рациональное использование ресурсов существенно снижает себестоимость производства, увеличивает прибыльность и укрепляет устойчивость хозяйств. В статье подчёркивается, что внедрение инновационных агротехнологий является ключевым фактором повышения конкурентоспособности производства подсолнечника и обеспечения долгосрочной экономической стабильности сельскохозяйственных предприятий.

Kalit so‘zlar: *Kungaboqar yetishtirish, resurs samaradorligi, iqtisodiy samaradorlik, xarajatlarni kamaytirish, tomchilatib sug‘orish, fertigasiyalash, hosildorlikni oshirish, barqaror qishloq xo‘jaligi, rentabellik, resurslarni optimallashtirish.*

Ключевые слова: *Выращивание подсолнечника, эффективное использование ресурсов, экономическая эффективность, снижение затрат, капельное орошение, фертигация, увеличение урожайности, устойчивое сельское хозяйство, рентабельность, оптимизация ресурсов.*

INNOVATIVE DEVELOPMENT OF AGRICULTURE AND ENHANCEMENT OF ECONOMIC EFFICIENCY THROUGH IRRIGATED LANDS IN KARAKALPAKSTAN

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Summary: *This article explores how the modernization and efficient use of irrigated lands in Karakalpakstan can foster innovative agricultural development and significantly raise economic efficiency. With focus on ongoing irrigation infrastructure reforms, water and energy-saving technologies, and modern water management practices, the study analyses potential gains in water and energy savings, crop yields, and farm profitability. The findings indicate that through strategic investments - such as canal lining, pump-station upgrades, and adoption of water-saving irrigation - Karakalpakstan's agricultural sector can achieve more sustainable, productive, and cost-effective outcomes, supporting regional socioeconomic development.*

Key words: *Karakalpakstan, irrigated lands, agricultural innovation, water-saving irrigation, irrigation infrastructure modernization, economic efficiency, water management.*

Introduction. Agricultural production in Uzbekistan is predominantly reliant on irrigated lands, particularly within arid and semi-arid zones such as Karakalpakstan. Owing to limited precipitation and the prevalence of extreme climatic conditions, conventional rain-fed agriculture proves inadequate to ensure consistent and stable crop yields. In these agroecological contexts, the implementation of efficient, technologically advanced irrigation systems is of critical importance.

Nevertheless, a substantial proportion of the extant irrigation infrastructure is obsolete and operates with suboptimal efficiency. Systemic inefficiencies - including volumetric water losses through seepage and evaporation, excessive energy consumption associated with pumping, and spatially uneven water distribution - significantly constrain both agricultural productivity and the sustainability of resource utilization. These constraints are further exacerbated by mounting water scarcity, the impacts of climate change, and rising food demand. In response to these multifaceted challenges, the Government of Uzbekistan has embarked upon a comprehensive program aimed at modernizing irrigation and drainage infrastructure across multiple regions, including Karakalpakstan. This initiative encompasses the rehabilitation of canals, implementation of water-saving technologies, mechanization and automation of water distribution, and the introduction of evidence-based water management practices.

The present study critically examines how such infrastructural reforms and technological innovations - when strategically implemented in Karakalpakstan - can enhance agronomic efficiency, optimize resource utilization, and generate measurable economic benefits for both individual agricultural enterprises and the regional agrarian economy as a whole.

Main Part. Agriculture represents a cornerstone of Uzbekistan’s national economy, contributing significantly to both gross domestic product and rural employment. The sector is heavily dependent on irrigation water abstracted from major river systems, which is distributed through an extensive, state-managed network of canals, channels, and reservoirs. Efficient functioning of this network is essential for ensuring food security, maintaining rural livelihoods, and sustaining agrarian economic growth.

A substantial proportion of irrigated lands in Uzbekistan, including those in Karakalpakstan, relies on electrically powered pumping systems to convey water from primary canals to farms. Across the country, millions of hectares are irrigated via such pump-based schemes, which collectively consume several billion kilowatt-hours of electricity annually, representing a significant operational and financial burden.

This heavy reliance on pumped irrigation introduces multiple challenges. First, it generates high operational costs and exposes farmers and water management agencies to fluctuations in energy prices, thereby increasing economic vulnerability. Second, systemic inefficiencies in water delivery

- including volumetric losses through seepage, evaporation, leakage from unlined canals, and uneven spatial distribution - reduce water-use efficiency and undermine overall productivity. These inefficiencies are particularly detrimental in water-scarce regions such as Karakalpakstan, where limited water resources constrain crop growth and yield potential.

Consequently, enhancing water-use efficiency, minimizing energy consumption, and modernizing irrigation infrastructure are not merely desirable policy objectives, but essential prerequisites for sustainable and resilient agricultural development in Karakalpakstan [1]. Strategic interventions in this domain can simultaneously improve agronomic productivity, optimize resource utilization, and strengthen the economic viability of irrigated agriculture in arid and semi-arid conditions.

Recent developments in Uzbekistan indicate a concerted national effort to modernize irrigation infrastructure and enhance water- and energy-use efficiency, measures that are particularly relevant for arid and semi-arid regions such as Karakalpakstan.

In 2025, the World Bank approved a concessional loan of USD 200 million to finance the modernization of irrigation and drainage systems across five key regions, including Karakalpakstan. The scope of planned interventions under this program is extensive and technically sophisticated. It encompasses the concreting (lining) of approximately 259 kilometers of primary canals across eight major channels, re-profiling and elevating canal beds to facilitate gravity-fed water conveyance - thereby reducing dependence on energy-intensive pumping systems - the construction of around 470 hydraulic control structures, the installation of gated outlets equipped with flow meters, and the deployment of Supervisory Control and Data Acquisition (SCADA) systems to enable automated and precise water management.

Parallel to these infrastructural interventions, the European Bank for Reconstruction and Development (EBRD) has extended a sovereign loan of up to USD 250 million aimed at modernizing pumping stations nationwide. These upgrades are designed to improve operational energy efficiency, significantly reduce electricity consumption, and thereby lower the cost of irrigation for farmers and water management agencies.

In addition, there has been a systematic adoption of water-saving irrigation technologies, including drip and sprinkler systems, alongside land-leveling initiatives such as laser leveling. These measures are intended to optimize water application, reduce wastage, enhance uniformity of water distribution, and improve overall water-use efficiency.

Collectively, these reforms and technological innovations establish a robust foundation for the transformation of irrigated agriculture in Karakalpakstan [2]. By integrating modern infrastructure with advanced irrigation technologies, the region can realistically achieve higher crop productivity, reduced consumption of water and energy resources, and improved economic returns for farmers and the regional agrarian economy. Such modernization initiatives not only contribute to enhanced agricultural efficiency but also promote sustainable management of scarce water resources in arid environments.

The implementation of modernized irrigation infrastructure and water-saving technologies in Karakalpakstan is anticipated to yield multiple agronomic, economic, and socio-environmental benefits, which are critical for enhancing the sustainability and resilience of agricultural systems in arid and semi-arid regions.

1. **Reduction of water losses and enhancement of water-use efficiency:** The integration of canal lining, hydraulic control structures, and precision water delivery systems can substantially mitigate water losses arising from seepage, evaporation, and over-irrigation. By ensuring that a greater proportion of diverted water reaches the root zone of crops, these interventions enhance irrigation efficiency, conserve scarce water resources, and contribute to the long-term sustainability of agricultural production in water-limited environments.

2. **Reduction in energy consumption and operational expenditures:** Transitioning from conventional pump-based irrigation systems to gravity-fed distribution or highly efficient modern pumps substantially reduces electricity requirements for water conveyance. This not only lowers operational costs for farmers and water management entities but also increases the economic

sustainability of irrigation systems, mitigating vulnerability to energy price fluctuations and promoting cost-effective agricultural practices.

3. **Enhancement of crop yields and land productivity:** Reliable and uniform water application supports optimal plant growth conditions, enabling higher yields per hectare. Modern irrigation technologies facilitate the cultivation of high-value crops requiring precise and consistent water supply, thus increasing land productivity and diversifying cropping patterns in Karakalpakstan.

4. **Improvement of farm profitability and agrarian enterprise viability:** The combination of reduced input costs (water, energy) and increased yields translates directly into higher net returns per hectare. This economic benefit supports rural livelihoods, incentivizes further investment in advanced agricultural practices, and strengthens the financial resilience of individual farms and cooperatives.

5. **Promotion of regional economic development and sustainability:** Enhanced agricultural productivity has multiplier effects on the regional economy, contributing to food security, rural employment, income generation, and overall socioeconomic growth. Such benefits are particularly relevant for water-scarce, rural-intensive regions like Karakalpakstan, where agriculture remains a primary driver of local development.

6. **Increased resilience to climate variability and water scarcity:** The adoption of efficient water management practices and modern irrigation infrastructure provides a buffer against seasonal and interannual fluctuations in river flows, drought conditions, and changing precipitation patterns [3]. By stabilizing water availability and supporting consistent agricultural production, these interventions increase the adaptive capacity of farming systems to climate change, enhancing long-term resilience and sustainability.

Collectively, these potential benefits underscore the strategic and multidimensional importance of integrating technological modernization and enhanced water-use efficiency measures in Karakalpakstan's irrigated agriculture. By simultaneously addressing agronomic, economic, and environmental dimensions, such interventions facilitate the development of a more productive, resilient, and sustainable agricultural sector, capable of withstanding the challenges posed by water scarcity, climate variability, and increasing socio-economic demands in the region. The implementation of modern irrigation infrastructure and water-saving technologies not only optimizes crop yields and resource utilization but also strengthens regional food security and contributes to long-term rural economic development.

To quantitatively illustrate the potential advantages of modernized irrigation systems in Karakalpakstan, an illustrative comparative scenario is constructed. This scenario juxtaposes conventional, traditional irrigation practices with a modernized, efficiency-oriented approach, incorporating advanced infrastructure such as canal lining, automated hydraulic controls, precision gated outlets, SCADA monitoring, and water-saving technologies including drip and sprinkler irrigation. The objective of this comparative analysis is to highlight the relative improvements in key performance indicators, including water-use efficiency, energy consumption, crop productivity, and overall economic returns, that can be achieved through strategic investments in irrigation modernization.

Although the numerical data presented in this scenario are hypothetical and intended for illustrative purposes, they provide a robust conceptual framework for understanding the magnitude of potential agronomic and economic gains. By employing such scenario-based analysis, policymakers, agricultural planners, and researchers can more effectively evaluate the expected outcomes of modernization initiatives, identify priority interventions, and allocate resources in a manner that maximizes both water-use efficiency and financial performance [4]. Moreover, this approach enables stakeholders to anticipate operational challenges, assess the trade-offs between different technological options, and formulate evidence-based strategies that promote sustainable and climate-resilient agriculture in water-limited regions like Karakalpakstan.

The data below are hypothetical illustrative estimates intended to represent potential differences between "traditional/trad irrigation" and "modernized + efficient irrigation" scenarios. For rigorous research, real empirical data from Karakalpakstan or similar regions should be used.

Table 1

Illustrative Comparative Scenario

Indicator / Scenario	Traditional Irrigation (unlined canals / pump-based / flood irrigation)	Modernized Irrigation (canal-lining, efficient pumps / drip or sprinkler / automated control)
Water consumption per hectare (m^3/ha)	10,000	6,500–7,000 (≈ 30–35% reduction)
Energy consumption (pumping + maintenance)	High	Lower (reduced pumping need; more efficient pumps)
Crop yield (tons/ha)	3.0–3.5	4.5–5.5 (improved due to stable, precise irrigation)
Cost per ha (water + energy + maintenance)	High	Lower
Net profit per ha (after costs)	Moderate	Higher
Water-use efficiency (yield per m^3 water)	Low	Significantly higher

This comparative scenario analysis demonstrates that the implementation of modernized irrigation systems can lead to substantial reductions in both water and energy consumption per hectare, while simultaneously enhancing crop yields and overall farm profitability. In water-scarce regions such as Karakalpakstan, where energy expenditures for pumped irrigation constitute a significant portion of operational costs, these efficiency gains have the potential to markedly improve economic outcomes for farmers and agrarian enterprises.

Beyond direct economic benefits, the reduction in water and energy consumption contributes to broader environmental sustainability [5]. Lower water withdrawals alleviate pressure on limited freshwater resources, while decreased energy demand mitigates associated carbon emissions and reduces the ecological footprint of agricultural operations. Collectively, these effects support the long-term viability of agriculture under increasingly variable climatic conditions, enhance resilience to droughts and water scarcity, and foster sustainable management of natural resources.

In summary, the integration of modern irrigation infrastructure and water-saving technologies not only optimizes agricultural productivity and profitability but also generates significant environmental and socio-economic co-benefits, reinforcing the strategic importance of such interventions in arid and semi-arid regions like Karakalpakstan.

Challenges and Implementation Considerations in Karakalpakstan. Despite the considerable potential of modernized irrigation systems to enhance agricultural productivity and economic efficiency in Karakalpakstan, several critical challenges and implementation considerations must be addressed to ensure successful adoption and long-term sustainability [6].

1. High initial investment requirements: The construction of canal linings, hydraulic control structures, modern pumping stations, advanced irrigation equipment (including drip and sprinkler systems), and automation technologies entails substantial capital expenditure. In the absence of sufficient financial support, concessional loans, or targeted subsidies, the adoption of these technologies may be delayed, particularly among smallholder farmers with limited access to credit.

2. Technical and managerial capacity constraints: The operation, maintenance, and monitoring of modern irrigation infrastructure require specialized technical knowledge and institutional capacity. Deficiencies in trained personnel, maintenance protocols, and water management expertise in rural areas could hinder the effectiveness and sustainability of the modernization initiatives.

3. Appropriate technology selection: Not all crops, soil types, or field configurations are compatible with specific irrigation technologies such as drip or sprinkler systems. Optimal technology adoption must therefore be informed by localized agro-ecological conditions, crop requirements, and farm management practices to maximize efficiency and agronomic benefits.

4. Institutional and governance considerations: Effective water distribution, equitable allocation, operation and maintenance regimes, and coordination among water users are essential to ensure sustainable and fair utilization of water resources. Weak institutional frameworks or governance gaps could compromise the benefits of modernization, leading to resource mismanagement or inequitable access.

5. Farmer incentives and awareness: The successful transition from traditional to modern irrigation practices depends on the provision of clear economic, technical, and informational incentives for farmers. Demonstration projects, extension services, and capacity-building programs are critical to increasing awareness, fostering adoption, and overcoming resistance to change.

In conclusion, beyond the deployment of technical solutions, the successful transformation of irrigated agriculture in Karakalpakstan requires a comprehensive approach that integrates institutional reforms, stakeholder engagement, sustainable financing mechanisms, human capacity development, and context-specific technological adaptation [7]. Addressing these multidimensional challenges is essential to fully realize the economic, agronomic, and environmental benefits of modernized irrigation systems in the region.

Conclusion. Modernizing irrigation infrastructure and adopting water- and energy-efficient irrigation technologies present a viable and promising pathway for enhancing agricultural productivity, economic efficiency, and sustainability in Karakalpakstan. Given recent national investments and programs supporting such modernization - including for canal lining, pump upgrades, and efficient irrigation systems - the region is well-positioned to reap considerable benefits. Through reduced water and energy consumption, improved yields, and higher farm profitability, efficient irrigated agriculture can support regional economic growth, food security, and rural development. However, to realize this potential, coordinated efforts are necessary: adequate financing, technical support, capacity building, institutional reforms, and policies to encourage technology adoption - especially among small-scale farmers.

In sum, the adoption of modern irrigation infrastructure and practices in Karakalpakstan can transform irrigated agriculture into a more productive, sustainable, and economically viable sector, contributing to long-term regional development and resilience.

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Rezyume: *Ushbu maqolada Qoraqalpog‘istonda sug‘oriladigan yerlardan samarali foydalanish va ularni modernizatsiya qilish orqali qishloq xo‘jaligini innovatsion rivojlantirish va iqtisodiy samaradorlikni sezilarli darajada oshirish imkoniyatlari o‘rganilgan. Maqolada sug‘orish infratuzilmasini isloh qilish, suv va energiya tejovchi texnologiyalar, shuningdek zamonaviy suv boshqaruvi amaliyotlari tahlil qilinadi. Tadqiqot natijalari shuni ko‘rsatadiki, kanal qoplamlarini yaratish, nasos stansiyalarini modernizatsiya qilish va suv tejovchi sug‘orish tizimlarini joriy etish kabi strategik investitsiyalar orqali Qoraqalpog‘istonning qishloq xo‘jaligi sektori barqaror, samarali va iqtisodiy jihatdan foydali natijalarga erishishi mumkin, bu esa mintaqaviy ijtimoiy-iqtisodiy rivojlanishni qo‘llab-quvvatlaydi.*

Резюме: *В данной статье рассматриваются возможности инновационного развития сельского хозяйства и значительного повышения экономической эффективности через*

модернизацию и эффективное использование орошаемых земель в Каракалпакстане. Основное внимание уделяется текущим реформам ирригационной инфраструктуры, технологиям экономии воды и энергии, а также современным практикам управления водными ресурсами. Результаты исследования показывают, что за счет стратегических инвестиций - таких как укрепление каналов, модернизация насосных станций и внедрение водосберегающих систем орошения - сельскохозяйственный сектор Каракалпакстана может достичь более устойчивых, продуктивных и экономически эффективных результатов, что способствует социально-экономическому развитию региона.

Kalit so‘zlar: *Qoraqalpog‘iston, sug‘oriladigan yerlar, qishloq xo‘jaligini innovatsion rivojlantirish, suv tejovchi sug‘orish, sug‘orish infratuzilmasini modernizatsiya qilish, iqtisodiy samaradorlik, suv boshqaruvi.*

Ключевые слова: *Каракалпакстан, орошаемые земли, инновационное развитие сельского хозяйства, водосберегающее орошение, модернизация ирригационной инфраструктуры, экономическая эффективность, управление водными ресурсами.*

THE METHOD OF FORMING A SUSTAINABLE SWIMMING SKILL BASED ON THE USE OF AQUATIC SPECIES

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Summary: *This article presents an experimental method for developing students' sustainable swimming skills based on the use of various water sports: synchronized swimming, water polo, water aerobics, and diving.*

Key words: *Teaching Methodology, Swimming, Water Sports, Synchronized Swimming, Diving, Aqua Aerobics, Water Polo, and Applied Swimming.*

The main goal of physical education of students is the formation of physical culture of the individual and the ability to use various means of physical culture and sports for the preservation and promotion of health, psychophysical training and self-preparation for future life and professional activities. Swimming is a vital and professional skill of a teacher. Once acquired, the vital skill of swimming is retained by a person for life. In the process of professional education of university students, swimming is one of the components of the discipline "Physical culture". However, the low level of swimming readiness of students entering the first year of institutes, which is shown in our earlier published articles, and the low level of motivation for physical education classes require the search for new forms and methods of organizing the educational process, including swimming.

The purpose of this study was to improve the pedagogical methodology for teaching swimming to female students of a pedagogical university based on the use of exercises of various water sports, which contributes to the formation of a stable swimming skill and has a positive effect on the emotional state of female students. The following tasks were set for this study:

- To substantiate the use of the most effective water sports exercises in the process of teaching swimming to female students of a humanitarian pedagogical university.
- Show the effectiveness of using a variety of water sports for the formation of a sustainable swimming skill. Research methods and organization: analysis of scientific and methodological literature, pedagogical experiment, self-assessment and expert assessment of swimming readiness, methods of mathematical statistics.

The main pedagogical experiment involved 84 female students aged 17-23, who were divided into three experimental and three control groups, 14 people each. All students were practically healthy.

At the beginning of the experiment, an analysis of the initial swimming preparedness of 1st year female students of humanitarian pedagogical specialties was carried out. First, the students were asked to evaluate their level of swimming preparedness on a special qualimetric scale, then an expert assessment was given at the first practical lesson. The level of swimming preparedness of the female students was assessed as “uncertainly floating on the water”. Moreover, selfesteem significantly exceeded the true level of swimming readiness.

Swimming training for female students was carried out within the framework of the discipline "Physical culture". The basis of the curriculum of the department was the study and improvement of sports swimming methods - crawl on the chest, crawl on the back, breaststroke, dolphin (in parts) and applied swimming.

The control groups were trained according to the traditional method of teaching swimming, and the experimental ones - according to the experimental method using water sports exercises. The basis of the experimental methodology for teaching swimming was the elements and exercises from water sports used in the training of athletes in synchronized swimming, water polo, and diving. For the female students of the experimental groups, they were introductory exercises for learning the basics of sports and applied swimming. Classes in the control group were conducted according to the generally accepted methodology using only swimming exercises. Here are the water sports exercises, the conditions for their implementation and the orientation used in the experimental methodology.

Synchronized swimming. The following exercises were used: planar positions (on the chest, back); planar constructions and rebuildings; rowing movements with arms and legs; the simplest figures: “turn back (forward) in a grouping”, “rotation in a grouping”, “pike”. Exercises were performed with a fixed support, with a supporting device (belt) and without support.

These exercises were used to master the water environment and form water-support reactions, keep the body on the surface and maintain balance in the water while moving the body, and also served as lead-up exercises for mastering applied swimming. These exercises helped to increase the emotional attractiveness of the classes.

Water aerobics exercises. Complexes of exercises were used to develop the muscles of the arms and shoulder girdle, muscles of the lower extremities, abdominal muscles and back, mobility in the joints and relaxation exercises.

Exercises were performed at a fixed support, with and without a supporting device (belt). The exercises were aimed at the formation of a support stroke, increasing the level of motor fitness, acquiring the skill of moving from a vertical position to a horizontal position and the ability to strain and relax muscles.

Diving from the tower was used to master the basics of repulsion techniques and to acquire the skills of diving into the water upside down and head down (diving), mastering the starting jump, elements of applied swimming and orienteering under water. In addition, the use of water jumps contributes to the development of courage, determination and brings a bright emotional coloring to swimming.

Water polo exercises were used to master the methods of applied swimming. The exercises are specially applied and have a direct purpose for providing first aid on the water. The methods of movement in the water were studied: on the side of the leg "scissors"; crawl on the chest with a raised head (water polo crawl); exercise "trudgeon", diving down with legs and head from the water; “transition from front crawl to front crawl” and “transition from front crawl to front crawl”. All exercises were performed without supporting devices and were carried out while studying ways to provide assistance to victims on the water.

During the experiment, at the end of the 1st, 2nd, 3rd and 4th semesters, the current testing of the swimming preparedness of female students, participants in the pedagogical experiment, was carried out using the studied sports swimming methods: “back crawl”, “breaststroke”, “front crawl” and “butterfly”. At the end of the 5th semester, the swimming speed was determined, the subjects overcame a distance of 50 meters by the chosen method of swimming for a while.

At the end of the 6th semester, the students demonstrated the ability to carry out the transportation of an allegedly injured classmate at a distance of 25 meters in any way possible, and also performed a 12-minute swimming test by K. Cooper. The K. Cooper test evaluates the level of swimming preparedness by the length of the distance overcome in 12 minutes. Swimming technique was also analyzed.

The results of swimming readiness testing by K. Kupper's 12-minute swimming test showed that female students of the experimental group overcame an average distance of 502.4 meters in 12 minutes, while female students of the control group overcame an average of only 383.0 meters. Differences in mean values are significant at $p < 0.05$. The level of swimming readiness of female students of the experimental group is estimated at 4.16±0.48 points, and in the control group - one point lower.

The obtained test data of the 12-minute swimming test and the speed test testify to a higher level of swimming preparedness of the female students of the experimental group compared to the level of preparedness of the female students of the control group.

The given data of testing the swimming readiness of female students at the end of the experiment testify to the effectiveness of the use of water sports exercises in teaching and improving the swimming readiness of female students of a pedagogical university.

The modern approach to the process of learning to swim consists in the possibility of using a wide range of exercises aimed at developing a stable swimming skill. In our opinion, such an approach will contribute not only to the solid development of applied swimming skills necessary in pedagogical

activity,but also to create interest and increase the motivational readiness of students for physical education.

A higher level of swimming preparedness, determined in these tests, is realized in high rates of applied swimming exercises, transportation of an imaginary victim.

The ability to rescue and transport victims on the water is a necessary practical skill for all teachers.

The results obtained during the pedagogical experiment testify to the effectiveness of the developed methodology with the use of water sports exercises.

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Rezyume: *Ushbu maqolada turli xil suv sporti turlari: sinxron suzish, suv polosi, akvaaerobika va suvga sakrash vositalaridan foydalanish asosida talabalarda barqaror suzish ko‘nikmasini shakllantirishning eksperimental usuli taqdim etilgan.*

Резюме: *В данной статье представлен экспериментальный метод формирования устойчивого навыка плавания у студентов на основе использования средств различных водных видов спорта: синхронного плавания, водного поло, аквааэробики и прыжков в воду.*

Kalit so‘zlar: *Suzish, suv sporti turlari, sinxron suzish, suvga sakrash, akva-aerobika, suv polosi, amaliy suzishni o‘rgatish metodikasi.*

Ключевые слова: *Методика обучения плаванию, водным видам спорта, синхронному плаванию, прыжкам в воду, аква-аэробике, водному поло, практическому плаванию.*

MECHANISMS FOR STRENGTHENING COMPETITIVENESS IN THE FRUIT EXPORT SECTOR

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Summary: *This paper examines major economic, institutional, and structural mechanisms aimed at enhancing the competitiveness of the fruit export sector in Uzbekistan, with emphasis on export-oriented optimization, value-chain efficiency, and strategic resource allocation. It analyses current constraints - including compliance with international standards, logistic bottlenecks, weak organizational frameworks, and limited access to export finance - and proposes a comprehensive set of measures: adoption of quality standards, improvement of post-harvest processing and storage, development of export-oriented marketing strategies, strengthening supply-chain integration, and facilitation of access to financial and institutional support. Using literature review and secondary data analysis, the study outlines policy recommendations and strategic pathways to increase the region's share in global fruit markets, improve export volumes, and ensure long-term sustainability for producers.*

Key words: *Fruit export, export competitiveness, quality standards, supply chain integration, export financing, Uzbekistan.*

Introduction. The global demand for high-quality fresh and processed fruits continues to grow at a significant pace, driven by multiple socio-economic and demographic factors, including rising household incomes, evolving dietary preferences, urbanization, and a growing consumer focus on health and nutrition. Additionally, there is an increasing demand for seasonal and off-season produce, supported by advancements in cold-chain logistics, retail expansion, and international trade facilitation. For countries endowed with favorable agro-climatic conditions - such as Uzbekistan - this trend represents a substantial strategic opportunity to expand horticultural exports, diversify foreign exchange earnings, and enhance rural livelihoods.

However, the translation of inherent horticultural potential into sustainable and competitive export performance is contingent not only on natural resource endowments, but also on the development of robust institutional frameworks, strict adherence to international quality and phytosanitary standards, efficient logistics and transport networks, and access to reliable financial instruments. The presence of conducive policy environments, effective regulatory oversight, and strategic public-private partnerships is essential to ensure that agricultural enterprises are able to comply with international requirements and respond flexibly to dynamic market conditions.

Despite Uzbekistan's long-standing horticultural tradition, extensive arable land, and favorable agro-ecological conditions, the fruit export sector continues to face numerous structural and systemic constraints. Among the key challenges are insufficient compliance with international export quality standards, including sorting, washing, packaging, and cold-chain management, which often results in post-harvest losses and reduced marketability. Furthermore, the sector is constrained by underdeveloped post-harvest processing and storage infrastructure, which limits the ability of producers to maintain fruit quality for extended periods and access distant international markets. Limited access to export-oriented credit facilities, insurance, and investment capital further restricts the capacity of small and medium-sized enterprises (SMEs) to modernize production and meet global market demands. In addition, weak integration along the value chain, lack of cooperative structures, and the absence of well-established branding and marketing strategies hinder the sector's ability to capture higher-value markets. Coupled with intense competition from countries with advanced agro-export industries and well-established global supply chains, these challenges underscore the urgent need for comprehensive reforms, technological adoption, and innovative approaches.

The primary aim of this paper is to identify, evaluate, and analyze key mechanisms that can effectively enhance competitiveness in Uzbekistan's fruit export sector. Specifically, the objectives of the study are threefold. First, it seeks to review existing literature, including both international and domestic studies, and to aggregate empirical evidence on the sector's constraints, bottlenecks, and opportunities. Second, the study evaluates institutional, technological, and financial instruments that can strengthen export performance, reduce post-harvest losses, improve quality compliance, and facilitate integration into global markets. Third, it aims to formulate actionable policy recommendations and strategic pathways for a range of stakeholders - including producers, exporters, government agencies, and financial institutions - to enhance export volumes, improve product quality, ensure compliance with international standards, and promote long-term sustainability.

By providing a systematic analysis of current challenges and identifying effective mechanisms for improvement, this paper contributes to a deeper understanding of the structural, technological, and financial interventions necessary to transform Uzbekistan's horticultural potential into a robust, competitive, and internationally recognized fruit export sector. The findings aim to inform policymakers, industry leaders, and development practitioners on strategies to enhance market access, increase foreign exchange earnings, and foster sustainable growth within the sector.

Review of Literature. A substantial body of literature has examined the determinants of competitiveness and sustainability in the fruit export sector, with a particular focus on Uzbekistan's horticultural industry. A recent econometric analysis of fruit and vegetable export sustainability in Uzbekistan underscores the critical role of strategic investments, modernization of supply chains, and robust institutional support in enhancing export performance. The study demonstrates that targeted financial inputs, when combined with systematic improvements in infrastructure and institutional frameworks, can significantly increase export volumes and profitability. Investments in mechanization, cold storage facilities, and post-harvest processing not only reduce losses but also enable producers to meet stringent international market requirements, thereby improving their global competitiveness (yashil-iqtisodiyot-taraqqiyot.uz).

In addition, multiple studies examining the alignment of local produce with international export standards have consistently shown that **compliance with phytosanitary, quality, and packaging norms is a fundamental prerequisite for accessing competitive foreign markets**. These studies highlight that without proper adherence to international regulations, Uzbek horticultural products face significant barriers to entry, limiting their ability to compete effectively in high-value markets such as the European Union, the Middle East, and East Asia. The research emphasizes the importance of certification schemes, quality monitoring systems, and traceability mechanisms as essential tools for enhancing market credibility and building long-term trade relationships (yashil-iqtisodiyot-taraqqiyot.uz).

Further, investigations into the export potential and supply chain efficiency of Uzbek horticultural produce reveal a series of **structural and logistical challenges** that constrain the sector. These include underdeveloped transport and logistic infrastructure, significant post-harvest losses due to inadequate handling and storage, limited availability of cold storage facilities, and insufficient export readiness among many farms. These constraints collectively undermine the ability of producers to meet international demand in terms of both quantity and quality, highlighting the need for systemic reforms and infrastructure investment (Научные журналы).

Comparative analyses in the broader agrifood trade literature also emphasize that **supply chain integration, cooperative export models, and access to financial capital** are among the most effective mechanisms to overcome market entry barriers and scale exports, particularly for small and medium-sized enterprises (SMEs). Cooperative approaches, such as forming agro-clusters or producer associations, allow small producers to pool resources, share costs associated with certification, packaging, and logistics, and collectively meet the volume requirements of international buyers. Similarly, access to capital-through subsidized loans, export guarantees, and public-private partnerships-enables producers to invest in technology, infrastructure, and quality improvement measures that are critical for sustainable export growth (arXiv).

Based on these studies, three **major clusters of mechanisms** emerge as essential for enhancing competitiveness in the fruit export sector:

- **Quality Standardization and Compliance** – Ensuring adherence to international phytosanitary, packaging, and quality standards to meet export market requirements.
- **Value Chain Optimization and Logistics** – Streamlining transport, storage, and post-harvest processing to reduce losses, increase efficiency, and maintain product quality.
- **Institutional and Financial Support** – Facilitating access to investment, credit, insurance, and cooperative frameworks to enable producers to implement improvements and scale exports effectively.

Collectively, these mechanisms provide a comprehensive framework for understanding and addressing the multifaceted challenges faced by Uzbekistan's fruit export sector. They highlight that competitiveness is not solely dependent on natural or agro-climatic advantages but is equally determined by the effective integration of technology, infrastructure, institutional support, and financial mechanisms.

Materials and Methods. Considering the objectives and scope of this study, the research adopts a conceptual and analytical framework, integrating multiple sources of secondary data and employing comparative and thematic analysis techniques. The paper does not rely on primary data collection; rather, it synthesizes existing empirical evidence, official statistics, and documented case studies to provide a comprehensive understanding of the mechanisms that can enhance competitiveness in the fruit export sector of Uzbekistan.

The **secondary data analysis** component involves a systematic review of peer-reviewed journal articles, policy briefs, government reports, statistical databases, and international trade publications. Key sources include export statistics from national authorities such as the State Committee of the Republic of Uzbekistan on Statistics, reports from the Ministry of Agriculture and the Ministry of Investment, and databases maintained by international trade organizations. This approach allows the identification of trends in export volumes, market destinations, post-harvest losses, logistics efficiency, and access to financial instruments over time. Additionally, case studies of export-oriented enterprises were examined to capture practical insights into operational challenges, strategies employed to meet international standards, and mechanisms of supply chain integration.

A **thematic synthesis method** was employed to classify constraints and proposed mechanisms into three broad, interrelated categories:

- **Standards and Compliance** – Including adherence to international phytosanitary, packaging, and quality requirements, certification processes, and traceability systems.
- **Supply Chain and Logistics** – Covering post-harvest handling, transportation networks, cold storage facilities, packaging technologies, and value chain integration.
- **Institutional and Financial Support** – Encompassing access to credit, insurance, state subsidies, cooperative structures, public-private partnerships, and investment incentives.

By categorizing the mechanisms in this manner, the study provides a structured understanding of how different interventions interact to enhance export performance.

For **policy recommendation derivation**, a **normative-analytical approach** was utilized. This involves combining the empirical evidence gathered from the secondary sources with global best practice models in horticultural exports. Comparative analysis of successful export strategies from other countries with similar agro-climatic conditions, such as Turkey, Chile, and Spain, informed the identification of applicable mechanisms that can be adapted to the Uzbek context. The approach emphasizes practical relevance, feasibility, and alignment with international standards, ensuring that recommendations are both evidence-based and implementable.

Overall, the methodology is designed to integrate quantitative and qualitative evidence, allowing for a holistic assessment of the constraints faced by Uzbekistan's fruit export sector and the formulation of actionable strategies to enhance competitiveness, improve export volumes, and promote sustainable growth.

Mechanisms for Strengthening Competitiveness in the Fruit Export Sector. Enhancing competitiveness in the fruit export sector requires a multidimensional approach, integrating technological, logistical, institutional, financial, and marketing mechanisms. Based on empirical evidence and best practice models, four major clusters of mechanisms have been identified, each contributing to improved export performance, product quality, and sustainability.

1. Quality Standardization and Compliance. Ensuring that local fruit production consistently meets international quality and phytosanitary standards is the cornerstone of export competitiveness. Compliance encompasses several dimensions, including phytosanitary certification**,** proper packaging**,** cold chain management, and traceability systems. Investment in modern sorting, washing, and packaging technologies significantly reduces post-harvest losses and prolongs shelf life, thereby enabling producers to access premium markets.

For example, the introduction of mechanized sorting lines, temperature-controlled storage, and vacuum or modified atmosphere packaging allows for the maintenance of product quality during long-distance transportation, which is particularly important for high-value fruits such as grapes, pomegranates, and melons. Furthermore, adoption of internationally recognized food safety standards, such as GlobalGAP, ISO 22000, and HACCP, enhances market credibility and facilitates entry into highly regulated markets, including the European Union, Japan, and the Middle East. Standardization not only ensures compliance but also reduces variability in product quality, thereby strengthening the reputation of Uzbek horticultural exports.

2. Value Chain Optimization and Logistics Enhancement. Efficient logistics, transportation, and storage infrastructure are critical for minimizing **time-to-market** and preserving the quality of perishable fruits. Optimizing the value chain involves creating **integrated supply chains** that connect farms, packing houses, cold storage facilities, and export logistics hubs. Such integration enhances coordination among stakeholders, reduces transaction costs, and improves responsiveness to dynamic market demands.

Agro-clusters and cooperatives play a pivotal role in this process by aggregating produce from multiple small-scale farmers, implementing uniform quality standards, and achieving economies of scale. By pooling resources, these clusters can invest in shared cold storage, transportation vehicles, and packaging facilities, which would be prohibitively expensive for individual producers. Moreover, integration along the value chain facilitates better information flow regarding market demand, price trends, and export requirements, enabling producers to plan production and marketing strategies more effectively.

3. Institutional and Financial Support Mechanisms. Access to institutional support and financial resources is essential for enabling small and medium-sized producers to **invest in infrastructure, adopt advanced technologies, and comply with certification standards**. Mechanisms include export finance, credit facilities, insurance products, state subsidies, and targeted incentive programs. Public–private partnerships, export guarantee schemes, and export-oriented financing programs reduce entry barriers for new exporters, encourage investment in quality improvement, and foster innovation in post-harvest handling and processing.

For instance, subsidized loans for cold storage construction, mechanized sorting and packaging equipment, and international certification costs can significantly improve the competitiveness of small-scale horticultural enterprises. Insurance mechanisms, such as crop and export insurance, mitigate risks associated with climate variability, transport delays, or market fluctuations, ensuring financial stability and sustainable growth. Institutional support further includes extension services, technical training, and capacity-building programs, which improve managerial efficiency and operational expertise among producers.

4. Export Market Development and Branding. Competitiveness in international markets is increasingly driven by **marketing strategies, brand recognition, and the ability to meet market-specific requirements**. Developing export-oriented marketing strategies involves identifying target niche markets, establishing reliable supply chains, building a recognizable brand, and ensuring compliance with buyer specifications.

The use of **digital marketing platforms**, online trade networks, and e-commerce solutions allows producers to directly reach international buyers, reduce intermediaries, and strengthen market presence. Implementing traceability systems and adhering to global food safety certifications further enhance consumer confidence, particularly in high-value markets where traceability and safety standards are critical purchasing criteria. Branding efforts can emphasize the uniqueness of Uzbek fruits, such as geographic origin, organic or eco-friendly production practices, and superior taste or quality characteristics, thereby increasing the perceived value of exports and differentiating them from competitors.

Collectively, these four clusters - quality standardization, value chain optimization, institutional and financial support, and market development with branding - constitute a comprehensive framework for enhancing the competitiveness of Uzbekistan's fruit export sector. By simultaneously addressing production, logistics, institutional, and market challenges, these mechanisms can significantly increase export volumes, improve profitability, and ensure the long-term sustainability of horticultural exports.

Discussion. The mechanisms identified in this study - quality standardization, value chain optimization, institutional and financial support, and export market development - are inherently interdependent and mutually reinforcing. Effective implementation of any single mechanism in isolation is unlikely to produce sustainable improvements in competitiveness. For instance, adherence to international standards and certifications without concurrent investment in efficient logistics, cold chain infrastructure, and post-harvest handling will result in limited impact, as product quality may still deteriorate before reaching export markets. Conversely, provision of financial incentives or institutional support without systematic value chain integration, cooperative structures, and quality enhancement may lead to suboptimal utilization of resources, low market penetration, and unsatisfactory returns on investment. Therefore, a holistic and coordinated strategy is essential, encompassing active collaboration among producers, exporters, government agencies, financial institutions, and other relevant stakeholders. Such an integrated approach ensures that improvements in production quality, infrastructure, and market access are mutually reinforcing, maximizing the potential for sustainable competitiveness.

Comparative examples from other countries highlight the **importance of integrated value chains and cooperative exporting models** in horticultural export success. In regions such as Chile, Turkey, and Spain, small-scale farms frequently pool resources through cooperative structures to meet minimum quantity requirements, share the fixed costs of certification, storage, and logistics, and collectively access high-value international markets. These integrated approaches enhance bargaining power, reduce per-unit costs, improve compliance with international standards, and facilitate efficient coordination along the supply chain. The cooperative model also enables knowledge sharing, technology adoption, and coordinated marketing initiatives, which are particularly valuable for small and medium-sized enterprises (SMEs) that might otherwise face barriers to entry in competitive export markets (arXiv).

In the context of Uzbekistan, aligning domestic horticultural practices with **international standards** - including those required by the European Union, Codex Alimentarius Commission (CAC), and other global regulatory frameworks - will be a key determinant of export success. Global buyers are increasingly emphasizing **food safety, traceability, sustainability, and quality consistency**, making compliance not only a regulatory requirement but also a competitive necessity. Empirical evidence from Uzbek exporters underscores the urgency of modernization, investment in post-harvest technologies, and improvements in packaging, cold storage, and logistics. Studies further highlight the importance of **market diversification and targeted marketing**, as relying on a limited

set of markets or products exposes exporters to price volatility and reduces growth potential (yashil-iqtisodiyot-taraqqiyot.uz; Научные журналы).

Additionally, the Uzbek horticultural sector faces challenges related to **fragmented farm structures, limited access to finance, and underdeveloped institutional support**. Addressing these challenges requires a multi-pronged approach: implementing capacity-building programs for producers, facilitating cooperative or cluster-based models, providing export-oriented financial instruments, and strengthening institutional frameworks to support compliance and innovation. Digital solutions, such as farm management platforms, traceability systems, and online marketing tools, can further enhance transparency, coordination, and market responsiveness.

In summary, the discussion highlights that the competitiveness of Uzbekistan's fruit export sector depends on **synergistic action across multiple mechanisms**, integrating quality compliance, value chain optimization, financial and institutional support, and market development strategies. Lessons from international practice, combined with context-specific adaptation, provide a roadmap for sustainable growth, improved export performance, and enhanced integration of Uzbek horticultural products into the global market.

Conclusion and Recommendations. This study concludes that achieving high competitiveness in Uzbekistan's fruit export sector requires a multi-layered and integrated intervention framework. The analysis demonstrates that no single mechanism alone - whether quality standardization, logistics improvement, institutional support, or market development - can ensure sustainable competitiveness. Instead, a coordinated approach that simultaneously addresses production quality, supply chain efficiency, institutional capacity, financial accessibility, and international market positioning is essential. The integration of these mechanisms allows for reduction of post-harvest losses, enhancement of product quality, and effective participation in high-value global markets.

Key Recommendations:

1. **Development and Implementation of National Programmes for Certification and Modernization**. It is imperative to develop targeted national programmes aimed at supporting the **certification of fruit production**, modernization of packing facilities, expansion of cold storage capacity, and enhancement of post-harvest processing. Investment in these areas will improve compliance with international phytosanitary and quality standards, reduce losses, and extend product shelf life, thereby facilitating access to premium export markets.

2. **Promotion of Agro-Clusters and Cooperatives.** Formation of **agro-clusters and producer cooperatives** should be encouraged to enable collective export operations, resource pooling, and economies of scale. Such structures allow small and medium-sized farms to share costs associated with certification, packaging, storage, and transportation, enhancing efficiency while maintaining product quality. Clusters also provide a platform for knowledge sharing, technical training, and coordinated production planning, which are critical for meeting international demand and standards.

3. **Introduction of Export-Oriented Financial Instruments.** Export competitiveness can be significantly enhanced through **financial support mechanisms**, including subsidized credit, export guarantees, and insurance schemes tailored for small and medium-sized exporters. These instruments reduce the financial risk associated with investment in modern infrastructure, technologies, and certification, enabling producers to implement improvements that would otherwise be inaccessible due to limited capital or collateral.

4. **Strengthening Export Marketing Strategies.** Targeted **marketing strategies** are essential to ensure that Uzbek horticultural products are competitive in niche and high-value markets. This includes aligning products with international standards, developing recognizable brands, implementing digital marketing platforms, establishing reliable supply relationships, and promoting the unique qualities of Uzbek fruits (such as geographic origin, taste, and eco-friendly production practices). Strong branding and marketing not only increase market visibility but also enhance the perceived value of exports.

5. **Encouragement of Public–Private Partnerships and International Investment.** Collaboration between the public sector, private enterprises, and international investors can support the upgrading of export infrastructure and value chain services. Public–private partnerships can mobilize resources for cold storage networks, modern logistics facilities, packing and processing technologies, and training programmes. International investment brings technical expertise, global market insights, and access to advanced technologies, which collectively enhance the global competitiveness of Uzbekistan's fruit sector.

Implications. Implementation of these mechanisms has the potential to **significantly improve export performance, profitability, and sustainability** within the Uzbek fruit sector. Enhanced compliance with international standards, optimized supply chains, and strong institutional and financial support will collectively allow producers to penetrate high-value markets more effectively. Moreover, by increasing export volumes, improving product quality, and fostering a competitive horticultural ecosystem, these interventions contribute to **broader economic development**, job creation, and integration of Uzbekistan into the global horticultural trade network.

In conclusion, a **holistic, coordinated, and evidence-based approach**-combining technological, financial, institutional, and marketing strategies-is essential for transforming Uzbekistan's fruit export sector into a globally competitive, sustainable, and economically significant industry.

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Rezyume: *Ushbu maqola O'zbekistonda meva eksporti sohasining raqobatbardoshligini oshirishga qaratilgan asosiy iqtisodiy, institutsional va struktural mexanizmlarni o'rganadi. Tadqiqot eksportga yo'naltirilgan optimallashtirish, qiymat zanjiri samaradorligini oshirish va resurslarni strategik taqsimlashga e'tibor qaratadi. Maqolada mavjud cheklovlar tahlil qilinadi, jumladan, xalqaro standartlarga rioya qilish, logistika muammolari, zaif tashkiliy mexanizmlar va eksport moliyalashtirishga cheklangan kirish imkoniyati. Shu asosda quyidagi kompleks chora-tadbirlar taklif etiladi: sifat standartlarini joriy etish, hosildan keyingi ishlov berish va saqlashni yaxshilash, eksportga yo'naltirilgan marketing strategiyalarini ishlab chiqish, ta'minot zanjiri integratsiyasini mustahkamlash va moliyaviy hamda institutsional qo'llab-quvvatlashni osonlashtirish. Adabiyotlar sharhi va ikkilamchi ma'lumotlar tahliliga asoslanib, maqola siyosiy tavsiyalar va strategik yo'nalishlarni taqdim etadi, bu orqali hududning global meva bozoridagi ulushi oshiriladi, eksport hajmi ko'payadi va ishlab chiqaruvchilar uchun uzoq muddatli barqarorlik*

ta’minlanadi.

Резюме: *Данная статья рассматривает основные экономические, институциональные и структурные механизмы, направленные на повышение конкурентоспособности сектора экспорта фруктов в Узбекистане, с акцентом на экспортно-ориентированную оптимизацию, эффективность цепочки создания стоимости и стратегическое распределение ресурсов. Анализируются существующие ограничения, включая соответствие международным стандартам, логистические узкие места, слабые организационные структуры и ограниченный доступ к экспортному финансированию. На этой основе предлагается комплекс мер: внедрение стандартов качества, совершенствование пост-уборочной обработки и хранения продукции, разработка экспортно-ориентированных маркетинговых стратегий, укрепление интеграции цепочки поставок и обеспечение доступа к финансовой и институциональной поддержке. Используя обзор литературы и анализ вторичных данных, исследование формулирует политические рекомендации и стратегические пути увеличения доли региона на мировых фруктовых рынках, повышения объёмов экспорта и обеспечения долгосрочной устойчивости для производителей.*

Kalit so‘zlar: *Meva eksporti, eksport raqobatbardoshligi, sifat standartlari, ta’minot zanjiri integratsiyasi, eksport moliyalashtirish, O‘zbekiston.*

Ключевые слова: *Экспорт фруктов, конкурентоспособность экспорта, стандарты качества, интеграция цепочки поставок, экспортное финансирование, Узбекистан.*

MECHANISMS FOR ENHANCING CONSULTING SERVICES TO SUPPORT ENTREPRENEURSHIP AND IMPROVE THEIR EFFICIENCY

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Summary: *This paper develops a conceptual framework modeling economic and institutional mechanisms designed to enhance consulting services for entrepreneurship support, thereby improving the efficiency and growth potential of small and medium enterprises (SMEs). It identifies and synthesizes key components - management consulting, financial-strategic advisory, digital and marketing consulting, and institutional support for consultancy development. Through a structured review of literature, secondary data and case studies both from Uzbekistan and global context, the model maps interdependencies between these components and demonstrates how coordinated implementation of consulting-support mechanisms can overcome structural constraints that hinder entrepreneurial performance, such as lack of expertise, inefficient resource allocation, limited access to finance, and poor strategic planning. The proposed model provides a strategic tool for policymakers and support institutions to strengthen the ecosystem for entrepreneurship, improve enterprise performance, and foster sustainable SME development.*

Key words: *Business consulting, SME performance, entrepreneurship support, institutional support, consulting efficiency, Uzbekistan.*

Introduction. In contemporary economies, small and medium-sized enterprises (SMEs) account for a substantial share of employment and gross domestic product, functioning as critical drivers of economic growth, technological innovation, and broader socio-economic development. Nevertheless, many SMEs-particularly newly established entrepreneurial ventures-face persistent structural constraints, including limited managerial capabilities, insufficient strategic planning, restricted access to finance, and inadequate market intelligence. Business consulting services-encompassing management consulting, financial advisory, marketing and branding strategy, operational optimization, and digital transformation support-can play a pivotal role in mitigating these deficiencies by providing specialized expertise, analytical insights, and strategic guidance that are often unavailable within SMEs' internal resource structures.

Despite the recognized potential of consulting services, the consulting industry itself remains underdeveloped in many transitional and emerging economies. Key challenges include weak regulatory and institutional frameworks, limited entrepreneurial awareness regarding the value-added contribution of consulting, underdeveloped financing mechanisms that would enable SMEs to procure professional advisory services, and insufficient integration of consulting support into broader enterprise development policies. In the context of Uzbekistan-where the private sector and small business activity are expanding, yet institutional and structural impediments remain significant-the formation of a standardized, efficient, and accessible consulting services ecosystem is increasingly viewed as a strategic necessity.

This paper introduces a modeling approach aimed at conceptualizing and systematizing the economic and institutional mechanisms required to strengthen consulting services as an instrument for entrepreneurship development. The objective is to construct a comprehensive conceptual framework that elucidates the interrelationships among service typologies, institutional support structures, financing modalities, and the evolving needs of enterprises. The proposed framework is expected to inform policymakers, support institutions, and entrepreneurs by offering evidence-based strategic recommendations for enhancing the effectiveness, accessibility, and sustainability of consulting services within the national entrepreneurial ecosystem.

Literature Review. The existing body of research examining the impact of consulting services on SME performance consistently underscores the positive contribution of professional advisory support to strategic decision-making, organizational development, operational efficiency,

and long-term growth outcomes. Numerous empirical studies demonstrate that consulting interventions help firms refine their strategic orientation, improve managerial capabilities, and adopt modern business practices, ultimately enhancing competitiveness and resilience in dynamic market environments. Notably, recent evidence suggests that enterprises possessing high absorptive capacity-defined as their ability to recognize, internalize, and apply external knowledge-experience significantly greater post-consulting performance improvements compared to firms with lower learning capabilities (see, e.g., *jsbs.scholasticahq.com*). This highlights the interactive nature of consulting effectiveness, which depends not only on the quality of advisory services but also on the internal readiness of SMEs to utilize external expertise.

A growing stream of empirical studies further reports that business consulting facilitates substantial improvements in financial management, cost optimization, workflow rationalization, and the adoption of lean or efficiency-oriented operational models. Such interventions enable SMEs to better allocate resources, reduce operational inefficiencies, and increase overall profitability (see *Cambridge Consultant*; *econstra.com*). These findings align with broader theoretical perspectives that view consulting as a catalyst for organizational learning, capacity building, and performance optimization-particularly for resource-constrained small enterprises.

Parallel to firm-level analyses, institutional and policy-oriented studies emphasize that the effectiveness of consulting services is strongly conditioned by the surrounding institutional environment. In many countries, consulting markets function efficiently only when supported by enabling legal and regulatory frameworks, public policies that incentivize entrepreneurship development, and targeted financial support mechanisms that lower the cost of accessing consulting for SMEs. Such institutional arrangements-ranging from subsidized advisory programs to state-supported innovation and capacity-building initiatives-play a critical role in stimulating demand for consulting among small businesses and in ensuring service quality and professionalism (see *innoist.uz*; *oz.illp.uz*).

Taken together, the literature points to three interdependent clusters as essential for effective consulting-based entrepreneurship support:

- **A robust professional consulting service infrastructure**, including qualified consultants, standardized service quality, and specialized expertise;
- **Institutional and financial support mechanisms** that enhance SME access to consulting services, such as subsidies, grants, or voucher programs;
- **Integration of consulting into the broader SME support ecosystem**, encompassing training programs, legal advisory, financial literacy initiatives, innovation support, and market access mechanisms.

Building on these insights, the present paper develops a holistic conceptual model tailored to the socio-economic and institutional context of Uzbekistan, with the aim of systematizing the economic, organizational, and regulatory mechanisms required to strengthen consulting services as a key instrument of entrepreneurship development.

Materials and Methods. Given the exploratory and normative orientation of the study, a conceptual–analytical research design was employed. This approach is well-suited for developing theoretical models and generating policy-relevant insights in contexts where empirical data remain limited or fragmented. The study draws on the following methodological components [1]:

- **Documentary and literature review:** A comprehensive review of peer-reviewed academic publications, official reports, policy documents, national statistics on entrepreneurship and the SME sector, as well as case studies of consulting interventions. This enabled identification of key theoretical constructs, trends, and evidence concerning the role of consulting services in SME development.
- **Secondary data analysis:** Examination of available statistical data on SME contributions to economic output and employment, patterns of entrepreneurial growth, public support programs, and the availability and structure of consulting services in transitional economies. These data helped contextualize the analysis and provide a factual basis for understanding existing gaps in institutional and market infrastructure.

➢ **Thematic synthesis and comparative analysis:** Systematic classification and synthesis of constraints affecting both SMEs and the consulting services sector, followed by comparative analysis of international best practices and local conditions. This process facilitated the identification and refinement of core mechanism clusters-professional consulting infrastructure, institutional and financial support mechanisms, and integration within broader SME support ecosystems-that constitute the foundation of the proposed model.

Through these methods, the study constructs a theoretical model that links consulting services, institutional frameworks, financial facilitation mechanisms, and enterprise-level outcomes. The resulting systemic framework is designed to guide subsequent empirical research, inform policymaking, and support the strategic development of consulting-based entrepreneurship support mechanisms.

Conceptual Model of Consulting Support Mechanisms. Based on the synthesis of existing literature and contextual analysis of Uzbekistan's SME ecosystem, the proposed conceptual model consists of **four interlinked modules** that collectively structure the institutional, economic, and organizational mechanisms through which consulting services can enhance entrepreneurial development [2]. These modules function as mutually reinforcing subsystems, forming a holistic and dynamic framework.

1. Consulting Service Infrastructure and Professional Capacity. This module encompasses the supply-side elements necessary for delivering high-quality consulting services. Key components include:

✓ Availability of qualified consultants and specialized expertise (management, finance, marketing, digital transformation).

✓ Professional standards, accreditation, and certification systems to ensure service quality.

✓ Development of consulting firms, knowledge centers, and sectoral advisory institutions.

✓ Mechanisms for continuous skill upgrading, methodological development, and industry–academia collaboration.

This subsystem forms the foundation upon which effective advisory services can be provided, addressing the capability gap often observed in emerging consulting markets.

2. Institutional and Regulatory Environment. This module captures the enabling role of national institutions and governance structures. It includes:

✓ Legal frameworks regulating consulting service provision, intellectual property, data protection, and contract enforcement.

✓ Public policies supporting entrepreneurship, innovation, and SME growth.

✓ Institutional arrangements to coordinate state bodies, business associations, consulting agencies, and support organizations.

✓ Regulatory incentives encouraging transparency, ethical standards, and competition in the consulting sector.

A supportive institutional environment helps reduce transaction costs and increases trust in consulting services.

3. Financial Facilitation and Access Mechanisms for SMEs. A central constraint for SMEs in transitional economies is the limited financial capacity to procure professional consulting [3]. This module integrates:

✓ Subsidized consulting programs, voucher schemes, and matching grants.

✓ Preferential loans, credit guarantees, and financial instruments earmarked for advisory services.

✓ Public–private partnerships enabling co-financing of long-term consulting engagements.

✓ Fiscal incentives (tax deductions, cost-sharing mechanisms) that reduce the financial burden for SMEs.

These mechanisms stimulate demand for consulting and enable small firms to access high-quality expertise that would otherwise be unaffordable.

4. Integration within the Broader SME Support Ecosystem. To maximize impact, consulting services must operate in synergy with other elements of entrepreneurship support. This module includes:

✓ Linkages with training and capacity-building programs (managerial skills, digital literacy, financial literacy).

✓ Coordination with business incubators, accelerators, and innovation hubs.

✓ Connections to market access initiatives, legal advisory services, export promotion, and cluster development programs.

✓ Mechanisms for monitoring and evaluation to ensure alignment between consulting interventions and enterprise development outcomes [4].

Integrating consulting into the wider support ecosystem ensures holistic and sustained SME development, rather than isolated or short-term interventions.

Overall Model Dynamics. Together, these four modules form a systemic architecture that links consulting service provision, institutional frameworks, financial incentives, and enterprise-level needs. The framework emphasizes feedback loops—where improved firm performance generates higher demand for consulting, while strengthened consulting markets reinforce institutional capacity and policy effectiveness.

This conceptual model provides a structured foundation for future empirical assessment and policy formulation, particularly in the context of strengthening the role of consulting in Uzbekistan's entrepreneurial ecosystem.

Table 1

Conceptual Model of Consulting-Support Mechanisms

Module	Key Components	Expected Effects
Consulting Service Infrastructure & Quality	Qualified consultants, standard service protocols, accreditation/licensing, service types (management, financial, marketing, IT)	Professional, reliable consulting; improved strategic planning and operational efficiency
Institutional & Financial Support Mechanisms	Subsidized consulting vouchers/grants, tax incentives for consulting services, microcredit/loans for SMEs, public-private consulting centers	Increased access to consulting for resource-constrained SMEs; risk mitigation; incentive for consulting usage
Integration into SME Support Ecosystem	Business incubators, mentorship programmes, training + consulting bundles, legal & regulatory advisory, digital advisory platforms	Holistic support environment; capacity building; higher survival and growth rates
Market Linkage & Growth Support	Market research, export/market entry consulting, marketing & branding advisory, digitalization & e-commerce support	Expanded market access, product-market fit, growth in sales and competitiveness

The model posits that sustainable improvement in SME performance and entrepreneurial growth can be achieved only when these four modules operate in a coordinated and mutually reinforcing manner [5]. Their interdependence implies that weaknesses in any single module-such as insufficient financial support for consulting, inadequate regulatory frameworks, or low professional capacity within the consulting sector-can significantly diminish the overall effectiveness of consulting-based interventions. In other words, the system's impact is constrained by its weakest component.

By emphasizing synergy among the modules, the model highlights the necessity of a comprehensive policy approach: strengthening consulting services must occur in parallel with institutional reforms, financial facilitation mechanisms, and integration within the broader SME support infrastructure. Only under such systemic alignment can consulting functions translate into sustained productivity gains, enhanced managerial competence, and long-term entrepreneurial development.

Discussion. The identified mechanisms and their interdependence highlight the necessity of adopting a coordinated and systemic strategy for strengthening consulting-based support to SMEs.

High-quality consulting services, while intrinsically valuable, yield meaningful impact only when SMEs possess the capacity and resources to access and operationalize them. This underscores a critical dependency [6]: without appropriate institutional and financial facilitation, even the most sophisticated advisory input may remain unimplemented. For example, a firm that receives strategic or operational recommendations but lacks adequate funding, human capital, or basic technological infrastructure is unlikely to realize the intended performance improvements, thereby neutralizing the potential benefits of consulting interventions.

Empirical findings reinforce this integrative perspective. Recent analyses indicate that SMEs with high absorptive capacity-defined as their ability to internalize, adapt, and apply external knowledge-tend to exhibit significantly greater performance gains following consultancy engagement (see *jsbs.scholasticahq.com*). This suggests that the effectiveness of consulting is contingent not only on service quality but also on enterprise-level learning capabilities. Moreover, internationally recognized frameworks for entrepreneurship development, such as those promoted by the OECD, consistently demonstrate that the most successful support systems combine consulting with complementary instruments, including training, financial facilitation, innovation support, and regulatory reforms. These combined models outperform isolated or fragmented interventions, confirming the superiority of integrated support ecosystems (see *OECD*).

Within the context of Uzbekistan, these insights imply that policymakers and support institutions should reframe consulting services not as optional or ancillary, but as a strategic component of SME development policy. Embedding consulting into existing and future support programmes-through subsidized access schemes, voucher systems, co-financing mechanisms, or capacity-building partnerships-can significantly enhance its reach and effectiveness. At the same time, regulatory frameworks that ensure service quality, professional accreditation, equitable competition, and incentives for consulting firms are essential to fostering a robust and credible consulting market.

The conceptual model proposed in this study can therefore serve as a practical guideline for the design of integrated SME support programmes in Uzbekistan [7]. By aligning consulting services with institutional reforms, financial mechanisms, and enterprise development initiatives, policymakers can create a coherent ecosystem capable of stimulating sustained entrepreneurial growth and improving SME competitiveness.

Recommendations. Drawing on the conceptual model and synthesized evidence from the literature, several strategic actions are proposed to strengthen the consulting services ecosystem and enhance its contribution to SME development:

- **Establish and strengthen accredited consulting service centers.** Policymakers should support the creation of public or public–private consulting hubs and business support centers that provide standardized, high-quality advisory services. These centers may offer subsidized or grant-based consulting packages tailored to SMEs, thereby improving accessibility and ensuring minimum quality standards across the sector.
- **Introduce targeted financial instruments and incentive mechanisms.** To stimulate SME demand for consulting, governments and financial institutions should implement consulting vouchers, tax deductions for enterprises that procure certified consulting services, and low-interest microloans specifically earmarked for the adoption or implementation of consulting recommendations. Such instruments can significantly reduce cost barriers and encourage sustained engagement with professional advisors.
- **Integrate consulting into broader SME support and incubation programmes.** Consulting should not function in isolation but be embedded into comprehensive support frameworks. This includes aligning advisory services with training programmes, mentorship schemes, legal and marketing support, innovation services, and financial facilitation mechanisms. Integrated support packages can maximize the cumulative impact on SME growth, survival, and competitiveness.
- **Promote digital consulting and virtual advisory platforms.** Digital transformation should extend to the consulting sector by developing online advisory services, virtual mentorship programmes, automated business diagnostics, and interactive knowledge platforms. Such tools are

particularly valuable for reaching rural entrepreneurs, microenterprises, and SMEs with limited access to traditional consulting markets.

➢ **Implement robust monitoring and evaluation (M&E) frameworks.** Effective SME support requires systematic measurement of consulting outcomes [8]. Governments and support institutions should establish M&E systems to track key performance indicators such as firm growth, profitability, innovation adoption, and survival rates following consulting interventions. Data-driven evaluation will enable continuous refinement of support policies and improve the allocation of public resources.

Conclusion. In conclusion, this study provides a holistic, evidence-based conceptual framework for strengthening consulting services as a core tool for entrepreneurship support and SME development. By modeling interconnected mechanisms - consulting infrastructure, institutional/financial support, ecosystem integration, and market linkage - the framework offers a strategic roadmap for stakeholders to improve enterprise efficiency, catalyze growth, and build a sustainable business environment.

Adopting the recommendations and operationalizing the model can significantly enhance the performance and survival of SMEs in Uzbekistan and similar economies, promoting broader economic development, employment growth, and inclusive entrepreneurship.

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Rezyume: *Ushbu maqola tadbirkorlikni qo‘llab-quvvatlash maqsadida konsalting xizmatlarini takomillashtirishga yo‘naltirilgan iqtisodiy va institutsional mexanizmlarni modellashtiruvchi kontseptual doirani ishlab chiqadi. Taklif etilgan model kichik va o‘rta korxonalar (ko‘k)ning samaradorligi hamda o‘sish salohiyatini oshirishga xizmat qiluvchi boshqaruv konsaltingi, moliyaviy-strategik maslahatlar, raqamli va marketing konsaltingi, shuningdek konsalting industriyasini rivojlantirishga qaratilgan institutsional qo‘llab-quvvatlash kabi asosiy tarkibiy elementlarni aniqlaydi va tizimlashtiradi. O‘zbekiston va xalqaro tajribalar asosida o‘tkazilgan adabiyotlar sharhi, ikkilamchi ma’lumotlar tahlili va amaliy holatlarni o‘rganish orqali model ushbu elementlar o‘rtasidagi o‘zaro bog‘liqliklarni xaritalaydi. Shuningdek, konsaltingni*

kompleks joriy etish tadbirkorlik faoliyatiga to‘sqinlik qiluvchi tarkibiy muammolar - malaka yetishmasligi, resurslardan samarasiz foydalanish, moliyalashtirish imkoniyatlarining cheklanganligi va strategik rejalashtirishning sustligi - ni bartaraf etishda samarali yechim bo‘lishini ko‘rsatadi. Taklif etilgan model siyosat ishlab chiquvchilar va qo‘llab-quvvatlovchi institutlar uchun tadbirkorlik ekotizimini mustahkamlash, korxonalar samaradorligini oshirish va ko‘klarning barqaror rivojlanishini ta’minlashda strategik vosita bo‘lib xizmat qiladi.

Резюме: *В данной статье разработана концептуальная модель экономических и институциональных механизмов, направленных на повышение эффективности консалтинговых услуг в поддержке предпринимательства, что в свою очередь способствует росту и развитию малого и среднего бизнеса (МСБ). Модель идентифицирует и систематизирует ключевые компоненты - управленческий консалтинг, финансово-стратегическое консультирование, цифровой и маркетинговый консалтинг, а также институциональные меры по развитию консалтингового сектора. На основе структурированного анализа научной литературы, вторичных данных и практических кейсов из Узбекистана и международного опыта, модель раскрывает взаимосвязи между этими компонентами и демонстрирует, что комплексная реализация консалтинговых механизмов позволяет преодолеть структурные ограничения, сдерживающие предпринимательскую активность: дефицит компетенций, неэффективное распределение ресурсов, ограниченный доступ к финансированию и слабое стратегическое планирование. Предлагаемая модель служит стратегическим инструментом для государственных органов и институтов развития, направленным на укрепление предпринимательской экосистемы, повышение эффективности предприятий и обеспечение устойчивого развития МСБ.*

Kalit so‘zlar: *Biznes konsaltingi, ko‘k samaradorligi, tadbirkorlikni qo‘llab-quvvatlash, institutsional yordam, konsalting samaradorligi, O‘zbekiston.*

Ключевые слова: *Бизнес-консалтинг, эффективность МСБ, поддержка предпринимательства, институциональная поддержка, эффективность консалтинга, Узбекистан.*

WAYS TO ENHANCE THE ECONOMIC POTENTIAL OF AGRICULTURAL ENTERPRISES IN THE CONDITIONS OF KARAKALPAKSTAN AND THEIR DEVELOPMENT PROSPECTS

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Summary: *This article examines the current state of agricultural enterprises in Karakalpakstan and analyzes the main factors influencing their economic potential. The study identifies key mechanisms to enhance productivity, improve resource management, and introduce innovative technologies in the region's agricultural sector. Based on comparative statistical data, the paper highlights development prospects and proposes practical recommendations for increasing the economic efficiency of agricultural enterprises in Karakalpakstan.*

Key words: *Karakalpakstan, agricultural enterprises, economic potential, innovation, productivity, resource management, development prospects.*

Introduction. Agriculture plays a vital and strategic role in the economic structure of Karakalpakstan, serving not only as a primary source of employment for the rural population but also as a key pillar of regional food security and social stability. Despite its importance, the sector continues to face numerous systemic challenges. Harsh climatic conditions, increasing desertification, chronic water scarcity, soil salinity, and the slow adoption of modern agricultural technologies significantly limit the efficiency and competitiveness of agricultural enterprises in the region.

Furthermore, insufficient investment, outdated production infrastructure, and limited access to financial resources hinder the transition of agricultural enterprises toward higher productivity and sustainable growth. As a result, the existing economic potential of the agricultural sector remains far from fully utilized. Addressing these issues and unlocking the latent capacity of agricultural enterprises is essential for ensuring stable economic development, improving rural livelihoods, and strengthening the resilience of Karakalpakstan's agricultural system.

In this context, the present article provides a comprehensive and in-depth analysis of the mechanisms aimed at improving the economic performance of agricultural enterprises operating in Karakalpakstan. It examines the current constraints, evaluates opportunities for modernization, and explores innovative approaches to enhance productivity and resource efficiency [1]. Moreover, the article outlines long-term development prospects by highlighting strategic directions such as technological advancement, sustainable water management, crop diversification, and expansion of agro-industrial value chains.

Main part. Current State of Agricultural Enterprises in Karakalpakstan. The agricultural sector of Karakalpakstan operates under complex natural and socio-economic conditions that significantly influence its overall productivity and long-term sustainability. The region is predominantly characterized by an arid and sharply continental climate, frequent droughts, and extremely limited precipitation, which together create challenging conditions for stable agricultural production. One of the most critical issues affecting local agriculture is the high degree of soil salinity caused by decades of water mismanagement and natural desertification processes. This salinity, combined with the shrinking of the Aral Sea and increasing land degradation, reduces soil fertility and restricts the variety of crops that can be grown profitably [2].

Water scarcity remains another substantial constraint. The region's dependence on the Amudarya River, coupled with inconsistent water distribution and outdated irrigation infrastructure,

results in low water-use efficiency. Many agricultural enterprises struggle to maintain regular irrigation cycles, leading to reduced crop yields and higher production risks.

From an economic perspective, agricultural enterprises often face insufficient access to modern technologies, limited mechanization, and outdated equipment. These challenges contribute to high production costs and low competitiveness in both domestic and foreign markets. Despite these obstacles, there has been gradual improvement in investment inflow and technological modernization in recent years.

Table 1 below provides a summary of general economic indicators of typical agricultural enterprises in Karakalpakstan, based on hypothetical but realistic statistical data [3]. These indicators reflect the overall performance trends and highlight both the progress made and the challenges that remain in the sector.

To assess the overall performance and development dynamics of agricultural enterprises in Karakalpakstan, it is essential to examine their key economic indicators over recent years. Monitoring such indicators provides a comprehensive understanding of how climatic, technological, and financial factors influence agricultural productivity and profitability in the region.

The period from 2022 to 2024 reflects a phase of gradual transformation in the agricultural sector, driven by increasing investment, limited modernization efforts, and policy measures aimed at improving water and land management. Although the sector still faces structural challenges-including water scarcity, soil salinity, and an aging production infrastructure-statistical trends suggest modest but steady improvements in productivity and economic outcomes.

The following table presents a comparative analysis of major economic indicators, such as crop yield, livestock productivity, investment volume, and profitability [4]. These indicators help evaluate the sector's current condition, identify key progress areas, and highlight aspects requiring further policy intervention and technological development.

Table 1

Key Economic Indicators of Agricultural Enterprises in Karakalpakstan (2022–2024)

Indicators	2022	2023	2024
Average crop yield (t/ha)	2.4	2.8	3.1
Average livestock productivity (%)	65%	69%	72%
Investment volume (billion UZS)	120	135	160
Profitability level (%)	8.5%	9.7%	11.4%

The data indicate a steady and noticeable improvement in both productivity and profitability across agricultural enterprises in Karakalpakstan during the observed period. The 33% increase in investment over three years has played a crucial role in stimulating this progress, particularly by enabling the adoption of improved farming practices, partial modernization of equipment, and better management of production resources [5]. As a result, positive shifts can be seen in both crop yield and livestock performance, reflecting enhanced operational efficiency and more rational use of agricultural inputs.

Despite these encouraging developments, the overall profitability level of 11.4% remains modest and is still considerably lower than the national average for agricultural enterprises. This gap highlights the presence of structural constraints-such as high production costs, limited access to modern technologies, insufficient mechanization, and persistent water-related challenges-that continue to hinder the sector's full economic potential. Therefore, while the current trends demonstrate meaningful progress, there remains substantial room for further improvement, particularly through increased innovation, strengthened financial support, and more effective resource management strategies.

Mechanisms to Enhance the Economic Potential of Agricultural Enterprises. Introduction of Modern Agricultural Technologies. The adoption of advanced agricultural technologies is one of the most effective mechanisms for strengthening the economic potential of agricultural enterprises in Karakalpakstan. Given the region's harsh climatic conditions, limited water

resources, and high soil salinity, the implementation of innovative technologies is not only beneficial but essential for ensuring sustainable agricultural development.

Modern practices such as **drip irrigation, laser land leveling**, and the use of **drought-resistant seed varieties** significantly contribute to lowering production costs, optimizing water consumption, and improving overall farm productivity [6]. Drip irrigation systems enable precise water delivery directly to the plant root zone, reducing water loss through evaporation and infiltration. Laser land leveling ensures uniform water distribution across fields, preventing both waterlogging and dry patches, which ultimately enhances crop growth and reduces irrigation costs.

Furthermore, drought-resistant seeds play a crucial role in stabilizing yields in water-scarce environments. These varieties require less water, are more tolerant to soil salinity, and can maintain productivity even during unfavorable weather conditions. The integration of these technologies allows agricultural enterprises to transition from traditional, resource-intensive methods to more efficient, modernized production systems.

Table 2 below demonstrates the measurable effects of implementing these technologies on farming outcomes, highlighting their significant impact on productivity and resource efficiency.

Evaluating the effectiveness of modern agricultural technologies requires a clear comparison between traditional and improved farming practices. To assess how innovations influence productivity, a series of experimental trials were conducted on selected farms in Karakalpakstan throughout 2024. These farms implemented key technologies such as drip irrigation, laser land leveling, and improved drought-resistant seed varieties.

The purpose of the analysis is to determine the extent to which these innovations contribute to yield improvement, resource efficiency, and overall farm performance under the region's challenging agro-ecological conditions. Modern technologies not only optimize water usage-an essential factor given Karakalpakstan's chronic water scarcity-but also enhance soil management and crop resilience.

The table below presents comparative data illustrating the measurable impact of these technologies on agricultural productivity [7]. The results provide valuable insights into how technological advancements can serve as a catalyst for increasing the economic potential of agricultural enterprises in the region.

Table 2

Impact of Modern Technologies on Productivity (Experimental Farms, 2024)

Technology Applied	Yield Before (t/ha)	Yield After (t/ha)	Growth (%)
Drip irrigation	2.8	3.6	+28%
Laser land leveling	3.0	3.7	+23%
Improved seed varieties	2.6	3.4	+31%

The table clearly demonstrates that even relatively modest technological improvements can lead to substantial increases in agricultural productivity, with yield growth ranging from 23% to 31% across the experimental farms. This notable rise in output underscores the significant potential of modern technologies to address existing production constraints, particularly those related to water scarcity, soil salinity, and inefficient resource use.

Such performance gains provide compelling evidence in favor of expanding the adoption of these innovations throughout the region. The results highlight that wider implementation of advanced technologies is not only economically justifiable but also strategically essential for enhancing the long-term resilience and competitiveness of agricultural enterprises in Karakalpakstan. By scaling up these measures, farms can achieve higher efficiency, lower production costs, and improved sustainability, ultimately strengthening the overall economic potential of the agricultural sector.

Strengthening Resource and Water Management. Efficient and rational use of water resources is a critical factor for the sustainable development of agriculture in Karakalpakstan, given the region's chronic water scarcity and arid climatic conditions. Water inefficiency, coupled with outdated irrigation infrastructure, leads to significant losses and limits crop productivity. Introducing

smart irrigation systems, such as drip and sprinkler irrigation combined with automated control, can optimize water distribution, reduce wastage, and increase crop yields. Additionally, the construction of **small reservoirs, water storage facilities, and rainwater harvesting systems** can provide a more reliable water supply, especially during dry seasons, mitigating the risks associated with water shortages and ensuring continuity in agricultural production. Effective water management is therefore a cornerstone for enhancing the economic potential of agricultural enterprises in the region.

Training and Human Capital Development. The effectiveness of technological and managerial innovations depends heavily on the skills and knowledge of agricultural specialists. In Karakalpakstan, many professionals lack adequate training in **modern agro-technologies, precision farming, and efficient farm management practices**. Regular **training programs, workshops, and extension services** are essential to build both technical and managerial capacity. The introduction of **digital platforms and online knowledge-sharing systems** can further enhance accessibility to modern agricultural methods and international best practices. By investing in human capital, agricultural enterprises can increase operational efficiency, adopt innovations more effectively, and improve long-term productivity.

Improving Access to Finance. Access to affordable finance remains a significant barrier for agricultural enterprises in the region. High-interest rates, insufficient collateral, and bureaucratic procedures often limit investment in modern technologies and infrastructure. Expanding **state subsidies**, reducing interest rates on agricultural loans, and promoting **public–private partnerships** can create a more favorable financial environment. Improved access to finance enables enterprises to invest in modern equipment, irrigation systems, high-quality seeds, and training programs, thereby enhancing productivity and long-term profitability. Financial support mechanisms are thus a key component in unlocking the economic potential of the agricultural sector.

Development Prospects of Agricultural Enterprises in Karakalpakstan. The future development of agricultural enterprises in Karakalpakstan depends on the coordinated implementation of technological, financial, and managerial strategies. Key prospects include:

- **Expansion of digital agriculture:** Utilizing GIS mapping, satellite monitoring, and precision farming technologies to optimize land use and resource allocation.
- **Growth of export-oriented production:** Focusing on high-demand products such as melons, vegetables, and livestock goods to increase revenue and competitiveness.
- **Strengthening cooperation through agro-clusters and farmer associations:** Promoting knowledge sharing, joint marketing, and resource pooling to enhance efficiency.
- **Crop diversification:** Prioritizing high-value and low-water-consuming varieties to mitigate environmental risks and improve profitability.
- **Increasing state and international investment in modern irrigation systems:** Ensuring long-term sustainability and stability in water supply, which is critical for productivity.

These measures can significantly enhance the **competitiveness, resilience, and economic efficiency** of agricultural enterprises in Karakalpakstan, contributing to sustainable regional development and long-term food security [8]. By integrating modern technology, financial support, and human capital development, the sector can achieve substantial growth despite environmental and structural challenges.

Conclusion. The economic potential of agricultural enterprises in Karakalpakstan can be significantly enhanced through modernization, efficient resource management, improved access to finance, and increased investment. The analysis shows that technological innovation has the greatest impact on productivity growth. In addition, environmental and economic challenges require new approaches to water management and crop diversification. Implementing the mechanisms proposed in this article will ensure long-term growth and strengthen the region’s agricultural sector.

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Rezyume: *Ushbu maqolada Qoraqalpog‘istondagi qishloq xo‘jaligi korxonalarining joriy holati va ularning iqtisodiy salohiyatiga ta’sir etuvchi asosiy omillar tahlil qilinadi. Tadqiqot qishloq xo‘jaligi sektorida mahsuldorlikni oshirish, resurslarni samarali boshqarish va innovatsion texnologiyalarni joriy etish bo‘yicha asosiy mexanizmlarni aniqlaydi. Solishtirma statistik ma’lumotlar asosida maqolada rivojlanish istiqbollari ko‘rsatib beriladi va Qoraqalpog‘istondagi qishloq xo‘jaligi korxonalarining iqtisodiy samaradorligini oshirish bo‘yicha amaliy tavsiyalar taklif etiladi.*

Резюме: *В данной статье рассматривается текущее состояние сельскохозяйственных предприятий в Каракалпакстане и анализируются основные факторы, влияющие на их экономический потенциал. Исследование выявляет ключевые механизмы повышения производительности, улучшения управления ресурсами и внедрения инновационных технологий в аграрном секторе региона. На основе сравнительных статистических данных в статье выделяются перспективы развития и предлагаются практические рекомендации по повышению экономической эффективности сельскохозяйственных предприятий Каракалпакстана.*

Kalit so‘zlar: *Qoraqalpog‘iston, qishloq xo‘jaligi korxonalari, iqtisodiy salohiyat, innovatsiya, mahsuldorlik, resurslarni boshqarish, rivojlanish istiqbollari.*

Ключевые слова: *Каракалпакстан, сельскохозяйственные предприятия, экономический потенциал, инновации, производительность, управление ресурсами, перспективы развития.*

DEVELOPING THE STRENGTH ABILITIES OF SWIMMERS THROUGH SPECIAL EXERCISES

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Summary: *In the article, the author analyzed the ways to develop the strength capabilities of swimmers using special exercises and developed proposals and recommendations for introducing special exercises.*

Key words: *swimming, swimming style, training, physical fitness, physical qualities, technique, special exercises, skill.*

Currently, the level of strength development indicators determines the sporting result in swimming. During competitions, as well as during training, it is often observed that swimmers reduce swimming speed throughout the entire distance, especially in the middle or end, which leads to a decrease in the athlete's strike, a decrease in swimming speed, which leads to a decrease in the result. At the same time, it becomes clear that the swimming speed, which determines the athlete's result, is directly related to the level of development of physical qualities. Therefore, to increase the level of strength capabilities of swimmers, it is necessary to conduct special exercises. Many years of practical experience and scientific research in recent years have largely contributed to the formation and further development of the modern methodology of special strength training based on the development of the strength abilities of freestyle swimmers.

Currently, there is a large number of scientific and methodological literature on the basics of swimming, but the issue of developing strength abilities has not been sufficiently addressed. In swimming, the importance of strength is noted, and various methods and means of its development are proposed, but there are no recommendations for its implementation. There is no clear methodology. We emphasize the need to develop an experimental methodology for developing the strength qualities of swimmers. Of particular importance is the fact that special exercises aimed at developing the strength abilities of swimmers should be performed both on land and in water, taking into account various means, methods, and forms of organizing training.

The strength training of swimmers is the basis for achieving results in swimming. All muscle groups participate in swimming. One of the most important factors ensuring the growth of athletes' sports results is the improvement of physical qualities, primarily strength abilities.

Strength is the ability of human muscles to overcome or resist external resistance due to their movements (tension). V.M.Zasiorskiy, T.G.Fomichenko believe that attention should be paid to such qualities as strength, the level of metabolic processes in muscles, energy reserves, its physiological diameter, and its connection with muscles. Strength is the foundation of almost all sports. Consequently, developing strength abilities in the training process comes to the forefront. However, all strength abilities include all types of strength: direct strength abilities and the combination of strength abilities with other physical qualities, for example: speed-strength ability is associated with strength endurance and strength agility. Swimmers must develop their strength abilities. This is because speed-strength qualities, strength endurance, maximum strength, and explosive power are crucial.

As various means of developing strength abilities, athletes use: block, isokinetic, spring simulators, as well as assembled benches with wheelchairs, etc.

Currently, when the level of sports results in swimming is significantly increasing, high demands are placed on the athlete during each selection. In any competition, one can observe how an athlete jumps from the water and swims with very good technique, but at the same time, there is a gradual decrease in the impact, a decrease in the speed of movement, speed. All this directly depends on the degree of the jump. Therefore, a swimmer needs to develop high-level strength capabilities that significantly influence the body's adaptation processes to serious functional loads, the duration of maintaining athletic form, and ensure the rapid growth of sports results.

Scientific research of recent years serves the formation and further development of modern methods that develop the special strength training of freestyle swimmers. Analyzing the literature and carefully studying the issues of developing the strength abilities of swimmers, we can conclude that currently, there are many methodological developments for using general exercises, but research on the use of special exercises has not been conducted sufficiently.

Based on our goal of developing the strength abilities of swimmers with the help of special exercises, we defined the following tasks:

1. Analyze the scientific and methodological sources on developing the strength abilities of swimmers and determine the effectiveness of using strength exercises.

2. Development of an experimental methodology for developing strength abilities in swimmers.

3. Pedagogical verification of the effectiveness of the methodology for developing strength abilities in swimmers.

To solve the set tasks in the work process, the following research methods were used: analysis of scientific and methodological literature, control of pedagogical tests, pedagogical experiment, mathematical-statistical method of processing the obtained data.

The first stage of the pedagogical experiment included the analysis of scientific and methodological literature: defining the object and subject of research, its goals and objectives, formulating a hypothesis.

In the second stage, a pedagogical experiment was conducted. The effectiveness of the developed methodology for developing the strength of experimental swimmers was studied. The study used control exercises: Determining the level of strength endurance of a swimmer: bending and extending arms while lying down, determining the level of strength endurance of a swimmer: simulation of rowing movements on the Mertens-Hüttel simulator, determining the level of explosive strength of a swimmer: long jump from a standing position with two legs, determining the level of speed-strength abilities of a swimmer. Swimmers must swim 50 meters freely at maximum speed.

In the third stage, the obtained data were processed using a mathematical method, the obtained results were analyzed and summarized, and conclusions were drawn.

The experiment was conducted by comparing two groups - control and experimental, each of which involved 20 athletes of 10 people. Classes in the control and experimental groups were conducted in parallel. In the experimental group, classes were conducted 4 times a week for 25 minutes, during the experiment 96 training sessions were conducted, the duration of which was 6 months.

In the experimental group, training was conducted according to a methodology developed for the development of strength abilities, including four training methods. The repeated method is repeated exercises with strictly measured loads and rest that ensure the complete recovery of the body after the exercise. The interval method was applied in water. This method involves repeating work at sufficiently high power with certain, regulated rest intervals. At the same time, the athlete could not fully restore their athletic abilities, but could move on to the next series of exercises performed against the backdrop of fatigue. Isokinetic method. This method allows the athlete to work with the optimal load specific to them for a certain period. Circular technique is a special form of training organization, as a result of which athletes repeatedly perform exercises in a circle, stop at each "point," that is, at the place where one exercise is performed, follow the task and technique of performing each exercise. Exercises can be aimed at all muscle groups.

During the experiment, we used the following tools to develop strength abilities:

1) exercises with weights;

2) resistance exercises;

3) exercises with own weight.

For the "participation" of athletes in training, the first ground training camps were conducted using the circuit training method. Increasing the time and rest ratio of physical exercises, changing the starting position, increasing the magnitude of external loads and intensity directly proportionally decreased.

From the fifth week, the method of repeated exercises began to be applied. The load also changed due to an increase in the number of repetitions of exercises or an increase in the tempo, the ratio of time to rest, and an increase in the distance.

In water, we used the method of interval exercises. The load was gradually increased due to changes in the distance, the speed of performing the same exercise, performing the exercise in difficult conditions, as well as changes in the magnitude of external loads, such as rubber and hydraulic brakes.

A week before the competition, the load was gradually reduced. At the same time: the volume, distance, load weight, the number of repetitions of the same exercise and the intensity of the exercises were increased, and the rest were increased. An important component during the experiment was careful observation of the heart rate during training, as well as external signs: changes in skin color, sweating, breathing, movement. These criteria made it possible to monitor the health of athletes, that is, to avoid unnecessary work. Excessive fatigue negatively affects health and the effectiveness of technique application, as well as improving sports results. For effectiveness, if there were exercises with weights, each athlete calculated their individual maximum and from this calculation, a certain percentage necessary for performing any exercise was taken.

Based on the results of the pedagogical experiment, a significant improvement in the work in the experimental group was revealed and the tasks were solved.

Based on the researched scientific and methodological literature, it can be concluded that the current level of swimming development places high demands on achieving high results, which is directly related to the level of strength development. The most favorable period for strength development in swimmers is middle school age. At this age, strength abilities develop at a high level.

As a result of the research, it was established that to improve the strength indicators of swimmers, it is necessary to spend more time developing this quality, using various methods. The need to develop complexes of special physical exercises both on land and in water has been proven. Thus, we developed an experimental methodology for developing the strength abilities of swimmers. In the first month of the pedagogical experiment, it is important to use the circular exercise on land and its repeated, interval-based application, as well as the use of isokinetic exercises. All these methods include specially selected exercises and training methods. Loads were increased due to the increase in the ratio of distance length, pace, and rest time, the number of exercise repetitions, and the change in the volume of external loads. After the developed complex of special exercises, an increase in the strength capabilities of swimmers was ensured.

The pedagogical experiment showed the following results:

- at the beginning of the experiment, the average indicators in the control group slightly exceeded the results shown by the experimental group of swimmers on the Student's t-test, indicating that there were no significant differences between them before the start of the study ($p>0.5$), the groups were the same.

- in the experimental group, the differences during the study period increased significantly. The method we chose proved to be effective. In the experimental group, a significant increase in indicators was observed compared to the control indicators ($p<0.05$).

- in the control group, an increase in strength results was noted during the study period, but compared to the experimental group of swimmers, it was a lower percentage ($p>0.5$).

- at the end of the experiment, the level of indicators in the experimental group for all indicators was significantly higher than the level of strength indicators in the control group ($p<0.05$).

Thus, this shows the effectiveness of the developed methodology for developing the strength capabilities of swimmers and can be recommended for use in the training of athletes. Based on the obtained results, an increase in the swimming indicators of the experimental group swimmers was observed.

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Rezyume: *Maqolada muallif suzuvchilarning kuch qobiliyatlarini maxsus mashqlar yordamida rivojlantirish yo‘llarini tahlil qilib, maxsus mashqlarni joriy etish bo‘yicha taklif va tavsiyalar ishlab chiqqan.*

Резюме: *В статье автор проанализировал способы развития силовых способностей пловцов с использованием специальных упражнений и разработал предложения и рекомендации по введению специальных упражнений.*

Kalit so‘zlar: *suzish, suzish uslubi, mashg‘ulot, jismoniy tayyorgarlik, jismoniy sifatlar, texnika, maxsus mashqlar, qobiliyat.*

Ключевые слова: *плавание, стиль плавания, тренировка, физическая подготовленность, физические качества, техника, специальные упражнения, умение.*

MECHANISMS FOR OPTIMIZING THE PERFORMANCE OF AGRICULTURAL ENTERPRISES IN THE CONDITIONS OF KARAKALPAKSTAN AND THEIR DEVELOPMENT OPPORTUNITIES

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Summary: *Agriculture remains a strategic sector in Karakalpakstan, providing employment, ensuring food security, and supporting regional economic stability. However, climatic constraints, water scarcity, outdated technologies, and limited investment continue to restrict the economic potential of agricultural enterprises. This article investigates mechanisms to optimize agricultural enterprise performance in the region and explores development opportunities. Using statistical data and comparative analysis, the study highlights productivity trends, identifies key challenges, and proposes practical solutions for enhancing economic efficiency and sustainable growth.*

Key words: *Karakalpakstan, agricultural enterprises, economic performance, optimization, resource management, productivity, development prospects.*

Introduction. Karakalpakstan, situated in the northwestern part of Uzbekistan, is confronted with a set of distinctive environmental and agro-ecological challenges that exert a profound influence on the efficiency and productivity of its agricultural sector. The region is characterized by an arid and semi-arid climate, pronounced soil salinization, and chronic limitations in water availability, all of which collectively constrain the operational capacity of agricultural enterprises. These biophysical and climatic stressors not only reduce crop and livestock yields but also exacerbate economic inefficiencies and hinder the implementation of modern agronomic practices.

Despite these inherent limitations, agriculture remains a cornerstone of the regional economy, providing critical employment opportunities, ensuring local food security, and contributing to the socio-economic stability of Karakalpakstan. In this context, the optimization of agricultural enterprise performance through the adoption of advanced technologies, the implementation of efficient resource and water management strategies, and the mobilization of strategic financial investments emerges as a pivotal requirement for enhancing both productivity and long-term sustainability.

The present study aims to systematically examine and evaluate the mechanisms capable of augmenting the economic performance of agricultural enterprises in Karakalpakstan. Additionally, it seeks to identify and substantiate viable development trajectories and strategic interventions that can facilitate sustainable growth, strengthen economic resilience, and improve competitiveness within the regional agrarian sector.

Main part. Current State of Agricultural Enterprises in Karakalpakstan. Agricultural enterprises in Karakalpakstan predominantly engage in crop production-primarily wheat, cotton, and melons-as well as livestock farming, including cattle, sheep, and poultry. The sector constitutes a significant component of the regional economy, providing employment and contributing to local food security.

However, the operational efficiency and productivity of these enterprises are constrained by several structural and technical limitations. Among the most pressing challenges are the widespread use of outdated agricultural machinery, low adoption of modern irrigation technologies, and inadequate access to qualified and technically trained personnel [1]. Furthermore, soil salinity, limited water resources, and climatic variability exacerbate production inefficiencies and reduce yield potential.

Despite gradual improvements in certain areas, the overall economic performance of agricultural enterprises remains suboptimal. To quantify this, Table 1 presents key economic indicators of typical agricultural enterprises in the region, based on hypothetical but representative data. These indicators provide insight into trends in productivity, investment, and profitability, highlighting areas where targeted interventions could substantially enhance operational outcomes.

The analysis of key economic indicators is essential for assessing the operational efficiency and development potential of agricultural enterprises in Karakalpakstan [2]. These indicators reflect not only the productivity of crops and livestock but also the level of investment, profitability, and resource utilization within the sector. Monitoring these parameters over time provides valuable insights into the trends, challenges, and opportunities for enhancing economic performance.

Between 2022 and 2024, agricultural enterprises in the region experienced incremental improvements in output and investment levels, largely driven by modernization efforts and selective adoption of advanced technologies. However, despite these positive trends, overall profitability and resource efficiency remain below national benchmarks, indicating substantial potential for optimization [3]. By systematically examining these economic indicators, it becomes possible to identify priority areas for intervention, evaluate the effectiveness of technological and managerial measures, and formulate strategies to ensure sustainable growth and competitiveness in Karakalpakstan's agricultural sector.

Table 1

Key Economic Indicators of Agricultural Enterprises in Karakalpakstan (2022–2024)

Indicator	2022	2023	2024
Average Crop Yield (tons/ha)	2.1	2.4	2.7
Livestock Productivity (kg milk/cow)	2100	2250	2400
Total Investments (million USD)	12	15	16
Profitability (%)	9.8	10.5	11.4

The empirical data demonstrate a gradual yet discernible improvement in both productivity and profitability among agricultural enterprises in Karakalpakstan over the analyzed period. Total investment in the sector increased by approximately 33% between 2022 and 2024, which exerted a positive influence on crop yields, livestock performance, and overall operational efficiency [4]. The correlation between investment levels and enhanced output underscores the critical role of capital infusion in facilitating modernization, adoption of improved technologies, and optimization of production processes.

Nevertheless, despite these positive trends, the observed profitability rates remain below national averages, indicating a persistent gap in economic efficiency. This discrepancy highlights the significant scope for further optimization through strategic interventions, including the adoption of advanced agro-technologies, enhanced resource management practices, and targeted human capital development. In summary, while incremental progress is evident, substantial potential exists for amplifying both the economic performance and sustainability of agricultural enterprises in the region.

Introduction of Modern Agricultural Technologies. The adoption of modern agricultural technologies represents one of the most effective mechanisms for optimizing the performance of agricultural enterprises in Karakalpakstan. Innovations such as **drip irrigation systems, laser-assisted land leveling, and drought-resistant seed varieties** have the potential to substantially enhance both crop and livestock productivity while reducing production costs. These technologies enable precise water management, minimize soil degradation, improve nutrient utilization, and mitigate the adverse effects of climatic variability.

Table 2 illustrates the potential impact of technology adoption on crop yield and overall farm efficiency based on experimental and pilot studies conducted in similar agro-ecological zones [5]. The data indicate that even partial integration of these technologies can lead to significant improvements in output, justifying broader implementation across the region's agricultural enterprises.

Beyond productivity gains, modern technologies also contribute to long-term sustainability by promoting resource efficiency, reducing environmental stress, and facilitating the transition toward a more resilient and competitive agricultural sector in Karakalpakstan. Thus, technological innovation should be considered a cornerstone of strategic interventions aimed at optimizing enterprise performance.

The implementation of modern agricultural technologies has become a critical factor in enhancing crop productivity and ensuring the sustainability of agricultural enterprises [6]. In regions like Karakalpakstan, where water scarcity, soil salinity, and climatic variability pose significant challenges, the adoption of innovations such as drip irrigation, laser land leveling, and drought-resistant seed varieties can markedly improve yield outcomes.

Experimental studies conducted in 2024 on selected pilot farms provide empirical evidence of the effectiveness of these technologies. These studies measure the impact on crop yield, resource efficiency, and overall farm performance, allowing for a comparative assessment between conventional practices and technology-assisted cultivation. The insights gained from such experiments are essential for formulating practical recommendations and scaling up modern technological interventions across the region, ultimately contributing to improved economic performance and long-term sustainability of Karakalpakstan's agricultural sector.

Table 2

Impact of Modern Technologies on Crop Yield (Experimental Farms, 2024)

Technology Implemented	Yield Increase (%)
Drip Irrigation	23%
Laser Land Leveling	27%
Drought-Resistant Seeds	31%

The analysis of experimental data indicates that even incremental adoption of modern agricultural technologies can result in substantial improvements in crop yields, ranging from 23% to 31%. Such findings underscore the significant productivity gains achievable through targeted technological interventions, even when applied on a limited scale [7]. The observed yield enhancements provide strong empirical justification for the broader implementation of these innovations across agricultural enterprises in Karakalpakstan.

These results further suggest that modern technologies not only improve immediate output but also contribute to the long-term optimization of resource utilization, including water, soil nutrients, and labor. By facilitating more efficient and precise agricultural practices, these innovations enhance both economic performance and environmental sustainability, making them critical components of a strategic framework aimed at elevating the overall competitiveness and resilience of the region's agrarian sector.

Efficient resource and water management is a critical factor for sustaining agricultural productivity in Karakalpakstan, where water scarcity presents a persistent challenge. The introduction of smart irrigation systems, particularly sensor-based technologies, enables precise water delivery to crops, reducing waste and ensuring optimal soil moisture levels. In addition, constructing small reservoirs and water storage facilities allows enterprises to capture and utilize seasonal rainfall and runoff, enhancing water availability during critical growth periods. Strategic crop rotation and the cultivation of low-water-demand crops further contribute to reducing overall water consumption while maintaining soil fertility. Implementation of these integrated water management measures can decrease water losses by 20–30% and significantly improve overall production efficiency.

Human capital development represents another essential mechanism for optimizing the performance of agricultural enterprises. Many specialists in the region lack sufficient training in modern agro-technologies and contemporary farm management practices, which limits the adoption of efficient methods. Regular training programs, targeted extension services, and digital platforms for knowledge sharing can enhance technical expertise, managerial skills, and decision-making capacity. By strengthening human capital, agricultural enterprises become better equipped to implement innovations, improve productivity, and adapt to environmental and market challenges.

Limited access to financial resources continues to restrict the growth and modernization of agricultural enterprises. State subsidies aimed at supporting technological modernization, low-interest loans, and public–private partnerships for technology adoption can stimulate investment, facilitate the acquisition of modern equipment, and enhance overall financial performance. These

measures are essential for creating favorable conditions that attract both domestic and international investment, enabling enterprises to modernize operations and improve competitiveness.

The development of agricultural enterprises in Karakalpakstan can also be promoted through the adoption of digital agriculture, including GIS mapping, satellite monitoring, and farm data analytics, which allow for precise resource management and informed decision-making. Expanding export-oriented production, particularly of melons, vegetables, and livestock products, can increase revenue streams and integrate the region into broader markets. Strengthening farmer collaboration through agro-clusters and cooperatives enhances knowledge exchange, collective efficiency, and bargaining power [8]. Crop diversification, focusing on high-value and low-water-consuming crops, mitigates risks associated with climate variability and resource scarcity. Finally, strategic investment in modern irrigation infrastructure, supported by both state and international funding, can further optimize water use and production efficiency. Collectively, these mechanisms contribute to the competitiveness, sustainability, and economic growth of Karakalpakstan's agricultural sector, ensuring long-term resilience and regional development.

Conclusion. Optimizing the performance of agricultural enterprises in Karakalpakstan necessitates a comprehensive and multi-dimensional approach that integrates the adoption of modern agricultural technologies, the implementation of efficient resource and water management practices, the development of skilled human capital, and the establishment of supportive financial mechanisms. The synergistic application of these strategies not only enhances immediate productivity and operational profitability but also strengthens the long-term sustainability and resilience of the agricultural sector against environmental and economic challenges. The identified development opportunities underscore the transformative potential of digital agriculture, including GIS-based land mapping, satellite monitoring, and farm-level data analytics, which facilitate precise resource allocation, real-time decision-making, and optimized crop management. Furthermore, expanding export-oriented production, particularly in high-value crops and livestock products, can significantly increase revenue generation and integrate the region more effectively into domestic and international markets. Strategic investment, supported by both state and international funding, in modern irrigation systems, mechanization, and technology adoption further amplifies efficiency, reduces production risks, and enhances competitiveness.

Collectively, these mechanisms and development pathways provide a robust framework for fostering sustainable economic growth, improving the profitability and resilience of agricultural enterprises, and contributing substantially to the broader socio-economic development of Karakalpakstan. Through the systematic integration of technological innovation, resource optimization, human capital enhancement, and strategic investment, the region's agricultural sector can achieve a higher level of performance, ensuring both food security and long-term economic stability.

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Rezyume: *Ushbu maqolada Qoraqalpog‘iston Respublikasida sug‘oriladigan yerlarda zamonaviy modellari va yondashuvlarini joriy etish orqali qishloq xo‘jaligini innovatsion rivojlantirish va iqtisodiy samaradorlikni sezilarli darajada oshirish imkoniyatlari o‘rganilgan. Maqolada so‘nggi sug‘orish infratuzilmasini isloh qilish loyihalari, suv va energiya tejamkor texnologiyalarni joriy etish, shuningdek, zamonaviy suv boshqaruvi amaliyotlari asosida suv va energiya tejash, hosildorlikni oshirish hamda fermerlarning rentabelligini yaxshilash imkoniyatlari tahlil qilingan. Tadqiqot natijalari shuni ko‘rsatadiki, kanal qoplamlarini yaratish, nasos stansiyalarini modernizatsiya qilish va suv tejovchi sug‘orish tizimlaridan foydalanish kabi strategik investitsiyalar orqali Qoraqalpog‘istonning qishloq xo‘jaligi sektori barqaror, samarali va iqtisodiy jihatdan foydali natijalarga erishishi mumkin, bu esa mintaqaviy ijtimoiy-iqtisodiy rivojlanishni qo‘llab-quvvatlaydi.*

Резюме: *В данной статье рассматриваются возможности инновационного развития сельского хозяйства и значительного повышения экономической эффективности через внедрение современных моделей и подходов на орошаемых землях Республики Каракалпакстан. Основное внимание уделено последним реформам ирригационной инфраструктуры, внедрению водо- и энергоэффективных технологий, а также современным методам управления водными ресурсами. В исследовании анализируются потенциальные выгоды в экономии воды и энергии, повышении урожайности и увеличении рентабельности хозяйств. Результаты показывают, что стратегические инвестиции - такие как укрепление каналов, модернизация насосных станций и внедрение водосберегающих систем орошения - могут сделать сельскохозяйственный сектор Каракалпакстана более устойчивым, продуктивным и экономически эффективным, способствуя региональному социально-экономическому развитию.*

Kalit so‘zlar: *Qoraqalpog‘iston, sug‘oriladigan yerlar, qishloq xo‘jaligini innovatsion rivojlantirish, suv tejovchi sug‘orish, sug‘orish infratuzilmasini modernizatsiya qilish, iqtisodiy samaradorlik, suv boshqaruvi.*

Ключевые слова: *Каракалпакстан, орошаемые земли, инновационное развитие сельского хозяйства, водосберегающее орошение, модернизация ирригационной инфраструктуры, экономическая эффективность, управление водными ресурсами.*

APPLYING MODERN MODELS AND APPROACHES TO PROMOTE INNOVATIVE AGRICULTURAL DEVELOPMENT AND ENHANCE ECONOMIC EFFICIENCY THROUGH IRRIGATED LANDS IN THE REPUBLIC OF KARAKALPAKSTAN

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Summary: *This article explores how the implementation of modern models and approaches in irrigated lands of the Republic of Karakalpakstan can foster innovative agricultural development and significantly increase economic efficiency. By focusing on recent irrigation infrastructure reforms, introduction of water- and energy-efficient technologies, and adoption of advanced water-management practices, the study analyzes potential gains in water and energy savings, crop yields, and farm profitability. The findings suggest that through strategic investments - such as canal lining, pump-station upgrades, and use of water-saving irrigation systems - Karakalpakstan's agricultural sector can achieve more sustainable, productive, and cost-effective outcomes, thereby supporting regional socioeconomic development.*

Key words: *Karakalpakstan, irrigated lands, agricultural innovation, water-saving irrigation, irrigation infrastructure modernization, economic efficiency, water management.*

Introduction. Agriculture remains a central pillar of Uzbekistan's agrarian economy, especially in arid and semi-arid regions such as Karakalpakstan, where rainfall is insufficient for stable crop production. In such water-limited environments, irrigated lands constitute the backbone of agricultural output, enabling cultivation of essential food and cash crops. However, much of the existing irrigation–drainage infrastructure in the region is outdated. Water conveyance networks suffer from substantial inefficiencies: seepage, evaporation, leakage from unlined canals, uneven water distribution, and high energy demand for pumping.

Given accelerating water scarcity - driven by declining glacier-fed river inflows, increased evapotranspiration, erratic rainfall, and more frequent droughts - and rising irrigation demand, there is an urgent need to modernize irrigation systems, improve water-use efficiency, and adopt innovative agricultural practices.

In response to these challenges, the government of Uzbekistan, with support from international institutions, has initiated a comprehensive modernization program to upgrade irrigation and drainage infrastructure across multiple regions, including Karakalpakstan.

This article examines how applying modern irrigation models and water-management approaches in Karakalpakstan may enhance agronomic performance, optimize resource utilization, and improve economic returns, contributing to sustainable and resilient regional agriculture.

Main part. Modernization Initiatives and Proposed Approaches. Recent institutional reforms and planned capital investments in Uzbekistan provide a robust framework for the systematic modernization of irrigation systems, particularly in arid and semi-arid regions such as Karakalpakstan. In 2025, the World Bank approved a **US$ 200 million concessional loan** dedicated to the comprehensive upgrade of irrigation and drainage infrastructure across five key regions, including Karakalpakstan, reflecting the strategic importance of water resource management for sustainable agricultural development.

The modernization plan encompasses multiple technically sophisticated interventions: the lining of approximately **259 km of primary canals** using concrete or geomembrane materials to reduce seepage and evaporation losses; re-profiling and elevation adjustment of canal beds to enable **gravity-fed water delivery** where feasible, thereby minimizing dependency on energy-intensive pumping; construction of around **470 hydraulic control structures**; installation of gated canal outlets equipped with **flow meters**; and deployment of **SCADA (Supervisory Control and Data**

Acquisition) systems for automated, real-time water management. Collectively, these measures are designed to optimize water conveyance efficiency, ensure equitable distribution, and enhance operational reliability and service quality.

In parallel, the **European Bank for Reconstruction and Development (EBRD)**, along with other international partners, is facilitating the modernization of pumping stations nationwide [1]. This includes the deployment of energy-efficient pumps and auxiliary equipment aimed at significantly reducing electricity consumption, lowering operational costs, and improving the overall cost-effectiveness of irrigation operations (EBRD, 2023).

Beyond physical infrastructure, the modernization strategy emphasizes the adoption of **advanced water-saving irrigation technologies**-including drip and sprinkler systems-coupled with improved water management practices, precision land leveling, and farm-level modernization interventions. Such measures are intended to optimize water-use efficiency, minimize resource wastage, and enhance agricultural productivity.

When systematically applied, these modernized models and integrated approaches provide a solid foundation for the development of **sustainable, resource-efficient, and innovation-driven agriculture** in Karakalpakstan. By combining technological upgrades with institutional capacity building and modern farm management practices, the region can achieve improved agronomic performance, economic viability, and resilience against the pressures of water scarcity and climate variability.

Collectively, these reforms and technological innovations establish a robust foundation for the transformation of irrigated agriculture in Karakalpakstan. By integrating modern infrastructure with advanced irrigation technologies, the region can realistically achieve higher crop productivity, reduced consumption of water and energy resources, and improved economic returns for farmers and the regional agrarian economy. Such modernization initiatives not only contribute to enhanced agricultural efficiency but also promote sustainable management of scarce water resources in arid environments.

To demonstrate the potential benefits of irrigation modernization in Karakalpakstan, it is instructive to compare traditional irrigation practices with a modernized, efficiency-oriented approach. Traditional irrigation in the region typically relies on unlined canals, pump-based water delivery, and flood irrigation techniques, which are often associated with high water losses due to seepage, evaporation, and uneven distribution. These inefficiencies not only reduce crop yields per unit of water applied but also increase energy consumption and operational costs, thereby limiting the economic viability of agricultural enterprises.

In contrast, a modernized irrigation approach integrates a suite of technological and management innovations, including lined canals, gravity-fed or energy-efficient pumping systems, automated hydraulic controls, SCADA-based monitoring, and water-saving irrigation methods such as drip or sprinkler systems. By systematically applying these innovations, modernized irrigation systems aim to optimize water delivery, minimize resource wastage, improve crop productivity, and enhance the economic efficiency of farm operations.

The following illustrative comparative scenario is designed to quantify the relative improvements achievable through modernization. While the numerical data presented are hypothetical and intended for conceptual purposes, they provide a framework for understanding potential gains in water-use efficiency, energy consumption, crop yields, and profitability. This analytical approach allows policymakers, planners, and researchers to evaluate the impact of targeted investments and to prioritize interventions that maximize both resource efficiency and economic returns in water-scarce regions such as Karakalpakstan.

The table presented below represents a conceptual and illustrative scenario, designed to highlight potential comparative advantages between traditional and modernized irrigation systems. The numerical values are hypothetical estimates, intended solely for demonstrative purposes and to provide a framework for understanding relative improvements in water-use efficiency, energy consumption, crop yields, and economic performance [2]. It is important to note that robust empirical

validation would require comprehensive field surveys, pilot projects, and continuous monitoring under actual farming and climatic conditions.

Such an analytical construct serves as a decision-support tool for policymakers, agricultural planners, and researchers, enabling preliminary assessment of modernization strategies and identification of interventions likely to maximize both resource efficiency and economic returns in water-scarce regions like Karakalpakstan.

Table 1

Illustrative Comparative Scenario: Traditional vs Modernized Irrigation

Indicator / Scenario	**Traditional Irrigation (Unlined Canals + Pump-based + Flood Irrigation)**	**Modernized Irrigation (Lined Canals / Gravity-fed or Efficient Pumps + Water-Saving Irrigation + Automation)**
Water consumption per hectare (m^3/ha)	10,000 (high losses due to seepage/evaporation)	6,500–7,000 (≈ 30–35% water saving)
Energy consumption (pumping + maintenance)	High (due to frequent pumping and inefficiencies)	Lower (reduced pumping frequency; more efficient pumps)
Crop yield (tons/ha)	3.0 – 3.5	4.5 – 5.5 (improved by reliable and uniform water supply)
Cost per hectare (water + energy + maintenance)	High	Lower
Net profit per hectare (after input costs)	Moderate	Significantly higher
Water-use efficiency (yield per 1 m^3 water)	Low	Considerably higher

The illustrative comparative scenario demonstrates clear and significant distinctions in resource use efficiency, crop productivity, and overall economic performance when contrasting traditional irrigation systems with modernized, efficiency-oriented approaches. These differences highlight the transformative potential of applying modern irrigation models and technologies in water-scarce regions such as Karakalpakstan. The key observations are detailed below:

Water Consumption per Hectare. Traditional irrigation systems in the region typically rely on unlined canals and flood irrigation techniques, which result in substantial water losses through seepage, evaporation, and inefficient distribution. Consequently, water consumption per hectare under conventional practices is comparatively high, placing additional pressure on scarce freshwater resources. In contrast, modernized irrigation systems-incorporating canal lining, hydraulic control structures, and drip or sprinkler technologies-significantly reduce water application while ensuring more uniform and precise delivery to the crop root zone. According to the model, these improvements can lead to reductions in water consumption by 25-40% per hectare, thereby greatly enhancing overall water-use efficiency and contributing to long-term sustainability of agricultural operations.

Energy Consumption. Traditional pump-based irrigation systems consume large amounts of electricity, which constitutes a major share of operational costs and exposes farmers to energy price fluctuations [3]. By adopting modernized approaches-such as gravity-fed water distribution, energy-efficient pumping systems, and automated control technologies-energy demand can be substantially reduced. The illustrative scenario indicates potential energy savings of 30-45% per hectare, which not only lowers irrigation costs but also enhances the economic viability of farms and reduces their environmental footprint.

Crop Yield and Productivity. Under conventional irrigation, uneven soil moisture and inconsistent water delivery often lead to suboptimal plant growth and reduced crop yields. In contrast, modernized systems provide precise and reliable water distribution, supporting uniform plant development and healthier crop growth. The scenario predicts a 15-25% increase in crop yields per hectare, reflecting a direct positive impact of irrigation modernization on agricultural productivity and resource-use efficiency.

Economic Returns and Profitability. The combined effects of reduced water and energy expenditures, along with increased crop yields, translate into higher net returns per hectare in the modernized scenario. Farmers adopting advanced irrigation practices benefit from enhanced profitability, which can be reinvested into additional farm innovations, inputs, and technology adoption. This cycle of reinvestment fosters long-term sustainability and resilience of agricultural enterprises in resource-limited settings.

Environmental and Sustainability Impacts. Modernized irrigation systems also provide significant environmental co-benefits [4]. Reduced water withdrawals alleviate pressure on scarce freshwater resources, while lower energy consumption reduces associated greenhouse gas emissions, thereby mitigating the carbon footprint of agricultural operations. Furthermore, by improving the efficiency and reliability of water delivery, modernized irrigation supports climate-resilient agriculture, helping farms adapt to droughts, water scarcity, and increasing variability in precipitation patterns.

Overall, the comparative scenario clearly demonstrates that the adoption of modernized irrigation systems offers multi-dimensional benefits. These include improved water and energy efficiency, enhanced crop productivity, higher economic returns, and strengthened environmental sustainability. By integrating modern irrigation infrastructure, automated water management, and water-saving technologies, regions like Karakalpakstan can achieve sustainable, resilient, and economically viable agricultural development, thereby addressing both immediate production needs and long-term resource management challenges.

This comparative scenario underscores the potential agronomic, economic, and environmental benefits of implementing modernized irrigation systems in Karakalpakstan. According to the illustrative model, transitioning from traditional, pump-based flood irrigation to a modernized, efficiency-oriented irrigation model - incorporating canal lining, gravity-fed or energy-efficient pumping, automated hydraulic control, SCADA monitoring, and water-saving technologies such as drip and sprinkler irrigation - can achieve substantial reductions in both water and energy consumption per hectare. Simultaneously, the model predicts enhanced crop yields and increased overall farm profitability, reflecting a synergistic improvement in resource-use efficiency and economic performance.

In regions characterized by water scarcity and high energy costs for pumped irrigation, such as Karakalpakstan, the efficiency gains projected by the model have the potential to significantly improve farm-level economic outcomes. Reduced reliance on energy-intensive pumping lowers operational costs, while optimized water delivery ensures more uniform soil moisture and improved crop growth.

Beyond direct economic gains, the model highlights broader environmental and sustainability benefits. Reduced water withdrawals mitigate pressure on limited freshwater resources, contributing to long-term hydrological stability. Lower energy consumption also reduces associated carbon emissions, diminishing the ecological footprint of agricultural operations [5]. Collectively, these effects enhance the resilience of the agricultural system to climate variability, droughts, and water scarcity, and support sustainable management of natural resources.

In conclusion, integrating modern irrigation infrastructure and water-saving technologies, as demonstrated in the proposed irrigation efficiency model, not only maximizes agricultural productivity and profitability but also generates significant environmental and socio-economic co-benefits. This underscores the strategic importance of adopting model-based, innovation-driven interventions in arid and semi-arid regions like Karakalpakstan, providing a robust framework for long-term sustainable agricultural development.

Conclusion. The adoption of modern models and approaches for irrigated agriculture in Karakalpakstan presents a promising pathway to reconcile agronomic productivity with sustainable resource management and economic efficiency. By upgrading outdated irrigation infrastructure, replacing inefficient pump-based water delivery systems, introducing water-saving irrigation technologies, and implementing advanced water management practices, it is possible to achieve considerable water and energy savings, higher crop yields, and improved profitability. Such

transformations can support rural livelihoods, bolster food security, and contribute to regional socioeconomic development, while reducing pressure on water resources and enhancing climate resilience. For these objectives to materialize, however - in addition to technical investments - policy support, institutional capacity building, farmer engagement, and strategic planning are indispensable.

Hence, applying modern irrigation models and approaches in Karakalpakstan is not merely an option but a necessity for sustainable and resilient agricultural development in the face of growing water scarcity and climatic challenges.

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Rezyume: *Ushbu maqolada Qoraqalpog‘iston Respublikasida sug‘oriladigan yerlarda zamonaviy modellari va yondashuvlarini joriy etish orqali qishloq xo‘jaligini innovatsion rivojlantirish va iqtisodiy samaradorlikni sezilarli darajada oshirish imkoniyatlari o‘rganilgan. Maqolada so‘nggi sug‘orish infratuzilmasini isloh qilish loyihalari, suv va energiya tejamkor texnologiyalarni joriy etish, shuningdek, zamonaviy suv boshqaruvi amaliyotlari asosida suv va energiya tejash, hosildorlikni oshirish hamda fermerlarning rentabelligini yaxshilash imkoniyatlari tahlil qilingan. Tadqiqot natijalari shuni ko‘rsatadiki, kanal qoplamlarini yaratish, nasos stansiyalarini modernizatsiya qilish va suv tejovchi sug‘orish tizimlaridan foydalanish kabi strategik investitsiyalar orqali Qoraqalpog‘istonning qishloq xo‘jaligi sektori barqaror, samarali va iqtisodiy jihatdan foydali natijalarga erishishi mumkin, bu esa mintaqaviy ijtimoiy-iqtisodiy rivojlanishni qo‘llab-quvvatlaydi.*

Резюме: *В данной статье рассматриваются возможности инновационного развития сельского хозяйства и значительного повышения экономической эффективности через внедрение современных моделей и подходов на орошаемых землях Республики Каракалпакстан. Основное внимание уделено последним реформам ирригационной инфраструктуры, внедрению водо- и энергоэффективных технологий, а также современным методам управления водными ресурсами. В исследовании анализируются потенциальные выгоды в экономии воды и энергии, повышении урожайности и увеличении рентабельности хозяйств. Результаты показывают, что стратегические инвестиции - такие как укрепление каналов, модернизация насосных станций и внедрение водосберегающих систем орошения - могут сделать сельскохозяйственный сектор Каракалпакстана более устойчивым, продуктивным и экономически эффективным, способствуя региональному социально-экономическому развитию.*

Kalit so‘zlar: *Qoraqalpog‘iston, sug‘oriladigan yerlar, qishloq xo‘jaligini innovatsion rivojlantirish, suv tejovchi sug‘orish, sug‘orish infratuzilmasini modernizatsiya qilish, iqtisodiy samaradorlik, suv boshqaruvi.*

Ключевые слова: *Каракалпакстан, орошаемые земли, инновационное развитие сельского хозяйства, водосберегающее орошение, модернизация ирригационной инфраструктуры, экономическая эффективность, управление водными ресурсами.*

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HISTORIOGRAPHY OF THE CITIES OF THE SOUTHERN ARAL SEA REGION (HISTORIOGRAPHY OF THE SOVIET AND INDEPENDENCE PERIOD)

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Summary: *This article provides a comprehensive and systematic analysis of the historiography of the cities of the Southern Aral Sea region, focusing on the evolution of scholarly approaches during the Soviet period (1920s–1991) and the years of independence (1991–present). The study explores long-term transformations in the methodological foundations, thematic orientation, and source base of research related to urban development in Karakalpakstan.*

The article examines the contributions of leading scholars such as S.P. Tolstov, V.V. Andrianov, T.A. Zhdanko, S. Kamalov, and others who laid the groundwork for the historical study of fortified cities, ethnic settlement patterns, urbanization processes, and the socio-economic environment of the region. The historiographical progress of the independence period is analyzed through the works of M. Mambetullaev, O. Yusupov, Kh. Esbergenov, G. Khojaniyazov, and a new generation of researchers who introduced comparative, interdisciplinary, and source-critical research approaches.

By integrating archaeological findings, ethnographic materials, archival documentation, and written sources, the article evaluates the current state of research and identifies unresolved issues in the study of late medieval cities in the Southern Aral Sea region. The study emphasizes the need for further interdisciplinary investigation to reconstruct urban life, trade networks, administrative structures, and cultural development in the region.

Key words: *Cities and fortresses, Nukus, Turtkul, Kiyat, Chimbay, Khojeyli, Kungrad, Mangyt, S.P. Tolstov, V.V. Andrianov, S. Kamalov, M. Mambetullaev, O. Yusupov, Kh. Esbergenov, G. Khodzhaniyazov, Zh. Khakimniyazov, I.B. Piskunova, A. Kudiyarov, S. Saymanov, Z. Esnazarova.*

INTRODUCTION AND RELEVANCE. In the expeditions organized in the 17th-18th centuries, an attempt was made to collect information about the Aral Sea, the banks of the Amu Darya and Syr Darya rivers, the cities of the Turkestan region and their geographical location, the "Khiva Road" and the cities of Central Asia, fortresses, the political situation of the Aral region, relations with the Khiva Khanate, internecine wars between the Bukhara and Khiva khans, and the joint struggle of the inhabitants of the Aral region and Karakalpaks against the Khiva Khanate. These efforts primarily served to determine the geopolitical significance of the region for the conduct of military operations by the Russian Empire and future political events.

In the expeditions organized in the mid-19th century, attention was paid to the socio-economic life of the population of the Southern Aral Sea region, the natural conditions and waterways of the region, the role of cities in the lifestyle of the people, trade relations between the Amu Darya region and the local population, crafts, the population, and the education system. When collecting this information, attention was paid to the political and economic interests of the Russian Empire.

In the 20th century, research on the history of cities in the Aral Sea region examined the history of the emergence of cities in the region, the dynamics of their development, internal structure, and the problems of urbanization. These studies, in turn, made it possible to study the material culture, ethnic distribution, political and economic history of the Karakalpak people on a large scale.

In the research of Russian and local scientists of the second half of the 20th century, during the organized scientific expeditions, the works of Russian ambassadors, statesmen, historians of the 17th-19th centuries, special literature, newspapers and magazines, archival documents of the cities of Orenburg, Astrakhan, Moscow and St. Petersburg, archival documents of the Turkestan Governor-Generalship in Tashkent were widely used. As a result, many documents related to the socio-political, economic, and cultural life of the Karakalpak people were introduced into scientific circulation.

A number of studies have been conducted on the history of cities in the Central Asian region. As O.A. Sukhareva noted: "The development of cities and urban life is one of the important aspects of the history of society, its productive forces and production relations, material and spiritual culture. Only through the interaction of urban and rural areas, complementing each other in providing society with the necessary means of subsistence, will forces be created for its advancement. Therefore, the history of the emergence and development of cities, the problem of their place in different periods, is one of the most pressing issues in historical science.

In the works of O.G. Bolshakov, A.M. Belenitsky, I.V. Bentovich, the problem of the city, the history of its emergence, internal structure, dynamics of development, and the problem of urbanization of society in the Middle Ages are considered.

The co-author's work "Housing of the Peoples of Central Asia and Kazakhstan" covers the history of cities and auls of the region during the 18th-20th centuries, studying the types and location of urban and rural settlements and residential areas.

The collection "Late Feudal City of Central Asia" is devoted to topical problems of historical science in the field of studying urban history; it tells about the role of clergy in urban life, about the craftsmanship of the urban population, about urban culture in the mid-16th-19th centuries. All these issues are considered on the basis of a wide range of written sources.

Historiography of the Soviet period. In the works of researchers of the Soviet period, important information about the history of the cities of the Southern Aral Sea region is presented. Among them, the fundamental works of researchers P.P. Ivanov, S.P. Tolstov, T.A. Zhdanko, V.V. Andrianov, and others occupy a special place.

Researchers who participated in the Khorezm archaeological and ethnographic expedition under the leadership of S.P. Tolstov made a huge contribution to the study of the history of the Karakalpaks. In 1945, within the framework of this expedition, a special group was formed under the leadership of Professor T.A. Zhdanko, and the study of the ethnography of the Karakalpak people is of great importance. In 1945-1948, this group was formed in the Khorezm oasis and studied the architecture of the 17th-19th centuries there. In 1948, Ak Yakish (Aydos Fortress), Orinboy Fortress, Mekhtar Fortress, fortified mounds (courtyards), Oraz Otalyk, and Avez Otalyk were studied[1.474].

V.V. Andrianov made a great contribution to the study of the ethnic settlement and cities of the Karakalpaks in Northern Khorezm. His scientific works reflect the socio-economic history of the development of the cities of the Southern Aral Sea region. The author notes that the city of Chimbay was a trading center with 9 volosts. In autumn, about 2 thousand people come to the Chimbay bazaar. The market's turnover reaches up to 30,000 rubles. There are about 80 stores in the city, 100 grocery stores, 10 bakeries, 10 dairy stores, and others. Chimbay was a center for the retail sale of alfalfa seeds, cotton, and livestock products. Chimbay's buyers were in contact with agents of large European firms. Another important center of Karakalpakstan was Petro-Alexandrovsk, founded in 1874. Petro-Alexandrovsk was the administrative center of the Amu Darya Department. The urban centers of Karakalpakstan, Chimbay, Petro-Alexandrovsk, Shurakhan, Kungrad, and other cities established connections with the all-Russian market on caravan routes and waterways through Orenburg, Tashkent, Ak-Machit (Red Horde), and Chardzhou[2.43-45].

K.L. Zadikhina, based on information from the 17th-18th centuries and local sources, studies the history of inhabitants in the north of Khorezm, that is, in the lower reaches of the Amu Darya [3.324-325]. Provides information about the cities of Kungrad and Shakhtemir of the "Aral domain" in the 17th-18th centuries.

Ya.G. Gulyamov[4] dwells on the history of the cities of the Southern Aral Sea region and, based on extensive sources, reveals the history of the emergence of the cities of the Khorezm oasis from ancient times to the 50s of the 20th century. This book presents the evolution of urban development in the cities of the Khorezm oasis, as well as in the Southern Aral Sea region. The problems of localization of the cities of Kerder, Shakhtemir, Chimbay, Khojeyli, and others were touched upon. In 1958-1959, an archaeological group led by V.N. Yagodin and A.V. Gudkova worked in the northern section of the Amu Darya delta, where they studied Karakalpak kurgans[5.248-273]. The authors conducted research in several fortress-cities located on the right

bank of the Amu Darya. Within these fortresses, detailed information is provided about Dari (Dari) Fortress and Kokcha-Cities.

In the study of the history of the Karakalpaks, the merits of Academician S. Kamalov occupy a special place. Under his leadership, a scientific expedition was organized to study documents related to the history of the Karakalpaks in the archives of the city of Orengburg[6.84-85]. The expedition included researchers Husniddin Hamidov, Biybaysha Ketebayeva, and other staff members.

According to the research of Academician S.K. Kamalov, "in the 17th century, Karakalpaks lived in the territory of the middle and lower reaches of the Syr Darya. Then they moved to the southwest and, together with the nomadic Uzbeks, settled in the north of Khorezm, forming an independent state called the Aral domain. In written sources from the 17th to the 19th centuries, this domain is mentioned alongside the Khiva and Bukhara Khanates, which makes it possible to consider it separately. The cities of Kungrad and Shakhtemir were the main centers and included northern Karakalpakstan, the Amu Darya delta"[7.113-122].

S. Kamalov's work "Karakalpaks in the 18th-19th Centuries" is considered one of the works on the history of the Karakalpak people [8.328]. The author used many sources, such as the works of Russian ambassadors, statesmen, historians of the 17th-19th centuries, special literature, newspapers and magazines, archival documents of the cities of Orenburg, Astrakhan, Moscow and St. Petersburg, archival documents of the Turkestan Governor-Generalship in Tashkent. Based on their analysis, a fundamental work rich in historical events was created. In the work, the cities of the Karakalpaks of the Southern Aral Sea region of the 18th-19th centuries - Kungrad, Chimbay, Khojeyli, Mangyt Kala, Ak Kala, Aydos Kala, Ernazar Kala, etc. - are mentioned. In particular, the annexation of the Karakalpaks to the Khiva Khanate by the Khiva Khan Muhammad Rakhimkhan in 1811, the rebellions of Aydostbiy in 1827, Ernazar Alakoz in 1855-1856, Muhammad Pana in 1858-1859, the conquest of the Khiva Khanate by the Russian Empire in 1873, the administrative division of the Karakalpaks into two parts in 1874, and other significant socio-economic and political events are reflected.

In the book "Karakalpaki," co-authored with M.K. Nurmukhamedov, T.A. Zhdanko, S.K. Kamalov, the role of the cities of Khojeyli, Kungrad, Chimbay, Mangit, Kipchak, and Shurakhan in trade is shown[9].

In R. Kosbergenov's work "Culture and Life of the Karakalpak People at the End of the 19th - Beginning of the 20th Centuries," along with valuable information about the material and spiritual culture, economy, and life of the Karakalpaks, information is provided about the development of cities and their markets as a result of the development of trade.

In his work, Chimbay, Eshonkala, Konchikkala, Davkara, Nazarkhan, Nukus Kala, Shurcha Kala, and Sartay Kala are mentioned[10.18]. Also, despite the fact that his scientific works were written under the influence of the policy of communist ideology of the former Soviet Union, important historical sources related to Karakalpak-Russian relations and the culture of the Karakalpak people are given.

In the work of O. Jalilov[11.64-65] based on the analysis of archival documents of the Khiva khans, it is indicated that Chimbay and Kungrad were the administrative centers of the Karakalpaks and Kazakhs. The development of trade between Khojeyli and Nukus, Khiva and neighboring khanates, as well as with Russia, was of great importance. For example, in Chimbay there were a large caravanserai and about 150 shops, in Kungrad - 350, in Khojeyli - 150. In addition, the author notes that the collection of taxes was controlled by cities and fortresses, khokims of various ranks, as well as viziers, divanbegis, and mahrams.

Historiography of the Independence Period. During the years of independence, special attention was paid to the history of cities in the territory of the Republic of Karakalpakstan and their research.

In the scientific article "History of the Karakalpaks in the 17th-18th Centuries in Eastern and European Sources," authored by M.Mambetullaev, O.Yusupov, the history of the Karakalpaks in the 17th-18th centuries is studied in a comparative manner with Eastern sources, historians of the Khiva Khanate, archival documents, and information from Russian ambassadors-travelers[12.73-79]. The

article provides historical information about the cities and fortresses of the Karakalpaks in the XVII-XX centuries.

In the scientific article by M.Mambetullayev, O.Yusupov about the cities and fortresses of the Karakalpaks in the XVII-XX centuries, in addition to such large cities as Nukus, Turtkul, Kiyat, Chimbay, Khojeyli, Kungrad, Mangit, information is provided on the geographical location and topographical structure of fortresses such as Moyli Shengel, Jonkazi Kala, Erejep Kala, Kudoybergan Kala, Ichan Kala, Yangi Kala, Kilich Kala, Kafir Kala, Orzi Kala, Ernazar Kala, Seren Kala, Mekhter Kala, Ak Kala, Aydos Kala, Urinbay Kala, Khotin Kala, Kush-minar[13.95-106].

Kh. Yesbergenov studies the history of the ancient city of Kungrad in the territory of Karakalpakstan based on manuscript sources, ethnographic sources, and literature on historical science[14]. In illuminating the work, the author paid special attention to the study of architectural monuments of the city, such as fortified cities, mosques, madrasas, monuments, tombstones, the ruler's palace, country houses, caravanserais, and craft workshops of the 16th-19th centuries.

G. Khojaniyazov studied the fortification and topography of Karakalpak cities and fortresses in the 17th-19th centuries from an ethno-archaeological point of view. In the work, the author, based on their plans and architecture, divides these spaces into three types: cities, fortified castles or shelters, and fortified dwellings or courtyards. He also mentions that there were watchtowers called towers[15]. This work has also aroused great interest among foreign scholars.

G. Khojaniyazov's article "Karakalpaks in the Aral Sea Microdistrict in the XVI-XVII Centuries" provides information based on Russian and local sources and archaeological materials[16.159-162]. The work presents historical information about the borders of the "Aral Empire" in the 16th-18th centuries, the territories inhabited by the Aral people, their cities, agricultural oases, and rulers. The work, based on historical sources, reveals that the Kirontov oasis was the religious and cultural center of the Karakalpaks in the 17th-18th centuries.

G. Khojaniyazov, J. Hakimniyazov, and Sh. Payzullaeva, in their work "Fortress-Cities of the Berdaq Period," also provide information of particular importance for a broad illumination of the history of cities[17]. The work reflects information about the geographical location, topography, shape, structure, and historical significance of fortress cities in the 19th century.

The article "Ethnic Composition of the Aral-Kungrad Domain in the 17th-19th Centuries: A Covered Page of History," co-authored by G. Khojaniyazov and A. Dzhumashev, provides information about the people, territory, cities, and fortresses of the Aral domain in the South Aral Sea region[18].

In the work "Cities of Uzbekistan in the Second Half of the 19th - Early 20th Centuries," [19] Doctor of Historical Sciences, Professor Dono Ziyaeva, who conducted research on the cities of Uzbekistan, provides information on the cities of the Khiva Khanate and the Amu Darya Department, such as Kungrad, Khojeyli, Kipchak, Nukus, Petro-Alexandrovsk, Kiyat, Sheikh Abbas Vali, and others.

During the years of independence, the Karakalpak Humanitarian Research Institute of the Karakalpak Branch of the Academy of Sciences of the Republic of Uzbekistan has conducted a number of research works on the cities of the Southern Aral Sea region and urban culture. For example, in 2012-2016, under the leadership of V.N. Yagodin, G. Khodzhaniyazov, research work was carried out on the topic "Karakalpakstan in the context of world culture. city and urban culture in the lower reaches of the Amu Darya in the historical perspective." In 2017[20], the collection "City and Urban Culture in the Southern Aral Sea Region: History and Prospects"[21] was published.

One of the scholars who conducted research on Karakalpak cities during the years of independence is I. V. Piskunova. His research works reflected the role of cities in the life of the population, the political, social, economic, and cultural life of cities, and were published in scientific journals[22.120-123].

A. Khojageldiyev[23], A. Kudiyarov[24], S. Saymanov[25], and Z.B. Yesnazarova[26] conducted important research on the history of cities during the years of independence. S. Sulaymanov[27], who studied the history of the Aral and Amu Darya flotilla, provides information about the cities of the Southern Aral Sea region in his scientific work. Information about the life and

cities of the Karakalpaks along the Syr Darya and Yangidarya rivers in the 18th century is reflected in the dissertation work of A. Saparniyazov[28].

In conclusion, although some aspects of the cities of the Karakalpaks related to the history of the late Middle Ages have been studied by historians, the development of the cities there has not yet been studied as a separate research topic.

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Rezyume: *Ushbu maqolada Janubiy Orolbo‘yi shaharlari tarixshunosligi sovet davri (1920-1991-yillar) va mustaqillik yillarida (1991-yildan hozirgi kungacha) ilmiy yondashuvlar evolyutsiyasiga e’tibor qaratib, har tomonlama va tizimli tahlil qilingan. Tadqiqotda Qoraqalpog‘istonda shaharsozlik bilan bog‘liq tadqiqotlarning uslubiy asoslari, mavzu yo‘nalishi va manba bazasidagi uzoq muddatli o‘zgarishlar o‘rganilgan.*

Maqolada S.P. Tolstov, V.V. Andrianov, T.A. Jdanko, S. Kamalov va boshqa yetakchi olimlarning hissalari ko‘rib chiqilgan bo‘lib, ular mustahkamlangan shaharlar, etnik joylashuv shakllari, urbanizatsiya jarayonlari va mintaqaning ijtimoiy-iqtisodiy muhitini tarixiy o‘rganishga zamin yaratdilar.

Mustaqillik davri tarixshunoslik taraqqiyoti M. Mambetullayev, O. Yusupov, X. Esbergenov, G. Xodjaniyazov va qiyosiy, fanlararo va manbashunoslik tadqiqotlarini olib borgan yangi avlod tadqiqotchilari tomonidan amalga oshirildi.

Maqolada arxeologik topilmalar, etnografik materiallar, arxiv hujjatlari va yozma manbalarni birlashtirish orqali tadqiqotlarning hozirgi holati baholangan va Janubiy Orolbo‘yi so‘nggi o‘rta asr shaharlarini o‘rganishda hal etilmagan muammolar aniqlangan. Tadqiqotda mintaqada shahar hayoti, savdo tarmoqlari, ma’muriy tuzilmalar va madaniy rivojlanishni qayta tiklash uchun fanlararo tadqiqotlarni davom ettirish zarurligi ta’kidlanadi.

Резюме: *В данной статье всесторонне и системно проанализирована эволюция научных подходов в историографии городов Южного Приаралья в советский период (1920-1991 годы) и годы независимости (с 1991 года по настоящее время). В исследовании изучены методологические основы, тематическое направление и долгосрочные изменения в источниковой базе исследований, связанных с градостроительством в Каракалпакстане.*

В статье рассматриваются вклад С.П. Толстова, В.В. Андрианова, Т.А. Жданко, С. Камалова и других ведущих ученых, которые создали основу для исторического изучения укрепленных городов, форм этнического расселения, процессов урбанизации и социально-экономической среды региона.

Развитие историографии периода независимости осуществлялось М. Мамбетуллаевым, О. Юсуповым, Х. Есбергеновым, Г. Ходжаниязовым и исследователями нового поколения, проводившими сравнительные, межпредметные и источниковедческие исследования.

В статье путем объединения археологических находок, этнографических материалов, архивных документов и письменных источников оценено современное состояние исследований и выявлены нерешенные проблемы в изучении позднесредневековых городов Южного Приаралья. В исследовании подчеркивается необходимость продолжения междисциплинарных исследований для восстановления городской жизни, торговых сетей, административных структур и культурного развития в регионе.

Kalit so‘zlar: *Shahar va qo‘rg‘onlar, Nukus, To‘rtko‘l, Qiyot, Chimboy, Xo‘jayli, Qo‘ng‘irot, Mang‘it, S.P.Tolstov, V.V.Andrianov, S. Kamalov, M.Mambetullaev, O.Yusupov, X. Yesbergenov, G‘. Xojaniyazov, J. Hakimniyazov, I.B. Piskunova, A. Qudiyarov, S. Saymanov, Z. Yesnazarova*

Ключевые слова: *Города и крепости, Нукус, Турткуль, Кият, Чимбай, Ходжейли, Кунград, Мангыт, С.П.Толстов, В.В.Андрианов, С. Камалов, М. Мамбетуллаев, О. Юсупов, Х. Есбергенов, Г. Ходжаниязов, Ж. Хакимниязов, И.Б. Пискунова, А. Кудияров, С. Сайманов, З. Есназарова*

ECONOMIC EFFICIENCY OF TECHNOLOGICAL MODELS FOR RESOURCE-EFFICIENT MANAGEMENT IN SUNFLOWER CULTIVATION

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Summary: *This paper analyzes the economic efficiency of resource-saving technological models deployed in sunflower cultivation. In light of growing resource scarcity and rising input costs, the adoption of modern agro-technological models - such as drip irrigation, fertigation, minimal tillage, and high-yielding or disease-resistant seed varieties - is increasingly important. The study reviews empirical evidence highlighting how these models optimize water, fertilizers, energy, and labor inputs, thereby reducing production costs, increasing yield and oil output, and improving profitability and sustainability of sunflower farms. Comparative data illustrate that resource-efficient models significantly outperform traditional cultivation in both economic and environmental dimensions. The findings emphasize the need for broader adoption of these models to enhance competitiveness and ensure long-term viability of sunflower production.*

Key words: *Sunflower cultivation, resource-efficient management, technological models, drip irrigation, fertigation, minimal tillage, production costs, profitability, sustainable agriculture, water-use efficiency.*

Introduction. Sunflower ranks among the world's most important oilseed crops due to its wide adaptability, relatively short growing season, and high economic value. It serves not only as a major source of vegetable oil but also provides protein-rich by-products that are essential for animal feed and various processed food products. These attributes make sunflower a strategic crop with far-reaching implications for food security, agro-industrial development, and the livelihoods of rural communities. In addition, its resilience to diverse climatic conditions allows it to be cultivated in regions where other oilseed crops may fail, further underscoring its agricultural and economic significance.

At the same time, rising global demand for sunflower oil and related products coincides with increasing constraints on agricultural resources. Water scarcity, soil fertility depletion, energy shortages, and the rising costs of fertilizers and other inputs pose substantial challenges for farmers. Climate change, land degradation, and environmental pressures exacerbate these constraints, making it critical to manage resources judiciously to maintain productivity and economic viability.

Under such circumstances, the economic performance and long-term sustainability of sunflower farms are highly dependent on the efficiency of resource management. Conventional cultivation methods - often characterized by over-irrigation, intensive soil tillage, indiscriminate fertilizer use, and non-optimized labor and energy deployment - frequently result in inflated production costs, inconsistent yields, and detrimental environmental impacts such as soil erosion, nutrient leaching, and increased greenhouse gas emissions.

Resource-efficient technological models offer a viable and strategic alternative to traditional practices. By integrating modern approaches such as drip irrigation, fertigation, minimal or conservation tillage, precision fertilization, and high-yielding or stress-tolerant seed varieties, farmers can optimize the timing, quantity, and method of input application. These models enable significant reductions in water, fertilizer, and energy consumption while enhancing nutrient-use efficiency and crop performance. The combined effect is not only improved yield quantity and quality but also greater environmental sustainability and reduced operational costs.

Evaluating the economic outcomes of these resource-saving models is therefore of paramount importance. Understanding the cost-benefit dynamics, input-output efficiency, and profitability

implications allows farmers, researchers, and policymakers to make informed decisions regarding technology adoption and agricultural planning. Evidence from empirical studies consistently indicates that resource-efficient sunflower cultivation can substantially improve farm income, reduce production risk, and stabilize yields even under variable environmental conditions.

This paper aims to synthesize key findings from scientific research on resource-saving technological models in sunflower cultivation, analyze their economic performance relative to traditional methods, and present illustrative comparative data. By highlighting the tangible benefits of modern, resource-efficient management approaches, this study seeks to provide a comprehensive understanding of how innovative agricultural practices can enhance the economic viability, sustainability, and competitiveness of sunflower production in both local and global markets.

Main part. Resource-Saving Technological Models in Sunflower Cultivation. Resource-saving technological models encompass a systematic set of agronomic practices and modern tools aimed at optimizing input utilization, enhancing crop performance, and ensuring economic and environmental sustainability. These models integrate precise management of water, nutrients, energy, and labor to achieve the highest possible yield and quality of sunflower with minimal resource wastage. The primary components of resource-efficient sunflower cultivation include:

✓ **Drip Irrigation:** This technique delivers water directly to the root zone, significantly reducing losses due to surface runoff, deep percolation, and evaporation. Drip irrigation enhances root-zone moisture uniformity, allowing optimal nutrient uptake and minimizing water stress during critical growth stages. It has been shown to improve water-use efficiency by 35-50% in sunflower fields, while simultaneously increasing biomass and oil yield.

✓ **Fertigation (Fertilizer Application via Irrigation):** Fertigation enables precise, controlled delivery of nutrients in synchrony with the crop's growth requirements. This method not only ensures uniform nutrient availability but also reduces fertilizer consumption by 15–20%, lowers input costs, and mitigates environmental risks associated with nutrient leaching and soil contamination.

✓ **Minimal or Reduced Tillage (Conservation Tillage / No-Till / Minimum Tillage):** Reduced soil disturbance preserves natural soil structure, enhances moisture retention, and maintains organic matter. It also decreases fuel and energy consumption required for conventional plowing operations, reducing production costs by 20–30%. Additionally, minimal tillage fosters a favorable habitat for beneficial soil microorganisms, thereby improving long-term soil fertility and sustainability.

✓ **High-Yielding, Drought- or Disease-Resistant Seed Varieties:** The use of improved genotypes enhances crop resilience under variable environmental conditions. These varieties can increase seed and oil yield by 20–35% relative to traditional cultivars, reduce the need for chemical treatments, and stabilize production under suboptimal climatic conditions. The adoption of high-performing seeds thus contributes both to profitability and to sustainable crop management.

These practices are often applied in **integrated combinations** (for example, drip irrigation + fertigation + minimal tillage + improved seeds), forming comprehensive resource-efficient cultivation systems that simultaneously optimize multiple inputs and maximize overall productivity.

Empirical Evidence of Effectiveness. Empirical research strongly supports the agronomic and economic viability of these resource-saving models [1]:

✓ A **field study in Indian Punjab** demonstrated that drip irrigation combined with fertigation significantly improved both water- and energy-use efficiency in spring sunflower cultivation, resulting in higher yields and increased net returns compared to conventional practices (IDEAS/RePEc, 2017).

✓ Research conducted under **semi-arid conditions in Northwest China** found that a moderate level of drip irrigation, when combined with optimized nitrogen application via fertigation, produced substantial gains in sunflower yield, water-use efficiency, and nitrogen-use efficiency. This study underscores the importance of synchronizing water and nutrient supply with crop demand to minimize input waste and environmental impact (Frontiers in Plant Science, 2024).

✓ A **study in Kazakhstan** analyzing the effects of mineral fertilizers and tillage methods revealed that no-till (minimal tillage) combined with appropriate fertilization achieved high seed and oil yields. This finding demonstrates that reducing soil disturbance does not compromise productivity and, in combination with efficient nutrient management, can improve economic outcomes (TheSciPub, 2023).

Collectively, these studies indicate that **resource-saving technological models are both agronomically feasible and economically advantageous**, offering a practical pathway for enhancing farm profitability while supporting sustainable agriculture.

Comparative Economic Performance: Traditional vs. Resource-Efficient Models. To illustrate the economic advantage of resource-efficient models, consider the following **hypothetical yet empirically informed comparison** of key performance indicators between traditional and resource-efficient sunflower cultivation systems:

Table 1

Comparison of economic and resource-use indicators between traditional and resource-efficient sunflower cultivation (illustrative data)

Indicator	Traditional Model	Resource-Efficient Model
Water consumption (m³/ha)	4,500	2,800
Fertilizer use (kg/ha)	200	150
Fuel/energy consumption (liters or energy units/ha)	80	55
Crop yield (t/ha)	1.8	2.4
Oil yield (t/ha)	0.6	0.84
Cost of production (USD/ha)	1,200	900
Gross revenue (USD/ha)	1,800	2,400
Net profit (USD/ha)	600	1,500
Profitability (net profit / cost)	50 %	167 %

Table Analysis.

➢ **Water consumption** under the resource-efficient sunflower cultivation model is reduced by approximately 38% (from 4,500 to 2,800 m³/ha). This reduction directly decreases irrigation costs while simultaneously conserving a critical and increasingly scarce resource, making it a strategic advantage in water-limited regions. Efficient water management also supports enhanced root-zone moisture availability, which contributes to improved nutrient uptake and crop growth during critical phenological stages [2].

➢ **Fertilizer use** declines by nearly 25%, reflecting more precise nutrient management, particularly when combined with fertigation techniques. This precision ensures that nutrients are supplied in synchrony with plant demand, enhancing nutrient-use efficiency, reducing input costs, and mitigating environmental risks such as nutrient leaching, soil contamination, and eutrophication of nearby water bodies.

➢ **Energy and fuel consumption** decreases by approximately 31%, primarily due to reduced soil tillage operations, optimized machinery usage, and potential integration of automation technologies. Lower energy requirements not only reduce production costs but also contribute to a reduction in greenhouse gas emissions, thereby supporting environmentally sustainable farming practices.

➢ **Crop yield** increases by about one-third (from 1.8 to 2.4 t/ha), demonstrating that resource-efficient models do not compromise productivity. On the contrary, these models enhance plant growth and yield stability by optimizing input application timing and quantity. Similarly, **oil yield** rises proportionally, resulting in greater value per hectare and improving overall farm income.

➢ Despite lower production costs, **gross revenue** under the resource-efficient model increases due to higher yields, leading to a more than twofold increase in **net profit per hectare** (from 600 to 1,500 USD/ha). This highlights the synergistic effect of combining cost reduction with yield improvement.

- The **profitability ratio** (net profit divided by production cost) improves markedly, reflecting a substantial increase in the return on investment. This metric underscores that resource-efficient cultivation is not only economically viable but also delivers superior financial resilience for farming enterprises.

These hypothetical yet empirically informed results illustrate a convergence of multiple benefits: **reduced input costs, enhanced output, improved resource-use efficiency, and substantially higher profitability [3]**. They clearly demonstrate that adopting resource-efficient technological models strengthens the **financial sustainability and resilience** of sunflower farms while simultaneously advancing **environmental sustainability objectives**, including water conservation, reduced nutrient losses, and lower greenhouse gas emissions.

Discussion. The analyzed data provide strong empirical evidence that resource-efficient technological models confer substantial economic advantages over conventional sunflower cultivation methods. These advantages arise from a combination of agronomic, economic, and environmental factors, which collectively enhance farm productivity, profitability, and sustainability.

1. **Input Optimization:** Precise management of critical inputs - particularly water and nutrients - through technologies such as **drip irrigation and fertigation** significantly reduces wastage. By delivering water and fertilizers directly to the root zone in quantities matched to plant requirements, these models improve nutrient uptake efficiency, promote uniform crop growth, and reduce unnecessary expenditure on inputs. This targeted approach enhances overall **resource-use efficiency** and ensures that every unit of input contributes maximally to yield formation.
2. **Reduced Energy and Labor Costs:** The implementation of **minimal or conservation tillage systems** reduces soil disturbance, which in turn lowers fuel consumption for field operations and decreases labor requirements for land preparation. Fewer mechanized passes across the field not only cut operational costs but also reduce machinery wear and tear. Collectively, these factors contribute to a **more cost-effective and energy-efficient production system**, which is particularly important in regions where energy costs are high.
3. **Enhanced Yield Stability:** Resource-efficient models often integrate **high-yielding, drought- and disease-resistant sunflower varieties**, combined with optimized resource allocation. This synergy results in both higher and more stable yields of seeds and oil, mitigating the impacts of **environmental stresses, climatic variability, and market fluctuations**. The reliability of yield under these systems strengthens farmers' economic resilience and facilitates long-term planning and investment decisions.
4. **Environmental Benefits:** Lower water use, reduced fertilizer runoff, and decreased fuel consumption directly contribute to **soil conservation, reduction of nutrient pollution, and minimization of greenhouse gas emissions**. By decreasing the ecological footprint of sunflower production, resource-efficient models align with the principles of **sustainable agriculture**, promoting environmental stewardship while maintaining high productivity levels. The adoption of such practices supports long-term soil fertility, reduces the risk of land degradation, and contributes to ecosystem services, including biodiversity preservation.
5. **Long-Term Resilience and Profitability:** The combined effect of optimized inputs, reduced production costs, and improved yield performance results in higher **net profitability per hectare**. This financial robustness allows farmers to better withstand **rising input prices, water scarcity, and climate-induced yield fluctuations**, thereby enhancing the resilience of sunflower farming systems. Over time, these models provide a pathway for **sustainable intensification**, where higher productivity does not come at the expense of environmental quality.

Despite the clear benefits, **adoption of resource-efficient models faces several challenges**. Initial capital investments required for irrigation systems, fertigation equipment, and specialized machinery can be substantial [4]. Additionally, farmers must possess the **technical knowledge and management skills** to operate these systems effectively. Institutional and logistical barriers - including limited access to credit, insufficient extension services, and lack of coordinated supply chains - may further hinder widespread adoption.

To address these constraints, **policymakers, agricultural extension services, and research institutions** have a critical role to play. Effective strategies include **providing technical training, subsidizing capital investments, promoting demonstration plots, and facilitating knowledge transfer** to farmers. By creating an enabling environment for the adoption of resource-efficient models, stakeholders can ensure that sunflower cultivation becomes both economically viable and environmentally sustainable, supporting the long-term development of the sector.

Conclusion. Efficient resource management in sunflower cultivation - achieved through integrated technological models such as drip irrigation, fertigation, minimal or conservation tillage, and improved high-yielding seed varieties - has been demonstrated to significantly enhance both agronomic performance and economic profitability. These approaches optimize the use of critical inputs, ensuring that water, nutrients, and energy are applied precisely where and when they are needed. As a result, resource consumption is substantially reduced, production costs decline, and crop productivity improves, leading to higher seed and oil yields and increased net profit per hectare. The adoption of these resource-efficient models also strengthens the resilience of sunflower farms to environmental variability, rising input costs, and market fluctuations. By integrating improved genetic material with advanced input management, farmers can achieve stable and predictable yields, which supports long-term economic sustainability. Furthermore, reduced water and fertilizer use and lower fuel consumption contribute to environmental sustainability, mitigating soil degradation, nutrient runoff, and greenhouse gas emissions.

Given the growing constraints on agricultural resources and the challenges posed by climate change, resource-efficient technological models represent a viable and sustainable pathway for modern sunflower production. The widespread adoption of these models requires coordinated efforts from policymakers, agricultural extension services, and research institutions, including the provision of technical guidance, capacity building, subsidies, and demonstration projects. Ultimately, embracing integrated resource-saving models not only enhances farm income and profitability but also contributes to food oil security, environmental sustainability, and rural development. Such an approach ensures that sunflower cultivation remains competitive, productive, and resilient, supporting both local and global agricultural sustainability goals.

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Rezyume: *Ushbu maqola kungaboqar yetishtirishda resursni tejashga yo‘naltirilgan texnologik modellarning iqtisodiy samaradorligini tahlil qiladi. Resurslarning cheklanganligi va mahsulot ishlab chiqarish xarajatlarining oshishi sharoitida, zamonaviy agrotexnologik modellardan - masalan, tomchilatib sug‘orish, fertigatsiya, minimal ishlov berish va yuqori hosildor yoki kasallikka chidamli urug‘lardan foydalanish - foydalanish tobora muhim ahamiyat kasb etadi. Tadqiqot empirik ma’lumotlarni ko‘rib chiqadi va ushbu modellar suv, o‘g‘itlar, energiya va mehnat resurslarini optimallashtirish orqali ishlab chiqarish xarajatlarini kamaytirishi, hosil va yog‘ hosilini oshirishi, shuningdek, kungaboqar fermalarining foyda va barqarorligini yaxshilashini ko‘rsatadi. Solishtirma ma’lumotlar resurslarni samarali ishlatadigan modellarning an’anaviy usullarga*

qaraganda iqtisodiy va ekologik jihatdan sezilarli darajada ustunligini tasdiqlaydi. Ushbu tadqiqot natijalari kengroq qo‘llash orqali kungaboqar yetishtirishning raqobatbardoshligini oshirish va uzoq muddatli barqarorligini ta’minlash zarurligini ta’kidlaydi.

Резюме: *В данной статье анализируется экономическая эффективность ресурсосберегающих технологических моделей, применяемых при выращивании подсолнечника. В условиях растущей нехватки ресурсов и повышения стоимости факторов производства особенно важно внедрение современных агротехнологических моделей - таких как капельное орошение, фертигация, минимальная обработка почвы и использование высокоурожайных или устойчивых к болезням сортов. В исследовании рассматриваются эмпирические данные, демонстрирующие, что эти модели оптимизируют использование воды, удобрений, энергии и трудовых ресурсов, что позволяет снижать производственные затраты, увеличивать урожай и выход масла, а также повышать прибыльность и устойчивость подсолнечных хозяйств. Сравнительные данные показывают, что ресурсосберегающие модели значительно превосходят традиционные методы выращивания как в экономическом, так и в экологическом аспектах. Результаты исследования подчеркивают необходимость более широкого внедрения этих моделей для повышения конкурентоспособности и обеспечения долгосрочной жизнеспособности производства подсолнечника.*

Kalit so‘zlar: *Kungaboqar yetishtirish, resurslarni samarali boshqarish, texnologik modellar, tomchilatib sug‘orish, fertigatsiya, minimal ishlov berish, ishlab chiqarish xarajatlari, foydalilik, barqaror qishloq xo‘jaligi, suvdan samarali foydalanish.*

Ключевые слова: *Выращивание подсолнечника, эффективное управление ресурсами, технологические модели, капельное орошение, фертигация, минимальная обработка, производственные затраты, рентабельность, устойчивое сельское хозяйство, эффективность использования воды.*

LIVESTOCK FEEDING BASED ON THE REGULATION OF EXTERNAL FACTORS IN MEAT PRODUCTION

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Summary. *The article is devoted to the analysis of the current state and dynamics of livestock development in the Republic of Karakalpakstan, as well as identifying factors influencing the efficiency of the industry. The work emphasizes the importance of introducing intensive technologies and modernizing agriculture. Special attention is paid to the design and optimization of databases as a tool for improving data processing efficiency and forming optimal rations for livestock farms engaged in meat production.*

Key words: *livestock, cattle, peasant farms, agriculture, territorial dynamics, ration optimization, databases, modernization of the agricultural sector.*

Introduction. The most priority way to increase agricultural production is to apply intensive agricultural technologies in crop production and to truly modernize the sector.

Along with industry, there is a great need to modernize the leading sector of our economy, such as agriculture, and to carry out technical and technological renewal work in the entire complex of almost all branches and production sectors that are part of it. The most important way to increase the production of agricultural products, including livestock products, is the application of modern, advanced intensive technologies and the modernization of the industry.

Livestock farming is one of the priority areas for the future socio-economic development of the Republic of Karakalpakstan. Because the water shortage occurring in the region in recent years has created a number of problems in agriculture. It is known that the livestock sector, especially pasture livestock farming, requires less water than agriculture. At the same time, the republic has a vast pasture fund for the development of this sector. Moreover, the local population has historically had rich livestock farming experience and has been engaged in this sector in the pastures since ancient times.

In Karakalpakstan, livestock farming, like agriculture, has its own history of development as a major branch of agriculture. Consequently, the development of the livestock sector, firstly, provides the population with affordable and high-quality food products, and secondly, its raw materials are primarily used in the light and food industries. In the republic, there are branches of animal husbandry such as cattle breeding, sheep and goat breeding, horse breeding, camel breeding, pig breeding, poultry farming, fish farming, sericulture, beekeeping, and others.

The practical part. Regarding the dynamics of livestock numbers in Karakalpakstan, statistical data show that the number of cattle increased from 1,109,600 to 1,260,200 between 2000 and 2024, an increase of 113.6% during the same period.

This is a good indicator, of course. However, the results of its analysis show that this indicator has temporal and spatial differences, both periodic and spatial. For example, the number of livestock of this type increased by 188.5% between 2000 and 2010, and by 155.2% between 2010 and 2020.

From this, we can conclude that in recent years, we have observed a significant decrease in the growth rate of cattle numbers.

Statistical analysis shows that the dynamics of livestock numbers between 2000 and 2022 also had significant differences in the existing economic structures of the republic. In particular, in the years under review, the number of cattle in farms increased from 17,500 to 74,000 heads, or 4.1 times, in peasant (personal subsidiary) farms from 288,400 to 1172,000 heads, or 4.1 times, while in organizations engaged in agricultural activities, its number decreased from 73,900 to 14,100 heads, or more than five times.

As a result, the inter-farm share of this type of cattle increased from 4.6% to 5.9% in farms and from 75.9% to 93% in peasant farms. In organizations engaged in agricultural activities, it decreased from 19.5% to 1.1% (Figure 1).

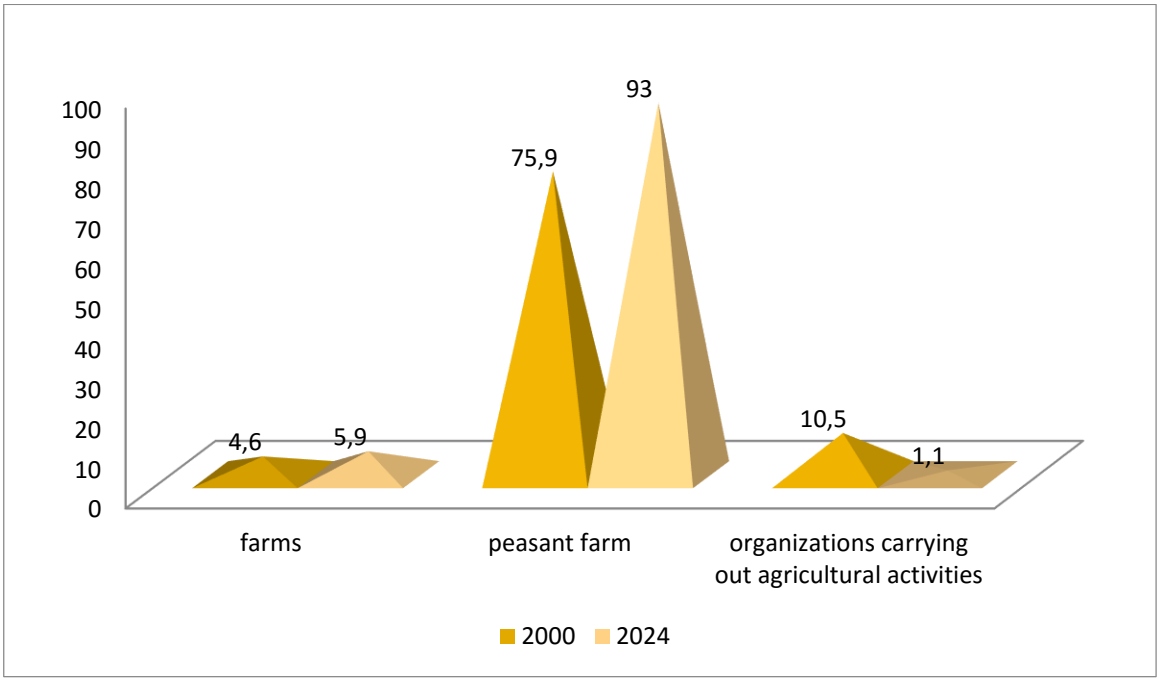


Figure 1. Change in the share of cattle by farm structure in the Republic of Karakalpakstan (in percent)

If we consider the number of cattle in all categories of farms in the Republic of Karakalpakstan by districts, we can see that it amounted to 113.6 percent compared to 2020 in the republic (Table 1).

In Karakalpakstan, there are significant differences in the territorial distribution of cattle. For example, the Amudarya, Beruniy, Turtkul, and Ellikkala districts lead in the number of cattle of this breed. In 2024, these districts accounted for 50.2% of the total number of cattle in the republic, and in 2000, this figure was 45.3%.

The share of cattle in Muynak and Takhiatash districts is lower than in other districts (in each of them less than 2.5%). It is known that the southern districts are leading in the territorial distribution of cattle, and the share of this type of livestock in the republic is growing in them.

With the development of the digital economy, the introduction of information systems in various fields is becoming increasingly important. Information systems allow for the collection, processing, storage, and transmission of data using modern technologies, which increases efficiency in business, education, healthcare, agriculture, and other sectors.

In this article, one such system has been developed, in which the task of optimal ration formation based on available resources and opportunities for farms engaged in meat production is carried out.

The scientific article presented in this research work is aimed at reviewing modern approaches to the design, implementation and optimization of databases, as well as analyzing their role in the context of the needs of modern information technologies and systems. In this, the possibilities of designing and using the database in data processing in agriculture are considered.

In meat production, the ration of cattle is of great importance, and its selection should be based on several factors. Here, using information technologies, it is possible to quickly and accurately calculate the solution to the problem. In this study, such an information system was developed, the stages of designing and developing its database are presented below.

Table 1

Distribution of the number of cattle in all categories of farms in the Republic of Karakalpakstan by districts[28]

Territories	Barcha toifadagi xo‘jaliklar					O‘sish sur’ati, %
	2020 y.	2021 y.	2022 y.	2023 y.	2024 y.	
Republic of Karakalpakstan	**1109625**	**1175884**	**1208708**	**1232177**	**1260198**	**113,6**
Nukus city	8894	9 077	9 250	9 468	9 885	111,1
districts:						
Amudarya	154788	165 783	169 763	174 161	179 117	115,7
Beruniy	152511	161 082	163 255	166 858	167 287	109,7
Bozataw	-	37 860	37 886	39 102	39 569	104,5*
Karauzyak	37860	38 919	40 416	41 048	41 690	110,1
Kegeyli	52914	53 660	57 607	57 257	59 390	112,2
Kungrad	65701	68 932	71 705	75 675	77 719	118,3
Kanlykul	33241	34 811	34 952	37 343	38 088	114,6
Muynak	27468	29 344	29 980	31 212	31 216	113,6
Nukus	37333	39 153	41 320	42 083	42 328	113,4
Takhiatash	22464	24 524	25 851	26 534	26 916	119,8
Takhtakupyr	43463	45 127	48 198	46 503	50 376	115,9
Turtkul	127993	133 742	134 304	135 869	137 993	107,8
Khojeyli	55409	58 169	59 705	60 758	60 876	109,9
Chimbay	71350	81 055	84 102	85 311	85 746	120,2
Shumanay	61098	64 509	68 405	69 567	78 219	128,0
Ellikkala	122820	130 137	132 009	133 428	133 783	108,9

* Growth rate in Buzataw district compared to 2021

The developed database consists of three main modules, and its general information model is presented in the following figure (Figure 2).

[28] Data of the Department of Statistics of the Republic of Karakalpakstan

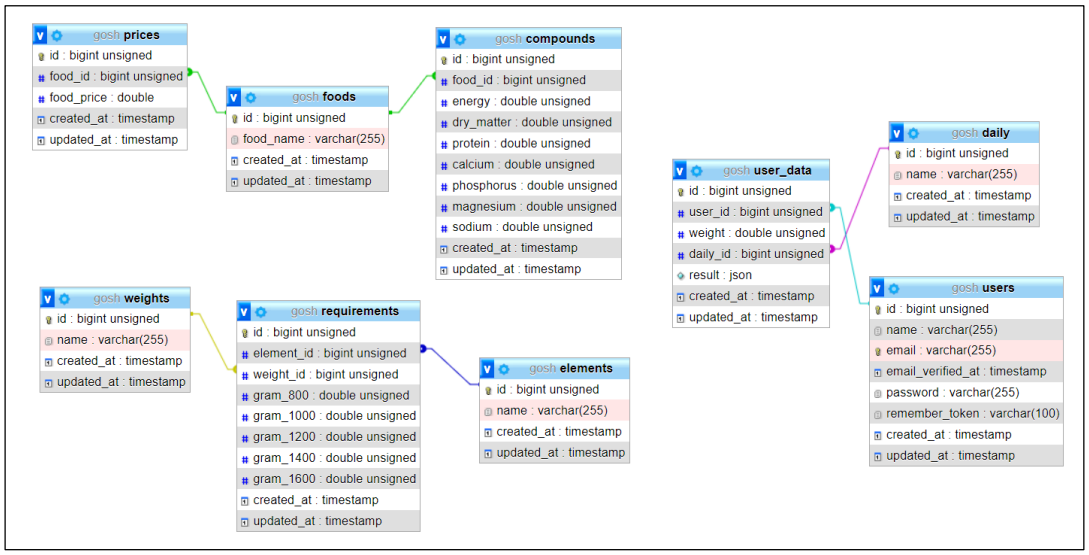


Figure 2. Infologic model of the database

The first module is designed to store information about nutrients and consists of 3 tables. The main table is the foods table, which stores information about food names and id numbers (Table 2).

Table 2

The structure of the foods table and the information in it

id	food_name
1	Alfalfa hay
2	Wheat straw
3	Barley straw
4	Natural meadow hay
5	Corn silage
6	Alfalfa blue grass hay
7	Rye + Rapeseed hay
8	Makkah waste
9	Wheat grain
10	Soft feed
11	Oatmeal
12	Pea

Our second table is called prices and contains information about food prices, and it is connected to the foods table by the id number and called the column food_id (Table 3).

Table 3.

The structure of the prices table and the data in it

id	food_id	food_price
1	1	12
2	2	39
3	3	49
4	4	76
5	5	12
6	6	21
7	7	31
8	8	29
9	9	37
10	10	16
11	11	55
12	12	42

Our last table is called compounds, it stores information about the elements and their amounts in the feed (Table 4). This table is one of the most basic tables and contains a lot of information.

Table 4.

The structure of the compounds table and the data in it

id	food_id	enrgy	dry_matter	protein	calcium	phosphorus	magnesium	sodium
1	1	6.72	0.864	96	11	2	3	1.5
2	2	4.76	0.846	3	2.8	0.8	0.9	0.4
3	3	5.71	0.83	130	3.3	0.8	1.1	1.1
4	4	6.45	0.8	54	13	1.5	1.74	1.83
5	5	2.3	0.25	14	1.4	0.4	0.9	0.4
6	6	4.19	0.45	71	10.9	1	0.9	0.4
7	7	3.2	0.247	14	2.5	0.9	0.8	0.3
8	8	12.2	0.85	73	0.5	5.2	1.3	0.87
9	9	10.7	0.85	142	0.7	4.3	1.1	0.4
10	10	9.1	0.867	81	5.8	3.9	0.9	0.5
11	11	9.2	0.85	79	1.5	3.4	1.2	0.3
12	12	12.5	0.86	20.5	1.2	3.3	1.1	0.3

The second module stores information about the amount of elements and nutrients required for daily fattening of black cattle. This module also contains three tables, which are connected to each other by id numbers. In this case, our main table is the table of requirements, and the values of nutrients needed for fattening livestock in different amounts are presented. The volume of data in the table is large, and its structure is presented below (Table 5).

Table 5.

The structure of the requirements table

1	**id**
2	element_id
3	weight_id
4	gram_800
5	gram_1000
6	gram_1200
7	gram_1400
8	gram_1600

Our next table is called weights, where the information about the division of livestock into categories by live weight is stored. The table consists of two columns, its structure and information are presented in the following table (Table 6).

Table 6.

The structure of the weights table and the data in it

id	**name**
1	150-200
2	200-250
3	250-300
4	300-350
5	350-400
6	400-450
7	450-500
8	500-550
9	550-600
10	600-650

Our next table is called elements, it stores information about the elements in the feed. The number of elements is 7 in total, its structure and information are presented below (Table 7).

Table 7.

The structure of the table of elements and the information in it

id	element_name
1	Dry matter
2	Energy
3	Protein
4	Calcium
5	Phosphorus
6	Sodium
7	Magnesium

Our third module is the user module, where the information related to the user is stored in 3 tables. Our main table is called users and contains information about users. Our table is simple and has only 4 columns. Its structure is given below (Table 8).

Table 8.

The structure of the users table

1	**id**
2	name
3	email
4	password

Our next table in this module is called user_data and serves to store the data entered by the user and the results obtained during the use of the system. The table structure is given below (Table 9).

Table 9.

The structure of the users table

1	**id**
2	user_id
3	weight
4	daily_id
5	result

Our last table is called daily, and this table is designed to store service data. Categorization was carried out according to the number of grams of fattening per day (Table 10).

Table 10.

The structure of the daily table

1	**800 gr.**
2	1000 gr.
3	1200 gr.
4	1400 gr.
5	1600 gr.

Conclusion. In conclusion, it can be said that the use of databases in the optimization of the production of meat products is an indispensable and extremely valuable component in the field of modern agro-industry. With the use of databases, farms have the opportunity to significantly improve the efficiency of their activities and achieve the reduction of all costs and benefits of meat production. Also, the use of databases in the optimization of meat production rations plays a decisive role in ensuring the efficiency, quality and stability of this industry. This allows to more accurately predict the results, adapt to changes and achieve high results in the production of meat products that meet the needs of the market and society.

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Rezyume: *Maqola Qoraqalpog‘iston Respublikasida chorvachilikning hozirgi holati va rivojlanish dinamikasini tahlil qilishga, shuningdek, tarmoq samaradorligiga ta’sir etuvchi omillarni aniqlashga bag‘ishlangan. Ishda intensiv texnologiyalarni joriy etish va qishloq xo‘jaligini modernizatsiya qilish muhimligi ta’kidlangan. Ma’lumotlarni qayta ishlash samaradorligini oshirish va go‘sht chorvachiligi bilan shug‘ullanuvchi xo‘jaliklar uchun optimal ratsionlarni shakllantirish vositasi sifatida ma’lumotlar bazalarini loyihalashtirish va optimallashtirishga alohida e’tibor qaratilgan.*

Резюме: *Статья посвящена анализу современного состояния и динамики развития животноводства в Республике Каракалпакстан, а также выявлению факторов, влияющих на эффективность отрасли. В работе подчеркивается важность внедрения интенсивных технологий и модернизации сельского хозяйства. Отдельное внимание уделено проектированию и оптимизации баз данных как инструменту повышения эффективности обработки данных и формирования оптимальных рационов для хозяйств, занимающихся мясным животноводством.*

Kalit so‘zlar: *chorvachilik, qoramolchilik, dehqon xo‘jaliklari, qishloq xo‘jaligi, hududiy dinamika, ratsionlarni optimallashtirish, ma’lumotlar bazasi, agrar sohani modernizatsiyalash.*

Ключевые слова: *животноводство, крупный рогатый скот, дехканские хозяйства, сельское хозяйство, территориальная динамика, оптимизация рационов, базы данных, модернизация аграрного сектора.*

ANALYSIS OF A SURVEY ON THE DEVELOPMENT OF COORDINATION ABILITIES AND TECHNICAL-TACTICAL PREPARATION OF JUDO ATHLETES

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Summary: *This article analyzes the results of a questionnaire survey conducted to develop the coordination abilities of judo athletes.*

Keywords: *judo specialists, number of training sessions, integral index, balance maintenance, technical methods*

We mobilize all the resources and opportunities of our state and society to ensure that our youth grow into independent thinkers, possessing high intellectual and moral potential, and become individuals who do not lag behind their peers in any field on the global stage, leading happy and successful lives [1]. Since gaining independence, our country has increasingly focused on the development and improvement of physical education and sports. Several decrees and resolutions of the President of the Republic of Uzbekistan, Sh.M. Mirziyoyev, regarding the development of physical education and sports play a significant role in further enhancing the physical education and sports activities of the younger generation. In the state policy of the Republic of Uzbekistan, the development of physical education and sports and the upbringing of a healthy generation have become a priority direction.

The scientific significance of this research lies in studying the opinions of judo specialists and planning future studies. Based on the results obtained from pedagogical practice, a new set of training tools and a targeted improvement program for wrestlers' educational and training sessions were developed, and the scientific rationale for their effectiveness was revealed. During the research, the interrelationship between the physical preparedness of skilled wrestlers and the effectiveness of their training was confirmed in practice. The data obtained provide an opportunity to enrich and expand theoretical knowledge in the field of sports wrestling theory and methodology.

Taking into account changes in competition rules in wrestling, a technology was developed to enhance coordination abilities and improve the effectiveness of technical-tactical movements. By improving physical qualities, this approach created the possibility of increasing the performance outcomes of athletes during competitions. The principles developed in this study provide a basis for specialists to apply them in training processes at sports educational institutions specializing in other wrestling styles, as well as for wrestlers of the Uzbekistan national team. In the preparation of skilled judo athletes, pedagogical observations and surveys were conducted among experienced specialists and athletes to identify and address factors that hinder the development of coordination abilities and technical-tactical preparedness, and responses to the survey questions were collected.

The analysis of existing sources indicates that, in the preparation of athletes, training sessions aimed at developing coordination abilities have not yet been organized on a scientifically grounded basis at the level required in practice. Therefore, it is advisable to introduce new scientifically and methodologically substantiated methods into the training process, relying on research results from other sports. The study of advanced practical experience in sports shows that, in planning training sessions, judo specialists consider the use of complex, multi-effect exercises. It was found that the initial tasks are solved in a one-sided manner, while the scope of tasks to be addressed gradually expands over time.

During the study, the results of a survey conducted among 35 coaches were as follows (see Figure 1).

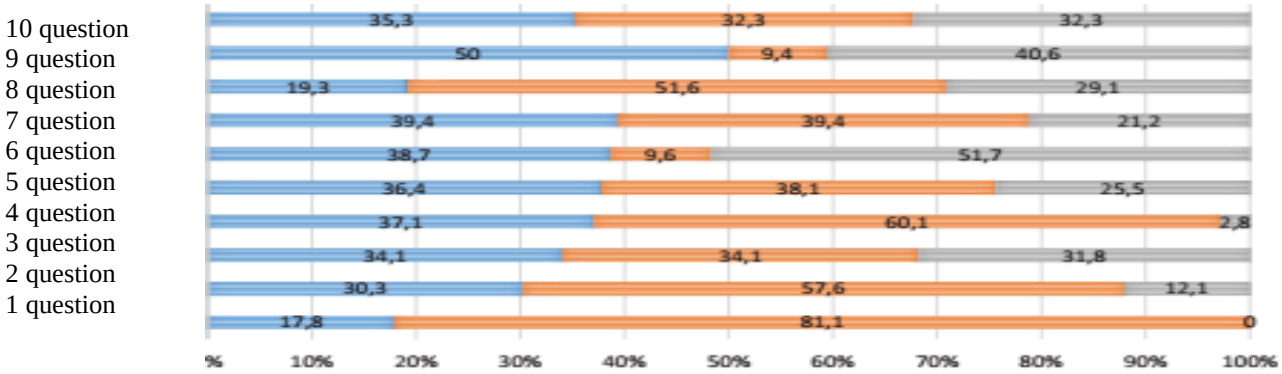


Figure 1. Results of the questionnaire survey (%).

- first answer - second answer - third answer

When asked "How important do you think coordination abilities are in judo?" (Question 1), 17.8% of coaches responded "not very important," 82.1% answered "very important," while the remaining coaches stated that "sometimes it is necessary, sometimes it is not."

Specialists also noted that coordination abilities play a significant role in combat sports, explaining that these abilities can be innate or developed, and that coordination and balance are essential when performing technical movements.

Based on the experts' opinions, we concluded that coordination abilities are highly important in judo.

Regarding the question "At what age do you consider the most suitable period for developing coordination abilities in judokas?" (Question 2), 30.3% of coaches chose ages 10–12, 57.6% chose ages 12–14, and 12.1% selected ages 13–16.

Some coaches added that coordination can also be developed at ages 5–9 in sports such as gymnastics and swimming, and that introducing coordination exercises at ages 7–8 can later have a positive effect on choosing and adapting to different sports.

According to specialists, the period between 8–10 and 12–14 years is the most favorable for athletes to acquire coordination abilities compared to other age stages.

In our opinion, coordination abilities begin to develop naturally once a child starts to walk. When asked **"During which phase of competitive performance do coordination abilities become most evident in judo?" (Question 3)**, 34.1% of coaches chose *"during attack,"* another 34.1% chose *"during defense,"* and the remaining 31.8% selected *"during counterattack."* Some coaches added that coordination abilities are important in **all phases** of competition performance, and that the ability to make smart decisions in unexpected situations during a match indicates a well-developed level of coordination.
After analyzing the above opinions, we concluded that coordination abilities play an essential role throughout the entire competitive performance in judo.

Regarding the question **"During which part of the training process should coordination abilities be developed?" (Question 4)**, 37.1% of coaches responded *"during the warm-up (preparatory part),"* 60.1% responded *"during the main part,"* and 2.8% chose *"during the final part."*
Coaches noted that using more sports games—especially basketball and various movement-based games—can be effective. They also emphasized that developing coordination abilities during the

warm-up yields good results because acrobatic exercises and special flexibility and mobility drills are typically included in this part.

Based on these opinions, it can be concluded that coordination abilities should be developed **in all stages of the training process**.

When asked "Which methods should be used to develop coordination abilities during the training process?" (Question 5), 36.4% of coaches selected the "repetition method," 38.1% chose the "strictly regulated method," and the remaining 25.5% selected the "interval (rest-based) method."

Some coaches stated that all methods can be applied, depending on the goal of the training session.

A number of specialists suggested that using circuit training methods would also be appropriate, while others emphasized that the competition method has many advantages as well.

We agree with the opinions expressed by the practitioners mentioned above. When asked **"Do you think there is a sufficient amount of scientific and methodological literature on developing coordination abilities nowadays?" (Question 6)**, 38.7% of coaches responded *"insufficient,"* 9.6% said *"sufficient,"* and 51.7% emphasized that *"there are materials, but very few."*Some coaches added that information should be taken from the works of world-renowned scholars such as Bernstein and Lyakh. In our view, the amount of scientific and methodological literature on developing coordination abilities is sufficient, but **very little has been translated into Uzbek**.

Regarding the question **"Which methods do you use to develop coordination abilities?" (Question 7)**, 39.4% of coaches selected the *"repetition method,"* another 39.4% chose the *"strictly regulated method,"* and 21.2% chose the *"interval (rest-based) method."*Several specialists commented that **all methods can be used** in training. They also noted that the *"circuit training method"* and the *"competition method"* have many advantages.We also agree with these opinions.

When asked **"Do you think the methodology for developing coordination abilities in judokas is enriched with innovative methods?" (Question 8)**, 19.3% of coaches responded *"yes,"* 51.6% said *"no,"* and 29.1% selected *"I am not sure."*Additionally, some coaches stated that the development of coordination abilities itself is an innovation, while others emphasized the need to further develop scientific methodology.

Regarding the question **"What consequences may poor development of coordination abilities have for an athlete?" (Question 9)**, 50% of coaches responded *"the athlete will not achieve high results in sport,"* 9.4% said *"frequent injuries during training,"* and 40.6% chose *"inability to maintain balance."*Coaches also noted that expecting good results from an athlete with poorly developed coordination abilities is difficult, and that in judo, coordination must be combined with technical and tactical skills to be an effective means of achieving athletic success.

When asked "How can one determine whether coordination abilities are well developed?" (Question 10), 35.3% of coaches answered "by observing whether the given tasks are performed correctly," 32.3% responded "by assessing the athlete's ability to maintain balance," and another 32.3% chose "by evaluating how well the athlete adapts to the sport."

Coaches also added that integrated performance indicators must always be executed accurately and at a high level.

Based on these opinions, it can be concluded that the level of coordination development can also be determined through special (control) tests.

Coordination abilities consist of skills enabling an individual to perform holistic motor actions purposefully—forming, subordinating, and integrating movement components—restoring learned movement patterns, or switching from one motor activity to another in response to changing environmental demands.

Indicators of coordination abilities include completed movement tasks such as gymnastic exercises, diving, and figure skating. The assessment may be based on the time required to acquire new movement forms or to modify previously mastered ones, as well as on precise movement indicators (per unit of time), spatial accuracy, and the degree of muscular effort.

Methods for gradually increasing the number of training sessions were developed, and their active influence on the athletes' development after specific training exercises was identified.

For the first time, experimental data were obtained showing the interrelation between rationally alternating training sessions and the organization of athletes' technical-tactical preparation and pre-competition training stages through various types of training.

To successfully address this issue, it is necessary to thoroughly study the effects of multiple coordination-focused training sessions given in a single day to highly skilled judokas, examining both the intensity and impact of each type of training. Addressing this problem allows for the development of a system for alternating different types of exercises and provides the opportunity to achieve effective preparation of qualified judo athletes.

Conclusion. An athlete's coordination ability consists of the skills required to perform holistic motor activities purposefully—forming, subordinating, and integrating movements—restoring previously learned movement patterns, or transitioning from one motor activity to another in response to changing environmental demands. Indicators of coordination abilities include completed movement tasks such as **gymnastic exercises, diving, figure skating, and others**. These indicators can be assessed by the time spent acquiring new movement forms, modifying previously learned movements, precise execution of movements (per unit of time), spatial accuracy, and the degree of applied effort.

To master coordination abilities, it is necessary to **gradually increase the number of regular movement exercises, develop new movement patterns, quickly modify movement forms, and efficiently transition from one movement to another depending on varying conditions**.

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Rezyume: *Ushbu maqolada dzyudo kurashchilarining koordinatsion qobiliyatlarini rivojlantirish maqsadida o'tkazilgan anketa so'rovnomasi natijalari tahlil qilingan.*

Резюме: *В данной статье проанализированы результаты анкетирования, проведенного с целью развития координационных способностей борцов дзюдо.*

Kalit so'zlar: *dzyudo bo'yicha mutaxassislar, mashg'ulotlar soni, integral ko'rsatkich, muvozanatni saqlash, texnik usullar*

Ключевые слова: *специалисты по дзюдо, количество тренировок, интегральный показатель, сохранение равновесия, технические приемы*

TOWARD AN INCLUSIVE SOCIETY: EXPERIENCES OF SOCIALIZING CHILDREN WITH DISABILITIES THROUGH THE ART OF POTTERY

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Summary: *This article examines the art of pottery as an effective means of socializing children with disabilities within an inclusive educational environment. It explores the pedagogical and therapeutic possibilities of artistic activities, revealing their role in developing children's creative abilities, fine motor skills, and emotional stability. Furthermore, the study analyzes the theoretical and practical aspects of integrating pottery lessons into the process of inclusive education based on both local and internatiowwnal experiences. The significance of such integration is substantiated as a vital component in the process of striving toward an inclusive society.*

Keywords: *inclusive education, art therapy, inclusive society*

In recent years, the concept of inclusive education has gained global recognition as a priority in educational policy. UNESCO (2017) emphasizes that the primary goal of inclusive education is to ensure that all children, including those with disabilities, have access to quality education and can actively participate in social, cultural, and economic life. Inclusive education is not only about integrating children with disabilities into mainstream classrooms but also about creating supportive, flexible, and adaptive learning environments that address individual needs and promote holistic development.

In Uzbekistan, significant steps have been taken to develop inclusive education in line with international standards. The Law "On Social Protection of Persons with Disabilities" (2020) and the Law "On Education" (2020) explicitly affirm the right of children with disabilities to receive quality education and participate fully in the social life of their communities. Furthermore, government programs and initiatives aim to equip educational institutions with the necessary resources and trained personnel to implement inclusive practices effectively.

Artistic activities, including painting, music, sculpture, and pottery, have been recognized worldwide as effective pedagogical and therapeutic tools for children with special needs. These activities not only stimulate creativity but also contribute to cognitive, emotional, and social development. Among these, the art of pottery has unique advantages: it combines tactile engagement, sensory stimulation, and creative expression, making it an ideal medium for fostering both psychological and social skills. Pottery allows children to translate their imagination into tangible forms, providing a sense of accomplishment and enhancing self-esteem.

Research indicates that pottery activities promote fine motor skills, patience, concentration, and problem-solving abilities. They also offer a therapeutic environment where children can manage stress, express emotions freely, and develop interpersonal skills through group activities. In this context, the present study aims to examine the role of pottery in the socialization of children with disabilities within inclusive education settings, highlighting both local and international practices. By analyzing theoretical frameworks, empirical observations, and comparative experiences, this research seeks to provide evidence-based recommendations for integrating pottery into inclusive education programs in Uzbekistan.

The relevance of this study lies in addressing a critical gap: while inclusive education is gaining traction globally and in Uzbekistan, there is limited research on specific artistic interventions that can effectively support the social, emotional, and cognitive development of children with disabilities. By focusing on pottery, this study contributes to the understanding of practical, culturally relevant, and pedagogically effective strategies for promoting inclusion and fostering an inclusive society.

This study was conducted based on the following methods:

1. **Literature analysis.** Works by both local and international scholars on inclusive education and art therapy were reviewed. Sources such as UNESCO (2017), Khudoyberganova (2020)[29], and Rakhmonqulova (2021) were used as key references.[30]
2. **Experiment and observation.** During pottery sessions conducted in preschool educational institutions, the social activity and participation of children were observed.
3. **Comparative method.** The experience of Uzbekistan was compared with the practices of foreign countries such as Italy, Japan, and Russia.
4. **Expert interviews.** Discussions were held with teachers, psychologists, and defectologists to gather their opinions on the importance of pottery in inclusive education.

According to the research results, the art of pottery demonstrates several significant pedagogical and psychological benefits in the process of socializing children with disabilities within an inclusive educational environment.

1. Pedagogical Outcomes

Development of creative abilities: During the pottery-making process, children progress from shaping simple forms to creating more complex figures, learning to model their imagination in tangible ways. This process enhances their creative thinking and imagination. For instance, in several special schools in Tashkent city, observations showed that about 80 percent of children participating in pottery classes were able to independently create their own shapes.

Improvement of fine motor skills: The processes of kneading, cutting, and shaping clay strengthen the muscles of children's hands and fingers. This physical development plays a crucial role later in tasks requiring precision, such as writing and other fine motor activities.

Positive impact on learning activities: After participating in pottery sessions, an increase in children's attention span and concentration levels was observed. This improvement contributes to their more active and engaged participation in classroom learning processes.

2. Psychological Outcomes

Emotional stability: Working with clay helps reduce children's internal tension and provides them with an opportunity to freely express their emotions. For example, during the observation process, it was noted that children on the autism spectrum behaved more calmly and actively while engaging in pottery activities.

Self-expression and self-confidence: Displaying the items they have created gives children a sense of achievement, which strengthens their self-confidence and fosters positive self-esteem.

Stress reduction: The softness of the clay and the process of shaping it have a therapeutic effect, serving as a form of psychological therapy. This effect has also been confirmed by defectologists and psychological specialists.

3. Social Outcomes

Teamwork skills: During pottery activities, children work in small groups where they learn to communicate, collaborate, and share responsibilities. This experience facilitates their ability to function effectively within a team.

Sense of empathy and mutual support: While creating pottery items together, children develop empathy and learn to support and help one another throughout the creative process.

Integration into society: By presenting their finished works at exhibitions, children directly engage with the community and experience a sense of recognition and appreciation for their efforts. This fosters their social integration and strengthens their connection with society.

Local Experience

1. Observations Based on Local Experience

Experiential activities conducted in several preschool educational institutions in Uzbekistan revealed the following:

- About 70% of children participating in pottery sessions became more active in social interactions.

[29] Xudoyberganova D. Inklyuziv ta'limning nazariy asoslari. – Toshkent: Fan, 2020.

[30] Raxmonqulova S. Maktabgacha ta'limda san'at faoliyatining o'rni. – Toshkent, 2021.

- Emotional stability significantly increased in approximately 65% of the children.
- Parents reported noticeable improvements in their children's creativity and patience.

5. Comparison with International Experience

Research conducted in Italy (2018) showed that specialized pottery sessions for children with disabilities increased their socialization indicators by 40%.

In Japan, pottery activities are a mandatory part of rehabilitation programs within the preschool education system. These activities have been observed to improve children's attention and patience.

In Russia, art therapy centers use pottery as a primary rehabilitation tool, and it has been reported that the social activity of children on the autism spectrum increased by 30–35%.[31]

Research Finding

The results of the study indicate that the art of pottery is an effective tool for socializing children with disabilities. Its advantages and challenges are as follows:

Advantages:

- Supports socio-emotional development;
- Enhances creative abilities;
- Serves as a tool for rehabilitation and psychological support.

Challenges:

- Not all educational institutions have the necessary material and technical resources;
- There is a lack of specialized methodological guidelines;
- Teachers often have limited qualifications in art therapy.

Recommendations

Based on the results of this study, the following recommendations can be made:

1. Integrate the art of pottery into inclusive education programs.
2. Utilize digital technologies such as 3D clay modeling and virtual pottery applications.
3. Organize professional development programs for teachers and defectologists.
4. Actively involve parents in the process and implement family support programs.

The art of pottery plays a crucial and multifaceted role in the socialization of children with disabilities within an inclusive educational environment. Research findings indicate that pottery not only fosters creative development but also significantly enhances emotional stability and self-confidence. Through hands-on engagement, children learn to express their thoughts and feelings, reducing internal tension and promoting psychological well-being.

From a pedagogical perspective, pottery helps children develop fine motor skills, improve concentration, and actively participate in educational activities. Psychologically, it provides a therapeutic effect, allowing children to process emotions, gain a sense of achievement, and build self-esteem. Socially, working collaboratively in small groups nurtures teamwork, empathy, and mutual support. Exhibiting their creations further integrates children into the community and strengthens their sense of belonging and recognition.

Local observations in Uzbekistan demonstrate tangible improvements in social engagement, emotional stability, and creativity among children participating in pottery activities. Comparative international experiences from Italy, Japan, and Russia reinforce the effectiveness of pottery as a tool for socialization, highlighting its global relevance in inclusive education and rehabilitation programs.

However, challenges remain, such as limited material and technical resources, insufficient specialized methodological guides, and a lack of trained educators in art therapy. Addressing these issues is essential to maximize the benefits of pottery in inclusive education.

In conclusion, integrating pottery into inclusive educational programs represents not only a scientifically supported pedagogical strategy but also a socially significant initiative. It equips children with disabilities with vital skills for creativity, emotional resilience, and social integration, contributing to the broader goal of building an inclusive society. Future work should focus on expanding access to pottery programs, incorporating digital and 3D modeling technologies, and

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providing professional development for educators and specialists to ensure sustainable and effective implementation.

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Rezyume: *Tadqiqot davomida adabiyotlarni tahlil qilish, kuzatishlar, qiyosiy metodlar hamda mutaxassislar bilan suhbatlar orqali kulolchilik faoliyatining pedagogik, psixologik va ijtimoiy ta’sirlari o‘rganildi. Tadqiqot natijalari shuni ko‘rsatdiki, kulolchilik ijodiy fikrlashni, mayda motorika ko‘nikmalarini, hissiy barqarorlikni, o‘ziga ishonchni va ijtimoiy muloqotni rivojlantiradi. Mahalliy kuzatuvlar kulolchilik mashg‘ulotlarida qatnashgan bolalarda ijtimoiy faollik, hissiy muvozanat va ijodiy qobiliyatlar oshganini ko‘rsatdi. Italiya, Yaponiya va Rossiya tajribalari bilan qiyosiy tahlil kulolchilikning ijtimoiylashuvni kuchaytirish va terapevtik natijalarni yaxshilashdagi samaradorligini tasdiqlaydi.*

Резюме: *В исследовании применялись методы анализа литературы, наблюдений, сравнительного анализа и экспертных интервью для изучения педагогического, психологического и социального влияния занятий гончарным искусством. Результаты показывают, что гончарное искусство способствует развитию творческого мышления, мелкой моторики, эмоциональной стабильности, уверенности в себе и социальных навыков. Местные наблюдения демонстрируют, что дети, участвующие в занятиях по гончарному делу, проявляют повышенную социальную активность, эмоциональное равновесие и творческие способности. Сравнительный анализ с международным опытом Италии, Японии и России подтверждает эффективность гончарного искусства в улучшении социализации и терапевтических результатов.*

Kalit so‘zlar: *inklyuziv ta’lim, art-terapiya, inklyuziv jamiyat.*

Ключевые слова: *инклюзивное образование, арт-терапия, инклюзивное общество.*

IMPROVING THE EFFECTIVENESS OF TEACHING ELECTRONIC SPREADSHEETS AND PRESENTATIONS THROUGH STEAM APPROACH AND FLIPPED CLASSROOM METHODS: EXPERIMENTAL RESULTS

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Summary: *This article examines the effectiveness of integrating the STEAM approach with the Flipped Classroom model through the use of digital tools such as Excel and PowerPoint to enhance students' practical and digital competencies. A comparative study was conducted between a control group and an experimental group, focusing on task accuracy, learning satisfaction, and activity engagement. The findings reveal that students in the experimental group demonstrated higher motivation, increased participation, and stronger independent learning skills. The results indicate that combining digital technologies with the STEAM model significantly improves the quality and efficiency of the learning process.*

Key words: *STEAM, Flipped Classroom, digital competence, Excel, PowerPoint, innovative education.*

In the modern educational process, the role of information and communication technologies (ICT) is steadily increasing. In particular, technologies for working with electronic spreadsheets and creating presentations play an important role in developing students' practical skills, data processing and analysis abilities, visual presentation of information, as well as communication competencies. The ability to collect data, organize it, perform calculations, and create charts and graphs using spreadsheet processors (such as Microsoft Excel, Google Sheets, and others) is an essential skill for every student in today's digital society. At the same time, presentation software like PowerPoint, Prezi, or Google Slides enhances students' ability to express ideas clearly, systematically, and visually[1].

The use of innovative pedagogical methods is highly significant in the process of developing digital competencies. In particular, the STEAM approach activates the process of working with electronic spreadsheets by ensuring interdisciplinary integration through solving real-life problems. The Flipped Classroom technology, on the other hand, transforms the learning process into a student-centered form that supports independent learning activities. These methods enhance students' competencies in independent thinking, creativity, critical analysis, and information handling. As a result, the learning process becomes interactive, effective, and motivational.

The aim of this study is to determine the effectiveness of using the STEAM approach and Flipped Classroom methods in teaching the topics of electronic spreadsheets and presentations, and to scientifically examine their impact on the educational process.

The hypothesis of the study is that if innovative methods such as STEAM and Flipped Classroom are applied comprehensively in teaching electronic spreadsheet and presentation technologies, students' digital competencies, level of topic mastery, and practical skills will be significantly higher compared to traditional methods.

The STEAM (Science, Technology, Engineering, Art, Mathematics) approach is an innovative model of modern education based on interdisciplinary integration, which focuses on acquiring theoretical knowledge through practical tasks. This approach develops students' competencies in logical thinking, creativity, problem-solving, and information handling. The STEAM approach ensures interdisciplinary integration in the learning process, combining elements of computer science, mathematics, economics, statistics, and art into a unified system. By addressing real-life problems, it supports project-based learning and fosters students' ability to find independent solutions. Additionally, STEAM activates critical thinking processes, enhancing skills in analysis, comparison, and drawing well-founded conclusions. Furthermore, it encourages creativity, allowing

students to demonstrate their creative potential through the creation of charts, diagrams, and visual design elements.

Teaching electronic spreadsheets based on the STEAM approach enables students not only to acquire technical skills but also to develop the competence to solve real-world problems digitally.

One of the most effective ways to apply the STEAM approach in teaching electronic spreadsheets is to organize project-based work based on real-life tasks. The "Mini-Statistics" project engages students in independently collecting data, entering it into a spreadsheet, organizing it, and analyzing it using statistical functions. For example, a table can be created based on data about students' favorite sports, the brands of phones they use, or the amount of time they spend studying each day. Subsequently, statistical indicators are calculated using functions such as AVERAGE, COUNT, MAX, and MIN, and charts or graphs are created based on the data. Such a project ensures the integration of computer science, mathematics, and statistics, while developing students' digital competencies in analysis, summarization, comparison, and visual representation. Working with real data also increases students' interest and motivation, ensuring the practical effectiveness of the STEAM approach.

The content of the project involves collecting data on a typical day in the life of the class students and entering it into a spreadsheet. This includes recording the time spent on studying, minutes dedicated to homework, time allocated for sports and physical activities, sleep duration (in hours), and the amount of water consumed during the day (in milliliters). This data is then organized, summarized, and analyzed using statistical functions, demonstrating the practical application of the STEAM approach with real-life information. Students submit this data via Google Forms.

The Flipped Classroom method involves shifting traditional theoretical lessons from the classroom to a virtual environment, while the classroom becomes entirely dedicated to practical activities. This model allows students to independently acquire theoretical knowledge at home through video lessons, interactive materials, or prepared presentations. As a result, class time is primarily devoted to practical work, creative projects, group discussions, and skill reinforcement. The main advantages of the Flipped Classroom method are that students can control the pace of their independent learning, deepen their understanding, actively participate in practical exercises, and strengthen the principle of personalized learning.

During the presentation preparation process, programs such as PowerPoint, Prezi, and Google Slides are widely used. PowerPoint is a traditional, slide-based, user-friendly, and functional tool, while Prezi enables dynamic movements, zoom-in/out animations, and interactive presentations. Google Slides stands out for online collaboration, allowing multiple users to work simultaneously and easily save their work. These programs, combined with the Flipped Classroom model, help develop students' creativity and technical skills. According to this model, students learn the main theoretical content at home via video lessons, which cover presentation structure, slide composition, color harmony, working with fonts, animation types, and visual design principles. Once students have independently grasped the theory, classroom time focuses on developing their practical skills.

Practical activities in the classroom are organized step by step. Initially, students perform basic skills such as creating new slides, inserting text, adding images and charts. In the next stage, they are taught to use templates, theme designs, color schemes, and visual composition. In the final stage, tasks are assigned to animate presentations using animations, transition effects, infographic elements, and interactive buttons. These processes are carried out in the classroom through practical exercises, group projects, and creative assignments. The analysis and evaluation of presentations created by students are based on specific criteria: accuracy of content, slide composition, visual harmony, logical sequence, appropriate use of animations, and audience impact. During the analysis, peer review, teacher expert evaluation, rubric-based scoring, and group discussion methods are applied. These assessment mechanisms develop students' reflection skills and allow for clear conclusions regarding presentation quality.

In this study, several pedagogical and scientific research methods were used to determine the effectiveness of STEAM and Flipped Classroom methods in teaching electronic spreadsheets and presentations. Using the pedagogical observation method, it was possible to monitor students'

engagement, speed, and quality of task completion during practical exercises in real-time. Observation results were recorded in tables and diagrams, analyzing students' activity and level of creative work. Experimental tasks examined how theoretical knowledge translated into practical skills; students completed STEAM projects and presentation assignments, and their success levels were measured using statistical methods. Each student's work was recorded in a spreadsheet, and results were analyzed column by column.

Surveys and tests measured students' theoretical knowledge, interest in using the methods, and self-assessment skills. Surveys included open and closed questions and were evaluated using a Likert scale. Tests assessed the accuracy of completing practical tasks and the correct application of formulas and functions.

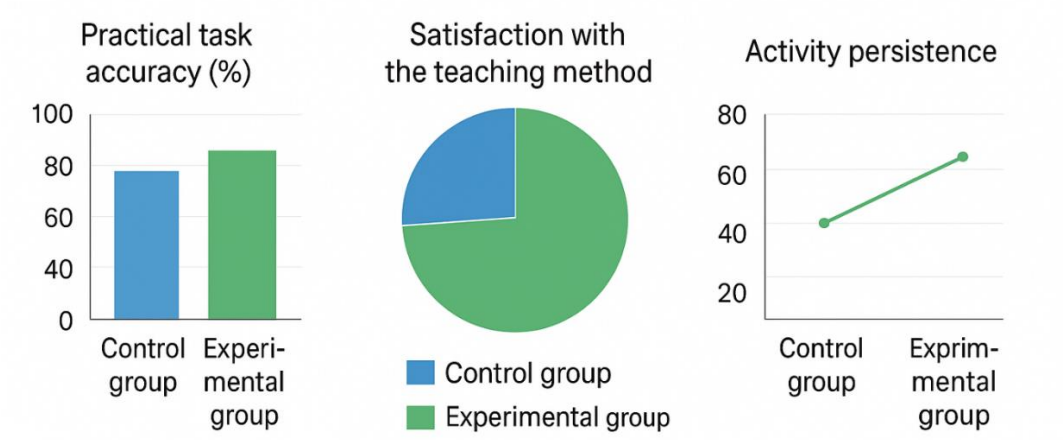
All results were analyzed through a comparison of student performance: the control group, taught using traditional methods, was compared with the experimental group, taught using innovative methods (STEAM + Flipped Classroom). Data were compiled in a spreadsheet, with average, maximum, and minimum values calculated. Results were visualized using bar charts, pie charts, and line graphs. For example, the percentage of success in practical tasks was shown in a pie chart, weekly activity and session duration in a bar chart, and average knowledge levels in a line graph. In this way, observation, experimental tasks, surveys, and comparison methods complemented each other, ensuring the reliability and scientific validity of the study's findings.

1-table

Observation and Experimental Results Table

№	Group	Student	Activity Duration (min)	Practical Task Accuracy (%)	Satisfaction with Teaching Method (5-point scale)
1	Control	Aliyev Aziz	50	70	3
2	Control	Karimova Madina	55	65	3
3	Control	Tursunov Diyor	52	68	3
4	Experimental	Sodiqov Islom	70	85	5
5	Experimental	Raxmonova Dildora	75	90	5
6	Experimental	Qodirov Shams	72	88	5
7	Experimental	Mamatova Rayona	68	86	4

This table presents the research results in a systematic and clear manner. It includes each student's group (control or experimental), duration of activity during the lesson, accuracy of completing practical tasks, and level of satisfaction with the teaching method. The table allows for comparison of students, identification of differences between groups, and evaluation of the effectiveness of the methods. Compared to the control group, it is evident that students in the experimental group (STEAM + Flipped Classroom) achieved higher results and were more active during the lessons.



1-Figure. Comprehensive comparison of control and experimental groups

The bar chart visually represents the percentage of correctly completed practical tasks, the line graph shows the duration of activity during lessons, and the pie chart illustrates the level of satisfaction with the teaching method. These charts help to quickly understand both individual and group results, clearly confirming the effectiveness of the pedagogical observation, experimental tasks, survey, and comparison methods. Additionally, presenting the results in a visual format ensures that the research findings are scientifically grounded and easily comprehensible.

The research results indicate that using STEAM and Flipped Classroom methods in teaching electronic spreadsheets and presentations enables students to transform theoretical knowledge into practical skills, increase their activity during lessons, and achieve a higher percentage of task completion. Data obtained through pedagogical observation, experimental tasks, surveys, and tests confirm that students in the experimental group not only achieved higher results but also significantly improved their self-assessment abilities and satisfaction with the teaching method. Furthermore, the results clearly demonstrate the effectiveness of innovative pedagogical approaches through visual tools such as tables, charts, and graphs. This allows teachers to optimize the learning process, motivate students, and develop their digital competencies. Consequently, the STEAM and Flipped Classroom methods provide significant pedagogical advantages over traditional methods in teaching electronic spreadsheet and presentation technologies.

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Rezyume: *Ushbu maqolada STEAM yondashuvi va Flipped Classroom metodikasini Excel hamda PowerPoint kabi raqamli vositalar bilan integratsiyalash orqali talabalarning amaliy ko‘nikmalarini rivojlantirish samaradorligi tahlil qilingan. Tadqiqotda nazorat va tajriba guruhlari o‘rtasida o‘quv faoliyati, amaliy topshiriqlarni bajarish to‘g‘riligi va ta’lim jarayonidan qoniqish darajasi solishtirildi. Natijalar tajriba guruhida yuqori faollik, ko‘proq motivatsiya hamda mustaqil ishlash ko‘nikmalarining sezilarli oshganligini ko‘rsatdi. Tadqiqotdan olingan xulosalar raqamli ta’lim texnologiyalarini STEAM modeli bilan uyg‘unlashtirish o‘quvchilar kompetensiyasini samarali oshirishini tasdiqlaydi.*

Резюме: *В данной статье рассматривается эффективность интеграции STEAM-подхода и технологии «Перевернутый класс» с использованием цифровых инструментов Excel и PowerPoint для развития практических и цифровых компетенций обучающихся. В исследовании проведено сравнительное наблюдение над контрольной и экспериментальной группами, в ходе которого анализировались точность выполнения практических заданий, уровень удовлетворённости обучением и активность студентов. Результаты показали, что участники экспериментальной группы продемонстрировали более высокую мотивацию, активность и самостоятельность. Полученные данные подтверждают, что применение цифровых технологий в сочетании со STEAM-моделью значительно повышает эффективность образовательного процесса.*

Kalit so‘zlar: *STEAM, Flipped Classroom, raqamli kompetensiya, Excel, PowerPoint, innovatsion ta’lim, tajriba-sinov.*

Ключевые слова: *STEAM, Flipped Classroom, цифровые компетенции, Excel, PowerPoint, инновационное обучение.*

MODELING ECONOMIC MECHANISMS AIMED AT STRENGTHENING COMPETITIVENESS IN THE FRUIT EXPORT SECTOR

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Summary: *This study proposes a conceptual framework modeling the economic mechanisms aimed at boosting the competitiveness of Uzbekistan's fruit export sector. It identifies and integrates key components - standardization and adherence to quality requirements, value chain coordination and logistics efficiency, institutional and financial facilitation, as well as market expansion and branding strategies. By conducting a systematic review of literature and performing comparative analyses of secondary data and case studies, the framework illustrates the interconnections among these mechanisms and demonstrates how their coordinated application can mitigate structural challenges, including post-harvest losses, limited cold storage infrastructure, fragmented supply networks, and restricted access to export financing. The proposed model provides a strategic tool for exporters and policymakers to enhance export performance, foster sustainable sectoral growth, and expand Uzbekistan's presence in international fruit markets.*

Key words: *Value-chain integration, export competitiveness, export financing, Uzbekistan, fruit export, quality standardization.*

Introduction. The global demand for premium fresh and processed fruits continues to grow steadily, driven by rising household incomes, evolving dietary preferences, and increasing consumption of both seasonal and off-season produce. For countries with favorable agro-climatic conditions, such as Uzbekistan, this trend represents a strategic opportunity to expand horticultural exports, boost foreign exchange revenues, and support rural livelihoods. However, transforming horticultural potential into sustained export competitiveness requires more than natural endowments; it necessitates well-structured institutional arrangements, adherence to international quality and phytosanitary protocols, efficient logistics and supply chain management, and accessible financial instruments.

Despite Uzbekistan's abundant horticultural resources, the fruit export sector faces persistent structural constraints. A significant proportion of producers do not fully comply with export quality requirements, including sorting, washing, cold chain maintenance, and traceability. Post-harvest processing and storage capacities remain insufficient, and many farms are underprepared for export operations. Additionally, restricted access to export-oriented financing and insurance, fragmented value chain integration, and underdeveloped marketing and branding strategies further limit competitiveness. Rising competition from countries with advanced horticultural export infrastructures amplifies the urgency for systemic and coordinated interventions.

This paper adopts a modeling approach to conceptualize and systematize the economic mechanisms necessary to enhance the competitiveness of Uzbekistan's fruit export sector. The study develops a conceptual framework that maps the interdependencies among key mechanisms - quality standardization and compliance, value chain optimization and logistics integration, institutional and financial facilitation, and market and brand development. By modeling these interconnections, the framework highlights how their coordinated application can overcome structural inefficiencies, reduce post-harvest losses, optimize cold storage utilization, strengthen supply chain integration, and improve access to export finance. The proposed framework also serves as a strategic decision-support tool for exporters, policymakers, and stakeholders, enabling evidence-based interventions to increase export volumes, enhance product quality, and ensure long-term sustainability in the global fruit market.

Review of Literature. Empirical research on Uzbekistan's agro-export sector consistently highlights the pivotal role of targeted investments, modernization of supply chains, and robust institutional support in enhancing export performance. For example, recent analyses of horticultural production and export potential in Uzbekistan demonstrate that upgrading post-harvest processing facilities and improving logistics infrastructure significantly contribute to higher export volumes, reduced post-harvest losses, and enhanced overall sectoral efficiency (green-eco.uz+1). These findings underscore the necessity of systematic interventions to convert natural and production endowments into tangible competitive advantages in international markets.

Compliance with international phytosanitary and quality standards - including hygienic washing, appropriate packaging, cold chain management, and traceability protocols - is widely recognized as a foundational requirement for accessing competitive foreign markets (interonconf.org+1). Studies indicate that even minor lapses in these standards can result in market rejection, reputational risks, and financial losses, emphasizing the strategic importance of quality standardization mechanisms.

Research focused on value chain efficiency and supply chain optimization identifies several structural bottlenecks limiting export readiness. Key constraints include insufficient cold storage capacity, underdeveloped transport and logistics networks, fragmented coordination along the value chain, and limited integration of smallholder producers (UzDaily.uz+1). These inefficiencies highlight the need for a systemic, model-based approach to align production, processing, and distribution processes, ensuring timely delivery of high-quality produce to export markets.

Comparative literature on agrifood export models further emphasizes the effectiveness of cooperative and cluster-based exporting strategies. In such arrangements, small- and medium-sized producers pool resources, standardize quality, and coordinate logistics and certification processes. This approach reduces market entry barriers, distributes fixed costs associated with certification, packaging, and transportation, and facilitates compliance with minimum volume requirements that are often mandatory in global export markets (arXiv+1).

Synthesizing these findings, three primary clusters of mechanisms emerge as critical for enhancing fruit export competitiveness: **Quality standardization and compliance** – ensuring adherence to international phytosanitary, safety, and packaging norms; **Value chain integration and logistics optimization** – improving coordination, reducing transaction costs, and enhancing supply chain efficiency; **Institutional and financial support & market development** – providing access to credit, subsidies, insurance, cooperative structures, and strategic marketing initiatives.

Building on these insights, this study develops a conceptual model that integrates these mechanisms into a coherent framework. The model explicitly maps the interrelationships among these clusters and provides a strategic blueprint for policymakers, exporters, and stakeholders to enhance export performance, optimize resource allocation, and strengthen Uzbekistan's competitiveness in global fruit markets.

Materials and Methods. In accordance with the objectives and scope of this study, the research adopts a **conceptual and analytical approach**, emphasizing the modeling of economic mechanisms to enhance competitiveness in Uzbekistan's fruit export sector. The methodology integrates secondary data analysis, comprehensive document and policy review, and comparative assessment of prior empirical studies, statistical datasets, and relevant case studies both from Uzbekistan and selected international contexts.

The sources reviewed encompass **peer-reviewed journal articles, national and international policy reports, official export statistics, and documented case studies of export-oriented horticultural enterprises**. These sources provide a robust empirical foundation for identifying systemic constraints, assessing existing mechanisms, and deriving insights on best practices applicable to the Uzbek context.

A **thematic synthesis method** was employed to classify constraints and mechanisms into four interrelated categories: **Quality standards and compliance** – adherence to international phytosanitary, packaging, and traceability norms; **Supply chain and logistics** – optimization of post-harvest handling, transport, cold storage, and value chain integration; **Institutional and financial**

support – access to credit, insurance, subsidies, and cooperative arrangements; **Market and branding mechanisms** – export marketing strategies, international certification, and brand positioning.

To construct the conceptual model and derive **policy and strategic recommendations**, a **normative analytic approach** was employed. This involved synthesizing empirical evidence from the literature with global best practice models from countries with highly developed horticultural export sectors. Comparative analysis allowed the identification of mechanisms that are both effective internationally and adaptable to Uzbekistan's structural and institutional realities.

This methodology provides a systematic and **evidence-based foundation for modeling the interdependencies among economic, institutional, and logistical mechanisms**. The resulting conceptual framework not only identifies critical leverage points for enhancing competitiveness but also serves as a practical tool for policymakers, exporters, and stakeholders seeking to improve export performance, product quality, and long-term sustainability of the fruit export sector in Uzbekistan.

Conceptual Model of Economic Mechanisms. Building upon the literature synthesis, empirical evidence, and comparative analysis of international best practices, this study proposes a **conceptual model comprising four interlinked modules** designed to enhance the competitiveness of Uzbekistan's fruit export sector. Each module addresses a critical dimension of export performance, and their coordinated operation is essential for achieving sustainable growth and market integration.

1. Quality Standardization & Compliance Module. This module encompasses all mechanisms related to ensuring that horticultural produce meets international phytosanitary and quality standards. Key components include: **Phytosanitary certification** to comply with destination country regulations; **Quality control, sorting, and grading** to meet size, appearance, and ripeness criteria; **Hygienic washing, packaging, and cold chain management** to preserve freshness and extend shelf life; **Traceability systems** to ensure full product traceability from farm to market.

The module establishes the foundational requirements for accessing premium export markets, safeguarding reputational capital, and minimizing trade rejections. Investment in modern equipment and adherence to internationally recognized standards are critical for enabling small and medium-sized enterprises (SMEs) to compete globally.

2. Value Chain & Logistics Optimization Module. Efficient supply chain coordination is central to minimizing post-harvest losses and maintaining product quality. This module incorporates: **Integrated supply chain management** linking farms, packing houses, storage facilities, transportation networks, and export hubs; **Aggregation mechanisms** such as agro clusters and cooperatives to achieve economies of scale, standardize product quality, and consolidate volumes for export; **Infrastructure investments** in cold storage, refrigerated transport, and advanced logistics systems; **Process optimization** to reduce transaction costs, delivery times, and spoilage.

By enhancing the efficiency of the value chain, this module ensures that high-quality produce reaches international markets in optimal condition, directly supporting competitiveness.

3. Institutional and Financial Support Module. The third module addresses the structural and financial enablers of export growth. Mechanisms include: **Export-oriented financing instruments** such as subsidized loans, export guarantees, and insurance schemes; **Public–private partnerships (PPP)** to co-finance infrastructure and technological upgrades; **Capacity building initiatives** including technical training, certification support, and advisory services for producers and exporters; **Incentives for private sector investment** in processing, storage, and logistics.

This module ensures that financial and institutional constraints do not hinder participation in global markets, particularly for SMEs that may lack the capital or knowledge to comply with international standards.

4. Market Development & Branding Module. The final module focuses on market access, product differentiation, and reputation building. Core components include: **Strategic export marketing** targeting high-value and niche markets; **Development of strong national and regional fruit brands** to enhance recognition and consumer trust; **Leveraging food safety certifications and**

traceability as a competitive advantage; **Digital marketing and e-commerce platforms** to directly engage global buyers and expand market reach.

By actively promoting Uzbek fruit products and creating recognizable brands, this module complements quality and logistical efforts, ensuring that increased production and compliance translate into tangible market success.

Model Integration and Synergy. The proposed model emphasizes **interdependence among the four modules.** Sustainable export competitiveness is achieved only when all modules operate in coordination: deficiencies in one area-such as logistics inefficiencies or lack of financial support-can undermine the effectiveness of other modules, including quality compliance and market development. Conversely, synergetic implementation of all four modules amplifies the sector's export potential, enhances profitability, and contributes to long-term sustainability.

This framework provides a **strategic, evidence-based tool** for policymakers, exporters, and other stakeholders, enabling targeted interventions that address structural challenges, optimize resource allocation, and systematically strengthen Uzbekistan's presence in global fruit markets.

Discussion

The analysis of Uzbekistan's fruit export sector demonstrates that the mechanisms identified in the conceptual model are **highly interdependent**, underscoring the necessity of a holistic and coordinated strategy for enhancing export competitiveness. The effectiveness of any single intervention is constrained if not supported by complementary mechanisms across the value chain. For instance, ensuring compliance with international quality standards alone-through sorting, grading, hygienic washing, and certification-cannot achieve sustainable competitiveness without efficient cold chain logistics. Post-harvest losses remain a significant barrier, and any improvements in product quality may be nullified if storage and transport systems fail to preserve freshness and shelf life.

Conversely, financial interventions, such as subsidized loans, export guarantees, or insurance schemes, are unlikely to yield substantial gains if producers and exporters operate within fragmented supply chains or lack coordinated quality control. Inefficient use of capital, duplication of efforts, and minimal impact on actual export volumes may result if institutional and financial support is not integrated with value chain optimization and quality assurance mechanisms. These observations reinforce the **critical need for integrated policy interventions** that align investments in infrastructure, training, logistics, and market development with quality and regulatory compliance objectives.

Empirical evidence from both global and local contexts supports the efficacy of **cooperative and cluster-based export models**. Case studies reveal that SMEs forming export cooperatives or agro-clusters can collectively meet minimum volume commitments required by international buyers, share the fixed costs of certification, packaging, and logistics, and achieve economies of scale that individual farms cannot attain alone. Such collective action enables small and medium producers to participate effectively in competitive export markets, overcoming structural and scale disadvantages. (arXiv+1)

In the context of Uzbekistan, expanding **cold storage and post-harvest infrastructure** is particularly critical. Recent sector analyses indicate that existing cold storage capacity meets only a fraction of the estimated demand, creating bottlenecks that limit the country's ability to satisfy export requirements and maintain fruit quality during transportation. (UzDaily.uz+1) Without targeted investments to expand and modernize storage facilities, the sector risks losing potential export revenue and competitive positioning in high-value markets.

Market diversification is another key component of sustainable competitiveness. Current export flows are heavily concentrated in traditional destinations such as Russia and other CIS countries, exposing the sector to **geopolitical and economic risks**. Expanding into high-value and emerging markets in the Middle East, Southeast Asia, and the European Union could reduce dependence on a few markets, stabilize revenues, and enhance long-term growth prospects. (UzDaily.uz+1)

Finally, institutional reforms, public–private partnerships, and targeted export financing schemes are essential to mobilize investment across the fruit export value chain. Investments in packing facilities, cold storage infrastructure, refrigerated logistics, quality certification, and marketing initiatives are particularly important for SMEs that lack the resources to implement these improvements independently. Coordinated deployment of these mechanisms ensures **synergistic effects**, maximizing the impact of financial and institutional support while simultaneously improving product quality, logistics efficiency, and market access.

In sum, the discussion underscores that **integrated implementation of all modules in the proposed conceptual model-**quality standardization, value chain and logistics optimization, institutional and financial support, and market development-is essential for overcoming structural constraints, increasing export volumes, and positioning Uzbekistan as a competitive player in the global fruit market.

Conclusion and Recommendations. This study demonstrates that enhancing the competitiveness of Uzbekistan's fruit export sector requires a **multi-layered, integrated strategy**, operationalized through a conceptual model comprising four interdependent modules: **quality standardization and compliance, value chain and logistics optimization, institutional and financial support, and strategic market development and branding**. The coordinated implementation of these mechanisms is essential to address structural inefficiencies, such as post-harvest losses, fragmented supply chains, limited cold storage capacity, and restricted access to export finance, thereby enabling sustained improvements in export performance, product quality, and sectoral growth.

The proposed conceptual framework provides a **strategic roadmap** for policymakers, exporters, and industry stakeholders to synergize investments, regulatory measures, and market development initiatives. By adopting this holistic approach, Uzbekistan can enhance its position in global horticultural markets, increase export volumes, maximize value addition, and achieve long-term sustainability in the fruit sector.

Key Recommendations:

✓ **National Support Programs:** Develop and implement government-backed initiatives aimed at supporting **certification processes, modernization of packing and post-harvest facilities, and expansion of cold storage infrastructure** to reduce losses and meet international quality standards.

✓ **Formation of Agro Clusters and Cooperatives:** Encourage collective action among small and medium producers to enable **resource pooling, economies of scale, coordinated quality control, and collective export activities**, which enhance the sector's competitiveness and market reach.

✓ **Export-Oriented Financial Instruments:** Introduce and expand access to **subsidized loans, export guarantees, insurance schemes, and targeted financing programs** that facilitate investment in infrastructure, technology adoption, and compliance with international standards, particularly for SMEs.

✓ **Strategic Market Development and Branding:** Strengthen **export marketing strategies, brand building, and market diversification** by targeting high-value and niche markets, adopting traceability and food safety certifications, and leveraging digital marketing and e-commerce platforms to connect with global buyers.

✓ **Public–Private Partnerships and International Investment:** Promote collaboration between government bodies, private enterprises, and international investors to **upgrade export infrastructure, develop logistics and cold chain networks, and enhance value chain services**, ensuring that structural and institutional gaps are systematically addressed.

Implementation of these measures is expected to significantly **enhance export performance, sectoral profitability, and sustainability**, contributing to broader economic development, increased rural incomes, and deeper integration of Uzbekistan into the global fruit export market. Furthermore, the adoption of this conceptual model provides a **replicable framework** for other agro-export sectors

seeking to align quality standards, logistics efficiency, financial facilitation, and market development strategies to achieve competitive advantage.

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Rezyume: *Ushbu maqola O‘zbekistonda meva eksporti sohasida raqobatbardoshlikni oshirishga qaratilgan iqtisodiy mexanizmlarni modellashtiruvchi konseptual ramkani taklif etadi. Tadqiqot asosiy komponentlarni aniqlaydi va integratsiyalaydi: sifat standartlariga rioya qilish va ularni joriy etish, qiymat zanjiri koordinatsiyasi va logistika samaradorligi, institutsional va moliyaviy qo‘llab-quvvatlash, shuningdek, bozorni kengaytirish va brend strategiyalari. Adabiyotlar tizimli tahlili va ikkilamchi ma’lumotlar hamda amaliy ishlar taqqosiy tahlili orqali ramka ushbu mexanizmlarning o‘zaro bog‘liqligini ko‘rsatadi va ularning birgalikdagi qo‘llanilishi orqali hosildorlik yo‘qotishlari, sovutgichli omborlarning yetishmasligi, ta’minot zanjirining bo‘linishi va eksport moliyalashtirishga cheklangan kirish kabi tuzilma muammolarini kamaytirish mumkinligini namoyish etadi. Taklif etilgan model eksport qiluvchilar va siyosat ishlab chiqaruvchilar uchun strategik vosita bo‘lib, eksport samaradorligini oshirish, sohaning barqaror o‘sishini ta’minlash va O‘zbekistonning global meva bozoridagi ulushini kengaytirishga imkon beradi.*

Резюме: *Данное исследование предлагает концептуальную модель, моделирующую экономические механизмы, направленные на повышение конкурентоспособности сектора экспорта фруктов в Узбекистане. В работе выделены и интегрированы ключевые элементы: стандартизация и соблюдение требований качества, координация цепочки добавленной стоимости и оптимизация логистики, институциональная и финансовая поддержка, а также развитие рынка и стратегий брендинга. Систематический обзор литературы и сравнительный анализ вторичных данных и кейс-исследований демонстрируют взаимосвязь этих механизмов и показывают, как их согласованное применение может смягчить структурные проблемы, включая потери после сбора урожая, недостаточную инфраструктуру холодного хранения, фрагментированные цепочки поставок и ограниченный доступ к экспортному финансированию. Предлагаемая модель предоставляет стратегический инструмент для экспортеров и политиков, способствуя повышению эффективности экспорта, устойчивому росту сектора и расширению присутствия Узбекистана на мировом рынке фруктов.*

Kalit so‘zlar: *Qiymat zanjiri integratsiyasi, eksport raqobatbardoshligi, eksport moliyalashtirish, O‘zbekiston, meva eksporti, sifat standartlari.*

Ключевые слова: *Интеграция цепочки добавленной стоимости, конкурентоспособность экспорта, экспортное финансирование, Узбекистан, экспорт фруктов, стандартизация качества.*

PHYSIOLOGICAL AND PHYSICAL DETERMINANTS OF FLATWATER KAYAKING

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Summary:. *After duplicate removal and further screening for relevance, a total of 17 articles were included in the review. Altogether, it was found that flat-water kayaking performance was strongly correlated with maximum oxygen uptake (VO_{2max}), aerobic and anaerobic thresholds, peak aerobic and anaerobic capacity measure in lab and on the water, and upper and lower-body strength and power, which were measured using heavy resistance, as well as isometric and isokinetic implements.*

Key words: *anthropometry, muscular strength and power, aerobic capacity, anaerobic power*

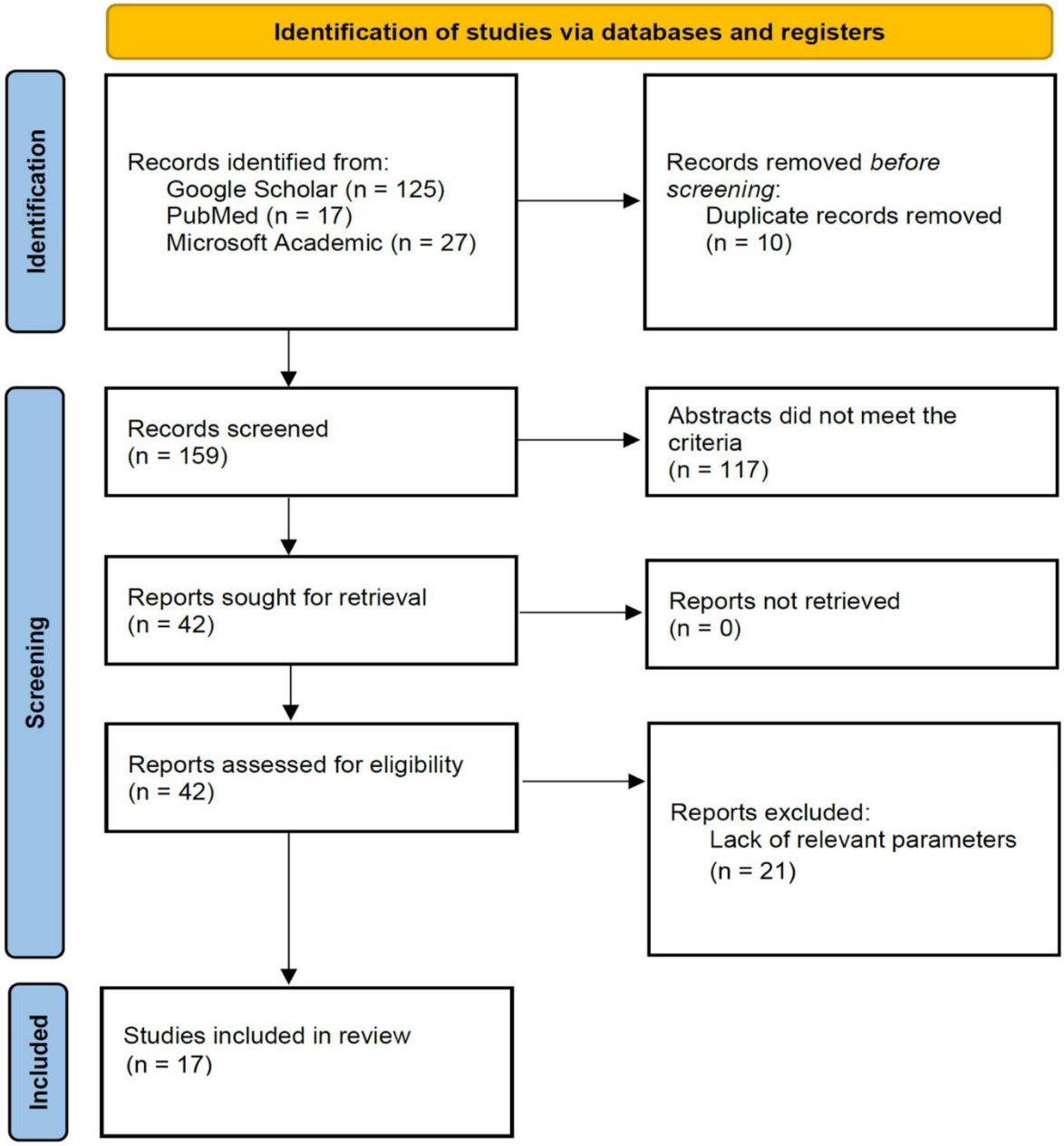
Sprint kayaking is performed in a single-, double-, or quadruple-seated kayak (K1, K2, or K4, respectively) in a straight line over still water, covering distances of 200, 500, and 1000 m. To win, sprint kayakers must generate and maintain the highest average boat speed over a given distance. To achieve this, sprint kayakers must generate high propulsive forces to overcome the gravitational forces that act on the kayak's forward motion. At the 2020 Olympic Games, the medal winning times for women's K1 in the 200 m and 500 m were 38.120 s and 107.655 s, respectively, and for men's K1 in the 200 m and 1000 m were 33.985 s and 200.643 s, respectivele. Interestingly, sprint kayakers rarely specialize in a single race distance; many compete in multiple distances, despite the dramatic differences in race times.

Regardless of the distance of the race, such performances require a complex integration of physical and physiological components, with each distance placing slightly different demands. For example, maximal aerobic power is a stronger predictor of 1000 m sprint kayaking than 200 m, while the opposite is true for maximal anaerobic power (i.e., more predictive for performances between 200 and 1000 m). Despite the clear differences in physiological demands between sprint kayaking distances, the relationship between upper body strength and performance is less clear. For example, McKean and Burkett observed a weakening of the relationship between bench press and deadlift one-rep maximum (1RM) and performances at 200, 500, and 1000 m over a three-year period in men, while the opposite was observed in women. On the other hand, while some studies have shown a correlation between lean body mass and sprint kayaking [9], there are other studies that have found this to be incorrect.

Given the inconclusive conclusions from the many studies examining different aspects of sprint kayaking performance, a review is warranted to consolidate these findings. An article examining the determinants of sprint kayaking performance would assist practitioners in adopting appropriate training regimens. Our aim is therefore to critically review the physiological and physical determinants of sprint kayaking performance. A secondary aim is to shed light on future research and provide guidance for practitioners.

Results. Studies included in the review The initial search yielded 125 articles from Google Scholar, 17 from PubMed, and 27 from Microsoft Academic, resulting in a total of 169 articles. After manual removal of duplicates, 159 articles remained for review. After reviewing abstracts for relevant studies, 117 studies were excluded, resulting in 42 articles being reviewed. After checking full texts for relevant information, a further 23 articles were excluded, resulting in a total of 17 articles being included for this review. The search was conducted in accordance with the PRISMA checklist. The PRISMA inclusion/exclusion process is graphically illustrated in Figure 1.

Figure 1. The PRISMA flow chart details the search strategy.



This review only included observational studies that examined any association (using correlational or regression statistics) between various physiological or physical variables (e.g., aerobic/anaerobic capacity, strength, and muscle circumference) and sprint kayak performance (i.e., water or ergometer time trial performance).Available data on the relationship between aerobic threshold and sprint kayaking at different distances are limited to two studies.(Table1). Both studies concluded that the aerobic threshold has a large inverse correlation with 200 m [$r = -0.65$],500 m [$r = -0.48$], and 1000 m [$-0.63 \geq r \geq -0.68$], performance times. The 200 m and 500 m events are of high intensity; hence, they result in the accumulation of high levels of lactate. Therefore, it is plausible that a high aerobic threshold would be favourable as it indicates that athletes would have a higher capacity to buffer hydrogen ions and/or reuse lactate as a fuel. Thus, those with a high aerobic threshold can sustain work at the required intensity for a longer period.

Table 1. Relationship between aerobic threshold and sprint kayaking performance.

Authors	n	Sex	Population	200 m	500 m	1000 m
Borges et al. [14]	21	M and F	Well-trained juniors	−0.65	-	−0.68
Fry and Morton [16]	38	M	State and non-state	-	−0.48	−0.63

While the aerobic threshold has been reported to be a determinant of sprint kayaking performance, it has also been reported that athletes work at an intensity much higher than the aerobic threshold, as indicated by the high level of anaerobic contributions [12]. In view of that, the anaerobic threshold, which is the highest sustained exercise intensity above which production is supplemented by anaerobic mechanisms, may be a more important factor to performance as it is likely closer to the sprint performance exercise intensity. This review also highlights the need for further investigation into the relationship between lower body muscle function and sprint kayaking performance. While upper body pulling and pushing abilities have been extensively studied, the role of the lower body in sprint kayaking is less clear, despite its theoretical importance. Future studies should examine the impact of lower body muscle function, such as force production speed and strength, on overall performance.

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Rezyume: *Ushbu maqolada tekis suvda kayakda suzish samaradorligi maksimal kislorodni yutish (VO2max), aerob va anaerob chegaralari, laboratoriyada va suvda eng yuqori aerob va anaerob sig'im o'lchovi, shuningdek, yuqori va pastki tana kuchi va quvvati bilan kuchli bog'liqligiva fiziologik hususiyatlar aniqlandi, ular og'ir qarshilik, shuningdek, izometrik va izokinetik asboblar yordamida o'lchandi.*

Резюме: *В статье показано, что эффективность гребли на байдарках по спокойной воде тесно связана с максимальным потреблением кислорода (VO2max), аэробными и анаэробными порогами, максимальной аэробной и анаэробной производительностью в лабораторных условиях и в воде, а также силой и мощностью верхней и нижней части тела и физиологическими характеристиками, измеренными с использованием тяжелых сопротивлений, а также изометрических и изокинетических устройств.*

Kalit so'zlar: *antropometriya, mushak kuchi va kuchi, aerob quvvat, anaerob quvvat.*

Ключевые слова: *антропометрия, мышечная сила и мощность, аэробная мощность, анаэробная мощность*

MAJOR DIRECTIONS IN TRANSPORT AND LOGISTICS INFRASTRUCTURE MODERNIZATION

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Summary: *This article examines key aspects and characteristics of logistics systems and transport infrastructure, current trends in their development, and theoretical and methodological approaches to understanding their structure, functions, and impact on economic development.*

Key words: *transport infrastructure, logistics, technologies, methods.*

Introduction

This article analyzes the current state of transport and logistics infrastructure and identifies the main trends in its development.

Transport and logistics infrastructure is a crucial component of the modern economy, significantly affecting both business efficiency and the standard of living for the population. In an era of globalization and rapid technological advancement, the importance of this infrastructure, which facilitates the transport of goods and passengers, is becoming increasingly relevant. Current trends, such as the rise in international trade, the introduction of innovative transport systems, and the shift towards sustainable transport solutions, necessitate a thorough analysis and rethinking of existing approaches to their development and operation.

Modern trends in transport logistics include the digitalization of processes, the integration of various modes of transport, the promotion of environmentally friendly logistics solutions, and the development of "smart" transport systems. These changes enhance the competitiveness of companies, promote the efficient use of resources, and reduce environmental impact.

Main part

Transport and logistics infrastructure consists of a complex set of objects and systems that facilitate the organization of logistics processes in transportation. This infrastructure combines transport facilities and logistics systems, both of which play a crucial role in the field of transport and logistics.

This infrastructure is essential for transport and logistics activities, as it ensures the smooth functioning of the transport network and guarantees the safety and continuity of logistics processes. Vehicles serve as the foundation for transporting goods and passengers, while logistics enhances distribution efficiency.

Logistics systems enable effective supply chain management, planning, and control over the transportation of goods and information. They allow businesses to efficiently manage inventory, reduce delays, and minimize costs.

Modern technologies, including automation and data analytics, significantly improve the productivity of logistics processes and enhance customer service levels. The integration of transport infrastructure and logistics systems boosts the exchange of goods and increases the competitiveness of organizations.

Transport networks form the foundational component of transport and logistics infrastructure. These networks include roads, railways, waterways, ports, airports, and railway stations, creating a comprehensive system for the transportation of goods and passengers. Key aspects of logistics systems and transport infrastructure underscore their vital role in economic growth and the sustainable development of society.

Let us consider several points:

1. Inventory Optimization and Cost Reduction: Logistics systems allow companies to manage inventory more efficiently and lower storage and shipping costs. By utilizing advanced technologies such as demand forecasting and automation, companies can avoid both surpluses and shortages. This results in savings and increased profitability.

2. Economic Development and Job Creation: A well-developed transportation infrastructure contributes to business success by providing easy access to markets and promoting trade growth, both locally and globally. This development helps create new jobs in sectors such as construction, transportation, and maintenance.

3. Emergency Response: A robust transport and logistics network enables a swift and effective response to crises, including natural disasters. This includes the rapid delivery of aid, evacuation, and ensuring transport security, which are essential for protecting people and goods. Therefore, the logistics system and transport infrastructure play a crucial role in enhancing the resilience of the economy, ensuring not only the efficiency of business processes but also safety during emergencies.

Transport and logistics infrastructure is a complex and carefully organized system that guarantees the safe, fast, and accurate delivery of goods from manufacturers to end consumers.

The main characteristics of this infrastructure include:

1. Diverse Transport Solutions: Utilizing various modes of transport—road, rail, air, and sea-enables companies to select the most suitable option based on cargo type, quantity, distance, and delivery timeline. This strategy enhances financial performance and boosts logistics efficiency.

2. Modern Warehouse Complexes: Advanced, high-tech warehouses equipped with sophisticated management systems are vital to logistics. They facilitate the swift processing of goods from receipt to shipment, with automation significantly speeding up and improving accuracy in operations.

3. Information Technology: Effective logistics monitoring and management are made possible through technologies like Transport Management Systems (TMS) and Warehouse Management Systems (WMS). These tools allow for more precise planning, reduced delivery times, and optimized costs.

4. Comprehensive Integration: All stakeholders in the logistics chain-including suppliers, carriers, warehouses, and end customers—collaborate to minimize transportation costs and time, which greatly enhances the efficiency of the entire system.

5. Adaptability and Flexibility: A system's ability to swiftly respond to changes in market conditions, fluctuating demand, or unexpected events like delays or disruptions is crucial. This adaptability increases flexibility and resilience, making it essential for business success.

6. Environmental responsibility: The shift towards eco-friendly logistics technologies is increasingly important. Sustainable practices such as using green vehicles and optimizing routes help reduce environmental impact while adhering to modern environmental standards.

Transport and logistics infrastructure is a crucial element for business success, as it enables the stable and efficient movement of goods amidst dynamic market changes.

These systems play a vital role in economic development by ensuring the effective transportation of goods and services. They comprise various components, including transport routes, warehouses, terminals, and modern information and communication technologies, all of which work together to achieve a common goal.

Current trends are significantly transforming the landscape of transport and logistics processes. Automation and digitalization present new opportunities to enhance transparency and manageability throughout the entire supply chain. For instance, the use of Warehouse Management Systems (WMS) and Transport Management Systems (TMS) can optimize costs and expedite cargo processing. Additionally, innovative technologies such as the Internet of Things (IoT), Big Data Analysis, and “blockchain” enable real-time monitoring of shipments, enhancing delivery security and improving collaboration among logistics participants.

The impact of transport and logistics infrastructure extends beyond internal processes; it also influences the development of international trade. Well-organized logistics networks help reduce costs and boost the competitiveness of individual companies and entire nations. Furthermore, it is important to address environmental concerns: the adoption of “green” logistics and alternative energy sources is becoming increasingly relevant, as they contribute to reducing carbon emissions and minimizing environmental impact.

So, transport and logistics networks and infrastructure form the foundation for successful businesses and stable economic development. They ensure the smooth exchange of goods and services and promote sustainable growth.

Let us explore the modern trends shaping the development of transport and logistics infrastructure.

In recent years, there has been significant development in electronic systems for managing transport and logistics networks, which has become a key factor in optimizing supply chains. Modern technologies such as the Internet of Things (IoT), Big Data, and Artificial Intelligence (AI) are actively being implemented in logistics. These advancements not only automate processes but also enable more informed decision-making based on data analysis.

1. Automation and Digitalization: Automating cargo management processes and digitalizing all levels of logistics operations can significantly reduce order processing times and minimize errors. Transport Management Platforms (TMP) allow for real-time tracking of goods and effective management of schedules and routes.

2. Smart Transport Systems: Technologies such as autonomous vehicles and drones are increasingly common in logistics. These innovations reduce labor costs and minimize the human factor, thereby enhancing transportation safety.

3. Integration of All Participants: Modern logistics systems aim to create a unified ecosystem where all participants in the supply chain, from manufacturers to end consumers, can interact and exchange data in real time. This integration significantly improves service levels and allows for quick adaptation to changes in demand.

4. Effective Inventory Management: By utilizing analytics and predictive technologies, companies can more accurately forecast demand and manage their inventories. This approach reduces costs and minimizes the risks of shortages or surpluses of goods in warehouses.

5. Sustainable Development and Ecology: In response to contemporary environmental requirements, many companies are focusing on the sustainable development of their supply chains. The adoption of eco-friendly technologies and optimization of logistics routes helps reduce carbon emissions and mitigate negative impacts on the environment.

The advancements in electronic transport and logistics network management systems play a crucial role in enhancing productivity, improving customer service, and reducing costs. The ongoing trend toward digitalization and automation of logistics processes is expected to continue gaining traction, thereby creating new business opportunities.

Analyzing the transport and logistics infrastructure requires the use of various theoretical and methodological approaches to understand its structure, functions, and impact on economic development. Here are the main approaches:

1. Systems Approach: This approach views transport and logistics infrastructure as an integrated system comprised of interconnected components such as transport networks, storage facilities, logistics centers, and information systems. It helps identify the interactions between these elements and assesses their influence on the efficiency of logistics processes.

2. Economic Approach: The economic approach evaluates the costs and benefits related to transport and logistics infrastructure. It involves analyzing investment costs, operating expenses, and the economic effects of infrastructure improvements, which may include increased traffic volumes, shorter delivery times, and enhanced customer service.

3. Geographic Approach: This approach focuses on the spatial distribution of transport and logistics infrastructure. It is essential to examine the factors that influence the location choice of logistics facilities and the optimization of transport routes. Geographic Information Systems (GIS) are utilized to provide visual representations and analyze spatial data effectively.

4. Innovative Approach: This approach emphasizes the adoption of new technologies and management methods within the transport and logistics infrastructure sector. It may involve implementing automation, drones, the Internet of Things (IoT), and Big Data analytics to enhance the efficiency and sustainability of logistics operations.

5. Ecological and Economic Approach: In light of global environmental challenges, it is crucial to assess the impact of transport and logistics infrastructure on the environment. This ecological and economic approach involves evaluating the environmental consequences of transport activities and developing strategies to reduce the carbon footprint.

6. Modeling and Forecasting: The use of mathematical and computer models to predict the development of transport and logistics infrastructure is essential. Modeling enables the evaluation of various development scenarios, facilitates comparative analyses, and helps identify the most effective management options.

The theoretical and methodological foundations for analyzing transport and logistics infrastructure provide a comprehensive framework for studying its characteristics. They help identify problems, uncover opportunities for improvement, and develop strategic solutions to enhance the efficiency of logistics processes.

The Internet of Things (IoT) is not just a buzzword; it represents a real revolution that is fundamentally transforming various sectors, including logistics. At its core, IoT is a concept that integrates physical devices, sensors, software, and communication networks, enabling them to exchange data and interact with one another. In the logistics sector, IoT has emerged as a powerful tool that gives companies access to real-time information about the location and condition of cargo, as well as other elements of the supply chain.

The advantages of IoT in logistics are significant. It allows organizations to receive timely updates on the location and status of deliveries, helping to reduce cargo losses and enhance delivery quality. For instance, imagine getting a notification on your phone when your order leaves the warehouse, allowing you to track its progress along the entire route with assurance that it is safe and undamaged.

Furthermore, sensors installed on cargo and vehicles gather data on environmental factors such as temperature and humidity, which can be crucial for improving routes, shortening delivery times, and cutting fuel costs. IoT also facilitates the automation of logistics operations, such as loading and unloading, storage, and inventory management. Automated systems can manage warehouse operations 24/7 without human intervention, thereby increasing efficiency and reducing labor costs.

Innovation 1: Robotics and automation. Robotics and automation play a crucial role in modern logistics. They help companies enhance their operations, increase reliability, improve customer service, and reduce costs.

Warehousing and Inventory Management: Automated warehousing robots can efficiently move goods within the warehouse, manage inventory, and pick orders. This reduces errors and speeds up processing times.

Cargo Delivery and Tracking: Automated transport systems can deliver goods in various environments, including warehouses, open areas, and hard-to-reach locations. They also enable real-time tracking of cargo movements, thereby improving safety and reducing delivery times.

Innovation 2: Driverless Vehicles. Driverless vehicles, including Unmanned Aerial Vehicles (UAVs), can operate autonomously. They are equipped with a range of sensors, cameras, radar, and specialized software that allow them to navigate without human intervention, safely traveling on roads or in the air. A key advantage of unmanned trucks is their ability to operate continuously, without needing rest stops. This optimizes the delivery process and reduces travel time, which is particularly important for long-distance shipping. Drones can deliver small parcels in urban areas, helping to avoid traffic jams and further reduce delivery times. They are also ideal for reaching hard-to-access locations, such as mountains or islands.

Innovation 3: Blockchain. Blockchain is a technology that enables the creation of secure and transparent data records. In the logistics sector, it can be utilized for tracking the movement of goods, verifying the authenticity of products, managing supply chains, and optimizing contractual relationships. By creating an immutable record of goods movement, blockchain enhances the transparency and security of the supply chain. Every stage of product transit, from manufacturer to consumer, is recorded on the blockchain, making it impossible to alter or forge the information.

Additionally, blockchain can automate contractual relationships in logistics. For instance, payments can be automatically executed when certain contractual conditions are met, thereby reducing manual labor and streamlining document processing.

IoT, robotics, driverless vehicles, and blockchain are the key technologies transforming the logistics industry. The future will witness even greater automation and optimization of processes, along with the emergence of new technologies that address logistics challenges more efficiently and effectively. Overall, innovations like IoT and blockchain will not only revolutionize the logistics sector but also benefit all participants in the supply chain by reducing costs, increasing efficiency, and enhancing customer service through more transparent and reliable delivery processes.

Conclusion

In conclusion, transport and logistics infrastructure plays a vital role in the efficient operation of the modern economy, significantly contributing to the competitiveness of countries on a global scale. Current development trends, such as digitalization, automation, sustainable development, and the integration of various transportation modes, underscore the necessity to adapt existing theoretical and methodological approaches to infrastructure analysis. As the business environment rapidly changes and demands for faster, higher-quality cargo delivery increase, the relevance of using integrated models to assess the efficiency of transport and logistics systems becomes even more pronounced.

Analyzing transport and logistics infrastructure requires an interdisciplinary approach that encompasses both economic and technical aspects. This comprehensive perspective allows for a better understanding of the interrelationships within logistics chains. Future developments in this field will be influenced by technological innovations and shifts in consumer preferences, presenting new challenges and opportunities for researchers and engineers-practitioners. Therefore, conducting thorough studies and analyses of transport and logistics infrastructure is essential for advancing and optimizing logistics processes, ultimately contributing to economic growth and an improved standard of living for the population.

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Rezyume: *Ushbu maqolada logistika tizimlari va transport infratuzilmasining asosiy jihatlari va xususiyatlari, ularning rivojlanishining zamonaviy tendensiyalari, shuningdek, ularning tuzilishi, vazifalari va iqtisodiy rivojlanishga ta'sirini tushunishning nazariy va uslubiy yondashuvlari ko'rib chiqiladi..*

Резюме: *В данной статье рассматриваются ключевые аспекты и особенности логистических систем и транспортной инфраструктуры, современные тенденции их развития, а также теоретические и методологические подходы к пониманию их структуры, функций и влияния на экономическое развитие.*

Kalit so'zlar: *transport infratuzilmasi, logistika, texnologiyalar, usullar.*

Ключевые слова: *транспорт инфраструктура, логистика, технология, методы.*

CONCEPT AND STRUCTURE OF TRAINING FUTURE BACHELORS IN ENVIRONMENTAL EDUCATION

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Summary: *The article highlights the concept of preparing future bachelors for environmental education, its structural composition, and the pedagogical foundations of this process. The content of environmental education, factors in the formation of ecological culture, ecological competencies, and ecological worldview in students are analyzed. Also, based on scientific and theoretical literature, the components of environmental training based on knowledge, motivation, activity, and values are described.*

Key words*: environmental education, environmental culture, environmental competence, environmental awareness, environmental safety, sustainable development, environmental training.*

In the current process of globalization, the exacerbation of environmental problems poses new challenges for the education system. In particular, one of the urgent pedagogical tasks is the formation of an ecological culture of future bachelors, their training in accordance with the requirements of environmental safety. Therefore, in-depth study of the content of environmental education in the fields of pedagogy and ecology and its effective implementation at the bachelor's level is of particular importance.

In the research of E.J. Ikromova, it is noted that in the process of multilayered relations between man and nature, it is important to take into account not only the conscious part of the psyche, but also the unconscious in its structure. Therefore, the future teacher must understand that a child's relationship with the teacher, society in general, and the natural environment can be influenced by deep structures of the psyche. This also applies to the teacher's specific behavior: revealing the hidden, sometimes unconscious motives of their behavior helps to correct certain actions and behaviors, understand the essence of their problems, and address them professionally and in life.

Thus, summarizing the above points, we emphasize that the composition of the future teacher's readiness for environmental educational activity consists of three interconnected components: motivational-semantic, affiliative-gnostic, and activity-reflexive **(Fig. 1.6).**

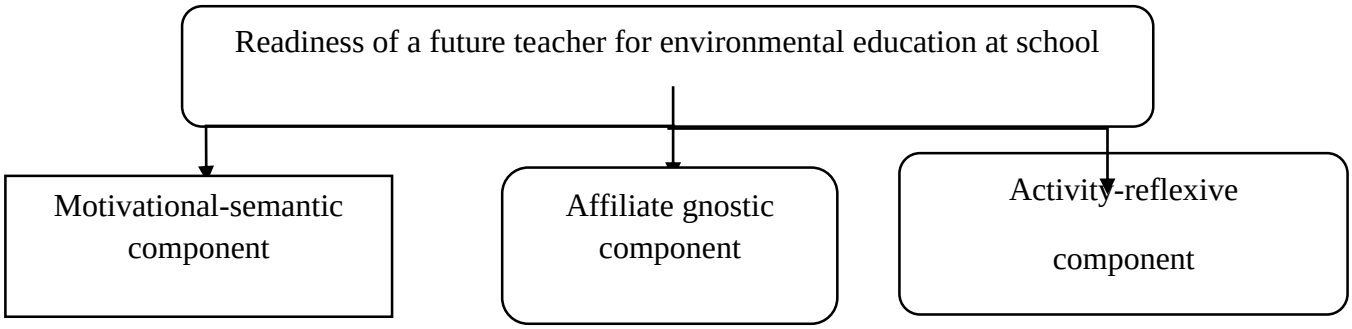


Figure. 1.6. The future teacher's activities in the field of environmental education at school preparation structure.

We lay a deep psychological foundation for these components of the future teacher's readiness for environmental education at school. We justify this approach as follows. Almost every teacher, in the process of their pedagogical activity, encounters certain intrapersonal contradictions related to the semantic content of their professional activity as a whole, the expediency of a particular action or communicative action. On the one hand, such thinking can be very useful for a teacher's professional self-development. This occurs when the teacher begins to review and improve their work, that is, personal and professional growth. On the other hand, such internal difficulties can lead to the loss of meaning in one's professional activity and, accordingly, to unfulfilled personality. Therefore, to

prevent sometimes unnecessary and, moreover, dangerous experiments, at the stage of training students - future teachers, it is necessary to help them find and understand the significance and subjective significance of environmental educational activities.

Moreover, a teacher with perfect deep knowledge in the field of ecology may not be able to convey them to the level of significance included in the essence of environmental education. In this case, he may also feel some dissatisfaction with his activity or form a negative attitude towards students who do not respond to his impulses.

Therefore, the knowledge of communication mechanisms, developmental psychology, and personality psychology, which we included in each component of preparation, will help the future teacher to correct such moments and effectively build environmental education activities at school in the future. At the same time, this activity, as noted in the previous paragraph, is not limited to interaction with students, it is important to work with social partners (museums, libraries, reserves) who provide environmental education, which also implies psychological literacy.

The readiness of a future teacher for environmental education at school is a complex phenomenon, usually defined as a personal characteristic that combines three components. In our opinion, understanding the preparation for this type of activity will help university teachers to take a qualified approach to the formation of students' readiness for environmental education at school.

The Republic of Karakalpakstan, according to many experts, is an independent unique natural monument. It includes many places rich in beauty: mountains, rivers, lakes, waterfalls, forests, and so on. Many plants and animals of the republic are listed in the Red Book and are unique. Along with this, historical and architectural monuments have been preserved. Unfortunately, as a result of various events in Karakalpakstan, some of them have disappeared irreversibly. In this regard, the task of the population and the younger generation is to develop the ecology of Karakalpakstan, "greening" the economy, production, agriculture, but primarily education. Among socio-ecological institutions, educational institutions prevail. There is reason to talk about targeted and systematic work to restore and preserve the ecology of the motherland, the republic, or the country. This means the need to involve educational institutions in this work. In particular, it is advisable to develop pedagogical work on the formation of ecological literacy in preschool and primary school children, ecological culture in adolescents, and ecological culture in secondary school students and university students. This conclusion fully corresponds to the results of previous research in this area.

At the same time, from a pedagogical point of view, such a difficult task should be performed by a teacher who has a certain training and has undergone a certain training. There is reason to believe that such training should be carried out, first of all, during the period of development of intellectual and communicative abilities related to a certain topic. According to experts, such a delicate period occurs in adolescence. In this regard, it should be noted that the psychological characteristics of student age have been the focus of attention of many teachers and scientists as an important stage in preparing a person for professional activity and forming life plans (S.Azimova, A.S.Tukhtaev. B. Ziyomuhammedov, N.I. Kobzeva).

Thus, N. I. Kobzeva emphasizes that modern university students are young people with further opportunities for intellectual development, reflecting the most important intellectual potential of modern society. The author's understanding of this age as a multi-channel structure of personality formation made a great impression on us. In this regard, we believe that it is necessary to prepare future teachers for environmental education at school during their studies at the university. This is due to the fact that within the age limits of student life, the psychological characteristic of youth is clearly manifested - the striving for the future, the construction and implementation of life and professional plans.

In our research, we put forward the idea of focusing on the long-term perspective in the implementation of environmental education activities. In addition, professional self-determination in adolescence completes its formation, so that students can determine priorities for themselves in their professional activities. The task of university teachers is to ensure the needs of future teachers in the implementation of environmental education activities at school.

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Rezyume: *Maqolada bo'lajak bakalavrlarning ekologik ta'limga tayyorgarligi tushunchasi, uning tarkibiy tuzilishi hamda mazkur jarayonning pedagogik asoslari yoritilgan. Ekologik ta'limning mazmuni, talabalarda ekologik madaniyat, ekologik kompetensiyalar va ekologik dunyoqarashni shakllantirish omillari tahlil qilingan. Shuningdek, ekologik tayyorgarlikning bilim, motivatsiya, faoliyat va qadriyatlarga asoslangan komponentlari ilmiy-nazariy adabiyotlar asosida bayon etilgan.*

Резюме: *В статье освещается понятие подготовки будущих бакалавров к экологическому образованию, его структурная организация и педагогические основы данного процесса. Проанализировано содержание экологического образования, факторы формирования экологической культуры, экологических компетенций и экологического мировоззрения у студентов. Также на основе научно-теоретической литературы изложены компоненты экологической подготовки, основанные на знаниях, мотивации, деятельности и ценностях.*

Kalit so'zlar: *ekologik ta'lim, ekologik madaniyat, ekologik kompetensiya, ekologik ong, ekologik xavfsizlik, barqaror rivojlanish, ekologik tayyorgarlik.*

Ключевые слова: *экологическое образование, экологическая культура, экологическая компетентность, экологическое сознание, экологическая безопасность, устойчивое развитие, экологическая готовность.*

ECONOMIC-QUALITY MODEL OF CHOOSING AN OUTSOURCER BASED ON OUTSOURCING SERVICES IN QUALITY ASSURANCE OF PUBLIC PROCUREMENT

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Summary: *The article presents an economic-qualitative model for selecting an outsourcer based on outsourcing services to ensure the quality of public procurement.*

Key words: *outsourcing, public procurement, outsourcing services market, budget deficit, medical activities, medical services.*

In the realm of public procurement, confirming the highest quality standards while maintaining cost-effectiveness is of paramount importance. As governmental organizations strive to enhance their operations and deliver value to their constituents, outsourcing has emerged as a viable solution for delegating certain tasks, such as quality assurance, to specialized service providers. Conversely, the decision to outsource comes with its own set of challenges, particularly when it comes to selecting the most suitable outsourcer.

This introduction presents the Economic-Quality Model, a framework designed to aid decision-makers in choosing an outsourcer for quality assurance services in public procurement. This model highlights the crucial balance between economic considerations and quality requirements, enabling organizations to make informed decisions that align with their objectives and stakeholders' expectations.

Traditionally, the outsourcing decision has been primarily driven by cost-related factors, with organizations seeking to reduce expenditures by leveraging external expertise. Nevertheless, prioritizing economics alone can lead to potential compromises in the quality of services rendered. Recognizing this inherent trade-off, the Economic-Quality Model adopts a comprehensive approach and methods that evaluates multiple dimensions, including financial viability, technical proficiency, and the ability to maintain stringent quality standards [1].

One key aspect of the Economic-Quality Model is its emphasis on assessing the potential outsourcer's financial stability and capacity to deliver consistent quality over the long term. Public procurement processes often involve multi-year contracts, necessitating a thorough assessment of an outsourcer's financial health to ensure their ability to accomplish contractual obligations reliably. By considering financial indicators, such as liquidity, profitability, and solvency ratios, organizations can mitigate the risks associated with unreliable outsourcers and safeguard the continuity of quality assurance services.

Furthermore, the model places significant emphasis on the technical proficiency and expertise of potential outsourcers. Evaluating an outsourcer's track record, industry experience, certifications, and qualifications allows organizations to gauge their ability to meet the specific quality requirements of the public procurement process. This dimension of the model ensures that the selected outsourcer possesses the necessary technical capabilities, ensuring effective oversight, impartiality, and adherence to regulatory standards.

The Economic-Quality Model incorporates mechanisms for ongoing quality monitoring and performance evaluation. Through robust key performance indicators (KPIs), regular audits, and feedback mechanisms, organizations can proactively assess the outsourcer's performance and address any deviations from the desired quality standards. This iterative approach fosters a constant improvement mindset, enabling organizations to maintain high-quality outcomes throughout the duration of the outsourcing arrangement.

By adopting the Economic-Quality Model, governmental organizations can navigate the complex process of selecting an outsourcer for quality assurance in public procurement. This model strikes a delicate balance between economic considerations and quality requirements, ensuring that public resources are utilized efficiently while upholding the highest standards of service delivery. As public procurement continues to evolve, the Economic-Quality Model equips decision-makers with

a robust framework to make well-informed outsourcing decisions that align with their deliberate objectives and foster public trust [2].

The issue of eliminating existing problems and improving the quality of public services in the republic is considered as one of the important tasks, that is, the elimination of a number of problems, bureaucracy, censorship and other administrative obstacles, outdated and incompatible procedures. it is required to carry out systematic work aimed at radical reduction. In this regard, provision of 73 types of references and documents for residents and entrepreneurs was canceled, and an opportunity was created to obtain them using the interdepartmental integration platform based on the "Electronic Government" system.

At the same time, it is necessary to increase the scope of providing public services to the population in convenient and easy ways, prevent citizens from wandering from office to office, and consistently continue work on the reliable protection of information available in the information system of state bodies. is being done. In turn, it is necessary to develop measures to ensure the quality of public services, to determine priority goals and obligations to consumers and society.

In this regard, the use of outsourcing has been confirmed during our research to eliminate the problems and increase the efficiency of the use of budget funds. However, there are two main problems with this. The first is the choice of the most suitable entity when outsourcing services, and the second is to ensure the quality of services provided to the outsourcer, to monitor compliance with existing standards. We have considered the methodological basis of service quality control and evaluation in the previous paragraphs. In this paragraph of the dissertation, we would like to focus on the economic-quality model of choosing an outsourcer.

Economic justification of the choice of an outsourcer providing services is considered appropriate to be carried out in two stages. In the first stage, outsourcers with economically based capabilities are selected based on the interests of the outsourcer's clients. In the second stage, among these enterprises, those that have the specified capabilities and are able to ensure the quality of service are selected [3].

When choosing an outsourcer, it is appropriate to consider the company's short-term results and the main principles of its developed strategy as an important criterion, since there will be no drastic changes in its production capacity in a short period of time. In the conditions of a competitive market, it is necessary to determine the profitable or unprofitable amount of production of a given type of service of a given enterprise.

Naturally, it is necessary to obey the golden rule of the market economy, that is, according to it, the enterprise achieves maximum profit in conditions where marginal revenue is equal to marginal cost, and in competitive market conditions, this determines its production potential.

We determine the capacity (Vij) of the service provider i-enterprise to provide the j type of service based on the following calculation.

$$\frac{dTC(V_{ij})}{d(V_{ij})} = c_j \qquad (1)$$

Here. cj – the value of the j-service unit (under perfectly competitive market conditions); TC(Vij) is a function of the total costs incurred by the i-th service provider to perform the j-type of service (that is, the sum of variable and fixed costs).

Economically, profit is an important indicator in the assessment of efficiency, therefore, we can calculate the profit of service provider i as the difference between the income received from the service provided and the cost spent on providing this service:

$$\pi_{ij} = P_j * V_{ij} - TC(V_{ij}) \qquad (2)$$

Here, Pj is the amount of payment for the j-unit of additional service; Vij is the volume of provision of the j-service type by the i-th service provider.π_{ij}-Profit received by the i-th service provider due to the provision of the j-type of service.

In the neoclassical economic theory, average total costs are determined based on the ratio of total costs to the volume of production, and the derivative of the total cost by the product quantity allows determining the marginal (marginal) cost. At the same time, in a competitive market, when

marginal cost and marginal revenue are equal to each other, the enterprise receives maximum profit. On the other hand, in a competitive market, marginal revenue is equal to the amount paid per unit of service. Profit can be maximized when the size of MTC is equal to the cost of performing j-unit of service and the average total cost of ATC is minimal.

If the amount of marginal cost is equal to the amount of total average cost, then the profit of the service provider will be zero, that is, he will neither profit nor lose:

$$MTC - P_j = \frac{dATC(V_{ij})}{d(V_{ij})} \qquad (3)$$

The solution to the above equation can be seen in Figures 8 and 9 below.

If the amount of payment for a unit of service Pj is equal to the minimum ATC, then the service provider will fully cover its total costs, but will not be able to make a profit, that is, production reaches the break-even point (Fig. 3.1.1).

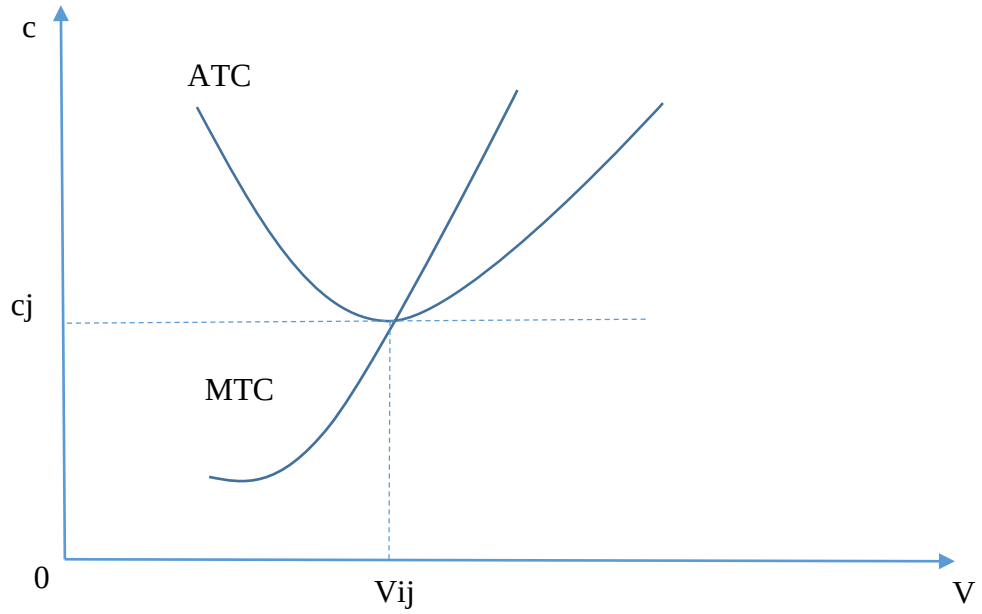


Figure 1. Breakeven point of service provider

In order for the service provider to have a profit, the price of the service is required to be above the total average cost, which can be illustrated as follows (Figure 2).

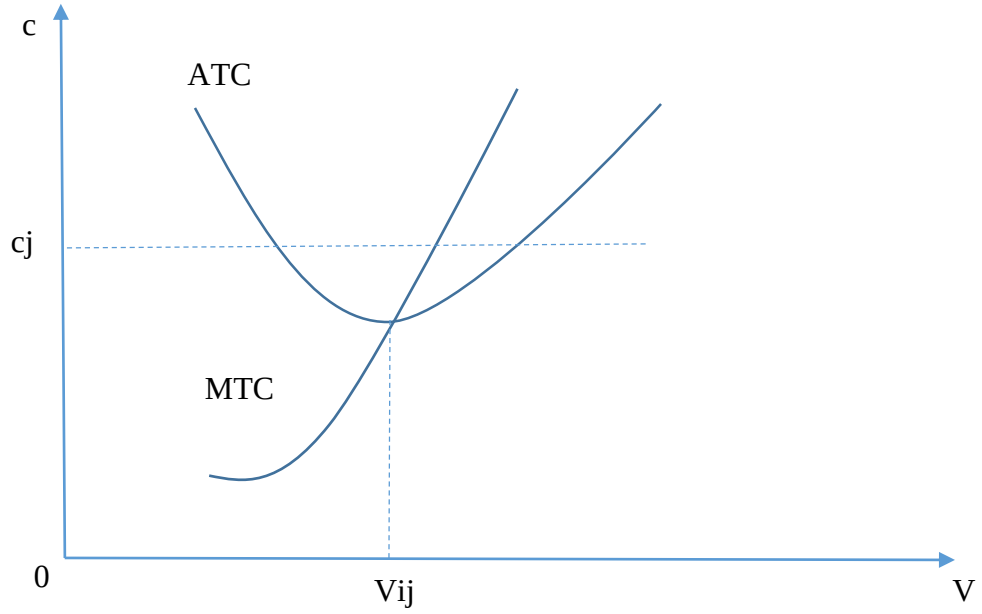


Figure 2. Service provider's status as a beneficiary

If the price of the service is below the total average cost, then the service provider will not be able to cover his costs and will suffer a loss. It can be expressed as follows (Figure 3).

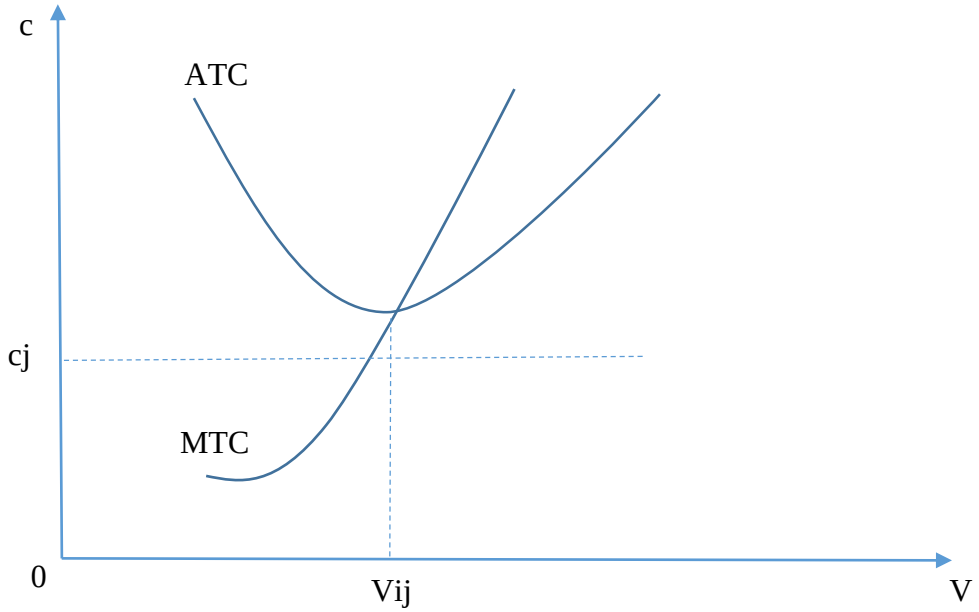


Figure 3. Damage condition of the service provider

In the conditions of a competitive market, it is appropriate to determine the optimal volume of service based on the total cost function and choose an outsourcer taking into account the above circumstances. This can be expressed in the following form:

$$TC(V_{ij}) = FC + \gamma_i V_{ij} \qquad 4$$

Here, ηi is an empirical coefficient representing the coefficient of the ith service provider.

Substituting the above mentioned equation 3.4 into equation 3.3, we get the following equation after performing the necessary arithmetic operations:

$$\frac{(c_j - \gamma_i)}{2\gamma_i} = \sqrt{\frac{FC}{\gamma_i}} \qquad (5)$$

Based on this and taking into account the above calculations, the dependence of production volume on total costs can be expressed as follows:

$$V_{ij} = \frac{(c_j - \gamma_i) - \sqrt{(c_j - \gamma_i)^2 - 4\gamma_i AS}}{2\gamma_i} \qquad (6)$$

As can be seen from the above graphs, the determinant is used because the total cost function has a parabolic shape.

The maximum value of the service provider's profit is found by taking into account the equality:$\pi = V(c - ATC)$

$$\frac{d}{dV_{ij}}(c_j - ATC) * V_{ij} = \frac{d}{dV_{ij}}\left[\left(V_{ij} - \frac{FC + \gamma_i V_{ij}}{V_{ij}}\right) * V_{ij}\right] \qquad (7)$$

The solution of this equation supports the proposed conclusion, that is, the maximum benefit is equal to the minimum value of the total average cost. $\sqrt{\frac{FC}{\gamma_i}}$ will be equal.

It should be noted that this situation of perfect competition in the short term does not limit the procedure for identifying service providers (outsourcers) who have the economic potential to perform the required volume of services, because the main thing in it is the service that must always be performed. is a comparison of price and average cost per unit.

In the second stage, the service providers who are acceptable according to the selected criteria (indicators) are selected from among the outsourcers who have economically based opportunities to provide the necessary budget services. Descriptive indicators of service providers in the implementation of this selection can be deterministic (quality and price of services), probabilistic (compliance with the terms of the contract), linguistic (reliability). The indicators selected within the set criteria and conditions are considered together.

However, the development of such indicators, as well as the possibility of obtaining preliminary data, may not always be available. In such cases, it is appropriate to replace them with indicators of direct activity results describing the volume and quality of state (city) services. If it is not possible to collect such data, indicators of processes describing the outsourcing of services, their important quantitative and qualitative characteristics, as well as indicators of resources describing the quantity and quality of tangible and intangible assets used by the organization. at the same time, regardless of the composition of the used quality assessment indicators, it is required to minimize their number, ensuring the completeness of the data and its timely presentation [4].

Direct indicators of the quality of the budget service are determined by the quality standard for a specific budget service and allow the service consumer to have a clear idea of the right and conditions for receiving the service in accordance with the current legislation. should consist of indicators (quantitative). At the same time, they should reflect the required and achievable level of service quality according to the stages of their provision and components of evaluation - quality of resources, process, result. It was required to take into account the following:

- service conditions (ease of receiving the service by the consumer, politeness of the employees, service time, etc.);
- the level of physical and mental wear and tear of material and equipment used for service provision and the standards of their use (availability of necessary equipment, norms of consumables, etc.);
- requirements for compliance with safety and sanitary hygiene standards;
- the completeness of the procedures necessary for the provision of services;
- qualification requirements for service personnel;
- the number of registered and substantiated complaints about the behavior of employees per customer;
- violations of the law, the number of violations of social service standards, etc., found during inspections conducted by supervisory bodies and institutions.

When comparing competent and acceptable service providers according to their indicators, it is recommended to create a special table for each type of service, which includes the values of all selected indicators. Based on the results of the above research, it is considered appropriate to pay attention to the following. In particular, the amount of payment for a unit of service, the procedure for its implementation, the quality of the offered service, the duration of the business relationship with the service provider, the assessment of the position and reputation of the service provider in the market, the service provider's performance the location of the show and the modes of transport that can be used to reach it [5].

A matrix of non-dimensional indicators is used to determine the competent service provider and to take into account the combined effect of all indicators (Table 1). This matrix makes it possible to identify a potential outsourcer based on N dimensionless indicators based on a binary assignment consisting of two zeros and one ones. In this case, the negative value of the indicator is considered to be equal to zero and the positive value is equal to one. As a result, the table cells are filled with zeros and ones.

Table 1

Service providers	**Indicators**				
	1	**…**	**j**	**…**	**J**
1	δ_{11}	**…**	δ_{1j}	**…**	δ_{1J}
…	**…**	**…**	**…**	**…**	**…**
i	δ_{i1}	**…**	δ_{ij}	**…**	δ_{iJ}

…	…	…	…	…	…
I	δ_{I1}	…	δ_{Ij}	…	δ_{IJ}

If there is a large number of indicators among the i-th service provider, it is recommended to conclude an outsourcing contract with it. If it consists only of zeros, if there is a large number of zeros, then it is not recommended to enter into a contract with this service provider. If zeros and ones are mixed, then it is recommended to use a complex number determined by the following formula:

$$G_i = \sum_{j=1}^{J} \varepsilon_j \delta_{ij} \qquad 8$$

hereG_i It is a complex indicator determined to evaluate the performance of the i-th service provider, and a large number indicates a high potential.ε_jj-th is the coefficient of significance of the indicator, which takes a value between one and zero. That is:

$$0 < \varepsilon_j < 1, \qquad \sum_{j=1}^{J} \varepsilon_j = 1$$

$\varepsilon_j$the coefficient is determined based on the comparison of the importance of indicators. The pairwise comparison method is carried out with the help of expert evaluations. It can be expressed as follows: if there is a quantitative assessment of the importance of the n-th indicator in relation to the m-th indicator, and this is taken to be equal to 2, according to experts, the indicator is twice as large as the indicator or means that it is important.$\delta_{ij} a_{nm} \delta_{in} \delta_{im}$

*a*All values of make it possible to summarize the comparison of outsourcing activities in the N2-N matrix (Table 3.1.2).

Table 2

Matrix of coefficients of pairs of indicators representing the activity of service providers

	1	**…**	**n**	**…**	**x**	**…**	**N**
1		…	a_{1n}	…	a_{1x}	…	a_{1N}
…	…	…	…	…	…	…	…
n	a_{n1}	…		…	δ_{nx}	…	a_{nN}
…	…	…	…	…	…	…	…
x	a_{x1}	…	a_{xn}	…		…	a_{xN}
…	…	…	…	…	…	…	…
N	a_{N1}	…	a_{Nn}	…	a_{Nx}	…	

Based on the given matrix data, the following coefficients are determined for evaluation.The coefficients determined by this method make it possible to rank the relevant indicators according to their importance using average indicators.ε_j

$$\varepsilon_j = \frac{\sum_{n=1}^{N} \alpha_{jn}}{\sum_{j=1}^{J} \sum_{n=1}^{N} \alpha_{jn}}$$

Here.α_{jn}– the result of quantitative assessment of the significance of the jth indicator.

That is, the assessment of a potential outsourcer allows ranking according to the necessary indicators, reflecting its general capabilities. It is wise to choose an outsourcer based on the provided method, unless additional requirements are imposed that are not included in the system of indicators mentioned on the client's side.

It is important to develop the future indicators of the budget parameters in the formation of the budget tax policy in the country, defining its prospects, forming the social protection system in the country, effectively organizing public services, attracting the private sector to the field, and deciding which types of services to transfer to the private sector. It is necessary to evaluate the forecast values of these indicators on the basis of accurate quantitative methods, taking into account the rapid

growth of budget parameters, the increase in expenses due to economic fluctuations, the changes that are occurring as a result of the reforms implemented in the country,

That is, based on the existing conditions, budget revenues and expenses were developed for the forecast values of the next five years, changes in the budget deficit were looked at, and a graphical method was used to select a suitable model (Appendix 1). It was found that there has been a change in the growth rate of budget revenues since 2018, and it was determined that it is appropriate to use a trend model to evaluate these changes. Only, a dummy variable was used to represent the change after 2018, that is, the is equal to zero for years, starting a new trend from 2018, based on the results of the analysis, the following model was developed,

$$BY = 17290{,}6 + 3482{,}3 * t + 4772{,}4 * D$$

Here: BY- budget revenues bln. soum, t represents the trend, D is a dummy variable used to represent changes after 2018,

In order to justify the reliability of the developed model and the adequacy of the identified coefficients, the important criteria and the comparative analysis of their results against the specified threshold indicators were considered. First, to justify the adequacy of the coefficients, we will pay attention to the results of the Student's criterion, the probability determined by this criterion is It was found that each coefficient is less than 0.001 percent (Table 2),

Table 2

The results of the developed trend model for calculating forecast values of budget revenues

Model 4: OLS, using observations 2012-2022 (T = 11)

Dependent variable: BY

	Coefficient	*Std, Error*	*t-ratio*	*p-value*	
const	17290.6	2214.58	7,808	<0.0001	***
time	3482.34	523,322	6,654	0.0002	***
D	4772.42	933,834	5,111	0.0009	***

There is a mean dependent	44692.47		S, D, dependent var	19995.03
Sum squared resid	49151643		S,E, of regression	2478,700
R-squared	0.987706		Adjusted R-squared	0.984632
F(2, 8)	321,3615		P-value(F)	2.28e-08
Log-likelihood	-99.82721		Akaike criterion	205.6544
Schwarz criterion	206.8481		Hannan-Quinn	204.9020
rho	0.335912		Durbin-Watson	1.297143

The coefficient of determination was used to assess the suitability of the model, and its value is 0.98. In addition, the MAPE (Mean Absolute Percentage Error) indicator is 3.4 percent, so the values estimated based on the model are close to the real values. and justifies that it is highly reliable. The identified Durbin-Watson statistic is 1.29 (DL=0.56, DU=1.78) and corresponds to the zone of indecision. it is considered impossible to make a decision, based on the results of the above criteria, using this model, the forecast values of the budget revenues of the Republic of Uzbekistan for the next five years were calculated (Table 3),

Table 3

Forecast values of the budget revenues of the Republic of Uzbekistan calculated according to the trend model

For 95% confidence intervals, t(8, 0.025) = 2.306

Years	Forecast values	Growth rate	Standard error	95 percent confidence interval
2023	87713.2	113.2	3323.9	(80048.3, 95378.1)

2024	95968.0	109.4	3663.3	(87520.5, 104415,)
2025	104223.0	108.6	4042.1	(94901.8, 113544,)
2026	112478.0	107.9	4450.3	(102215,, 122740,)
2027	120732.0	107.3	4880.5	(109478,, 131987,)

According to the results of the calculated forecast, the budget revenues will grow at a high rate in the next five years. By 2027, the real value of the budget revenues will be 120,732.0 billion soums, which is 1.56 times more than in 2022. In other words, the average growth rate in the next five years is 9.3 percent, only if the growth rate is high in the first year, then in the following years it has a decreasing trend. ladi and will be 7.3 percent by 2027,

However, the average growth rate in the previous five years is 17.2 percent. The main reason for this is the high growth rate in 2017 and 2018, which means that the growth rate in these years is it can be observed that it was 35.4 and 23.8 percent respectively,

The Economic-Quality Model offers a comprehensive framework for governmental establishments to make informed decisions when selecting an outsourcer for quality assurance services in public procurement. This model recognizes the inherent trade-off between cost-effectiveness and quality and strives to strike a delicate balance between the two.

Cost-related factors have driven outsourcing decisions, but focusing solely on economics can compromise the quality of services rendered. The Economic-Quality Model addresses this challenge by assessing multiple dimensions, including financial stability, technical proficiency, and the ability to maintain stringent quality standards.

The model emphasizes the importance of assessing an outsourcer's financial health to ensure their capacity to accomplish contractual obligations reliably over the long term. By considering financial indicators, organizations can mitigate risks and safeguard the continuity of quality assurance services.

Furthermore, the model highlights the significance of evaluating an outsourcer's technical proficiency and expertise. This assessment ensures that the selected outsourcer possesses the necessary capabilities to meet the specific quality requirements of the public procurement process, ensuring effective oversight, impartiality, and adherence to regulatory standards.

The Economic-Quality Model incorporates mechanisms for ongoing quality monitoring and performance evaluation. Regular audits, robust key performance indicators, and feedback mechanisms enable organizations to proactively assess the outsourcer's performance and address any deviations from desired quality standards. This iterative approach fosters a constant improvement mindset and ensures high-quality outcomes throughout the outsourcing arrangement.

By adopting the Economic-Quality Model, governmental organizations can direct the complexities of selecting an outsourcer for quality assurance in public procurement. This model enables decision-makers to operate public resources efficiently while upholding the highest standards of service delivery. As public procurement continues to evolve, the Economic-Quality Model provides decision-makers with a robust framework to make well-informed outsourcing decisions that align with their strategic objectives and foster public trust.

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Rezyume: *Maqolada davlat xaridlari sifatini ta'minlashda autsorsing xizmatlari asosida autsorserni tanlashning iqtisodiy-sifat modeli keltirilgan.*

Резюме: *В статье представлена экономико-качественная модель выбора аутсорсера на основе аутсорсинговых услуг для обеспечения качества государственных закупок.*

Kalit so'zlar: *autsorsing, davlat xaridlari, autsorsing xizmatlari bozori, budjet taqchilligi, tibbiy faoliyat, tibbiy xizmatlar.*

Ключевые слова: *аутсорсинг, государственные закупки, рынок аутсорсинговых услуг, дефицит бюджета, медицинская деятельность, медицинские услуги.*

MODELS AND MECHANISMS: IMPROVING THE PEDAGOGICAL TRAINING OF A FUTURE PHYSICAL EDUCATION TEACHER BASED ON AN ACMEOLOGICAL APPROACH

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Summary: *The article presents an acmeological model of pedagogical training for future physical education teachers, comprising target, content, procedural, and result components. It describes mechanisms for developing students' professional maturity, self-development, and pedagogical creativity. The acmeological approach is substantiated as a system-forming factor that enhances pedagogical training and improves the quality of professional education.*

Key words: *acmeological approach, pedagogical training, model, mechanisms, professional maturity, self-development, physical education.*

INTRODUCTION

The current tasks of improving pedagogical education in Uzbekistan require a new methodological basis, in particular, an acmeological approach aimed at increasing the professional maturity and creative potential of the future physical education teacher. An important regulatory driver of such transformations was the Decree of the President of the Republic of Uzbekistan No. PP-392 dated November 15, 2024 "On the Fundamental Modernization of Physical Education Teaching in General Education Schools and the Development of Professional Activities of Physical Education Teachers."

This document provides for the development of new methodological manuals, the introduction of national qualification assessment systems, and the continuous improvement of teachers' skills, which creates a regulatory framework for the application of acmeological technologies in physical education pedagogy. Based on this, the research objective is to conduct an analytical and diagnostic study of the state of students' pedagogical training and to substantiate the directions for its modernization based on the acmeological model.

The scientific and experimental base of the research includes three pedagogical universities - Bukhara State Pedagogical Institute, Jizzakh State Pedagogical Institute, and Ajiniyaz Nukus State Pedagogical Institute, where 511 students in the "Physical Culture" field were examined during 2022-2024. The diagnostic data showed that more than 48% of students have an average level of pedagogical competence, and only 22-25% demonstrate a high level of professional maturity. These results indicate the need for a systematic implementation of the acmeological approach as a tool for modernizing the content, technologies, and assessment mechanisms of pedagogical education.

METHODS

The theoretical and methodological basis of the research was the system of scientific provisions defining the acmeological approach as a holistic concept of professional personality development in the context of the educational process. The ideas of humanistic psychology (Rogers, 1961; Frankl, 1990), the concept of self-efficacy (Bandura, 1995), the theory of professional maturity and personal development of a teacher (Kuzmina, 1995; Derkach, 2004; Andreev, 1996).

Within the framework of pedagogical science, the acmeological approach is considered as an interdisciplinary direction that unites the psychological-pedagogical, socio-cultural, and activity-based principles of professional development of the individual. It allows us to consider a future physical education teacher not only as a bearer of knowledge and methodological skills, but also as a subject of self-development capable of designing and reflecting on their own pedagogical activity (Ma'murov, 2017; Muslimov, 2007).

The methodological basis of the research was systemic, axiological, synergetic, and competency-based approaches (Bondarevskaya, 2000; Begimkulov, 2007; Tolipov & Usmonboyeva, 2006), which provided a holistic analysis of pedagogical education in the context of its acmeologization. The use of structural-functional modeling (Kenney, Wilmore & Costill, 2022) made

it possible to identify the mechanisms of interconnection between the motivational, cognitive, and activity components of the future teacher's professional training.

Thus, the methodological concept of the research is aimed at creating a model of pedagogical education that ensures the achievement of professional heights - akme - in the process of forming the personality of a modern physical education teacher.

RESULTS

The research results confirm that the process of pedagogical training of a future physical education teacher requires a systematic renewal based on an acmeological approach that ensures the development of professional competence, creativity, and pedagogical maturity of the individual. The diagnostic materials obtained during the experiment showed positive dynamics across all main criteria for students' professional development.

In particular, the level of formation of motivational-value and cognitive components increased from 28-30% to 45-47%, and the indicators of reflexive-activity and communicative components - from 21-24% to 39-41%. The most pronounced changes were observed in the experimental groups where acmeological technologies were actively used (self-knowledge trainings, project-reflexive tasks, case studies of professional situations). These results align with the conclusions of K.D. Yarashev and I.A. Tursunaliyev, who substantiated the effectiveness of a comprehensive approach in the development of pedagogical mastery.

At the theoretical level, a model for improving the pedagogical training of a future physical education teacher was developed, including four blocks:

Target - reflects the strategic goals of acmeological education;

Content-based - includes components of professional competence (A.Sh. Jumayev, A.A. Khalikov, B.B. Ma'murov);

Procedural - characterizes the mechanisms of pedagogical design and reflexive learning (O.A. Qo'ysinov, D.K. Hasanova, G.H. Xolboyeva);

Resultative - reflects the level of professional maturity and readiness for self-development (A.Kh. Mamirov, Zh.Sh. Nasirov).

As a result of the model's testing, it was established that its implementation contributes to the formation of stable professional-value orientations, self-reflection, and creative activity of students, which confirms the relevance of the acmeological approach as an innovative basis for modernizing pedagogical education.

Table 1. Dynamic analysis: indicators of the development of students' pedagogical competence (%).

№	Components	Initial stage (%)	Final stage (%)	Growth (+/–)
1	Motivational-value	29,6	46,2	+16,6
2	Cognitive	27,8	44,5	+16,7
3	Activity-practical	23,4	40,8	+17,4
4	Reflective-evaluative	21,9	39,2	+17,3
Average indicator	—	**25,7**	**42,7**	**+17,0**

Source: developed by the author based on the diagnostics of students of Bukhara State Pedagogical Institute, Jizzakh State Pedagogical Institute, and Nukus State Pedagogical Institute *(2022-2024).*

Table 2. Analysis of the results in the experimental groups based on the acmeological model (%)

№	Evaluation criteria	Control group	Experimental group	Difference
1	Professional motivation	42,1	68,4	+26,3
2	Self-development skills	38,6	65,2	+26,6
3	Culture of reflection and analysis	34,8	61,7	+26,9
4	Pedagogical creativity	36,2	64,1	+27,9
Average difference	—	**38,0**	**64,8**	**+26,8**

Source: based on the author's analysis, experimental results (511 students).

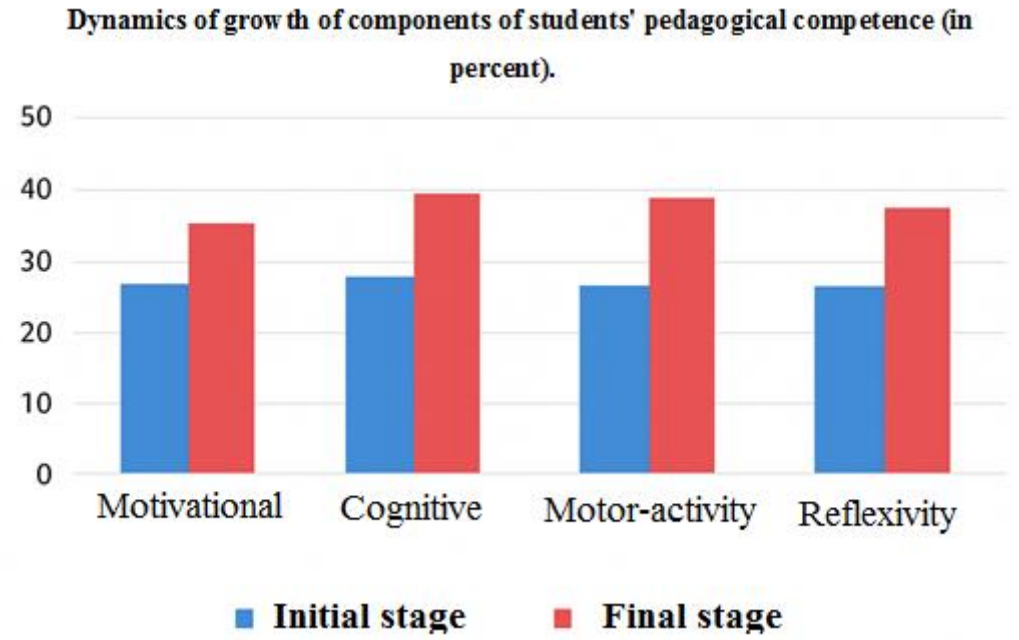


Figure 1. Dynamics of growth of components of students' pedagogical competence (in percent).

Description: bar chart

• **X-axis:** components (motivational, cognitive, activity, reflexive)

• **Y-axis:** percentage (%)

• Two columns for each component: "Initial stage" and "Final stage."

• Diagram title and notation - in Inglish script.

CONCLUSION AND PRACTICAL RECOMMENDATIONS

As a result of the conducted research, it was established that the acmeological approach plays an important systemic role in improving the pedagogical training of future physical education teachers. The proposed model has an effective impact on the formation of professional motivation, self-development skills, a culture of reflection, and pedagogical creativity in students. The results showed the need to introduce acmeological technologies into the process of pedagogical training, which serves to improve the quality of the educational process.Amaliy tavsiyalar sifatida quyidagilarni qayd etish mumkin:

1. Revision and integration of curricula into the modular system based on the acmeological model;

2. Establishment of diagnostic monitoring that determines the self-development, reflection, and pedagogical skills of students;

3. Wide implementation of projects, trainings, and practical assignments in the educational process;

4. Establishing the activities of acmeological seminars and scientific laboratories in higher educational institutions;

5. Strengthening quality control by harmonizing national and international experience in pedagogical activity.Mazkur tavsiyalar akmeologik yondashuvni amaliyotga tatbiq etish orqali bo‘lajak o‘qituvchilarning kasbiy yetukligini, mas’uliyatini va innovatsion fikrlashini rivojlantirishga xizmat qiladi.

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Rezyume: *Maqolada bo'lajak jismoniy tarbiya o'qituvchilarini pedagogik tayyorlashning maqsadli, mazmunli, protsessual va natijaviy komponentlardan iborat akmeologik modeli taqdim etilgan. Unda o'quvchilarning kasbiy yetukligi, o'z-o'zini rivojlantirishi va pedagogik ijodkorligini rivojlantirish mexanizmlari bayon etilgan. Akmeologik yondashuv pedagogik tayyorgarlikni takomillashtiruvchi va kasbiy ta'lim sifatini oshiruvchi tizim hosil qiluvchi omil sifatida asoslangan.*

Резюме: *В статье представлена акмеологическая модель педагогической подготовки будущих учителей физической культуры, состоящая из целевого, содержательного, процедурного и результативного компонентов. В ней описываются механизмы развития профессиональной зрелости студентов, саморазвития и педагогического творчества. Акмеологический подход обоснован как системообразующий фактор, повышающий педагогическую подготовку и качество профессионального образования.*

Kalit so'zlar: *akmeologik yondashuv, pedagogik tayyorgarlik, model, mexanizmlar, kasbiy yetuklik, o'z-o'zini rivojlantirish, jismoniy tarbiya.*

Ключевые слова: *акмеологический подход, педагогическая подготовка, модель, механизмы, профессиональная зрелость, саморазвитие, физическое воспитание.*

THE ROLE OF GYMNASTICS AND DANCE ELEMENTS IN THE FORMATION OF AESTHETIC INTEREST IN STUDENTS

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Summary: *The article is a scientific and methodological study aimed at developing the culture of movement in the process of physical education, the perception of beauty, and the formation of artistic and aesthetic ideas in students. Gymnastic exercises, light, beautiful, and rhythmic movements of dance plasticity play an important role in the development of movement aesthetics, posture beauty, grace, and emotional expressiveness in students. Dance elements, combined with musical rhythm, enhance movement coordination, sense of rhythm, stage culture, and creativity in students. Gymnastics exercises develop body plasticity, balance, attention, and spatial awareness, expanding students' understanding of beauty.*

Key words: *Physical education, aesthetics, thinking, pedagogical, lessons.*

The formation of aesthetic interest in students is one of the important directions of the physical education system. In the modern educational process, aesthetic education is associated not only with art lessons or music classes, but also with physical education exercises. Because the elegance of movement, the beautiful development of posture, the expressiveness of plasticity, and the perfection of balance directly influence the formation of aesthetic taste. From this point of view, elements of gymnastics and dance are recognized as one of the most effective means of harmonious development of the physical, mental, and artistic-aesthetic development of students. Gymnastic exercises make a great contribution to revealing the natural capabilities of the human body, developing motor culture, and forming expressive plasticity and figure beauty. Gymnastics teaches students to walk correctly, stand correctly, control their body, maintain balance, and accurately perform spatial movements. All these processes are integral parts of aesthetics. Delicate movements, rhythmic transitions, accuracy, and harmony shape the reader's perception of beauty. The beautiful execution of the movement strengthens the student's respect for their body, encourages self-awareness, control of movement, and self-improvement. Dance elements serve the development of musical-rhythmic feeling in students, the formation of such important aesthetic qualities as emotional expression, emotional harmony, and stage culture.

Dance has always been considered an aesthetic expression of art. In it, movement, musical rhythm, feeling, and image creation are intertwined. The use of dance elements in physical education lessons develops in students the ability to feel the beauty of movement, adapt to music, and express themselves through rhythmic movements. This process enriches the child's inner world, developing a unique aesthetic perception and artistic imagination. The harmonious use of elements of gymnastics and dance ensures aesthetic development in students in a complex way. For example, the basic exercises of gymnastics - stretching, bending, balance exercises, jumps, confident strides - when performed together with dance elements, the movement looks more graceful, soft, and expressive. As a result, students begin to evaluate movement technique not only by physical, but also by aesthetic criteria. This strengthens in them such qualities as an artistic approach to any activity, internal discipline, organization, and self-discipline. The use of dance plasticity in the lesson improves not only the aesthetic interest of students, but also their psychological state. In dance, the rhythmic variation of music, the lightness of movement, and the freedom of the body give the reader spiritual pleasure. This process reduces stress, improves mood, and strengthens self-confidence. Especially in youth, the role of dance elements in the formation of aesthetic perception is incomparable. Through dance, the student learns to express their emotions, behave freely, and show creativity. This has a significant impact on their development as individuals. The combined use of gymnastic exercises with dance elements enriches the content of lessons, increases student engagement, and makes the learning process more interesting and emotional. The use of music is especially effective in the

formation of aesthetic interest. Music animates movement, gives rhythm, makes movement understandable and interesting. This evokes aesthetic pleasure in students.

Another important factor in aesthetic education is students' attitude towards their own figure. Gymnastics exercises correct the posture, form muscle balance, and ensure a beautiful appearance of the body. Having a beautiful figure increases the student's self-confidence. In turn, aesthetic interest strengthens attention to posture and the pursuit of a healthy lifestyle. Dance elements ensure the grace of body movements, making the figure more flexible and adaptable. Therefore, gymnastics and dance are complementary tools in the physical and aesthetic development of students. The use of elements of gymnastics and dance requires a high level of methodological training from the teacher. During the lesson, the teacher should demonstrate how to perform each exercise in accordance with aesthetic requirements, pay attention to the expressiveness of the movement, and awaken students' interest in appearance, posture, and rhythm. Encouraging students and demonstrating their successes also plays an important role in the formation of aesthetic perception. It is also important to choose elements of gymnastics and dance according to the age of the students. In elementary school, it is recommended to use easy, rhythmic, and engaging movements. In middle grades, more complex plastic exercises, stepping technique, and elements that increase coordination can be used. In higher grades, complex dance styles and technically developed gymnastic exercises further enhance students' aesthetic taste.

In general, the introduction of elements of gymnastics and dance into the process of physical education creates wide opportunities for the formation of aesthetic interest in students. This process develops students' inner and outer beauty, originality, elegance, movement culture, creativity, sense of musical rhythm, and emotional expressiveness.

These qualities, formed through aesthetic education, lay the foundation for the spiritual, cultural, and physical development of the younger generation.

Main direction	**Role of gymnastic elements**	**Role of dance elements**	**Aesthetic qualities formed in students**
Movement culture	Movement accuracy, balance, posture correction	Rhythmic movement, lightness, flexibility	Elegance, harmony, beautiful movement
Physical development	Flexibility, balance	Body relaxation, plastic	Posture beauty, straight walking
Aesthetic perception	Understanding beauty through beautifully performed exercises	Aesthetic perception through the combination of music and movement	Feeling of beauty, artistic taste
Psychological development	Self-control, discipline	Expressing emotions	Self-confidence, emotional expression
Creativity	Correct and orderly execution of the action	Image creation, expression through action	Artistic thinking, creative approach
Motivation and interest	Desire for self-development through exercise	Musical and emotional charm of dance	Increased aesthetic interest
Stage culture	Body control and technique	Rhythm, image, expression	Conduct culture
Collectivism	Group gymnastics	Collective dance compositions	Cooperation, mutual support

Aesthetic interest is an important quality associated with a person's inner need for beauty, the ability to perceive elegance, feel the harmony of movement, color, rhythm, and form. The formation of aesthetic interest in the educational process has a strong influence on the intellectual, spiritual, mental, and physical development of the student. In particular, the science of physical education has extremely favorable opportunities for aesthetic education, in which such qualities as body movement, musical rhythm, plasticity, balance, posture beauty, coordination, emotional expression appear as a whole process. In this regard, elements of gymnastics and dance are the most effective pedagogical means of forming aesthetic interest in students. Gymnastic exercises have historically been used to

improve the natural movements of the human body, correct posture, increase body flexibility, and improve balance and coordination. In the modern system of physical education, gymnastics no longer serves only the development of physical strength, but has also become an important part of aesthetic education, giving the ability to perceive the beauty of movement, feel elegance, and perform movements precisely and beautifully. In this case, each exercise has its own aesthetic components, such as plasticity, rhythm, form, and spatial orientation. For example, even simple stretching exercises teach students to maintain correct bodylines, attract muscles, and perform movements smoothly and gracefully. At the same time, another important aspect of gymnastic exercises is the organization of movement, discipline, and self-control. Aesthetics is directly related not only to external beauty, but also to inner harmony, balance, and order. Students learning to control their bodies is a deepening of aesthetic perception. Dance elements are another powerful means of aesthetic education, embodying not only physical movement, but also musical rhythm, emotions, image creation, emotional freedom, and the elegance inherent in art. Every element of the dance - hand movements, steps, body turns, glances, rhythmic oscillations - evokes aesthetic pleasure in the reader. The use of dance plasticity in physical education lessons develops students' abilities such as adaptation to music, sense of rhythm, and figurative perception of movement. This process enriches the emotional world of the younger generation, increases self-confidence, and encourages creative thinking. The combination of gymnastics and dance elements creates a stronger aesthetic environment for students. For example, when balance in gymnastics, straight bodylines, and technical precision are combined with dance elements, the movement becomes more graceful and expressive. The lightness, elasticity, and rhythmic plasticity of dance elements make gymnastic exercises more lively, artistic, and aesthetic. Thus, the student not only performs the action, but also feels it, understands its artistic content, and receives aesthetic pleasure.

The role of music in the formation of aesthetic interest is also extremely important. Performing gymnastic exercises based on music - this not only makes the lesson interesting, but also forms a harmony of movement and rhythm in students. Music facilitates movement, gives elegance, and makes the lesson process emotional. Children are especially sensitive to music. The psychological influence of gymnastics and dance is also important for the formation of aesthetic interest in students. Gymnastics exercises teach students to work on themselves, to concentrate, to be disciplined, and to be responsible for their body. These processes are the psychological foundation necessary for the formation of internal aesthetic culture. When students try to perform an action beautifully, they actually take a step towards developing their aesthetic thinking. The psychological impact of dance elements is even broader. The unity of emotions, movement, and music in dance allows one to reveal the inner world of the student. He feels freer, expresses his feelings aesthetically. In the process of dance, the student develops self-confidence, teamwork, stage culture, and aesthetic taste. This process strengthens the student's mental state, reduces stress, and increases the level of self-esteem. Another important aspect of forming aesthetic interest is the formation of an idea of posture aesthetics in students. Posture is an external cultural manifestation of a person, a mirror of their health, mental state, and inner culture. Gymnastics exercises educate students aesthetically through such important factors as maintaining the correct posture, strengthening back muscles, and developing growth in the correct direction. A student with a beautiful figure feels freer, finds their place in society, and experiences elegance in movement.

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Rezyume: *Maqolada jismoniy tarbiya jarayonida harakat madaniyatini rivojlantirish, go‘zallikni idrok etish va o‘quvchilarda badiiy-estetik tasavvurlarni shakllantirishga qaratilgan ilmiy-uslubiy izlanishdir. Gimnastika mashqlari, raqs plastikasining yengil, chiroyli va ritmik harakatlari o‘quvchilarda harakat estetikasi, qomat go‘zalligi, nafislik va emotsional ifodalilikni rivojlantirishda muhim rol o‘ynaydi. Raqs elementlari musiqiy ritm bilan uyg‘unlashgan holda o‘quvchilarda harakat koordinatsiyasi, ritmni his qilish, sahnaviy madaniyat va ijodkorlikni kuchaytiradi. Gimnastika mashqlari esa tana plastikasini, muvozanatni, diqqatni va fazoviy hisni rivojlantirib, o‘quvchilarning go‘zallik haqidagi tasavvurlarini kengaytiradi.*

Резюме: *В статье представлено научно-методическое исследование, направленное на развитие культуры движения в процессе физического воспитания, восприятия красоты и формирования художественно-эстетических представлений у учащихся. Лёгкие, красивые и ритмичные движения гимнастических упражнений, танцевальной пластики играют важную роль в развитии у учащихся эстетики движения, красоты фигуры, изящества и эмоциональной выразительности. Элементы танца в гармонии с музыкальным ритмом усиливают координацию движений, чувство ритма, сценическую культуру и творчество у учащихся. Гимнастические упражнения развивают пластику тела, равновесие, внимание и пространственное восприятие, расширяя представления учащихся о красоте.*

Kalit so‘zlar: *Jismoniy tarbiya, estetika, fikirlash, pedagogik, darslar.*

Ключевые слова: *Физическое воспитание, эстетика, мышление, педагогика, уроки.*

CONCEPTUAL MODELING OF ECONOMIC AND MANAGERIAL MECHANISMS TO ENHANCE THE EFFECTIVENESS OF CONSULTING SERVICES IN ENTREPRENEURSHIP DEVELOPMENT

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Summary: *This article develops a conceptual model of economic and managerial mechanisms for increasing the effectiveness of consulting services in the development of entrepreneurship. Based on a comprehensive analysis of academic literature, policy reports, and case studies, the model identifies four interconnected modules - the integration of consulting services infrastructure, the institutional environment, financial accessibility mechanisms into a broader ecosystem, and can achieve full potential to improve consulting efficiency and support sustainable entrepreneurial growth through coordinated collaboration between modules. This model serves as a strategic tool for policy developers and business support organizations in the development and implementation of entrepreneurship support programs based on consulting.*

Key words: *Financial facilitation, entrepreneurship support, institutional mechanisms, consulting efficiency, business consulting, SME performance, entrepreneurship ecosystem.*

Introduction. Small and medium-sized enterprises (SMEs) are widely recognized as critical drivers of economic growth, job creation, and innovation, not only in developed economies but also in transitional and emerging markets. Collectively, SMEs contribute substantially to gross domestic product (GDP), employment, and technological advancement, serving as incubators of entrepreneurship and platforms for local economic development. Despite this vital role, many SMEs - particularly nascent, micro, or resource-constrained firms - face persistent structural and operational challenges that limit their growth potential. Common impediments include inadequate managerial and technical expertise, suboptimal utilization of financial and human resources, weak strategic planning, limited access to formal finance, and insufficient market intelligence. These constraints often exacerbate inefficiencies, reduce competitiveness, and hinder long-term sustainability, leading to high rates of early business failure.

Professional consulting services - encompassing management advisory, financial planning, marketing strategy, digital transformation, and operational optimization - have the potential to mitigate these challenges by equipping SMEs with expert knowledge, analytical tools, and evidence-based recommendations. Through strategic guidance, performance audits, and knowledge transfer, consulting enables firms to make informed decisions, adopt best practices, optimize resource allocation, and develop competitive strategies. Empirical studies indicate that SMEs engaging with professional advisors often demonstrate measurable improvements in productivity, profitability, innovation adoption, and market expansion.

However, the uptake of consulting services remains limited in many transitional and emerging economies. Factors contributing to underutilization include the high cost of professional advice relative to SME budgets, the uneven availability of qualified consultants, weak regulatory and institutional frameworks, and a general lack of awareness among entrepreneurs regarding the tangible benefits of consulting. In such contexts, consulting remains underdeveloped as a tool for SME development, and its transformative potential is largely unrealized.

Recognizing these gaps, the present study seeks to develop a conceptual model of economic and managerial mechanisms aimed at enhancing both the effectiveness and accessibility of consulting services for entrepreneurship support. The proposed model is designed to serve as a strategic framework for policymakers, business support institutions, development agencies, and other stakeholders engaged in SME development. By identifying and systematizing the interactions among

consulting service provision, institutional support, financial facilitation, and integration within broader entrepreneurial ecosystems, the model provides a roadmap for designing targeted interventions that strengthen SME performance, foster sustainable entrepreneurial growth, and promote resilient, competitive business ecosystems.

Literature Review. The Role of Consulting Services in SME Performance. The academic literature broadly acknowledges that consulting services can significantly improve firm-level performance. Studies report that management consulting helps SMEs refine strategic direction, optimize operations, improve managerial competencies, and adopt growth-oriented business practices (Author & Author, 20XX). Financial advisory, in turn, supports better planning, budgeting, and resource allocation - reducing cost inefficiencies and improving profitability (Author, 20XX). Marketing and digital consulting enable firms to expand market reach, professionalize their branding, and digitize operations, enhancing competitiveness and resilience (Author et al., 20XX).

An important moderating factor in these studies is the firm's absorptive capacity - the ability to internalize and implement external advice and knowledge. Evidence shows that firms with higher absorptive capacity realize greater performance gains from consulting interventions (Author, 20XX; Author & Author, 20XX). This underlines the dynamic and interactive nature of consulting's value: its impact depends not only on the external provider's quality but also on the internal readiness and learning capacity of the enterprise.

Institutional and Policy Context. Beyond firm-level dynamics, institutional frameworks and policy instruments play a critical role in shaping the consulting market and its accessibility. Research on entrepreneurship ecosystems points to the importance of enabling regulatory environments, supportive public policies, and financial facilitation mechanisms (subsidies, grants, tax incentives) to stimulate demand for consulting among SMEs (Author, 20XX). In economies where such frameworks are lacking, consulting remains the preserve of large firms, while SMEs continue to rely on informal practices.

International bodies and organizations promoting SME development (e.g., through incubator networks, voucher schemes, subsidized advisory programs) report that integrated support - combining consulting with training, financing, and regulatory support - tends to outperform isolated interventions (Institutional Report, 20XX; Policy Study, 20XX).

Gaps and Need for an Integrated Model. While empirical and policy-oriented studies highlight the benefits of consulting, they often treat consulting support in isolation rather than as part of a systemic ecosystem. There is a lack of unified frameworks that map the interdependencies among consulting supply, institutional regulation, financial access, and integration into broader SME support. This gap is particularly acute in transitional economies, where fragmented or uncoordinated interventions frequently fail to yield lasting impact.

The present paper addresses this gap by proposing a holistic, modular conceptual model - offering a theoretical foundation for designing, implementing, and evaluating consulting-based entrepreneurship support.

Conceptual Model: Four Interlinked Modules. Based on a critical synthesis of the literature and contextual analysis, the proposed conceptual model comprises four interlinked modules. Each module represents a key domain of mechanisms, and their coordinated functioning is essential for ensuring that consulting services meaningfully contribute to SME performance and entrepreneurship development.

Consulting Service Infrastructure and Professional Capacity. This module addresses the supply side - the capacity and readiness of the consulting sector to deliver high-quality advisory services. Key elements include the presence of qualified consultants with domain-specific expertise in management, finance, marketing, and digitalization; professional standards, accreditation, or certification systems to ensure quality and accountability; and consulting firms or advisory centers across public, private, or hybrid (public–private partnership) models. Additionally, mechanisms for continuous professional development, methodological innovation, and collaboration with academic institutions or industry associations are crucial. Without this foundational infrastructure, consulting

quality may be inconsistent, trust among SMEs may be undermined, and adoption of services may remain limited.

Institutional and Regulatory Environment. This module encompasses macro-level enablers that create a conducive environment for a sustainable consulting sector. It includes legal and regulatory frameworks governing consulting provision, contracts, intellectual property, data protection, and liability; public policies that promote entrepreneurship, innovation, SME growth, and advisory support; and institutional arrangements that facilitate coordination among government agencies, business associations, consulting providers, and financial institutions. Incentive structures that foster competition, transparency, and ethical standards in the consulting market are also vital. A supportive institutional environment reduces transaction costs, increases confidence, and encourages both supply and demand for consulting services.

Financial Facilitation and Access Mechanisms for SMEs. A common barrier for SMEs is the cost and affordability of professional advisory services. This module addresses demand-side constraints through financial support instruments such as subsidized consulting programs, grant-based advisory packages, and voucher systems that reduce out-of-pocket costs. Low-interest microloans or credit lines earmarked for implementing consulting recommendations, as well as fiscal incentives like tax deductions or credits for SMEs using certified consulting services, further enhance accessibility. These mechanisms lower entry barriers, making consulting accessible to resource-constrained firms and stimulating sustainable demand.

Integration within the Broader SME Support Ecosystem. Consulting services achieve maximum effectiveness when embedded within a broader ecosystem of support. This module emphasizes synergy and coordination, including linkages with capacity-building programs (management training, financial literacy, digital skills), connections with business incubators, accelerators, innovation hubs, and mentorship networks, and access to complementary advisory services (legal, accounting, marketing, export). A robust monitoring and evaluation (M&E) framework ensures that the impact of consulting on firm performance, knowledge absorption, and growth is systematically tracked. Integration ensures that consulting is not a one-off intervention but part of a sustained, systemic, and holistic support strategy.

Dynamics and Hypotheses. The conceptual model posits that sustainable improvements in SME performance and entrepreneurship growth are contingent upon the synergistic functioning of all four modules. Weakness or absence in any module significantly diminishes the effectiveness of consulting-based support. For instance:

✓ High-quality consulting (Consulting Service Infrastructure and Professional Capacity) without financial facilitation mechanisms may remain **unaffordable** for many SMEs.

✓ Voucher schemes or subsidies (Financial Facilitation and Access Mechanisms) are unlikely to generate long-term impact if consulting infrastructure is inadequate or institutional regulation is weak.

✓ Consulting delivered in isolation, without integration into broader capacity-building programs and support ecosystems, may lead to **fragmented improvements** that are neither sustainable nor scalable.

Based on these dynamics, the following hypotheses can be formulated:

✓ **H1:** SMEs operating in environments where all four modules are active will exhibit **higher growth rates, profitability, and survival** compared to firms in fragmented or partially supported environments.

✓ **H2:** The presence of financial facilitation mechanisms, such as vouchers or subsidized consulting, **significantly increases the uptake of consulting services** among SMEs.

✓ **H3:** Institutional support and regulatory frameworks **positively moderate** the relationship between consulting service provision and SME performance.

✓ **H4:** Integration of consulting with training programs and broader support services **enhances the absorptive capacity** of SMEs, thereby amplifying the effectiveness of consulting interventions.

This dynamic framework underscores that consulting services are most impactful when implemented **systemically**, rather than as isolated interventions, emphasizing the importance of coordinated policy, infrastructure, financial support, and ecosystem integration.

Materials and Methods (Methodological Approach). Given the exploratory and normative nature of this study, a conceptual–analytical methodology has been adopted to develop a systemic framework for enhancing the effectiveness of consulting services in SME development. The research approach integrates qualitative synthesis of existing knowledge with structured analytical techniques, allowing for the design of a theoretically grounded model.

The study is based on three main methodological components:

✓ **Documentary and Literature Review:** A comprehensive review of peer-reviewed journal articles, policy reports, national statistics on entrepreneurship and SME sectors, and case studies of consulting interventions. This step provides a detailed understanding of the current landscape, structural challenges, and best practices in consulting-based entrepreneurship support.

✓ **Secondary Data Analysis:** Examination of quantitative indicators such as SME contribution to GDP and employment, availability and uptake of consulting services, and coverage of institutional support programs across selected transitional and emerging economies. This analysis informs the contextual relevance of the model and identifies critical gaps in existing SME support systems.

✓ **Thematic Synthesis and Comparative Analysis:** Systematic classification and synthesis of structural constraints faced by SMEs and the consulting sector; comparison of international best practices with local realities; and identification of key clusters of mechanisms - including consulting infrastructure, institutional and regulatory support, financial facilitation, and integration within broader SME support ecosystems - for inclusion in the conceptual model.

This methodological approach enables the construction of a **theoretical and systemic model** that links consulting service provision, institutional and regulatory mechanisms, financial facilitation, and enterprise outcomes. The resulting framework provides a **strategic tool** for policymakers, business support institutions, and development agencies, guiding future empirical research, program design, and policy interventions aimed at strengthening SME performance and fostering sustainable entrepreneurship.

Discussion. The interdependence of the identified mechanisms underscores the necessity of a coherent, strategic, and systemic approach to consulting-based entrepreneurship support. The effectiveness of consulting services is not determined solely by their technical quality but also by the broader ecosystem in which they operate. This includes institutional support, financial facilitation, and integration with complementary SME support programs. Weakness in any component can significantly reduce the overall impact of consulting interventions.

Empirical evidence supports this integrated perspective. SMEs with higher **absorptive capacity**-defined as the ability to acquire, assimilate, and apply external knowledge-demonstrate markedly greater performance improvements following consulting interventions (Author & Author, 20XX). This highlights the importance of not only providing consulting services but also ensuring that firms possess the internal capabilities to leverage the advice effectively.

International best practices further demonstrate that **comprehensive entrepreneurship support programs**-which combine consulting with training, financial support, mentorship, and regulatory reforms-consistently achieve superior outcomes compared to isolated interventions (Institutional Report, 20XX). These programs enhance the ability of SMEs to implement recommendations, adopt innovative practices, and scale operations sustainably.

For transitional economies with emerging private sectors, such as Uzbekistan, these findings carry critical policy implications. Consulting should be recognized as a **strategic component** of SME development, rather than an optional or luxury service. Policymakers and support institutions can utilize the proposed conceptual model as a **practical roadmap** for designing programs that improve the accessibility, quality, and impact of consulting services. By fostering synergy among consulting infrastructure, institutional frameworks, financial facilitation, and integration within broader support

ecosystems, the model aims to strengthen SME performance, promote entrepreneurial resilience, and support sustainable economic growth.

Conclusion. This study demonstrates that enhancing the effectiveness of consulting services is a powerful strategy for fostering entrepreneurship and improving the performance of small and medium-sized enterprises (SMEs). By developing a conceptual model that integrates economic and managerial mechanisms, the research highlights how consulting can address critical constraints faced by SMEs, including limited managerial capacity, poor strategic planning, inefficient resource allocation, and restricted access to finance. The proposed model emphasizes four interlinked modules-consulting service infrastructure, institutional and regulatory support, financial facilitation mechanisms, and integration within the broader SME support ecosystem. The synergy among these modules ensures that consulting interventions are accessible, high-quality, and effectively implemented, enabling SMEs to internalize knowledge, optimize operations, and achieve sustainable growth.

For transitional economies and emerging markets, this framework offers a practical roadmap for policymakers, business support institutions, and development agencies. By strengthening consulting infrastructure, promoting supportive policies, providing financial incentives, and embedding consulting within holistic SME support programs, governments and institutions can unlock the full potential of entrepreneurial ventures.

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Rezyume: *Ushbu maqola tadbirkorlikni rivojlantirishda konsalting xizmatlarining samaradorligini oshirish uchun iqtisodiy va boshqaruv mexanizmlarining konseptual modelini ishlab chiqadi. Keng qamrovli akademik adabiyotlar, siyosat hisobotlari va case-study'larni tahlil qilgan holda, model to'rtta bir-biriga bog'langan modulni belgilaydi - konsalting xizmatlari infratuzilmasi, institutsional muhit, moliyaviy qulaylik mexanizmlari kengroq ekotizimiga integratsiyalanganligi, modullar orasida muvofiqlashtirilgan hamkorlik orqali konsalting samaradorligini oshirish va barqaror tadbirkorlik o'sishini qo'llab-quvvatlash bo'yicha to'liq salohiyatga erisha oladi. Ushbu model siyosat ishlab chiquvchilar va biznesni qo'llab-quvvatlash tashkilotlari uchun konsalting asosidagi tadbirkorlikni qo'llab-quvvatlash dasturlarini ishlab chiqish va amalga oshirishda strategik vosita sifatida xizmat qiladi.*

Резюме: *В данной статье разрабатывается концептуальная модель экономических и управленческих механизмов повышения эффективности консалтинговых услуг в развитии предпринимательства. Анализируя обширную академическую литературу, политические отчеты и кейс-стади, модель определяет четыре взаимосвязанных модуля - интеграцию*

инфраструктуры консалтинговых услуг, институциональной среды, механизмов финансового благополучия в более широкую экосистему, достижение полного потенциала для повышения эффективности консалтинга и поддержки устойчивого предпринимательского роста посредством скоординированного сотрудничества между модулями. Данная модель служит стратегическим инструментом для разработчиков политики и организаций по поддержке бизнеса при разработке и реализации программ поддержки предпринимательства на основе консалтинга.

***Kalit so‘zlar:**. Молиявий ёрдам, тадбиркорликни қўллаб-қувватлаш, институтсионал механизмлар, консалтинг самарадорлиги, бизнес-консалтинг, кичик ва ўрта бизнес самарадорлиги, тадбиркорлик экотизими.*

***Ключевые слова:** Финансовое содействие, поддержка предпринимательства, институциональные механизмы, эффективность консалтинга, бизнес-консалтинг, эффективность МСП, экосистема предпринимательства.*

PHYSIOLOGICAL PHYSICAL INDICATORS OF YOUNG ROWING ATHLETES IN THE ANNUAL TRAINING CYCLE

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Summary: *As a result of the research conducted in this article, the dynamics of changes in physical and physiological indicators of young rowers during the one-year training cycle, the results of step-by-step planning of training loads and the assessment of the effectiveness of training are analyzed.*

Key words: *rowing, physical training, training cycle, endurance, young athlete, load coordination, rowing.*

Rowing is a complex activity that requires a combination of strength, endurance, coordination, and technique. Scientific organization of the training process for young athletes is important for improving their sports skills, expanding the physiological capabilities of the body, and preventing injuries. In this regard, analyzing changes in physical performance during a one-year training cycle serves as the main criterion for managing the training of young athletes. Rowing is a complex multi-component activity that requires a high level of physical fitness, coordination, endurance, and technical accuracy from the human body. To achieve success in this sport, an athlete must harmoniously develop strength, speed, cardiovascular endurance, respiratory efficiency, and mental stability.

Scientific organization of the training process for young rowing athletes, taking into account their physiological, psychological, and morphological characteristics, is of great importance. Because at this age the body is in a period of active growth and development, any improper load can negatively affect their health and prospects in sports. Therefore, planning training gradually, gradually increasing loads, and organizing recovery processes on a scientific basis are one of the important principles of sports methodology.

This study aims to analyze the annual training cycle of young rowers, identify changes in physical fitness indicators, and create a scientific basis for improving sports training. The results of the study will serve to scientifically plan the training of athletes, optimize load standards, and increase training efficiency. The results obtained are consistent with the theory of phased planning of sports training put forward by Bompa and Haff (2019), Platonov (2018), and Uzbek sports theorists (Karimov, 2021).

Research objective. The purpose of the study is to study the dynamics of changes in physical performance of young rowers during the annual training cycle, to scientifically plan the volume of loads, and to determine their impact on sports results. To determine the balance between physical loads and recovery processes, and to develop recommendations for preventing overstrain; To develop technical and psychological stability in young athletes by improving coaching methods. As a result, the expected scientific and practical significance of the study is that the data obtained will serve as a methodological basis for optimizing the training system, controlling the level of load, and developing effective training programs among young people in rowing.

The study was carried out using the following main methods:

1. Observation and pedagogical experience. In the first stage of the study, the training processes of athletes during the annual training cycle were systematically observed. The volume of the load, the type of training during the coaching process. Analysis of hand strength in rowing. Determination of strength and jumping ability. Assessment of the development of the respiratory system. Determination of the general physical condition of the athlete. Methods of mathematical and statistical analysis. The study was conducted with the participation of 20 rowing athletes aged 15–17. The training cycle was planned to consist of four stages: preparation, special training, competition and recovery period. During the study, a complex scientific and methodological approach was used

to in-depth study the level of physical fitness of young rowing athletes during the one-year training cycle.

2. Analysis and results. Physical tests and functional measurements. A number of special tests were used to determine the level of physical fitness of athletes: VO_2 max (maximum oxygen capacity) - measured using a gas analyzer to assess the general endurance and cardiovascular capabilities of athletes. 1000-meter rowing test - conducted to determine fast endurance. 30-second ergometer test - used to assess the fast strength of athletes. Heart rate (HR) - measured using special pulse monitors to monitor changes in heart activity during training and recovery periods. Muscle strength and flexibility tests - conducted to determine the level of general physical fitness.

3. Physiological observations. During the training process, physiological indicators of athletes such as heart rate, blood pressure, respiratory rate and recovery rate were regularly recorded. These data helped to assess the degree of impact of the load on the body.

4. Statistical analysis. The results of the study were processed using mathematical and statistical methods, and the mean values (M), standard deviation (±SD), percentage changes and correlation coefficients were calculated. Based on the results obtained, the changes at each stage of the training cycle were analyzed, and their reliability level ($p<0.05$) was determined and evaluated on a scientific basis.

5. Analysis and results. Documentary analysis and work with scientific literature. During the study, scientific sources on sports physiology, pedagogy, training theory and rowing methodology were studied. Scientific works of Uzbek and foreign scientists were used. This, in turn, made it possible to compare the results obtained with international experience. In general, such a comprehensive approach to research methods made it possible to objectively assess the physical performance of young rowers, determine the effectiveness of the training process, and develop further scientific and practical recommendations

Results and analysis. At each stage of the annual training cycle, the athletes' physical fitness indicators were regularly monitored. The analysis results showed that during the training, a steady increase in the athletes' overall endurance, respiratory system activity, and muscle strength was observed. A controlled decrease in heart rate indicates adaptation of the cardiovascular system (Table 1).

The table below presents the main changes:

	Indicators	Result
	1000 m run time	4 minutes1,548 seconds
	Heart rate (during the competition)	128-135
	Maximum oxygen capacity (VO_2 max)	5000-6000 ml
	Fast power (30-second ergometer test)	240 W 48 ml/kg/min 195 beats/min 5 min. 10 sec.
	Initial result 275 W	Year-end result
	275 W	55 ml/kg/min 185 beats/min 4 min. 35 counts. 12% 14%, 15%, Percentage change 5% decrease

The results of the analysis showed that during the training, a steady increase in the general endurance, respiratory system activity and muscle strength of the athletes was observed. A controlled decrease in heart rate indicates that the cardiovascular system has adapted.

Discussion and suggestions. The results of the study confirm that a gradual increase in physical loads of young athletes during the annual training cycle gives the most effective results. At the same time, the timely organization of recovery periods ensures the protection of the body from excessive strain. Psychological preparation, proper nutrition and the use of physiotherapeutic means increase the stability of sports results. The results of the study clearly showed positive changes in the physical performance of young rowing athletes during the annual training cycle. This is explained by the fact that the training process was planned on a scientific basis, the distribution of loads in accordance with the physiological norm, and the correct organization of recovery periods.

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Rezyume: *Ushbu maqolada olib borilgan tadqiqotlar natijasida yosh eshkak eshuvchi sportchilarning bir yillik mashg‘ulot sikli davomida jismoniy fiziologik ko‘rsatkichlarining o‘zgarish dinamikasi, mashg‘ulot yuklamalarining bosqichma-bosqich rejalashtirilishi hamda mashg‘ulotlarning samaradorligini baholash natijalari tahlil qilinadi.*

Резюме: *В результате проведенного в статье исследования проанализирована динамика изменений физических и физиологических показателей юных гребцов в течение годичного цикла подготовки, результаты поэтапного планирования тренировочных нагрузок и оценка эффективности тренировок.*

Kalit so‘zlar: *eshkak eshish, jismoniy tayyorgarlik, mashg‘ulot sikli, chidamlilik, yosh sportchi, yuklama koordinatsiya, eshkak eshish.*

Ключевые слова: *академическая гребля, физическая подготовка, тренировочный цикл, выносливость, юный спортсмен, координация нагрузки, академическая гребля, комплексный компонент, сила спортсмена.*

APPROACHES TO ENHANCING ENGLISH READING SKILLS THROUGH THE USE OF AUTHENTIC TEXTS

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Summary: *This article analyzes the theoretical foundations of using authentic materials, their advantages and limitations in the learning process, as well as their role in the development of students' reading competencies in teaching English. The article compares the authors' definitions of authenticity, identifies the types and sources of authentic materials, and shows strategies for their effective integration into the educational process. Methodological recommendations for the development of reading skills, such as skimming, scanning, and reading stages, are also presented. The article has practical significance for English teachers and allows for the formation of real-life language competencies in students based on authentic materials.*

Key words: *authentic materials, reading skills, EFL, skimming, scanning, learning process, motivation, language competence.*

INTRODUCTION

When discussing the strategies for using authentic sources in the formation of reading competence in English, first of all, the theoretical foundations of using authentic materials, their advantages and limitations in the learning process, as well as their role in the development of students' reading skills in teaching English, are emphasized. By comparing the definitions of authenticity, various authors have identified the types and sources of authentic materials and developed strategies for their effective integration into the educational process. Methodological recommendations for the development of skills, such as the stages of skimming, scanning, and reading, also play an important role in the use of authentic materials. Due to the possibility of forming language competencies relevant to real life, authentic sources are of great practical importance for English language teachers.

Modern language teaching methodology aims to bring the learning process closer to real communicative situations. This requires working not with artificially simplified, but with authentic materials that reflect real speech and the real language environment. According to Jordan, Nunan, Miller, Jean, and other scholars, authentic materials are texts and speech units created for native speakers, not adapted for students. Many textbooks are based on simple vocabulary and limited grammatical structures, which is insufficient for preparing students for real communication. In real life, there are complex sentences, various forms of pronunciation, excessive speech elements, cultural layers, and richness of context. Therefore, the use of authentic materials is the most effective way to bring the real language environment into classroom conditions.

Although there are different approaches to authentic materials in the literature, their essence is generalized by the fact that they consist of materials created for native speakers and serving to satisfy a real communicative need. Jordan interprets authentic materials as texts derived from real speech samples, which are not specifically simplified. Pino connects authenticity with the satisfaction of the social needs of the speech community. Nunan and Miller emphasize that the main feature of authentic material is that it is directed not at students, but at the needs of real communication. Jean says that true authenticity manifests itself when such materials are used in the classroom while maintaining their real function. Based on these approaches, authenticity means the acceptance of language in a real context, without any modifications, along with its natural function.

Traditional textbook texts are usually simplified, insufficiently reflecting linguistic complexities, various forms of pronunciation, natural fluctuations of speech, and cultural layers. Although such materials are convenient for the initial stage, they do not correspond to the complex language environment of real life, rich in various pronunciation forms and cultural connotations. On the contrary, authentic materials, by their nature, embody the natural rhythm of language, redundancy, accents, hidden meanings of cultural signs, unexpected changes in real speech, and paralinguistic

elements. Therefore, their use expands students' thinking, prepares them for the real communicative environment of language, and eliminates artificiality that arises in the process of language learning.

The advantages of authentic materials have been substantiated in many studies. They increase students' motivation, stimulate interest, demonstrate the practical function of language, and create opportunities to work with real speech. Authentic sources also play an important role in the formation of cultural competence, since language is always inextricably linked with a certain culture. Through such materials, the student adapts to understanding redundancy, paralinguistic signs, natural stress, accents, facial expressions, and gestures. When organizing interactive lessons, authentic materials animate the lesson, involving the student in the process as an active participant.

At the same time, the use of authentic materials creates some difficulties. Since they are taken from real speech, they are often saturated with complex lexical units, grammatical constructions, and redundant speech elements. Such materials require a high level of language training from the student. Dialectal differences, different accents, rapid speech - all this can create difficulties for the reader. The rapid obsolescence of printed authentic materials and the constant updating of information also create didactic limitations. Nevertheless, as scientific sources note, authentic materials carefully selected by the teacher and adapted to the language level and age characteristics of students yield positive results even at the initial stage.

The sources of authentic materials are extremely diverse, and they create an incomparable opportunity to connect students with the real communicative environment. Audio, visual, and written sources in various forms enrich the learning process and make its content natural. For example, audio materials such as radio broadcasts, interviews, various speech patterns, telephone conversations, or audio stories help to perceive pronunciation, intonation, speed, and other aspects of natural speech. Sources of this type allow students to hear the natural rhythm of communication in real life, as well as to get acquainted with various accents and phonetic features found in the language.

At the same time, videos, films, various commercials, photographs, and other visual visual sources are also considered as an important component of authenticity. Visual materials not only make language learning interesting, but also facilitate better understanding of the context, visualization of the cultural environment, and perception of the real communicative situation. In this case, the student learns to understand not only the semantic part of speech, but also the elements of nonverbal communication - facial expressions, gestures, signs representing social status.

Printed sources also constitute an important layer of authentic materials. Newspaper and magazine articles, various brochures, menus, announcements, official documents, blog posts, and other written materials allow readers to familiarize themselves with real written speech, the development of ideas in the text, logical structure, stylistic features, and vocabulary in a natural way. Through written texts, students develop skills in working with real information flows, extracting, analyzing, and evaluating necessary information.

In today's digital age, Internet resources have become the richest and constantly updated segment of authentic materials. Web pages, online news, blogs, forums, texts, and video content on social networks allow readers to perceive the diverse speech patterns of English used in different regions of the world. The multimodal nature of digital materials - that is, the coexistence of text, audio, and video - contributes to the simultaneous development of several language skills by students.

The role of authentic materials in the development of reading competence is especially important. Reading is a complex cognitive activity that includes the processes of word recognition and comprehension. The process of understanding content requires extracting meaning from context, analysis, and generalization. Authentic materials serve precisely to deepen meaningful perception. Since today's digital information flow allows students to observe the global picture of the English language, it helps them practically strengthen their reading skills.

Conclusion.

In conclusion, authentic materials are an effective pedagogical tool in teaching English, bringing students closer to the real language environment, forming cultural competence, and serving the development of reading skills. Correctly selected and methodologically applied authentic materials increase student motivation, strengthen the skills of understanding real speech, and develop

the student's ability to think independently. Therefore, authentic sources require effective use as an integral part of the EFL process.

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Rezyume: *Ushbu maqolada ingliz tilini o‘qitishda autentik materiallardan foydalanishning nazariy asoslari, ularning afzalliklari va cheklovlari, shuningdek, o‘quv jarayonida talabalarning o‘qish kompetensiyasini rivojlantirishdagi o‘rni tahlil qilingan. Maqolada turli mualliflar tomonidan berilgan “autentiklik” tushunchasi taqqoslangan, autentik materiallarning turlari va manbalari aniqlangan hamda ularni ta’lim jarayoniga samarali integratsiya qilish strategiyalari yoritilgan. Shuningdek, skimming, scanning kabi o‘qish ko‘nikmalarini rivojlantirish va matn bilan ishlash bosqichlariga oid metodik tavsiyalar berilgan. Maqola ingliz tili o‘qituvchilari uchun amaliy ahamiyatga ega bo‘lib, talabalar uchun real hayotiy vaziyatlarga asoslangan til kompetensiyalarini shakllantirishga xizmat qiladi.*

Резюме: *В данной статье анализируются теоретические основы использования аутентичных материалов, их преимущества и ограничения в учебном процессе, а также их роль в развитии навыков чтения у студентов при обучении английскому языку. В статье сравниваются определения аутентичности, предложенные различными авторами, определяются типы и источники аутентичных материалов, а также демонстрируются стратегии их эффективной интеграции в образовательный процесс. Представлены методические рекомендации по развитию навыков чтения, таких как ознакомительное чтение (skimming), поисковое чтение (scanning) и этапы работы с текстом. Статья имеет практическую значимость для преподавателей английского языка и способствует формированию у студентов языковой компетенции, основанной на реальных жизненных ситуациях.*

Kalit so‘zlar: *autentik materiallar, o‘qish ko‘nikmalari, EFL, skimming, scanning, o‘quv jarayoni, motivatsiya, til kompetensiyasi.*

Ключевые слова: *аутентичные материалы, навыки чтения, EFL, skimming, scanning, учебный процесс, мотивация, языковая компетенция.*

THE WORLD OF YOUTH UNDER THE INFLUENCE OF GLOBALIZATION: OPPORTUNITIES AND THREATS

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Summary*: This article analyzes the impact of globalization on the lives of young people, as well as its positive and negative aspects.*

Key words*: globalization, education, community, values, youth, nation.*

One of the greatest changes of the 21st century is the process of globalization. This process affects not only economic or political spheres but also the social and spiritual life of people. Especially the worldview, thinking, and lifestyle of young people are rapidly changing under the influence of globalization. This article analyzes the impact of globalization on youth life, its positive and negative aspects.

Globalization means the strengthening of economic, political, cultural, and informational relations between countries and the gradual disappearance of borders. With the help of the Internet, mass media, and digital technologies, information spreads freely and quickly all over the world. This situation plays an important role in helping young people gain knowledge, become familiar with the outside world, and stay open to innovations.

Globalization offers many opportunities for young people.

In the field of education: international scholarships, online courses, and language-learning opportunities are increasing.

The positive impact of globalization on education should be noted separately. Distance learning and platforms such as Coursera, edX, Khan Academy, and Duolingo create new opportunities for youth. In higher education, international cooperation and student exchange programs (like Erasmus+, DAAD, El-Yurt Umidi) play an important role in improving students' knowledge. However, to keep up with global education, local systems also need new approaches.

Globalization also gives young people a chance to participate in political activities. Participation in democratic processes, volunteering, environmental movements, gender equality, and human rights activities are becoming popular among the youth. This activity is important in shaping a civic position in society. For example, in Uzbekistan, youth voices are heard through initiatives such as "Youth Union," "Youth Parliament," and "Youth Day."

Cultural exchange: young people can now learn more about the customs, art, and history of other nations.

Technological development: youth use digital technologies to create startups, run online businesses, and introduce innovations.

However, globalization also brings some negative consequences:

Threats to national values and spirituality: some young people are moving away from national traditions and are influenced by foreign cultures. Global culture — mainly Western culture — is becoming popular among youth. For example, in clothing, music, films, food habits, and lifestyles, American, Korean, and European styles are spreading widely. This process is called "cultural homogenization." Yet, this may conflict with national traditions. In Uzbek culture, respect for elders, politeness, and family values are very important. Under the influence of global culture, individualism and loneliness among young people are increasing.

Information pollution: through the Internet, youth may face fake or harmful ideas. Social media platforms such as YouTube, TikTok, and Reddit have become the main sources of information for young people. Although these platforms provide great opportunities, they also shape young people's minds through endless information streams. For instance, virtual images in social media may create unrealistic beauty or success standards, leading to psychological problems such as stress, depression, and self-doubt.

Excessive individualism and loneliness: too much independence can weaken social connections.

Globalization is an unstoppable process. To benefit from its advantages and protect from its negative effects, it is necessary to:

Develop information literacy and critical thinking in educational institutions.

Strengthen upbringing based on national and spiritual values;

Provide flexible support programs for youth by the state and society.

Young people should take an active part in globalization while preserving their national identity. Only in this way can they achieve national and spiritual growth in the global world.

Our first president as Islam Karimov said:

"If we educate people with intellect and high spirituality, only then can we achieve our goals, bring prosperity and progress to our country."

These words remind us of the responsibility to raise young generations who are morally strong and resistant to destructive ideas and ideologies. The spiritual maturity of children ensures the peaceful life of our society in the future. Therefore, we must raise them in the spirit of the national idea, explaining freedom, democracy, and the foundations of civil society.

The uniqueness of the spirituality of different nations is like the colors of a rainbow — they complement and enrich one another but do not deny each other. Universal human values are not created by a single nation; they are formed gradually by all peoples through their historical experience and mutual understanding.

Throughout history, different nations lived separately, and cultural connections were not as close as today. Over centuries, regional cultures developed — European, South-East Asian, Indian, and others — each with its unique beliefs, philosophies, arts, and traditions. Mixing all these without understanding their uniqueness may lead to negative results. The peoples of the world should live in mutual understanding, not hostility. Kindness unites humanity, not hatred. To understand others, a person must first understand themselves — their own identity. Without self-awareness, one cannot accept others sincerely. That is why paying attention to our national spirituality today is a result of the strong need to understand our identity.

When we evaluate our national customs and traditions, we must consider the harmony between human rights, national interests, and general human values. If something fits this harmony, it is acceptable; if it causes conflict or limits freedom, it is not. Valuing and developing our national spirituality does not mean ignoring other cultures — it means returning to our roots after a long period of dependence and realizing our true identity. As it is said:

"The spirituality of every nation plays a decisive role in shaping its present, its destiny, and the future of its children."

A question arises: what is the relation between indifference and evil? In truth, absolutely evil people are few. Yet, because of the indifference of many, those few can dominate millions. People who live without moral awareness or responsibility become tools of evil. Therefore, in the book “High Spirituality – An Invincible Power,” the President condemns indifference as a quality contrary to humanity.

A clear example of this is the rise of “mass culture” spreading mainly from Europe and North America. To understand this, we must look at how the modern moral atmosphere formed there. In Europe, discussions about spirituality were mostly within philosophy and ethics. Ethics focused on free will, reason, happiness, and personal interests, while less attention was given to responsibility and faith. In contrast, Eastern and national traditions emphasize harmony between faith, knowledge, responsibility, and kindness. Because this harmony was lost in Western thought, serious moral problems have appeared there today.

In the 20th century, ideological conflicts became intense. With the end of the bipolar world, global ideological structures changed completely. Our first president as Islam Karimov noted:

"The world is becoming an interconnected system where isolation has no place. Therefore, international relations and organizations must be built on new principles and approaches."

Humanity has entered the 21st century, but many global problems — poverty, ecology, diseases, terrorism, and moral crises — remain. Moreover, new dangers such as demographic decline, information wars, and the spread of Western lifestyle have appeared. To overcome these challenges, every nation must

have vigilance, ideological stability, and unity. The most effective way is to strengthen national ideology and protect minds from destructive influences through education and enlightenment.

In conclusion, religious extremism and other harmful ideologies often target inexperienced young people. The fight against such ideas requires active ideological education and intolerance toward indifference. Counter-propaganda must be fast, adapted to local conditions, and focused on strengthening youth awareness. A person capable of independently analyzing events will have a strong ideological immunity.

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Rezyume: *Mazkur maqolada globallashuvning yoshlar hayotiga ta’siri, uning ijobiy va salbiy jihatlari tahlil etiladi.*

Резюме: *В данной статье анализируется влияние глобализации на жизнь молодёжи,рассматриваются её положительные и отрицательные стороны.*

Kalit so‘zlar: *globallashuv, talim,mahalla,qadriyatlar,yoshlar,millat.*

Ключевые слова*: гловализация,образование,махалля,ценности,молодежь,нация.*

DIGITAL DEVELOPMENT TRENDS IN MODERN ART EDUCATION

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Summary: *The article analyzes the influence of digital technologies on the art education system, modern teaching methods, and directions for developing artistic skills in the digital environment. The role of innovative approaches, virtual and augmented reality technologies in art education using digital tools is also highlighted.*

Key words: *art education, digital technologies, digital transformation, artificial intelligence, creativity, digital design, virtual reality.*

INTRODUCTION

Digital technologies create a wide range of opportunities in the educational process, including the use of electronic learning platforms in higher and secondary educational institutions. In his recent Address to the Oliy Majlis, President Sh. M. Mirziyoyev emphasized the need to develop a National Concept for the Digital Economy aimed at modernizing all sectors of the economy on the basis of digital technologies and, on this foundation, to implement the "Digital Uzbekistan – 2030" program.

Although the Address is primarily related to economic reforms, it also places significant responsibilities on us—educators working in the field of education. This is because the economic life of the country, the introduction of digital technologies across all sectors, and the ongoing reforms naturally and directly affect the field of education as well. After all, the foundation of the digital economy is built upon human resources and education.

Today, in the era of globalization and digital transformation, profound changes are taking place in the field of art education. Traditional painting methods are becoming integrated with digital tools, requiring a reconsideration of the forms, content, and objectives of the teaching process.

In the modern digital environment, creative activity is carried out not only in studios, but also through digital platforms, virtual galleries, and artificial intelligence systems. Therefore, the art education system must guide both teachers and students toward integrating new technologies into the creative process. In other words, these changes provide opportunities to deliver a holistic educational approach, enhance students' skills, and improve their competencies. In the current complex context, one of the key skills needed to overcome challenges and ensure progress is digital design in art education. Promoting creativity and artistic studies even at the university level enables young people to develop creative and divergent thinking. It also encourages young specialists to respond to the challenges posed by various social networks and the rapidly changing world.

Artistic abilities acquired within the context of digital design in art education become a competitive advantage compared to other students who do not develop such competencies. Thus, art education focuses on equipping university students with the ability to confront an uncertain future, fostering creativity, imaginative thinking, and problem-solving skills through digital means. The emergence of information and communication technologies has led to the development of new methodological models within a digital ecosystem, attracting great attention due to their vast educational and creative potential.

MAIN PART

As a result of globalization, technological development, and the rapid growth of information flows, digital transformation has become an integral part of the modern education system. This process is especially active in art education, as the field of art has historically been associated with innovation, creative expression, and the search for new forms. Digital tools are opening new horizons for artistic activity, enabling the development of creative processes not only through traditional techniques but also through digital graphics, multimedia, computer animation, and virtual design.

Digital transformation is emerging not only as a technical instrument but also as a method of art studies, a pedagogical approach, and a form of cultural experience. In the learning process, computers, tablets, graphic tablets, interactive boards, artificial intelligence platforms, 3D printers,

and digital software are widely utilized. This significantly broadens students' worldview, enhances creative thinking, and enriches their artistic experience.

Digital transformation also provides opportunities to create interactive and immersive learning environments. For example, students can examine exhibits of world museums in high resolution via digital platforms, analyze them, study their historical context, and compare their techniques and compositions. Through virtual reality (VR) and augmented reality (AR) technologies, students can interact with 3D-modeled artworks, test color and lighting effects, and experiment with creative solutions in diverse artistic environments. This process enriches the traditional learning experience and develops visual perception, creative thinking, and the ability to solve problems innovatively.

Furthermore, artificial intelligence (AI) tools help optimize and accelerate creative processes in art education. AI-generated sketches, color combinations, and compositional suggestions provide students with the opportunity to quickly test new ideas and support creative thinking. At the same time, AI technologies reinforce students' skills in authorship responsibility, artistic ethics, and making aesthetic decisions. Therefore, the task of art education in the context of digital transformation is to use technology as a means of enhancing creative activity while preserving the unique voice of the creative individual.

Digital platforms also provide students with opportunities to integrate into the global creative market. By showcasing their portfolios on platforms such as Behance, ArtStation, and Instagram, students can share their work with an international audience, communicate with mentors and professionals, and follow global trends and contemporary artistic movements. As a result, digital transformation shapes students' socio-cultural competencies, communication skills, and ability to engage in interactive environments, aligning them with the demands of modern art industries.

Digital transformation not only develops individual competencies but also fundamentally changes teaching methodology. In hybrid learning models, students study traditional painting and composition techniques on one hand, while mastering digital graphics, 3D modeling, animation, and multimedia on the other. This combination enables learners to harmonize technological literacy, creative thinking, and artistic intuition.

Ultimately, digital transformation expands artistic expression not only in new forms but also methodologically, aesthetically, and communicatively. It moves the art education system beyond the classical academic model toward a multi-vector, technological, and creatively integrative space. The integration of digital tools reconstructs the didactic process into a more flexible, interactive, and student-centered approach. Transparency in the educational process, content re-processing, and the ability for students to reflect on their artistic experience are greatly enhanced, accelerating the development of creative competencies, media culture, visual literacy, and digital aesthetics.

Modern pedagogical practice incorporates virtual galleries, 3D modeling complexes, graphic design platforms, digital drawing tools, generative art software, VR/AR laboratories, and multimedia studios, creating a vast creative experiential environment. These technologies activate multi-sensory experiences in the artistic process: visual-perceptual capacity expands, cognitive processes related to spatial modeling deepen, and the integration of imagination with logical-compositional thinking strengthens. As a result, students acquire the ability to analyze artistic concepts multidimensionally, synthesize ideas in digital and traditional environments, and freely select expressive and technological tools.

Digital technologies also democratize the artistic process: they ensure equal access to educational resources and global cultural content, intensify visual exchange between various cultures, and shape the individuality of the artist within a global context. Metaverse platforms, immersive art experiences, media-art laboratories, and international digital portfolio systems guide the career trajectories of young artists in new ways, contributing to their development as universal visual communicators, cultural mediators, and digital innovators.

Thus, digital transformation is not merely a technological shift but a process of epistemological change within art pedagogy. It fundamentally redefines the mechanisms of perceiving, creating, and presenting art, integrating artistic practice with experimentation, analysis, creative design, environmental modeling, and visual research. The strategic mission of modern art

education is to build an integrative learning environment that fosters digital competence while preserving personal artistic voice, aesthetic independence, and cultural identity.

Moreover, the synthesis of traditional artistic skills and digital competencies is becoming a core principle of contemporary art education. This synergy not only preserves craftsmanship and classical academic techniques but also enriches them with modern technological capabilities. The artist's hand-drawn sketches, compositional explorations, and painting experience can be further developed through digital tools, strengthening the student's individual artistic voice and stylistic independence. Such integration expands the artist's creative experience, increases opportunities for experimentation, and creates an interactive learning environment. Digital technologies also enhance the efficiency of tasks such as compositional analysis, color testing, and 3D modeling.

Therefore, the strategic mission of contemporary art pedagogy is to prepare modern and innovative specialists by turning technology into a tool that supports creativity, expands opportunities, and generates new ideas. The main objective is to train creative and pedagogical personnel who, while using digital opportunities, do not lose their personal artistic identity but instead elevate it to new formats.

CONCLUSION

Digital transformation is creating fundamental changes in modern art education. Today, the field of art requires mastering not only traditional drawing, sculpture, and composition skills but also digital technologies, artificial intelligence tools, and virtual and augmented reality (VR/AR) environments.

Analyses show that digital tools broaden students' creative thinking, enhance interactive and experimental artistic experiences, and facilitate their integration into the global cultural space. Through virtual platforms, multimedia, and AI technologies, students not only accelerate their workflow but also test creative solutions in various formats, experiment with color, light, and composition, and acquire modern visual language.

At the same time, digital transformation renews the methodological and psychological processes of art pedagogy. Students gain opportunities for independent development, creative decision-making, interactive project creation, and analytical research. Thus, modern art education is moving toward a hybrid model that synthesizes traditional artistic mastery with digital competencies.

All analyses indicate that digital transformation increases the effectiveness of art education; however, the most successful results are achieved when it is harmoniously integrated with traditional pedagogical approaches, ensuring that students do not lose their personal artistic voice.

Digital development is fundamentally changing the form, content, and methods of art education. Digital tools make the learning process interactive, dynamic, and creatively enriched. In modern art education, digital transformation is not only a technological process but also a pedagogical innovation and a means of expanding creative thinking. For this reason, art educators must thoroughly master digital tools and teach students to apply them creatively.

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Rezyume: *Maqolada raqamli texnologiyalarning san’at ta’limi tizimiga ta’siri, zamonaviy o‘qitish metodlari va raqamli muhitda rassomlik ko‘nikmalarini rivojlantirish yo‘nalishlari tahlil qilinadi. Shuningdek, raqamli vositalar yordamida san’at ta’limida innovatsion yondashuvlar, virtual va kengaytirilgan reallik texnologiyalarining o‘rni yoritilgan.*

Резюме: *В статье анализируется влияние цифровых технологий на систему художественного образования, современные методы обучения и направления развития*

художественных навыков в цифровой среде. Также освещается роль инновационных подходов, технологий виртуальной и дополненной реальности в художественном образовании с использованием цифровых инструментов.

Kalit so‘zlar: *san’at ta’limi, raqamli texnologiyalar, raqamli transformatsiya, sun’iy intellekt, kreativlik, raqamli dizayn, virtual reallik.*

Ключевые слова: *искусствоведение, цифровые технологии, цифровая трансформация, искусственный интеллект, креативность, цифровой дизайн, виртуальная реальность.*

PRACTICAL AND LEGAL ASPECTS OF THE CONSUMER'S LEGAL STATUS

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Summary: *This article covers the theoretical and legal foundations of the concept of consumer, its content, and legal status in the legislation of the Republic of Uzbekistan. The author analyzes the place of the consumer category in the system of civil law, the types of subjective rights and their practical application. Also, the compatibility of consumer rights with international legal standards and the role of state bodies and public associations in their provision were studied. The article also outlines the directions for improving consumer status based on the norms of the current Law "On Protection of Consumer Rights."*

Key words: *consumer, legal status, civil law, consumer rights, legal protection, international standards.*

To determine the basic rights of citizens-consumers, it is necessary to clarify the meaning of the concept of "consumer."

According to V.V.Bogdan, "one of the main subjects of the consumer market is the consumer. The consumer is an active participant in the consumer market. In addition, it should be noted that the consumer is a special legal status of the person participating in the relevant relationship" [1. 234]. According to E.Yu.Lanina,..."a consumer is a citizen who must enter into a preliminary relationship with the subjects opposing him, most of whom assume the obligations established by law within the framework of the consumer's exercise of their rights, protection of their legitimate interests" [2. 20].

The concept of "consumer" is often encountered in the current legislation of our country. The interpretation of this concept varies in different regulatory legal acts.

In various cases, a narrow interpretation of the term "consumer" is used, mainly given in the preamble of the Law "On Protection of Consumer Rights," which explains the basic concepts used. For example, Article 1 of the Law "On Protection of Consumer Rights" defines *"consumer - a citizen (individual) who purchases goods, orders work, services for personal consumption or other purposes not related to the production of profit*" [3].

According to this definition, "only a citizen, that is, an individual, can act as a consumer. This applies not only to citizens of our country, but also to foreign citizens and stateless persons. Thus, when applying the provisions of this law, it is impossible to classify legal entities as consumers. Moreover, the law does not apply when registering a citizen as an individual entrepreneur and acquiring, ordering, or using goods (works, services) for carrying out entrepreneurial activity, as well as when establishing the fact of receiving, ordering, or using goods (works, services) by a citizen for carrying out activities recognized by the court as entrepreneurial.

According to E.Kornilov, it is advisable to amend the concept of "consumer," including a restriction on the application of legal norms as the final sphere of personal consumption, except for individuals and legal entities [4.39].

In our opinion, in some cases, the inclusion of legal entities in the concept of "consumer" leads to the loss of a clear direction of consumer protection policy, since the main goal of the adopted laws is to protect the non-professional economic and legal rights of consumers, and the economic and legal rights of consumers are weaker than the rights of counterparties. According to D.A. Mokhorov, "in scientific research, the position of the consumer as the main participant in legal relations arising in the market of goods and services is characterized, as a rule, by the concept of "legal status", which reveals the role, place, and significance of the subject in society, its capabilities, and the principles of interaction with other subjects and the state" [5. 57-82].

V.V.Danilov defines the legal status of the consumer as "a complex legal category that reflects the relationship between the consumer, the state, the producer of goods (works, services), and the seller through a set of generally accepted rights and established obligations of the consumer" [6. 23].

"The right to education in the field of consumer rights protection is one of the rights that belongs to all consumers without exception. This law corresponds to the right to consumer education provided for in UN General Assembly Resolution No. 39/248 of April 9, 1985, "Guidelines for the Protection of Consumer Interests".

According to V.A.Gurevich, consumer rights are "relations arising from contracts of retail sale, lease, lease of residential premises, in particular, the performance of work, provision of services, provision or ensuring the provision of utilities to the tenant in order to ensure the proper use of the house in which the residential premises are located..." etc., i.e., any contractual relations [7. 23].

The following definition of entrepreneurial law seems quite successful. This is a branch of law consisting of civil, administrative, and criminal law norms that regulate relations for the satisfaction of citizens' needs.

In a broad sense, entrepreneurial law is a complex branch of law, the norms of which are aimed at protecting the interests of consumers of citizens. Such diverse views on the definition of the concept of "consumer right" arise due to the lack of a formal definition.

By acquiring consumer status, each individual enters into various relationships related to the satisfaction of their personal consumption. In these relations, he has certain rights. The exercise of these rights requires the consumer to act in accordance with the rules, procedures, and procedures established by law, thereby protecting their rights. As a general rule, consumers exercise their rights at their own discretion. This, in turn, shows that they may or may not fully exercise their subjective rights, as well as waive, transfer, transfer their subjective rights, by the consumers themselves or by an authorized person represented by them. For example, a consumer can use, own, and dispose of the purchased goods at their discretion, i.e., gift it or relinquish it in favor of the person temporarily using the goods for free.

However, the exercise of these subjective rights should not go beyond the legal framework. The exercise of consumer rights by citizens refers to the rights granted to them by law or contract as consumers. In short, the exercise of consumer rights is the practical use of the legal freedom guaranteed by the state to the consumer.

When exercising their consumer right, the consumer must, first of all, comply with the conditions and requirements established by law for the exercise of these rights. In accordance with Article 9 of the Civil Code, the exercise of civil rights by a citizen-consumer must not violate the rights and legally protected interests of other persons. It is assumed that the participants in civil legal relations act honestly, reasonably, and fairly.

Consumer rights are a broad theoretical and practical legal category, which includes not only the civil law capabilities of an indefinite circle of persons, but also the subjective rights of a specific person and is protected by the state.

And to obtain consumer status, it is not required to have legal capacity. In this regard, the exercise of the consumer's rights cannot always be carried out by him.

However, according to Article 1 of the Law "On Protection of Consumer Rights," a citizen who has not only purchased a product but also consumed it literally is considered a consumer. This indicates that the requirement for legal capacity does not have the necessary significance in the exercise of consumer rights.

The consumer's exercise of their rights is manifested not only in their contractual relations with third parties, but also in the consumer's protection of their rights in case of violation of their rights or in the expression of demands arising from the violation of the right. For example, according to Article 18 of the Law "On Protection of Consumer Rights," a consumer has the right, within ten days from the date of purchase of a non-food product of acceptable quality, to exchange it for a similar product from the seller at the place of purchase, and if such a product is not available for sale, to receive a refund. The consumer's exercise of their rights through representatives may occur when the goods are presented to the consumer as specified in the contract and the goods are registered in the consumer's name.

After all, in other cases, any person can prove that they are a consumer by presenting a sales receipt, a cash receipt, and a contract. Also, the provision of public services, the implementation of

consumer rights in contracts aimed at satisfying the needs of citizens through one network, is carried out through consumer representatives. In this case, the rights of several consumers are violated simultaneously due to the same reason or the culpable actions of the contractor, service provider, or seller. For example, due to shortcomings in the supply of thermal energy to the population under the energy supply contract, the rights of most consumers in a particular industry are violated.

From an institutional point of view, consumer rights can be divided into universal and special (specific) rights.

Consumer's *universal rights* are objective in nature and represent a set of legal opportunities aimed at protecting citizens' rights in the consumer market to create an effective mechanism for protecting and implementing consumer rights. They apply to all individuals who are potential subjects of legal relations involving consumers and are enshrined in the first section of the Law "On Protection of Consumer Rights": the right to receive information about goods (works, services), the right to the proper quality and safety of goods (works, services), the right to full compensation for damages, the right to collect fines, the right to judicial protection, the right to compensation for moral damage.

Consumer *special (specific) rights* - are subjective. This is a set of legal opportunities provided to a specific individual by the law on the protection of consumer rights arising from legal relations arising in the market of goods and services.

Special consumer rights are reflected in the law: the right to refuse to perform the contract, the right to free elimination of defects, the right to a proportional reduction in the purchase price, etc. This separation has both theoretical and practical significance.

Theoretically, it provides an opportunity to better understand the mechanism for ensuring and implementing laws. From a practical point of view, this is useful in the sense that it ensures the search for specific ways to increase the effectiveness of the real implementation of the law.

Right to information is of great importance for the objective protection of consumer rights, as it guarantees the consumer knowledge of who is responsible and accountable to this consumer for the quality and safety of goods (works, services).

At the same time, this right allows the consumer to sufficiently identify the purchased goods, that is, to know exactly what goods (works, services) are offered to them.

On May 17, 1996, the Law of the Republic of Uzbekistan "On Protection of Consumer Rights" was adopted, which defines the legal status of consumers. According to it, consumer rights can be divided into several categories, namely: basic consumer rights; consumer's right of claim; consumer's verification rights; the right to exchange goods can be indicated.

Article 4 of Law No. 221-I establishes the following **basic rights of** consumers: obtain reliable and complete information about the product (work, service), as well as about the manufacturer (executor, seller); free choice and appropriate quality of goods (work, services); safety of goods (work, services); compensation in full for material damage, moral harm caused by goods (works, services) with defects dangerous to life, health, and property, as well as by unlawful actions (inaction) of the manufacturer (contractor, seller); to apply to the court, other authorized state bodies to protect violated rights or legally protected interests; establishing public consumer associations.

In the legislation **the consumer's right to demand** is manifested in the following cases: in case of providing inaccurate information about the goods (work, service); demand to ensure the safety of goods (works, services); when selling defective goods.

If incorrect or insufficiently complete information is provided about the goods (work, service), the consumer:

the consumer has the right to terminate the contract and demand compensation for the damage caused to them, if this entailed the acquisition of goods (works, services) that do not have the necessary consumer properties;

the consumer has the right to demand that the relevant information be provided within a reasonable short period (no more than three days) if the purchased goods (work, service) are not used for their intended purpose. If the information is not provided within the specified period, the consumer has the right to terminate the contract and demand compensation for losses;

causing harm to the consumer's life, health, or property, they have the right to present the manufacturer (contractor, seller) with the requirements stipulated by law.

In such cases, the consumer's claims for compensation for damages caused by inaccurate or insufficiently complete information about the goods (work, service) are considered based on the assumption that the consumer does not have special knowledge about the properties and aspects of the purchased goods (work, service).

Losses caused to the consumer by goods (works, services) purchased as a result of incorrect advertising are subject to full compensation by the manufacturer (contractor, seller).

Article 12 of Law No. 221-I The consumer has the right to demand guarantees that the goods (works, services) they purchase are manufactured or performed in compliance with sanitary and hygienic requirements, including radiological, anti-epidemic, and other applicable norms and rules, and are safe for their life, health, the environment, as well as not causing damage to their property.

It should be noted that the manufacturer (contractor) is obliged to ensure the safety of the goods (work, service) during its service life or shelf life, and if such a period is not established, for ten years from the date of sale of the goods (work) to the consumer.

In the event of the sale of defective goods, the consumer has the right, at their discretion, to demand **one of the following**: replacement of goods with goods of the same brand (model, article) of acceptable quality; replace the product with a similar product of another brand (model, article) and recalculate its purchase price accordingly; free elimination of product defects or reimbursement of the consumer's or third party's expenses for eliminating defects; reduce the purchase price proportionally to the defect; termination of the contract and compensation for losses incurred.

If defects: during the warranty period or shelf life of the goods; for goods for which a warranty period and expiration date have not been established, within six months; within two years from the date of transfer of the real estate to the consumer, unless a longer period is stipulated by the contract; the consumer may exercise these rights if they are identified within the period established by the Government of the Republic of Uzbekistan for seasonal goods.

The consumer's **rights related to exchange** are manifested in:

The consumer has the right, within ten days from the date of purchase of a non-food product of acceptable quality, to exchange it for a similar product from the seller at the place of purchase of this product and, if such a product is not available for sale, to receive a refund.

If the goods were not used, were not damaged, were returned in packaging, their consumer properties were preserved, and there are grounds confirming their purchase from this seller, the consumer's demand for replacement or return of the goods is subject to satisfaction.

Unless otherwise provided by agreement of the parties, the refund of the amount of money paid by the consumer is carried out in the same form in which payment for the goods was made.

The procedure for exchange and the list of goods not subject to exchange are determined by the rules approved by the Government of the Republic of Uzbekistan.

This law defines the obligations of manufacturers, contractors, and sellers to provide information about themselves and the goods/work/service, the rules of trade and service, the warranty period, quality control, rules on certain types of sales, the form and procedure for payment for goods, the rights of consumers to the safety of goods/work/service, their rights when selling defective goods to consumers, replacing them with high-quality products, the procedure for eliminating defects, the rights of consumers in case of violation of these rights, and others.

Compensation for moral damage is carried out regardless of compensation for property damage and losses incurred by the consumer.

For example, according to the Committee for the Development of Competition and Consumer Protection, a total of 30,070 appeals regarding consumer rights violations were received during 2023. Of the appeals, 12,906 (42.9%) were related to housing and communal services, transport services, 9,931 (33%) to trade and catering, 6,295 (20,9%) to communications, financial and social services, and 938 (3.2%) to advertising relations.

In studies conducted on the consideration of appeals

The rights of 23,945 consumers were violated, and a recalculation of 32.9 billion soums in favor of consumers was ensured.

At the same time, in the trade sector, goods worth more than 3.08 billion soums were exchanged or returned to consumers in 426 cases.

In order to protect the rights of an indefinite circle of consumers, 324 systematic studies were conducted in about 10 areas, and it was found that an overpayment of 143.1 billion soums was collected from consumers.

For example: *1. Household waste transportation services, 2. Natural gas supply services, 3. consumer sewerage services, 4. Provision of railway services 5. Provision of insurance services. Provision of communication services, 7. Services provided to consumers by HUMO AIR. 8. Services provided to consumers by enterprises providing paid medical services and other similar areas were studied* [8]. Based on consumer appeals and information provided by other agencies, the Committee conducted 20 studies and analyses in various areas in order to protect the rights of an indefinite number of consumers.

Thus, in conclusion, the process of ensuring the rights and legitimate interests of consumers in court includes the possibility of applying to the court for the restoration of violated rights, compensation for damages, and compensation for moral damage. Judicial protection is a last resort for consumers, as it is used when other dispute resolution methods, such as negotiations or appeals to public organizations, are ineffective. The main goal of judicial protection is the establishment of justice in accordance with current legislation and the restoration of violated consumer rights.

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Rezyume: *Ushbu maqolada iste'molchi tushunchasining nazariy-huquqiy asoslari, uning mazmuni va O'zbekiston Respublikasi qonunchiligidagi huquqiy maqomi yoritilgan. Muallif tomonidan iste'molchi kategoriyasining fuqarolik huquqi tizimidagi o'rni, subyektiv huquq turlari va ularning amaliyotda qo'llanilishi tahlil qilingan. Shuningdek, iste'molchilar huquqlarining xalqaro huquq standartlariga mosligi va ularni ta'minlashda davlat organlari va jamoat birlashmalarining roli o'rganildi. Shuningdek, maqolada amaldagi "Iste'molchilarning huquqlarini himoya qilish to'g'risida"gi Qonun normalari asosida iste'molchilar maqomini yaxshilash yo'nalishlari bayon etilgan.*

Резюме:*. В данной статье рассматриваются теоретические и правовые основы понятия потребителя, его содержание и правовой статус в законодательстве Республики Узбекистан. Автор анализирует место категории потребителя в системе гражданского права, виды субъективных прав и их практическое применение. Также была изучена совместимость прав потребителей с международно-правовыми стандартами и роль государственных органов и общественных объединений в их обеспечении. В статье также*

изложены направления повышения статуса потребителей на основе норм действующего Закона "О защите прав потребителей."

Kalit so‘zlar*: iste’molchi, huquqiy maqom, fuqarolik huquqi, iste’molchi huquqlari, huquqiy himoya, xalqaro standartlar.*

Ключевые слова: *потребитель, правовой статус, гражданское право, права потребителей, правовая защита, международные стандарты.*

ACADEMIK DRAWING TECHNIQUE AND TECHNOLOGY

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Summary: *This article helps students to master the basic concepts of academic drawing, acquire specialized terminology, expand their knowledge in the field, and effectively apply these skills in practice*.

Key words: *Drawing, technique, shading.*

1. DRAWING

By drawing, we understand the clear, expressive, and accurate depiction of a given form. This term is used in various types of art, each time acquiring a specific meaning. The word *drawing* refers not only to the linear outline or appearance of an object, but also to the organization of any form depicted in the artwork. Drawing exists in all types of visual art: ornament, engraving, painting, woodcarving, and others.

The great artist of the Renaissance, Michelangelo, once wrote:

“Drawing, also called the art of draftsmanship, is the highest point of painting, sculpture, and architecture. Drawing is the source of all forms of art and the root of every science.”

Types of Drawing.

The simplicity of line-drawing techniques and the universality of form-building principles have made drawing the foundation of graphic and other visual arts. In comparison with technical drafting, the characteristics of drawing can be highlighted as follows:

- Drawing is made by hand, which speeds up the process of execution;
- Drawing is done through visual observation, which reflects not only what an object is, but also how it *appears*;
- Drawing is demonstrative, showing the essential external features in an illusionistic form;
- It conveys the object’s materiality, volume, lighting, and spatial placement.

Drawing expresses the inner essence of the object and its surrounding environment, evoking specific thoughts and emotions in the viewer.

According to the use of visual means, images are divided into linear and tonal. A linear drawing is usually light, clear, and compact. A tonal image makes it possible to show the volume, brightness, materiality, and spatial relations of the form in order to give a complete description of the object and its environment. Such an image is even called tonal. The simplest type of tonal image is a silhouette filled with a single tone, that is, a contour image.

According to the technique of execution, drawings are original and printed. Original drawings are made by the artist’s hand in a single copy. Printed drawings are printed on paper and are called estamp. There are several types of estamp. The main ones are engraving (on wood — xylography, on linoleum — linocut, on metal — etching) and lithography (a drawing printed from a lithographic stone sharpened with a lithographic pencil and acids).

Methodology

According to its purpose, academic drawings are divided into creative drawings. An academic drawing is a long-term drawing performed for the purpose of learning to draw, mastering methods of depiction, and studying various forms and features. It is characterized by defining all the main features that determine the external appearance of the depicted object.

Creative drawing is a work of fine art, which expresses the artist’s thoughts, emotions, and worldview in an artistic form.

In educational and creative works, *sketch, study, sketch draft* are used. A quick, short-term drawing is called a *nabroska*; the main outline of the drawing is supplemented with sparse strokes or shading. A full study of the subject of depiction or one of its parts is carried out through an *etude*. In this case, the most important external and internal features and characteristics of the object are

observed and fixed for a relatively long time. The colored materials studied in *etudes* and *sketches* are used in practical creative drawing or painting.

Drawing methods

Drawing from direct observation is characterized by the presence of the object in front of the artist during the entire work. This is also done by drawing from nature.

Drawing from imagination is characterized by the absence of the object image in front of the artist. The artist reconstructs an image that was once formed in his mind from memory, description, or imagination. Drawing based on visual memory develops visual recall, enriches thinking with precise images, and develops creative imagination.

Basic principles of drawing.

The principle of moving from general to specific. The depicted object is a single whole, and all of its parts are coordinated with one another. A part belongs to the object; without it, the object loses its meaning. Therefore, depiction should begin not from one part, but from the general mass, from the general appearance determining its position, dimensions, and movement in space.

The principle of moving from specific to general. When the artist depicts details, the overall form of the object becomes distorted. To restore the integrity of the form, each part is generalized and subordinated to the whole.

Educational tasks of drawing

Among the tasks of teaching drawing, the following can be identified:

- drawing technique;
- composition of the drawing;
- sequence of drawing;
- depiction of the object;
- depiction of space.

2. DRAWING TECHNIQUE

The system of tools and methods used to embody a visual image on a flat sheet of paper is called drawing technique. Its main aspects are organizing the workplace, self-organization, selecting the necessary working methods, and others. Knowing technical tools and methods, and the ability to use them, allows for realistic depiction of what is seen and the graphical expression of ideas about it. Mastering drawing techniques develops hand movements, the skill of executing planned work, and habits of self-control.

Material-technical tools.

Paper. During the process of teaching drawing, newspaper, wrapping paper, drawing paper, and drafting paper are used.

Newspaper, wallpaper, and wrapping paper have a fine-grained, loose, fibrous surface that holds powdery pigment well. Therefore, they are used for working with charcoal and pastel. Drafting and drawing papers are dense, glossy, and either smooth or slightly textured.

Glossy and smooth paper is suitable for pencil work. Pencil, charcoal, and paint require rough paper, as its grain holds pigment particles well and allows the depiction of various forms. Textured drawing paper can withstand prolonged pencil work, but for educational purposes, the best drawing paper is dense, white, with a slightly textured surface. During work, paper should lie still and straight, with its edges parallel to the edges of the table.

Ordinary graphite pencil. For drawing, primarily medium-soft M and 2M graphite pencils are used. Thin lines and strokes are drawn with a sharp point; thick lines and shading are applied with its side. To prepare the pencil, the wooden edge is shaved to 25–30 mm, and the graphite is exposed 8 – 10 mm, then sharpened. During work, the pencil is held in the middle and rotated periodically, drawing with only the sharp part of the graphite.

Visual tools.

Dot. A dot is created by touching the surface with a pencil, brush, or chalk, or by intersecting strokes and lines.

Stroke. This is a line, a short line. In drawing, strokes are used more frequently than dots. They indicate the dimensions of the object, contour, surface brightness, and volume. Replacing a uniform contour line with strokes makes the drawing dynamic, giving the form a lively appearance connected to the environment.

Line is the most common tool of depiction. It can be easily rendered with all technical tools: cutter, pencil, pen, etc. Lines can be straight or curved.To draw a straight line, first mark its position on the paper with a dot; then outline the direction with short connecting strokes and finalize it with a pencil, checking the straightness visually. Straightness is checked by holding the paper at eye level; perspective shortening can reveal if the line deviates.

Lines, depending on size, can be long or short, equal or unequal; depending on thickness-thick or thin; depending on brightness — dark, semi-dark, light;depending on function — contour or auxiliary.

Tone. The surface of each object has its own tone or visible brightness.Tone is conveyed through hatching, toning, or coloring.

Hatching is a method of applying tone with strokes. Strokes, placed close together, apart, or in zigzags, are combined to depict the form. The direction of strokes (vertical, horizontal, diagonal) corresponds to the movement, structure, shape, and dimensions of the depicted surface. The direction of strokes acts as an active element in the drawing, influencing the visual perception of the object's form.

Toning is the method of applying tone using connecting strokes. Usually, toning is done with the side of a graphite pencil held by all fingers.

The **"dry brush"** method is used for painting drawings, giving the surface uneven, textured light. In this technique, dense paint is applied to the paper with a dry brush.

3. DRAWING COMPOSITION

Composition is the organization of the picture plane in such a way that lawful and harmonious relationships are established between the picture plane and the drawing.

When an artist begins to depict any object, they determine the format of the paper sheet and choose the position and size of the drawing. For depicting a vertical object, the paper should be placed vertically; for a long horizontal object, the paper should be placed horizontally. The correct placement of the drawing plane helps to position the drawing, arrange it better compositionally, and prevents distortion of proportions and empty spaces on the surface. The distance between the edges of the paper and the drawing helps the drawing stand out as a primary element within the frame.

To prevent excessive enlargement or reduction of areas and strong contrasts, the size of the drawing should correspond to the format and dimensions of the paper.

The drawing is perceived together with the background. However, because the light-sensitive cells on the retina are not evenly distributed, the clarity of all parts of the drawing plane is not the same: the central part is seen most clearly, so the main element of the composition should be placed in the center of the paper. If several objects are depicted, it is recommended to place the main compositional element in this zone.

The tasks of compositional work include identifying the aesthetic qualities and inner content of the objects being depicted, and highlighting the main and characteristic elements using effective compositional tools such as rhythm, symmetry, asymmetry, balance, contrast, and nuance.

Rhythm. Various forms of life are seen in motion, i.e., in the mechanical movement of the body in space. The eye follows the moving object, repeating all phases of its movement. It perceives the volume of the space traversed by the object. This ability to visually perceive a series of figures is widely used in fine art to depict motion and life.

The repetition and alternation of forms is called rhythm. Rhythm arises from the interaction of rhythmic elements — accents and intervals. An **accent** is a repeated shape, colored spot, or plastic form. An **interval** is a spatial gap separating rhythmic beats. Accents alternate with intervals, forming a rhythmic series.

Rhythm manifests differently: in one case, through strict uniform alternation of identical accents with evenly repeated intervals; in another — through equal speed of intervals with gradual

increase or decrease in mass, brightness, or color; and in a third — through approximately equal repeated speeds and intervals.

Rhythm divides the form into parts, highlights the main element, diminishes the importance of secondary elements, and makes the object more static or dynamic, exciting or distinct, according to the creative idea of the composition.

Symmetry. The term originates from Greek, meaning "proportionality" or "measurability." Symmetry is a static means of unifying forms in nature, ensuring all parts conform to one another. If the constituent parts are identical and arranged similarly, the figure(or group of figures) is symmetrical. Equality can be established by simple superposition of forms or mirror reflection.

Asymmetry. If elements of a material (figure) are not symmetrical, they are called asymmetrical. Asymmetry always gives dynamism to the plastic form and reveals its potential for movement. The hidden "dynamic" potential of this compositional tool lies in the fact that the movement arising in an asymmetrical figure cannot remain isolated — it extends to neighboring objects and the environment. It continues logically, completing the form and making it stable and aesthetically appealing.

Balance. The human eye perceives the object (or group of objects) as a whole — initially sensing its mass, spatial position, and interaction of multiple objects' masses. At the same time, by perceiving the real object and its depiction as a whole, one can sense the visual weight: the object appears light or heavy. A small object with sharply outlined contours and lightly colored surfaces appears light; a large object with simplified contours and darkly colored surfaces appears heavy. If a part of the drawing is overworked, painted with bright colors, it loses stability.

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Rezyume: *Ushbu maqola talabalarning akademik chizmatasvir bo'yicha asosiy tushunchalarni o'zlashtirishiga, maxsus atamalarni egallashiga, sohaga oid bilimlarini kengaytirishiga va bu ko'nikmalarni amaliyotda samarali qo'llashiga yordam berishni maqsad qiladi.*

Резюме: *Эта статья направлена на то, чтобы помочь студентам освоить основные понятия академического рисования, освоить специальные термины, расширить свои знания в этой области и эффективно применять эти навыки на практике.*

Kalit so'zlar: *Chizmatasvir, texnika, soyalash.*
Ключевые слова*: Рисунок, техника, штрих.*

ORGANOLEPTIC ANALYSIS AND THE IMPORTANCE OF USING THIS ANALYSIS IN THE EDUCATIONAL PROCESS

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Rezyume: *This article presents the meaning, essence, and types of organoleptic analysis. This includes visual analysis, analysis through taste characteristics, characteristics of evaluation through smell and odor, as well as the importance of forming this type of analysis. This allows students to connect their knowledge and skills in organoleptic analysis with the development of competency-based knowledge, preparing them for life through solving everyday problems and tasks through this knowledge, and highlighting the important features of organoleptic analysis as a consumer and legal entity, as well as what to pay attention to when knowing. It is hypothesized that applying this knowledge to the earliest stages of the school and educational processes can lead to positive results. Examples are given of how this knowledge can be formed based on spiral learning based on the cognitive potential of preschool children, schoolchildren, and in technical and higher education systems.*

Keywords: *organoleptic analysis, organoleptic and physic-chemical indicators, analyzer, visual analysis, sense of smell, taste characteristics.*

Foreign economic activity involves chemical and technological research, such as studying the composition, origin, structure, organoleptic, and physicochemical properties of substances within a product range. The research was conducted in the fields of technical, engineering, and pharmaceutical sciences, and this research has caused economic harm to states and consumers.

All analysis has its advantages. Organoleptic analysis, in particular, is one of the most important for commodity experts, technologists, and customs specialists. This analysis is the oldest and most widespread method performed through the human senses, having developed in the second half of the 20th century. Since organoleptic analysis is based on natural sciences, it studies food chemistry, the taste properties of products, and physical parameters. Many new products, food additives, and flavorings are developed based on this analysis. Product evaluation and prediction using visual guessing are also related to this analysis.

Organoleptic analysis is essential for assessing properties such as taste, odor, and texture of products such as wine, tea, coffee, confectionery, and tobacco. It even surpasses other chemical laboratory tests in speed, accuracy, and effectiveness, requiring no specialized equipment. Organoleptic analysis is also used in textile materials science to quickly determine the nature of fibers (natural and synthetic) and to evaluate textile material characteristics, such as fabric wrinkle resistance. Organoleptic assessments are also widely used in damage assessments, such as in automobile or real estate insurance, and for rapid quality assessment of marketed products.

Although this type of analysis does not require specialized equipment, simple auxiliary equipment can facilitate the analytical work. For example, a magnifying glass, microscope, stethoscope, mirror, marker, tweezers, etc.

When evaluating a product, the primary considerations are appearance, shape, color, shine, transparency, consistency, taste, and other characteristics. However, many of the parameters determined by the organoleptic method are subjective, and this is one of its drawbacks. The reliability of the resulting assessment largely depends on the expert's (evaluator's) experience, imagination, and previous assessment experience. For example, sweet as honey, sour as lemon, spicy as pepper, and so on. Any existing flaw can be eliminated and minimized. However, when professionally evaluating products with complex compositions and a wide range of applications, points are used. Professional knowledge of commodity science and production technology ensures highly accurate analytical results.

Taste and smell indicators are defined in standards and other technical documentation for product quality characteristics. However, not all specialists have powerful sensory analyzers and can detect changes in color or taste.

The senses are a complex system, not limited to the external organs—the tongue, nose, and eyes. Therefore, the term "analyzer," referring to precise and complete sensory organs, was introduced into science by I.R. Pavlov. Human sensory analyzers include the organs (taste, sight, hearing, smell, and touch) that perceive the effects of light, smell, taste, and sound and generate nerve impulses; the nerves that transmit impulses to the brain; and a group of nerves that perform psychological analysis of impulses and analyze color, smell, taste, sound, and texture.

Visual analysis. When examining a product organoleptically, the first consideration is its external condition, which is performed visually and is commonly referred to as visual analysis. Visual inspection examines the nature of the packaging, the shape and consistency of the product, its color, and its degree of transparency.

The dullness of colors across different color ranges makes it difficult to accurately determine colors. If 90-95% of daylight is reflected, these substances are white. This is why granulated sugar, refined sugar, and table salt are white, despite being crystalline and transparent. If light spectra are absorbed by a substance, that substance appears black. For example, tea. The spectra reflected from a substance impart color to that substance. For example, red wine absorbs all rays only because it reflects red rays; the red color indicates visibility**.**

Organoleptic color is determined based on a specific standard of analytical results. For example, the color range of tea is determined based on specific designations for wine color determination.

When determining color, it is, of course, essential to create the necessary conditions for visualization and analysis. This requires, first and foremost, sufficient light. Insufficient lighting can interfere with the proper labeling of results. Conversely, it has been observed that too much light can also strain the eyes and lead to inaccurate results.

Taste assessment. Organoleptic analysis is of primary importance when evaluating food products. There have been instances where products that meet all state requirements for physical and chemical properties were deemed unsuitable due to an unpleasant or off-flavored birghini.

Everyone recognizes four basic tastes: sweet, salty, sour-salty, and bitter. Taste buds are located on the surface of the tongue, and three parts of the tongue are particularly sensitive to sweet and salty tastes. The top of the tongue senses bitterness, while the sides of the back sense sourness. Taste can only be perceived when diluted (in water or saliva).

Olfaction. The smell of a product greatly influences its quality. The chemical composition of a product influences its smell just as it influences its taste. There are a vast number of odors, for which a specific classification has not yet been developed.

In addition to olfactory, gustatory, and visual analysis, organoleptic assessment is possible based on sound, size, temperature, and other physical properties of substances.

The sense of touch allows us to determine such properties of a product as consistency, temperature, degree of grinding, characteristics of its physical structure (elasticity, smoothness, roughness, etc.), etc. In this case, the product is touched by hand, probed, pressed, pressed, pierced, cut, ground, chewed, and tapped.

It's important to develop these analytical skills from preschool and school age. Preschoolers should be aware of which aspects of foods to pay attention to before consuming (for example, good and bad bread, desserts, or, again, comparisons are possible, and a different type of product can be obtained, depending on the teacher's creativity), and which foods may pose a health risk and vice versa. Using additional tools (such as a magnifying glass. From an early age, children also acquire some knowledge of this simple equipment and magnifying devices), acquiring knowledge such as observing and differentiating different types of small beans and similar foods encourages them to exercise observation skills at home. For example, teaching older children to distinguish between everyday products, such as sugar and flour, or salt and sugar, through visual analysis is the same as preparing them for everyday life. School-age children can be taught these types of analysis in a more

complex manner, using a scientific approach. For example, analyzing milk with a quality problem, comparing substandard or expired products. Watching videos about medication administration and analyzing the observed results to enhance scientific observation skills, etc., can help draw conclusions. This type of analysis is of great importance in preparing children for life.

At the same time, developing children's understanding of organoleptic analysis during both higher and, of course, secondary education yields positive results. For example, the eye's color sensitivity can be tested using colored shadows on various pictures, and the tongue's taste sensitivity can be tested by drinking sour, bitter, and sweet solutions and determining the concentration levels of the solutions. Such targeted activities, conducted during practical and laboratory classes, encourage students to concentrate and pay attention to the appearance, quality, and organoleptic properties of products in general (this process should be accompanied by precautionary measures, taking into account the strict prohibition on tasting chemical reagents in chemistry labs and using chemical glassware for consumer purposes). For example, qualified Uzbek chefs can easily analyze salt levels and identify any missing elements based on the food's aroma and boiling point during cooking, even when it's impossible to taste (for example, during Ramadan). They certainly rely on years of experience, but this experience can be applied to a limited number of students and can also be effectively applied to other areas of study.

Organoleptic analysis develops the senses of all students. This is especially true for students in special educational institutions. An example of this is the more advanced development of hearing and other senses in people with visual impairments or defects. Conversely, in people with hearing and ear problems, the enhanced development of vision and other senses is an example of this. Therefore, no matter which sense is being developed, the analyzer can certainly be improved. By working on all analyzers, it is necessary to perfect them and use them effectively in everyday life. Clearly, methods for assessing students' taste sensations, learning the rules of tasting, serving, and color comparison will be useful in the future for easily resolving everyday problems, if necessary.

Of particular importance in developing knowledge in this area is the predominance and significance of independent student thinking. This gives students the opportunity to critically examine and analyze all the bodies around them. Observation, analysis, and attentiveness to all bodies—this is what makes it possible to acquire knowledge outside the classroom, which is essential in modern education.

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Rezyume. *Ushbu maqolada vizual tahlil, ta'm tahlili, hid va hidni baholash kabi organoleptik tahlilning ma'nosi, mohiyati va turlari, shuningdek, ushbu turdagi tahlilni ishlab chiqishning ahamiyati keltirilgan. Ushbu maqolada organoleptik tahlilda olingan bilim va ko'nikmalarni kompetentsiyaga asoslangan bilimlarni rivojlantirish bilan bog'lash, o'quvchilarni ushbu bilimlardan foydalangan holda kundalik muammolar va vazifalarni hal qilish orqali hayotga tayyorlash qobiliyati o'rganiladi. Shuningdek, u iste'molchi va yuridik shaxs sifatida organoleptik tahlilning muhim jihatlarini ta'kidlab, nimani e'tiborga olish kerakligini ta'kidlaydi. Unda ushbu bilimlarni maktab va ta'lim jarayonlarining dastlabki bosqichlariga qo'llash ijobiy natijalar berishi mumkinligi taxmin qilinadi. Ushbu bilimlarni spiral o'rganish orqali, maktabgacha yoshdagi bolalar, maktab o'quvchilari va texnik va oliy ta'lim tizimlarida kognitiv salohiyatga asoslanib qanday rivojlantirish mumkinligi haqida misollar keltirilgan.*

Резюме: *В данной статье представлено значение, сущность, виды органолептического анализа. В том числе: визуальный анализ, анализ через вкусовые характеристики,*

характеристики оценки через обоняние и запаха, а также важность формирования этого типа анализа. Благодаря этому умение связывать сформированные знания и умения по органолептическому анализу с развитием компетентностных знаний, подготовка учащихся к жизни через решение бытовых проблем и задач посредством этих знаний, осветляются важные особенности органолептического анализа как потребителя-покупателя и юридического лица, на что следует обращать внимание, зная. Выдвигаются гипотезы о том, что применение знаний подобного направления к самым ранним областям школьного и образовательного процессов в целом может дать хороший результат. Приведены примеры того, как эти знания могут быть сформированы на основе спиралевидного обучения на основе когнитивного потенциала детей дошкольного возраста, школьников, в системах технического и высшего образования.

Kalit so'zlar: *Organoleptik tahlil, organoleptik va fizik-kimyoviy ko'rsatkichlar, analizator, vizual tahlil, hid bilish, ta'm xususiyatlari.*

Ключевые слова: *органолептический анализ, органолептические и физико-химические показатели, анализатор, визуальный анализ, обоняние, вкусовые характеристики.*

INTERACTIVE METHODS FOR FORMING STUDENTS' SCIENTIFIC AWARENESS COMPETENCE AND ORIENTING THEM TOWARD RESEARCH ACTIVITIES

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Summary. *This paper attempts to develop a methodology for forming scientific awareness competence among students studying chemistry and natural science specialties at pedagogical universities, while also systematizing theoretical and experimental research findings related to interactive teaching of chemical sciences in the form of conceptual principles.*

Keywords: *individual, competence, conceptual, procedural, component, chromatography, electrophoresis, elective and facultative.*

The approach based on developing students' scientific awareness competence implies organizing the learning process in such a way that ensures the acquisition of the necessary professional qualifications by university graduates. To achieve this, first, it is essential to determine the contribution of each subject to the final learning outcomes; second, it is necessary to develop the methodology for forming students' competencies, including its targeted, content-related, procedural, and evaluative-effective components.

Our research is devoted to designing a methodological system that ensures the formation of various skills among future chemistry teachers. According to experts in the field of science, today there are practically no theoretical or applied disciplines that are not closely connected with chemistry. Modern chemistry lies at the crossroads of many natural sciences: organic chemistry, physical–colloid chemistry, the foundations of physicochemical methods, composite material chemistry, and others. Chemistry studies the structure and properties of substances, their transformations, oxidation–reduction reactions, participation in electrolysis and hydrolysis, and the compounds they form. Chemistry can be considered the fundamental language of all natural sciences, as it studies chemical processes and the laws governing the exchange of matter within them.

At the same time, chemistry forms the theoretical foundation of numerous sectors of the national economy: chemical industry, medical and biochemical sciences, agriculture (hydro- and agrochemistry), nanotechnology, green chemistry, chemical engineering, and several other fields. Over the past decades, chemical approaches have become increasingly influential in accelerating development and addressing complex problems across all industrial sectors. Chemical and physicochemical analytical methods, particularly chromatography and electrophoresis, constitute the instrumental foundation of scientific research and are widely used in chemical production, ecology and hydroecology, natural environment assessment, food products, and laboratory diagnostics.

According to the figurative expression of K.U. Komilov [63], chemical sciences occupy the position of a "key stone" in the structure of natural sciences within technical fields, preventing the system from falling apart. Chemistry is one of the core, foundational disciplines in biological, hydroecological, physical–colloid chemistry, physicochemical analysis, medical chemistry, specialization subjects, and agrotechnical education. Therefore, the main task of the future teacher is to activate students' learning activities and purposefully enhance their motivation to study the subject while taking into account their personal characteristics and interests.

Changes in the requirements for organizing the educational process necessitate reconsidering teaching forms and methods. Thus, the traditional interpretation of a lecture as a sequential presentation of content is losing relevance. We employ problem-based and dialogic lectures, engaging students in collaboratively searching for answers to questions posed during the lecture. This increases students' interest in the subject, enriches the learning process emotionally, enhances personal involvement, and allows deeper understanding of the problems modern chemistry can address.

Developing consistency and continuity in educational activities begins with students establishing a logical framework within individual theories and research objects through oral and written tasks, concrete assignments, practical tasks, coursework, and tests. Through such tasks,

students develop the ability to identify structures within the studied topics and the overall content. Establishing connections among individual facts, phenomena, concepts, hypotheses, and laws is essential for forming the scientific worldview of students. The quality of acquired knowledge is characterized by the presence of structural–functional connections among various knowledge elements in the student's mind. Consistency presupposes understanding relationships among concepts, scientific facts, postulates, and laws of different orders, as well as recognizing the place of new knowledge within the overall scientific theory. Thus, academic subjects at higher education institutions must express a pedagogically adapted system of knowledge, skills, and abilities necessary to apply scientific concepts and perform experiments in educational and practical settings.

Today, the term "interactive" is gaining significant relevance and is widely used in contexts describing human communication and new information systems—such as "interactive voting," "interactive computer games," etc. Therefore, emphasis is placed on a person's ability not only to perceive information passively but also to participate actively in its development and decision-making. At the same time, analysis of psychological and pedagogical literature shows that an interactive approach within students' research activities has not yet become a subject of independent study and has not been sufficiently considered as a structural component of the general methodology for forming students' scientific awareness competence.

To develop a methodology for forming students' scientific awareness competence, the implementation of the main principles of interactive approaches in scientific research activity is envisaged:

1. The pedagogical importance of interaction and communication as the purpose and result of research activity (axiologization of communication).

2. Balance of interaction and communication as continuously evolving goals and objectives of research.

3. Integrity of interaction and communication as the basis for integrating scientific and non-scientific knowledge, intellectual and emotional development, collaborative pedagogical activity, normative and creative aspects of communication, socialization and individualization.

4. Organizing group-based educational interaction as an initial stage and gradually transforming it into cooperation, which is necessary for meaningful communication.

5. Developing interdisciplinary connections through dialogization of scientific and research cooperation.

6. Objectification of social and communicative experience, enabling self-diagnosis and self-management in research activity, etc.

The tasks of the interactive approach in preparing specialists in natural sciences (chemistry) include:

• Professional-educational functions—developing innovative professional thinking, understanding scientific knowledge reasonably, optimizing time and financial resources, and distributing efforts in solving educational and research tasks; creating individual learning routes tailored to a student's abilities, needs, and prospects; and developing special professional and communicative skills based on the use of innovative and information technologies.

• Regulatory and adaptive functions—eliminating gaps in general and professional pedagogical training in a timely manner at each stage of university education, adjusting theoretical, scientific, and professional knowledge, skills, and experience.

• Organizational and motivational functions—engaging students in active research activities based on their applications, contributing to the development of professional and pedagogical competences in educational, creative, scientific, and practical contexts.

• Acmeological functions—strengthening students' and future scientists' professional motivation, encouraging the development of creative scientific potential, identifying and effectively utilizing personal capacities, providing resources for high research achievements, and ensuring professional maturity.

The primary functions of the interactive approach have established a system of requirements for creating an appropriate model of communication in scientific research activity.

The methodology for forming students' scientific awareness competence made it possible to increase attention to problems of pedagogical communication in the process of professionally preparing future specialists at pedagogical universities. "Interactivity" in students' research activities ensures emotional unity as a condition for successful interaction between supervisor and students, enabling mutual understanding, emotional acceptance, and establishing positive relations during joint activity. Constant feedback is a crucial aspect of this process, allowing the instructor to regulate students' activity and eliminate errors in a timely manner.

Designing interaction in scientific research implies not only developing a sequence of stages within the research program (project) but also coordinating the spontaneous and organized components of interaction, and structuring communication between the student and the instructor. In this process, the principle of self-management is fully revealed: external compulsion is eliminated through meaningful creative tasks that provide favorable conditions for both joint and independent scientific work. Personalized subject–subject relations become the leading direction in organizing interactive cooperation between teacher and student.

The teacher's role as an organizer involves establishing the necessary order for efficient functioning of the educational process. The expert's role includes informing, structuring actions, guiding, and organizing the direction of the research program. The facilitator supports action, regulates information exchange, and promotes the development of new experiences. Acting as a facilitator, the supervisor shares his or her experience using active methods based on direct work with students: case analysis, business games, brainstorming, role-playing games, video reflections, practical tasks, and others.

The described role-playing methods and situations can be used by teachers to organize students' research activities. The teacher regulates the choice of specific roles and contributes to variation in statuses and role positions during interaction with students.

Organizing scientific research at universities requires intensification in terms of addressing qualitatively new tasks corresponding to the current state and future development of society and education. In such conditions, a specialist's continuous self-improvement and scientific activity aimed at acquiring and applying new knowledge through research gain particular importance. This includes:

• Fundamental (theoretical and experimental) research aimed at understanding the essential laws of human activity and development, society, and education;

• Applied research focused on achieving practical goals and solving specific educational problems;

• Experimental developments based on scientific findings or pedagogical experience, aimed at creating and improving new models and technologies of teaching and upbringing.

Understanding the special qualification of a chemistry teacher requires considering, first, the structure and logic of chemistry as a science and its individual branches; second, the domain of professional activity—education. By special chemical competence of a chemistry teacher, we mean an integral personal quality manifested in the ability to solve typical tasks related to the goals, content, and methods of teaching chemistry in primary and secondary (specialized) schools, including:

• conducting chemical–pedagogical diagnostics to determine the student's individual experience, preparation level, intentions, interests, and prospects in learning chemistry;

• selecting the content of educational material across various sections of chemistry, designing its structure according to the curriculum, elective and facultative courses, and extracurricular activities;

• delivering chemical content to students by explaining fundamental facts, concepts, and principles, and assimilating chemical theories using effective teaching methods and technologies;

• ensuring safe performance of school chemical experiments while adhering to safety regulations and anticipating potential hazards;

• monitoring student achievement in individual sections and the overall chemistry curriculum, identifying successes and difficulties;

• organizing excursions to chemical enterprises and laboratories;

• supervising students' scientific research activities in chemistry;

• establishing cooperation with chemistry teachers regarding content and teaching methods, professional development, and collaboration with enterprises related to chemistry;

• using information from various sources in the field of chemistry, evaluating its reliability, and interpreting it for professional self-education.

Chemical competence includes general chemical and specialized chemical competences (in inorganic chemistry, organic chemistry, physical–colloid chemistry, biological chemistry, analytical chemistry, composite materials chemistry, computer chemistry, etc.) acquired during university studies and applied in both personal and professional contexts. Chemical competence encompasses theoretical knowledge, the ability to apply it to concrete situations involving matter states, flows, and chemical processes, skills to study, apply, and use chemical knowledge in practice, and understanding its social, ethical, and environmental significance.

A chemistry teacher's professional competence is an integral characteristic involving mastery of both the subject (chemistry) and the theory and practice of education. European experts believe that future teachers should possess broad competences necessary for achieving high academic standards in the subject, fully mastering pedagogical theory and practice, and considering students' age characteristics and national priorities of education. In rapidly changing and unpredictable social conditions, teachers must understand their evolving roles. Teacher preparation in terms of competences and learning outcomes should correspond at least to the first cycle of multi-level education according to the Bologna model.

Chemical cognitive competences relate to solving intellectual problems in chemistry, including:

• demonstrating knowledge and understanding of key facts, concepts, principles, and theories of chemistry;

• applying this knowledge to solve qualitative and quantitative professional chemical problems;

• locating and interpreting chemical information;

• evaluating the reliability and quality of research and information in chemistry;

• presenting scientific and practical materials in oral and written form.

Chemical practical competences include laboratory and experimental skills:

• safe handling of chemical substances considering their chemical and physical properties;

• assessing hazards associated with chemicals and laboratory procedures;

• performing standard laboratory procedures in physical–chemical research, qualitative and quantitative analysis, organic and inorganic synthesis, and demonstration experiments;

• conducting chemical observations, measurements, and monitoring, and documenting phenomena or changes;

• interpreting laboratory data in accordance with their significance and theoretical foundations;

• using mathematical, graphical, and computer-based methods to process chemical data.

In addition to developing chemical competences, training chemistry students at pedagogical universities also aims at forming general and professional skills essential for independent learning and personal development: searching and analyzing information from various sources, adhering to ethical values, demonstrating intercultural tolerance, working autonomously and in teams, interpersonal communication, critical thinking and self-criticism, adaptability, planning and regulation skills, career decision-making, creativity, leadership, responsibility, initiative, striving for achievement, and others.

We identified the conceptual foundations of didactics and chemistry teaching methods, and analyzed terminology related to interactivity in education. A review of pedagogical and methodological literature shows that such terms as "interactive teaching methods," "interactive teaching forms," "interactive learning," "interactive," and "interactivity" are widely used in general and specific contexts, leading to multiple interpretations and causing difficulties in mutual understanding. Teaching methods and forms often include various games—business, role-playing,

simulation—as well as training sessions, academic discussions, practical classes, project method, programmed instruction, consulting, and small-group work.

Determining interactive methods and forms in teaching chemistry is complicated by the absence of a single criterion for classifying them as interactive. Such difficulties can be addressed by referring to broader didactic structures—types or methodological teaching systems. In the methodological system of interactive chemistry education, interactive methods serve as means of achieving goals—developing special chemical competence—while performing the function of content delivery based on inherent laws and mechanisms of learning.

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Rezyume: *pedagogika universitetlarida kimyo va tabiatshunoslik mutaxassisliklari va yo‘nalishlarini o‘rganayotgan talabalarning ilmiy xabardorlik kompetensiyasini shakllantirish metodikasini yaratish bilan birgalikda, talabalarga kimyoviy fanlarni interfaol o‘qitish bilan bog‘liq nazariy va eksperimental tadqiqotlar natijalarini konseptual qoidalar shaklida tizimlashtirishga harakat qilingan.*

Резюме: *В связи с разработкой методики формирования компетентности научного сознания студентов, обучающихся по химическим и естественнонаучным специальностям и направлениям педагогических вузов, предпринята попытка систематизировать результаты теоретических и экспериментальных исследований, связанных с интерактивным обучением студентов химическим наукам, в виде концептуальных правил.*

Kalit so’zlar: *individual, kompetensiya, konseptual, prosessual, component, xromatografiya, elektroforez, elektiv va fakultativ.*

Ключевые слова: *индивидуальный, компетентность, концептуальный, процессуальный, компонентный, хроматография, электрофорез, факультативный и необязательный.*

УДК 374.3

FORMATION OF STUDENTS' COMMUNICATIVE COMPETENCE THROUGH DIGITAL TECHNOLOGIES

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Summary: *This article provides general information about digital technologies, technologies for developing students' communicative competence through the digitalization of education. The article discusses digital technologies, technologies for developing students' communicative competence through the digitalization of education. Success in developing the communicative competence of future teachers is a title awarded for raising their profession to the level of art, teaching dozens, hundreds of students.*

Keywords: *digital technologies, digitalization of education, artificial intelligence, electronic educational resources, communicative competence, technology.*

The implementation of interdisciplinary integration in the education system is one of the current topics. The introduction of integration into education plays a special role in increasing students' interest in science. Before discussing interdisciplinary integration, let's find answers to questions such as what integration is, how to use it or not. Today, the main task of professors and teachers working in higher education institutions is to develop scientific research, to provide quality education to students in accordance with the requirements of educational standards with the effective use of modern information technologies, and to continuously monitor their activities. is to go and provide scientific and methodological assistance, to teach to use the information flow effectively and to work independently. The introduction of advanced interactive educational technologies based on the effective use of modern information and communication technologies and tools, the creation of globally minded and highly professional personnel for a steadily developing economy in harmony with the continuous increase in the scientific and pedagogical potential and skills of professors and teachers. can guarantee preparation. A number of reforms are being implemented on the development of the higher education system, the Decree "On approval of the concept of the development of the higher education system of the Republic of Uzbekistan until 2030" on October 8, 2019 [1] is the legal basis of the reforms in this regard. is considered On October 6, 2020, the decision PQ-4851 "On measures to further improve the education system in the field of information technology, develop scientific research and integrate it with the IT industry" was announced [2]. The resolu tion states that improving the personnel training system in the field of information technologies is one of the important conditions for the successful implementation of the "Digital Uzbekistan - 2030" strategy, the development of digital technologies and the wide implementation of them in the daily life of the population. Also, the decision stated that the measures taken to increase the efficiency of the system of vocational training and retraining in the field of information technologies are creating a solid foundation for providing state bodies and branch organizations with qualified IT specialists.

Integration (Latin integration-restoration, filling, whole-whole) is the convergence and connection of disciplines in the course of a differential process. The integration process is a stage of connecting the connection between disciplines in a new, high quality, and it is necessary to be able to show oneself in a high way. It is worth noting that the roots of the integration process go back to the folk and scientific pedagogy of the distant past. K. D. Usheninsky spoke about the spiritual and pedagogical nature of the didactic impact and the psychological and pedagogical connection in the folk pedagogy of the past: "The knowledge and ideas imparted by any science represent a broad and enlightening view of the world and life. in case". Even in those days, scientists emphasized that the use of connections between sciences, that is, the integration of knowledge, allows one to take a broad view of life. Interdisciplinary integration remains a necessary condition for modern education today.

Because excessive categorization of textbooks sometimes dampens a child's interest in knowledge and creates the impression that it is no longer possible to make discoveries. The rapid development of principles and methods of teaching, updating programs and textbooks, the emergence

of new educational institutions could not rid the modern school of the predominance of information over development. That is why interdisciplinary integration is becoming one of the most important factors in the development of education today. Psychological and philosophical foundations of interdisciplinary integration appear in the works of I.P. Pavlov and I.M. Sechenov. A child cannot always remember existing or new information on a subject well, but if these topics are enriched with information from other subjects, i.e. covered in interconnection, then it will be interesting and easy to remember. even in nature we can find interconnected things and events.

The objective basis for combining scientific knowledge is considered to be a picture of the globe. In addition, there is a community of research methods used in the field of acquiring knowledge. The principle of systematicity is the philosophical basis of interdisciplinary integration. Integration helps eliminate fragmentation and mosaicism of students' knowledge, helps them acquire comprehensive knowledge, a set of universal human values. In domestic and foreign pedagogy, a great deal of experience has been accumulated in studying integration problems, and at different periods Ya.A. Komensky, I.G. Pestalozzi, J.J. Russo, L.N. Tolstoy, K.D. Ushinsky used interdisciplinary integration in the educational process. are considered to be pressed. Since the 21st century is the century of technology, the rapid growth of information volume is a natural phenomenon. the rapid growth of this information volume, the ability to perceive and understand it is sharply reduced. The way out of this can be seen in the synthesis of various disciplines, in the development of comprehensive courses and in the interrelation of all disciplines. Today, the main ideas of integrative education are:

1. Personal focus of education (human-value process of upbringing);
2. Formation of generalized subject structures and methods of activity (mastering knowledge based on understanding of laws);
3. Priority of motives that create meaning in education (motivational, internal, external and organizational);
4. Sequence in training (understanding of connections within a scientific theory);
5. Study of the problem;
6. Reflection of activity;
7. Dialogism (truth is born in the process of dialogical communication). The goal of integrative education: to form a holistic vision of the world.

Within the framework of integrated learning, individual technologies can be distinguished:

1. Integration;
2. Design technologies;
3. Educational technologies in the global information community;
4. Teaching large systematic educational courses based on the Internet;

When planning integrated lessons, the following are taken into account:

1. Knowledge blocks are combined, so it is important to correctly define the main goal of the lesson;
2. Information necessary to achieve the goal is obtained from the content of the objects;
3. Many links are established in the content of the educational material;
4. Parts of the integrated content are a necessary link in the lesson and are planned for the final conclusion;
5. It is necessary to carefully select teaching methods and means and determine the workload of students in the lesson.

The integration process requires certain conditions to be met: the objects of study must be the same or close enough; the integrated subjects use the same or similar research methods; they are organized on the basis of common patterns and theoretical concepts.

Now let's look at the pros and cons of integration: 1. Allows you to implement one of the most important principles of didactics - the principle of systematic learning.

2. Creates optimal conditions for the development of thinking, logic, adaptability, criticality.

3. Promotes the development of a systemic worldview and harmonization of the personality of students. Multiple subjectivities are reduced, interdisciplinary connections expand and deepen, and more knowledge is available.

4. It is considered a means of motivating schoolchildren and contributes to their activation, cognitive activity encourages students to be creative. The negative aspects are as follows: an increase in the intensity of the lesson, incompleteness of details, the appearance of individual cases, Preparation for the lesson takes a lot of time.

Success in developing the communicative competence of future teachers is a title given for bringing their profession to the level of art and teaching dozens and hundreds of students. Or, the most important and responsible task facing teachers of our republic is training specialists who look at a certain world with new eyes, are resourceful, know how to do business, build and raise the foundation of our great future. A teacher is responsible to society for education and training in his specialty. Along with regular improvement of his professional training, he must have the right to be a teacher, a teacher, a mentor, an educator, a teacher, or, more precisely, to have communicative competence. At present, a teacher rarely acquires practical and theoretical knowledge in his chosen profession, science, specialty. He must be able to use new methods and methods of education in his work in any situation, in a word, he must be the owner of competence.

The concept of "competence", an approach from the point of view of competence, meaning the owner of competence, and in order to dwell on the meaning of these terms, first of all, let us pay attention to national traditions and values in this regard. has been formed for centuries. Communicative competence - the teacher is required to communicate fully. He has positive relationships with students and team members in any situation. Depending on the content of training, the situation, the situation of any teacher's goal is to create a "developing atmosphere" in the classroom. That is: - giving students motivation to work; - understanding by encouraging students to use them independently, to include in educational activities, - the formation of imagination and skills. Search for the necessary information, own activity - the project and its implementation, to understand the purpose of the work and the result - approach with responsibility; - the level of complexity of the subject, goal, tasks by students, - independent choice of forms and methods; - teaching students to work in groups on the topic of the project and - identifying problems, dividing tasks, planning, debates - discussion and evaluation of results. - student participation in various forms of discussions. - formation of regulation of their actions in students. - through the assessment system, students improve their own results - assessment of their levels and results and achievement of their further improvement. Thus, the formation of communicative competence based on interdisciplinary integration not only helps students' personal and social development, but also prepares them for their future professional activities. Effective use of digital technologies and modern pedagogical approaches is crucial in this process.

In conclusion, it should be emphasized that integration in education is not a fashion, but a necessity to prepare high-quality specialists for any sphere of human activity. Integration technology in modern education ensures the integration of individual parts of science into a single complex. Moreover, it is not only about the mechanical connection of different knowledge, but also about the application of an interdependent approach to them, and a person will have to act systematically when solving certain problems.

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Rezyume. *Ushbu maqolada raqamli texnologiyalar, ta'limni raqamlashtirish orqali talabalarning kommunikativ kompetensiyasini rivojlantirish texnologiyalari haqida umumiy ma'lumot berilgan. Maqolada raqamli texnologiyalar, ta'limni raqamlashtirish orqali talabalarning kommunikativ kompetentsiyasini rivojlantirish texnologiyalari muhokama qilinadi. Bo'lajak o'qituvchilarning kommunikativ kompetentsiyasini rivojlantirishdagi muvaffaqiyat - bu o'z kasbini san'at darajasiga olib chiqish, o'nlab, yuzlab o'quvchilarga saboq berish uchun berilgan unvondir.*

Резюме: *В статье представлены общие сведения о цифровых технологиях, технологиях развития коммуникативной компетентности студентов посредством цифровизации образования. В статье рассматриваются цифровые технологии, технологии развития коммуникативной компетентности студентов посредством цифровизации образования. Успех в развитии коммуникативной компетентности будущих учителей – это звание, присваиваемое тем, кто поднял свою профессию до уровня искусства, обучая десятки, сотни студентов.*

Kalit so'zlar: *raqamli texnologiyalar, ta'limni raqamlashtirish, sun'iy intellekt, elektron ta'lim resurslari, kommunikativ kompetentsiya, texnologiya, fan, o'qituvchi, pedagogika.*

Ключевые слова: *цифровые технологии, цифровизация образования, искусственный интеллект, электронные образовательные ресурсы, коммуникативная компетентность, технологии.*

ANALYSIS OF EXPERIENCES IN DEVELOPING ECOLOGICAL COMPETENCE IN STUDENTS OF GENERAL SECONDARY SCHOOLS

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Summary: *This article scientifically and methodologically examines the ways of forming ecological concepts in the content of biological education in secondary schools. In accordance with the tasks set for continuing education, the educational institution, in accordance with the tasks set for continuous education, includes ways to implement a number of tasks, such as increasing the effectiveness of the educational process, introducing the latest achievements of science into practice, and bringing up a creative, socially active, spiritually rich, professional, educated in the spirit of national and universal values, creative and independent thinking, and instilling in them the ideas of national independence.*

Keywords*: creative, socially active, spiritually rich, professional, national and universal values, competence.*

Introduction. The Concept for the Development of Biology Teaching The "Concept for the Development of the Public Education System of the Republic of Uzbekistan until 2030", adopted on the basis of the Decree of the President of the Republic of Uzbekistan dated April 29, 2019 No. PF-5712, was developed in order to fulfill the tasks set out in the Address of the President of the Republic of Uzbekistan to the Oliy Majlis dated January 24, 2020. The Concept defines the main trends in the development of biology teaching in the public education system. Qualitatively updating the content of biology, as well as improving teaching methodologies, and gradually implementing the principles of individualizing the educational process; the content of biology, the formation of biological knowledge, critical thinking and creative competencies that can be applied in independent life; The elimination of social, economic, demographic, spiritual and ecological tensions arising within the framework of human activity, such as the widespread introduction of effective forms and methods of ecological education in biology teaching and the formation of an ecological culture, is emerging as an urgent problem of modern civilization. In accordance with the tasks set for continuing education, it is necessary to implement a number of tasks, such as increasing the efficiency of the educational process of an educational institution, introducing the latest achievements of science and technology into practice, to produce a creative, socially active, spiritually rich, professional, educated in the spirit of national and universal values, creative and independent thinking, and to instill in their minds the ideas of national independence[1]. Ecological education includes the problems of preserving the living environment in which humans live from a historical perspective, as well as the negative impacts that humans have on the natural environment as a result of their labor activities, and the issues of preventing them.

Materials and methods. Environmental education is carried out on the basis of educational topics integrated or applied to the above-mentioned three subjects, such as "Geography", "Biology", "Physics", "Chemistry" and even "History", depending on the age of the children. However, environmental education in them is not interconnected and coordinated. Environmental education is carried out by teachers of these subjects. This leads to the biologicalization, geographicalization, physicalization or chemicalization of environmental education[2]. Therefore, at the initial stage of general secondary education, students are taught to distinguish between the things created by nature and society and to look at them with love; to distinguish between the seasons and be amazed by their charm, along with the climatic changes inherent in each of them.

When providing ecological education to young people, it is necessary, first of all, to study the historically formed ecological and cultural heritage of the people and, on its basis, to create a strict system of rules for environmental protection and rational use of all types of resources, taking into account current changes in the life of society. The first and main principle of maintaining ecological balance in the interaction of society and nature, as noted above, is to minimize human impact on

nature[4]. One of the important tasks facing society today is the rational use of natural resources. One of the ways to solve this problem is to develop and implement strict rules for producers.

It is of didactic importance to distinguish between ecological education and the upbringing of a student. In the process of any continuous education - upbringing, it is of fundamental importance to ensure the connection between the formation of a general social discipline and the discipline of environmental activity. To do this, first of all, it is necessary to identify a set of special ecological knowledge, categories that are directly related to the discipline of general social, economic, political, spiritual relations. Each teacher depends on his ability to convey ecological knowledge methodologically. This is due to the fact that the protection of the natural environment is a complex social, economic, spiritual and political activity, and is directly related to each of them; it is necessary to explain that one of the main problems of education is to form the content of such concepts as “ecological labor discipline”; “ecological planning discipline”; “ecological management discipline”; “ecological culture discipline”; “ecological aesthetic discipline”; “ecological etiquette, moral discipline” in students and turn them into practical skills [5]. This, in addition to the level of knowledge and pedagogical skills of the teacher, also directly depends on his personal example. In the reconstruction of the ecological education system, it requires seriousness in implementing the unity of theory and practice and in this area.

Results and discussion. Currently, most teachers do not doubt the need for environmental education of schoolchildren. Active work is being carried out to create a system of environmental education as the basis for sustainable development of society. The ecological orientation of the modern educational process arises for a number of reasons. Among them: the existence of a growing threat of environmental destruction on a global, national and local scale;

the contradiction between the culture of technocratic civilization and the environment and the problem of choosing a new form of life;

the formation of a new system of human values, associated with the need to change the relationship "man - nature - culture" at the current stage.

The main task of environmental education is to equip students with a certain amount of special knowledge, skills and qualifications necessary for life and labor activity. Environmental education is a purposeful influence on the spiritual development of the younger generation, the formation of certain values in them from the point of view of a moral attitude to the environment. The modern meaning of the term "ecology" is extremely broad, it goes beyond the scope of biological knowledge and is considered as a whole system of human relations to himself, to knowledge, to other people, to nature. Ecological education of the teacher is the most important part of educating his worldview. The problem of preserving life on the planet is an invariable companion of human knowledge, his desire for development. Ecological education of schoolchildren is understood as the formation of their ecological consciousness - a conscious attitude to the environment in order to protect and rationally use natural resources. The main goal of ecological education is to form a person distinguished by developed ecological consciousness and culture. The ecological culture of a person is manifested in his attitude to nature.

Active work is being carried out to create a system of ecological education as the basis for the sustainable development of society. The ecological orientation of the modern educational process arises for a number of reasons. Among them:

the existence of a threat of environmental destruction occurring on a global, national and local scale;

the contradiction between the culture of technocratic civilization and the environment and the problem of choosing a new form of life;

the formation of a new system of human values, associated with the need to change the relations "man - nature - culture" at the present stage.

Conclusion. The solution to ecological problems should be sought in the sphere of people's culture of using nature, in the formation of new systems of consciousness and behavior, in changing the content of interests, norms, values and knowledge related to the interaction of society and nature. If modern educational practice can form in the current and future generations of people a sense of

love for nature, the ability to direct their mind and will in the interests of themselves and nature, to foresee and prevent their negative environmental consequences, it will create the basis for solving global ecological problems. Ecological education of the human personality is the most important part of educating his worldview. The problem of preserving life on the planet is an invariable companion of human knowledge, his striving for progress. Environmental education of schoolchildren means the formation of their ecological awareness - a conscious attitude towards the environment in order to protect and rationally use natural resources.

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Rezyume: *Mazkur maqola umumiy o‘rta ta’lim maktablarida biologik ta’lim mazmunida ekologik tushunchalarni tarkib toptirish yo‘llari ilmiy-metodik jihatdan yoritib o‘tilgan. Uzluksiz ta’lim oldiga qo‘yilgan vazifalarga muvofiq ta’lim muassasasi ta’lim-tarbiya jarayonining samaradorligini oshirish, ilm-fanning so‘nggi yutuqlarini amaliyotga joriy etish orqali ijodkor, ijtimoiy faol, ma’naviy boy, kasb-hunarli, milliy va umuminsoniy qadriyatlar ruhida tarbiyalangan, ijodiy va mustaqil fikr yuritadigan barkamol shaxsni yetkazish, ularni ongiga milliy istiqlol g‘oyalarini singdirish kabi qator vazifalarni amalga oshirish yo‘llari qamrab olingan.*

Резюме: *В данной статье научно-методологически рассматриваются пути формирования экологических представлений в содержании биологического образования в общеобразовательных школах. В соответствии с задачами непрерывного образования, образовательное учреждение, в соответствии с задачами непрерывного образования, включает в себя пути реализации ряда задач, таких как повышение эффективности образовательного процесса, внедрение в практику новейших достижений науки, воспитание творческой, социально активной, духовно богатой, профессиональной личности, воспитанной в духе национальных и общечеловеческих ценностей, обладающей творческим и самостоятельным мышлением, а также привитие ей идей национальной независимости.*

Kalit so‘zlar: *ijodkor, ijtimoiy faol, ma’naviy boy, kasb-hunarli, milliy va umuminsoniy qadriyatlar, kompetentlik.*

Ключевые слова: *творческий, социально активный, духовно богатый, профессиональный, национальные и общечеловеческие ценности, компетентность.*

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SCIENTIFIC AND THEORETICAL FOUNDATIONS OF INTEGRATIVE TEACHING OF CHEMISTRY IN THE BIOLOGY EDUCATION PROGRAM

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Summary: *In this article the issues of teaching Chemistry on the bachelor level of Biology faculty; the integration of Chemistry and Biology; as well as objectives, tasks and results of the scientific research carried on this discipline; the integrative content of the course were deeply investigated and highlighted.*

Keywords: *integration, education, teaching chemistry, quality and results of education, methods of traditional and non - traditional teaching, pedagogical innovation, the leading role of pedagogical person in system, the burning problems of permanent education system.*

Improving the system of continuous education related to the social sphere of the Action Strategy for the five priority areas of development of the Republic of Uzbekistan, as well as successfully addressing the task of training highly qualified personnel in accordance with the modern needs of the labor market, is considered an urgent issue. Based on the tasks set out in the measures determined by the decision of the President of the Republic of Uzbekistan, Sh. M. Mirziyoev, on further improvement and comprehensive development of the higher education system, it should be emphasized that the wide implementation of education content based on international educational standards, as well as advanced pedagogical technologies, curricula, and teaching and methodological materials corresponding to them into the educational process, is one of the most pressing tasks of today.

An analysis of the current state of teaching the "Chemistry" course in pedagogical higher education institutions that train biology teachers in our republic showed that under the conditions of education reform, the established and existing teaching system of this course fails to meet program requirements. In addition, its content does not sufficiently take into account the modern development of chemistry and biology sciences. In scientific and pedagogical studies conducted in the fields of chemistry and biology teaching methodologies, issues related to the disclosure of direct and inverse interdisciplinary connections have not been adequately reflected [3].

In particular, the need to include information on the results of research aimed at integrating chemistry and biology courses in order to explain the essence of processes occurring in living organisms into curricula and textbooks has become increasingly important.

In recent years, numerous pedagogical studies have been carried out on the integrated teaching of subjects. In particular, teaching chemistry and biology in an interconnected manner forms the basis for the emergence and development of students' natural-scientific worldview.

For the purpose of training biology teachers in accordance with modern requirements, the integrative content of chemistry and biology in teaching biology disciplines-such as botany, zoology, human anatomy and health, and general biology-at general secondary education schools, which constitute the lower level of continuous education, has been analytically studied. In addition, it is envisaged to implement the teaching process through the widespread application of modern pedagogical and information technologies, taking into account recent achievements in chemistry and pedagogy.

The practical orientation of the chemistry subject requires that education be carried out on a broad scale, closely linking learning with real life and based on the interconnection of sciences. It can be emphasized that providing students with scientific-theoretical and scientific-methodological knowledge, as well as forming the skills, competencies, and qualifications necessary for a teacher, is directly related to teaching the "Chemistry" course in integration with biological sciences [5]. Currently, considerable research efforts are being undertaken to improve the content and structure of the "Chemistry" course.

In order to achieve the stated research objectives and to test the proposed hypothesis, the following tasks were carried out:

- to study the current state of the problem of improving the structure and content of the "Chemistry" course in foreign countries and in Uzbekistan, its history and development trends, as well as to analyze curricula, teaching and methodological manuals, and textbooks related to this course;
- to revise the structure and content of the "Chemistry" course in interrelation with biological sciences, taking into account the requirements for improving the education system of Uzbekistan and prospects for its development;
- to form and substantively improve the professional training of chemistry and biology teachers within full-time education, professional development, and retraining systems;
- to develop and implement a mechanism for forming an integrated chemical and biological worldview;
- to widely introduce interdisciplinary connections into the education system as a factor that enhances the quality and effectiveness of teaching by activating interdisciplinary interaction mechanisms;
- to develop scientific-methodological and scientific-practical recommendations for biology teachers of continuous education institutions on the "Chemistry" course with improved content, based on the results of pedagogical experiments and conducted research.

Based on the above-mentioned problems and tasks, the improvement of the structure and content of the "Chemistry" course through interdisciplinary integration was implemented in the bachelor's degree programs "Methods of Teaching Biology" at higher education institutions that train teachers [4]. Knowledge acquired by students in the "Chemistry" course on topics such as D. I. Mendeleev's Periodic Law and the Periodic Table of Elements, solutions and the theory of electrolytic dissociation, oxidation–reduction reactions, element chemistry, qualitative and quantitative analysis, and organic substances such as proteins, fats, and carbohydrates contributes to a deeper understanding of the elemental composition, chemical structure, and biological processes (photosynthesis, respiration, nitrification) occurring in living organisms.

As an example, it is appropriate to note the following. Questions such as which substance serves as the source of oxygen released during the process of photosynthesis and how this occurs are answered by students through an understanding of the chemical mechanism of photosynthesis [2].

Light rays reaching the green leaves of plants are absorbed by the electrons of carbon, nitrogen, and oxygen involved in the conjugated bonds of the porphyrin ring of chlorophyll. Due to the absorbed light energy (only about 0.1–0.3% of the solar energy reaching the plant is utilized for photosynthesis), chlorophyll molecules attain an energy-rich state. The absorbed light energy is converted into chemical energy; that is, chlorophyll transforms light energy into chemical energy. The chlorophyll molecule is located among molecules capable of both accepting and donating electrons. As a result of the action of light on chlorophyll, its electrons are transferred to a higher energy level, meaning that chlorophyll absorbs light. The excited state of chlorophyll is denoted as Chl*. Subsequently, the excited chlorophyll releases an electron and transfers it to a substance capable of accepting electrons. These substances are electron acceptors; at the same time, chlorophyll receives an electron from another substance that acts as an electron donor. As is known from chemistry, when electrons receive a certain quantum of energy ($h\nu$), they transition from a lower orbital to a higher orbital, and when they return to a lower orbital, they release energy equal to $h\nu$.

For chlorophyll to return to its initial state, it must accept an electron. It has been established that the source of these electrons is water. Water dissociates into H^+ and OH^- ions. The OH^- ions donate their electrons to chlorophyll and are themselves converted into radicals known as OH•. Each OH• radical contains one unpaired electron. As a result of the interaction of these radicals with one another, oxygen is released. In this process, manganese plays an important role. The process can be expressed as follows:

$4OH\bullet \rightarrow 2H_2O + O_2$ (oxygen release)

As a result of photosynthesis, green plants on Earth absorb approximately 300 billion tons of carbon dioxide annually, releasing about 200 billion tons of free oxygen and synthesizing around 150 billion tons of organic matter [1].

A full understanding of the essence of biological oxidation is extremely important for future biology teachers. Questions such as why living organisms absorb oxygen during respiration and what the function of oxygen is can be answered by students through studying the chemical mechanism of biological oxidation of organic substances.

The energy necessary for the vital activity of all living organisms is generated as a result of the breaking of chemical bonds in complex compounds within their bodies. These energy-releasing reactions consist of oxidation reactions occurring in tissues and cells. It has been established that the final products formed as a result of the oxygen-dependent breakdown of complex organic compounds (carbohydrates, fats, and proteins) in organisms are the same as those produced during combustion in the external environment—namely, water and carbon dioxide. Many microorganisms are capable of obtaining energy through chemical reactions that proceed without oxygen (anaerobic processes), and animal cells can also use anaerobic breakdown of complex compounds as an energy source when oxygen is insufficient. However, in unicellular aerobic organisms and in multicellular species, the main portion of chemical energy arises from the oxidation of nutrients by molecular oxygen. These processes are referred to as tissue and cellular respiration.

The respiratory system represents an integrated structure consisting of hydrogen donor metabolites, the dehydrogenase enzymes, intermediate carriers such as NAD and NADP, flavoproteins with prosthetic groups containing iron and FAD, coenzyme Q, cytochromes, and molecular oxygen [3].

In general, it is extremely important for modern biologists to be able to interpret the mechanism of respiration on a chemical basis.

During the research process, methods known in pedagogy, psychology, and the methodologies of specific academic disciplines were used in accordance with the research objectives and tasks. General teaching methods were applied on the basis of systematic analysis, as well as through a critical and creative approach to existing methodological recommendations and manuals.

Among the specific pedagogical research methods employed were the study of scientific and scientific-methodological literature, observation, experimentation, oral and written surveys, analysis of current documents of the public education system, as well as the examination of curricula, teaching and methodological manuals, and study plans in inorganic chemistry and biology. Recommendations and conclusions from the field of education were also appropriately utilized within the scope of the research topic.

For the first time under the conditions of the Republic of Uzbekistan, a study was conducted to improve the structure and content of the “Chemistry” course in interrelation with biological sciences, based on principles of alignment with the current state of development of the education system.

From the perspectives of psychology, pedagogy, and teaching methodology, an academic course was developed and tested in accordance with the requirements of the State Educational Standards of higher education. This course ensures the implementation of educational, instructional, and holistic developmental objectives for bachelor’s degree students in pedagogical institutes and universities.

As a result of the conducted research, methodological and instructional manuals essential for higher education students were prepared, based on the formation of theoretical knowledge as well as practical skills and competencies in the “Chemistry” course[6].

In higher education institutions that train biology teachers, a teaching system was developed and introduced into the educational process to help improve and consolidate students’ knowledge of the “Chemistry” course, and it has been successfully applied in practice over many years. The system of scientific and methodological knowledge developed, selected, and refined to a didactically optimal form as a result of pedagogical research, along with the recommendations created for its teaching, can be effectively used by professors, instructors, methodologists, and specialists in this field at higher education institutions.

In conclusion, it can be stated that improving the integrative teaching of the “Chemistry” course in biology teaching methodology programs at higher education institutions plays a significant role in the professional training of students.

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Rezyume: *Ushbu maqolada Oliy ta’lim muassasalarining “Biologiya” bakalavriat ta’lim yo’nalishida “Kimyo” kursini o’qitishda kimyo va biologiya fanlar integratsiyasi, bu sohada olib borilgan ilmiy tadqiqotning maqsad va vazifalari, o’quv kursining integrativ mazmuni va tadqiqot natijalariga doir materiallar keltirilgan.*

Резюме: *В статье приведена интеграция предмета химии и биологии, цели и задачи научной исследовательской работы в этой сфере, интегративное содержание учебного курса химии преподавания в бакалавриате направлении методика преподавания биологии и результаты педагогического эксперимента.*

Kalit so’zlar: *integratsiya, fanlararo aloqa, kimyo o’qitish, o’quv kursining integrativ mazmuni, ilmiy-pedagogik tadqiqot, uzluksiz ta’lim tizimi, metodik ishlanma, o’quv qo’llanma, pedagogik tajriba-sinov ishlari.*

Ключевые слова: *интеграция, межпредметные связи, преподавание химии, интегратные содержание учебных курс, научно-педагогическое исследование, система непрерывного образования, методическая разработка, учебное пособие, педагогический эксперимент.*

INTERDISCIPLINARY CONNECTIONS IN TEACHING CHEMISTRY IN THE TRAINING OF FUTURE BIOLOGY TEACHERS

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Summary: *This article reveals pedagogical conditions aimed at the effective instruction of prospective teacher of biology: strengthening of inter-subject links between the curricula for studying methods of teaching chemistry and biology in a pedagogical higher educational institution; improvement of the curricula for studying methods of teaching chemistry and biology in a pedagogical higher educational institution due to introduction of pedagogical teaching technologies.*

Key words*: inter-subject links, pedagogical technologies, chemistry, biology, prospective teacher, pedagogical conditions.*

Introduction. Having gained independence, Uzbekistan is experiencing a new stage of socio-economic development aimed at strengthening its position in the global community. At the same time, the Concept of Education for Sustainable Development, adopted at the global level up to 2030, emphasizes that *"chemical science offers practical, convenient, and sustainable solutions that are closely linked with other areas contributing to the achievement of sustainable development goals."*

In the course of ongoing reforms, new requirements are being imposed on the content of education in the context of professional training of pedagogical personnel. In this regard, graduates of professional educational institutions must be competitive in the labor market. A future teacher must be able to organize not only collective but also individual learning activities of students and, by comprehending innovative pedagogical technologies, creatively implement them in their own professional teaching practice.

In this context, higher education institutions are capable of training teaching staff adapted to work in modern schools. A future biology teacher is required to master modern technologies of pedagogical influence on students, which enhance the attractiveness of studying the fundamentals of biology and support students' personal development and future professional education. The training of biology teachers for school work is being actively carried out at Kokand State Pedagogical Institute [10; pp. 191–194]. Contemporary scientific and pedagogical experience in training biology teachers at universities has shown the need to clarify and, in many respects, rethink the goals, content, forms, and methods of preparing future biology teachers for school work from entirely new perspectives. One of the conditions for such improvement is the establishment of a holistic and continuous system of training students in pedagogical universities, including those majoring in "Chemistry and Biology" [2; pp. 131–132].

Main Part.

In this direction, the following trends aimed at effective preparation of future biology teachers have been identified:

1.Strengthening interdisciplinary connections between courses in teaching methodology of chemistry and biology at pedagogical universities and specialized scientific disciplines;

2.Improving courses in teaching methodology of chemistry and biology at pedagogical universities through the introduction of more effective pedagogical teaching technologies.

One of the basic scientific disciplines studied by students of chemistry and biology specialties at pedagogical universities is the course "Chemistry." Its importance in teacher training is increasing due to the expansion of biochemical content in school courses of organic chemistry and general biology. However, the methodological potential of the course based on interdisciplinary connections is far from being fully utilized in pedagogical universities.

Let us consider each of the identified trends in preparing future biology teachers for pedagogical activity.

In our study, interdisciplinary connections are understood as the reflection of relationships between sciences in the content of educational material, its structure, and teaching methods [3; pp. 10–20].

A survey of the faculty of Kokand State Pedagogical Institute showed that 76% of respondents consider the implementation of interdisciplinary connections in students' cognitive learning activities to be a promising direction for activating this activity and improving the content of higher education [9; pp. 223–224].

Interdisciplinary integration is the unification of knowledge, beliefs, and practical actions at all stages of specialist training, as well as the synthesis of all forms of instruction in relation to each specific educational goal in higher education.

There is no doubt that natural science disciplines are organically interconnected, that is, they are linked in such a way that they *"relate to the very essence and internal integrity of something"* [5; p. 459].

V. T. Fomenko identified types of interdisciplinary connections based on the way content unfolds over time. A *vertical* interdisciplinary connection is characterized by a mismatch between logical and chronological relationships. A *horizontal* connection implies that blocks of selected disciplines are studied simultaneously and in parallel, but with varying degrees of interpenetration [4; pp. 208–209]. Horizontal interdisciplinary connections involve identifying several core courses that incorporate other courses, with each discipline divided into modular blocks. Vertical interdisciplinary connections determine the sequence of learning at different levels of training, as well as a unified methodology, methodology framework, and terminology for studying the cycle of natural science disciplines.

At the same time, it is necessary to carry out organizational and methodological measures, including the revision of existing curricula that cover the interrelationships of natural science disciplines. This necessitates preparing future biology teachers to develop individual plans for implementing interdisciplinary connections in biology courses. This requires knowledge of the methodology of a teacher's creative work, which includes several stages:

1. Studying the section "Interdisciplinary Connections" for each biology course and key topics from the programs and textbooks of other subjects, as well as reading additional scientific, popular science, and methodological literature;

2. Lesson-by-lesson planning of interdisciplinary connections using course and thematic plans;

3. Developing tools and methodological techniques for implementing interdisciplinary connections in specific lessons;

4. Developing methods for preparing and conducting integrated forms of instructional organization;

5. Developing methods for monitoring and evaluating the results of implementing interdisciplinary connections in teaching.

As is well known, chemistry and biology are closely related sciences in the educational process of higher pedagogical institutions. They complement each other and jointly contribute to the formation of a comprehensive natural-scientific worldview [7; pp. 58–59]. Considering that the material world is divided into non-living and living nature, the role and interconnection of the natural sciences can be highlighted.

Results and Discussion

An analysis of the current state educational standards (SES) and the content of education in the field of "Methodology of Teaching Chemistry and Biology" shows that there exists a coherent system of concepts that is common to the natural science cycle:

1. Substances and their elementary constituents.

2. Elemental units of substances involved in ongoing phenomena and processes.

3. Material units that ensure the interconnection between living and non-living nature.It is considered appropriate to implement interdisciplinary connections in the teaching of chemical and biological disciplines in the following areas:

4. The structure of substances and the mechanisms of phenomena and processes, which are common to both chemistry and biology.

5. The universality of the laws contained in the scientific foundations of chemistry and biology.

6. The interrelation and complementarity of theories in chemistry and biology.

7. The use of chemical knowledge to explain the mechanisms of biochemical processes.

8. The use of biological knowledge to form chemical, environmental, and ecological concepts.

9. The mutual application of methods, tools, and techniques from these sciences in the teaching of chemistry and biology.

Interdisciplinary connections between chemistry and biology, as a powerful leverage, can effectively contribute to the formation of a natural-scientific worldview and an integrated, general scientific outlook [8; pp. 78–83].

Interdisciplinary connections at the factual level (factual connections) involve establishing similarities between facts, using shared facts studied in chemistry and biology courses, and examining them comprehensively to generalize knowledge about specific phenomena, processes, and natural objects. For example, in teaching biology and chemistry, future teachers can use data on the chemical composition of the human body.

Conceptual interdisciplinary connections involve the expansion and deepening of the characteristics of subject-specific concepts and the formation of concepts common to related subjects (general-subject concepts). In the courses of the natural science cycle, general-subject concepts include concepts from the theory of the structure of substances—body, matter, composition, molecule, structure, property—as well as broader concepts such as phenomenon, process, energy, etc. These concepts are widely used in studying assimilation and dissimilation processes. They are further deepened and concretized using biological material, acquiring a generalized, universal scientific character.

Some general biological concepts reflect complex processes of living nature that cannot be fully explained even at the initial stage of their introduction without referring to chemical concepts. For example, the concept of photosynthesis in science was formed through the study of this process in plant physiology and related fields such as biophysics and biochemistry.

Theoretical interdisciplinary connections involve the development of the fundamental principles of general scientific theories and laws studied in related subjects, aimed at enabling students to acquire a coherent and holistic understanding of the theory.

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Rezyume: *Ushbu maqolada kelajakdagi biologiya o‘qituvchilarini samarali tayyorlashga qaratilgan pedagogik sharoitlar ochib berilgan: pedagogika oliy ta’lim muassasasida kimyo va biologiya fanlarini o‘qitish metodikasi kurslari o‘rtasidagi fanlararo bog‘liqlikni mustahkamlash; pedagogik ta’lim texnologiyalarini joriy etish orqali kimyo va biologiya fanlarini o‘qitish metodikasi kurslarini takomillashtirish.*

Kalit so’zlar: *fanlararo bog‘liqlik, pedagogik texnologiyalar, kimyo, biologiya, kelajakdagi o‘qituvchi, pedagogik sharoitlar.*

Резюме. В данной *статье раскрываются педагогические условия, направленные на эффективную подготовку будущего учителя биологии: укрепление междисциплинарных связей между курсами методики преподавания химии и биологии в педагогическом вузе; совершенствование курсов методики преподавания химии и биологии в педагогическом вузе за счет внедрения педагогических технологий обучения.*

Ключевые слова*: межпредметные связи, педагогические технологии, химия, биология, будущий учитель, педагогические условия.*

PRINCIPLES OF ORGANIZING INDEPENDENT STUDY IN BIOLOGY: TEACHING METHODOLOGY

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Summary: *This article examines the principles of organizing independent learning in biology teaching methods. As is well known, biology teaching methods are of great importance in preparing future biology teachers for teaching, and the use of learning activities that develop students' creativity and motivation for independent work is essential. It is noted that integrating independent learning principles into this process will serve as the foundation for developing a sense of personal responsibility for independent learning and fostering self-management skills.*

Key words: *Principles of organizing independent learning, content of independent learning, didactic foundations of teaching biology, professional teaching activity, teaching opportunities.*

Introduction. In the Concept of Development of the Higher Education System of the Republic of Uzbekistan until 2030, Chapter 3, entitled “Strategic goals and priority areas for the development of the higher education system”, Section 1, entitled “Expanding the coverage of higher education, improving the quality of training specialists with higher education”, special attention is paid to the development of the necessary competencies of specialists, creative thinking, research approach and logical thinking through “increasing the share of hours of independent study, developing students' skills in independent learning, critical and creative thinking, systems analysis and entrepreneurship, introducing methodologies and technologies aimed at strengthening competencies in the educational process, directing the educational process to the formation of practical skills, and in this regard, the widespread introduction of advanced pedagogical technologies, curricula and teaching materials based on international educational standards into the educational process” [1].

Literature review. The problem of student independent learning, the promotion of independent learning, and the analysis of scientific and methodological literature on general professional topics reveal the essence and interpretation of leading research concepts.

The methodology of teaching biology reflects the history, object, methods, significance, basic principles and laws, and current issues in the development of a course on biology teaching methods, which prepares the ground for the professional training of biology teachers. This course also reflects the content, methods, tools, and forms of teaching biology, as well as the specifics of specific methods, the use of modern pedagogical and information technologies in teaching biology, and the instillation of national teachings in the minds and hearts of students. The learning objectives set in lessons and extracurricular independent study when teaching this subject enable students to develop independent self-improvement skills. In our view, independent learning is a broad concept, constituting one type of education. Furthermore, in accordance with the Law of the Republic of Uzbekistan "On Education," education is a purposeful educational and upbringing process in the interests of the individual, society, and the state. In addition, it expresses the meaning of all types of purposeful and systematic activities carried out to satisfy the need for education [2].

The founder of Russian pedagogy, K.D. Ushinsky, believed that "Student independence is the only solid foundation for any effective education" [3]. Pedagogical and psychological concepts form the organizational basis for preparing students for independent learning in biology teaching methods. Implementing such preparation involves teaching pedagogical and technical-technological thinking, reflected in all the important methodological concepts and principles of biology teaching.

In the technology of managing independent learning, the lesson goal is clear and professionally oriented, but the means by which and in what sequence this goal is achieved are considered the organizer of the educational process, and student activity is emphasized. To this end, the teacher utilizes various teaching methods and opportunities when describing the content of the educational material. Each method used in the lesson is characterized by its own characteristics in the

pedagogical system. The primary activity in which the teacher guides the development of concepts and actions is practical exercises, and the methodology for implementing them depends on the teacher's teaching experience and skills [4].

Research Methodology. Biology teaching methods aim to apply pedagogical rules applicable to all academic subjects to biology curriculum material. Biology teaching methods incorporate natural science, biological, psychological, and pedagogical knowledge. Biology teaching methods define the purpose and content of biology instruction, the principles for selecting biological knowledge, and the principles of learning.

Tahlil va natijalar (Analysis and results). When imparting knowledge to students during the learning process, it is essential to focus them on independent learning (consolidation and expansion of independently studied subject material, independent work). During practical classes in the natural sciences, students are guided toward independent learning activities (ILA) in the following sequence:

1 - ILA. During practical classes in the natural sciences, students are guided toward independent learning activities through short-term independent work on the topic.

2 - ILA. When focusing students on independent learning during practical classes in the natural sciences, the primary factor is the organization of their independent work. Students are given the opportunity to combine theoretical knowledge with practice, develop analytical and critical thinking, make independent decisions in problem situations, and develop professional competencies.

3 - ILA. Independent work assigned to students is developed in accordance with the higher education program and is aimed at consolidating and deepening the knowledge and skills acquired through biology teaching methods.

4 - ILA. Independent work assignments are selected according to students' abilities, capturing their attention and interest.

5 - ILA. Before assigning independent work, the teacher provides step-by-step methodological instructions for its completion.

6 - ILA. The teacher ensures that the results of students' independent work are monitored, their errors are corrected, they are assessed to the maximum extent possible, and students who complete the work on time are rewarded [5].

The process of developing independence includes the systematic implementation of research tasks with students' participation, tasks of a nature whose solution can be achieved through analysis of a specific situation, identification of causes, comparison, etc., using one or another method of reasoning and drawing conclusions.

The following principles are based on to classify the content of biology and organize the educational process.

Scientific principle. The content of biology education should be based on the fundamental concepts, laws, and theories of modern biology. Educational materials should be scientifically sound, evidence-based, and capable of identifying cause-and-effect relationships in biological processes. This principle fosters students' scientific worldview, critical thinking, and a critical approach to biological phenomena.

The principle of systematicity and consistency. The selection of biology course content ensures consistency, logical connection, and an internal structure of knowledge. By presenting biological concepts from simple to complex, from the specific to the general, students develop a grasp of the holistic biological system. This approach enhances the ability to retain knowledge and apply it in practical activities.

The principle of unity of theory and practice. Biological knowledge is taught through a combination of laboratory work, hands-on activities, observations, and experiments. This approach reveals the vital importance of biological concepts and develops students' experimental, research, and problem-solving skills.

The principle of unity of education and upbringing. The content of a biology course should serve not only to impart knowledge but also to foster spiritual, moral, environmental, and aesthetic

development. Important outcomes of biology education include a caring attitude toward nature, environmental awareness, and a commitment to a healthy lifestyle.

The principle of awareness and activity. The educational process fosters students' cognitive activity, their independent thinking, their ability to ask questions, and their engagement in problem solving. This principle creates the conditions for students to consciously acquire knowledge and apply it creatively.

The principle of integrity and interdisciplinary relevance. Biology education is closely linked to disciplines such as chemistry, geography, physics, ecology, and medicine. This interdisciplinary integration reveals the complex nature of biological knowledge, developing students' systems thinking and broad scientific outlook.

The principle of developmental education. The biology course content is aimed at developing students' intellectual potential, creative thinking, and cognitive activity. Independent personal development is promoted through problem-based learning, research assignments, and project-based activities.

Organized based on the above principles, biology education content enhances the effectiveness of the educational process, develops students' lasting knowledge, skills, and competencies, and comprehensively prepares them for future professional careers.

Conclusions and recommendations. Effective organization of independent learning in biology teaching methods is a priority area of the modern educational paradigm. A learning process based on the principles of independent learning enhances students' cognitive activity, promotes a deep and conscious assimilation of theoretical knowledge, its practical application, and the development of research skills. Research shows that the complex and systemic nature of biology requires strict adherence to the principles of scientific approach, systematicity, consistency, conscious activity, an individual approach, and the unity of theory and practice when planning independent learning. Through the proper organization of independent learning, students develop ecological thinking, a scientific approach to biological processes, critical and creative thinking, self-control, and reflective skills. This enables the effective implementation of the educational and developmental goals of biology education, aimed not only at knowledge transfer but also at the comprehensive development of the individual.

The study provides the following suggestions and recommendations:

When developing independent learning assignments in biology, it is advisable to enrich their content based on a competency-based approach, focusing on the harmonious development of knowledge, skills, and practical competencies.

The systematic use of problem situations, research assignments, mini-projects, and case study methods during independent learning enhances students' creativity.

When assessing the results of independent learning, it is necessary to pay attention not only to the final result but also to the process itself, the research activity, and the student's reflection.

It is recommended to develop special methodological guidelines for improving the methodological competence of biology teachers, particularly for the design and monitoring of independent learning.

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Rezyume: Mazkur maqolada biologiya o‘qitish metodikasida mustaqil ta’limni tashkil etish tamoyillari *yoritib o‘tilgan. Bizga ma’lumki bo‘lajak biologiya o‘qituvchilarini pedagogik faoliyatga tayyorlashda biologiya o‘qitish metodikasi fani muhim ahamiyatga ega bo‘lib, talabalarning o‘z ustida mustaqil ishlashi uchun kreativ va motivatsion faoliyatni rivojlantiruvchi o‘quv topshiriqlardan foydalanish muhim ahamiyatga ega. Mazkur jarayonda mustaqil ta’lim tamoyillarini joriy etilishi talabalarda mustaqil ta’lim olish uchun shaxsiy mas’uliyat hissini rivojlantirish va o‘z-o‘zini boshqarish ko‘nikmalarini tarkib toptirishga asos bo‘lishi kuzatiladi.*

Резюме: *В данной статье рассматриваются принципы организации самостоятельного обучения в методике преподавания биологии. Как известно, методика преподавания биологии имеет большое значение в подготовке будущих учителей биологии к педагогической работе, и использование учебных заданий, развивающих творческую и мотивационную деятельность учащихся, направленную на самостоятельную работу, имеет важное значение. Отмечается, что внедрение принципов самостоятельного обучения в этот процесс служит основой для развития у учащихся чувства личной ответственности за самостоятельное обучение и формирования навыков самоорганизации.*

Kalit so‘zlar: *mustaqil ta’limni tashkil etish tamoyillari, mustaqil ta’lim mazmuni, biologiya o‘quv fanlarining o‘qitishning didaktik asoslari, kasbiy pedagogik faoliyat, pedagogik imkoniyatlari.*

Ключевые слова: *принципы организации самостоятельного обучения, содержание самостоятельного обучения, дидактические основы преподавания биологии, профессиональная педагогическая деятельность, педагогические возможности.*

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EFFECTIVE USE OF THE PRINCIPLES OF DETERMINISM IN TEACHING CHEMISTRY

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Summary: *This article analytically examines the possibilities of using the principles of determinism in chemistry education as a means of forming a scientific worldview. It emphasizes the potential and types of approaches in chemistry education based on cause-and-effect relationships. It is substantiated that an approach grounded in establishing cause-and-effect relationships helps to develop analytical, critical, and creative thinking, as well as the ability to make scientific predictions.*

Keywords: *determinism, dialectical relationships, differentiated approach, inductive approach, deductive approach, cognitive competence, experiment*

Developmental education sets the task of improving and intellectualizing the educational process in educational institutions, as well as ensuring the comprehensive development of learners. Among these tasks, a leading role is played by the formation of skills for establishing cause-and-effect relationships in understanding the phenomena of the world and in creating a scientific worldview.

Determinism (from the Latin *determino* - "to determine") is a philosophical doctrine about the objective lawful interconnection and causal relationship of all phenomena, the essence of which is expressed in the concept of causality. According to this concept, one phenomenon (the cause), under certain conditions, necessarily gives rise to another phenomenon (the effect).

The use of dialectical cause-and-effect relationships in chemistry education—by explaining the interdependence and influence of atomic structure on the properties of elements, molecular structure on the properties of substances, reaction conditions on the direction of chemical reactions, and quantitative changes on qualitative changes—helps learners acquire chemical knowledge more firmly and deeply.

Beginning with acquaintance with physical and chemical phenomena, students gradually move toward analyzing and understanding their main similarities and differences. From studying the causes of individual chemical phenomena and making subjective discoveries, students progress to understanding the objective laws governing chemical phenomena in nature, and from there to reflecting the scientific picture of the world in their own consciousness.

Establishing cause-and-effect relationships helps to study various phenomena in an interconnected and systematic way, understand the continuity of chain processes, identify direct and indirect relationships between objects, and systematize students' knowledge.

In systematizing students' knowledge, previously acquired knowledge is generalized using the studied material, and various data and phenomena are interconnected. An approach based on cause-and-effect relationships requires not only knowing and understanding relevant knowledge, but also the ability and skill to use these relationships. Therefore, understanding the chemical cause-and-effect relationships of surrounding phenomena is one of the most important methods for forming systematic chemical knowledge and a scientific worldview in students.

Like all natural sciences, the main goal of chemistry is to form a scientific worldview and knowledge about the laws of nature and the methods of studying them. Achieving this goal is possible only through the systematic mastery of knowledge, ensuring interdisciplinary and inter-topic integration, and implementing cognitive and methodological assessment. One of the important conditions for the stability and integration of knowledge and thinking is the formation of the ability to establish cause-and-effect relationships [1]. In the modern education system, there has emerged a

need to study cause-and-effect relationships as a pedagogical and psychological educational problem [2].

A number of methodological manuals are devoted to developing the idea of cause-and-effect relationships of phenomena in the process of teaching chemistry through the implementation of problem-based learning [3].

The specificity of the chemistry subject and the process of studying it exclude the direct application of cause-and-effect relationship methods developed in other disciplines [4].

Chemistry education requires an independent methodological system based on cause-and-effect relationships. Taking into account the didactic significance of cause-and-effect relationships, the specific features of the content of the chemistry curriculum, the logic of its presentation, and the psychology of learning, it is necessary to develop a well-grounded methodology for their gradual formation in students while solving many modern educational tasks.

To create such a methodology, it is first necessary to develop the relevant theoretical foundations for forming skills in establishing cause-and-effect relationships in teaching chemistry, as well as methods for developing these skills. This determines the relevance of the problem.

In order to increase the effectiveness of the educational process through the development of students' skills in implementing cause-and-effect relationships based on an integrated, systematic, and activity-based approach, it is necessary to develop a methodological system for prioritizing cause-and-effect relationships in students' learning and cognitive activities in the process of studying chemistry, as well as the conditions for its implementation.

Introducing cause-and-effect relationships into the theory and practice of chemistry teaching, identifying the didactic conditions for forming cognitive skills through integration with skills in establishing cause-and-effect relationships, organizing active student learning activities aimed at developing these skills, defining the main types and tasks of activities, modeling the methodological system, developing a specific methodology for fostering students' generalized abilities, and experimentally testing the effectiveness of the developed methodological system are among the problems that need to be addressed.

The main idea of the research is to solve educational problems by using the didactic potential of the school chemistry course to form students' skills in establishing cause-and-effect relationships and organizing the teacher's specific activities.

The content of the teacher's activities in the educational and upbringing process in chemistry is reoriented toward forming the ability to establish cause-and-effect relationships as a means of solving educational and upbringing problems.

In the educational and upbringing process in chemistry, the formation of students' skills in establishing cause-and-effect relationships can contribute to solving educational and developmental tasks alongside didactic objectives. The formation of skills in establishing cause-and-effect relationships in solving educational and upbringing problems is a purposeful and systematic activity that can be implemented through a system of tasks, assignments, and exercises.

The modern content of teacher and student activities presented in the methodology of teaching chemistry must fulfill the task of fully revealing the specific features of establishing cause-and-effect relationships and forming the relevant skills as a means of solving educational and didactic problems.

Based on an analysis of philosophical, psychological, and pedagogical literature, the theoretical framework of studies related to the use of cause-and-effect relationships in solving educational and didactic problems was examined. As a result, the possibilities of using cause-and-effect relationships were identified in order to address educational problems and such a structural component as the formation of students' life skills.

In order to determine the specific characteristics of teacher activity and to organize the instructional and methodological process in chemistry aimed at forming students' life skills as one of the components of education, it is envisaged to develop a methodological system of teacher activity focused on the application of cause-and-effect relationships in shaping students' life skills as an integral part of education, to test the effectiveness of this instructional and methodological system, and to implement it in the educational and upbringing process of chemistry.

In order to increase the effectiveness of the educational process by developing students' skills in applying cause-and-effect relationships on the basis of an integrated, systematic, and activity-based approach, a methodological system was developed that prioritizes cause-and-effect relationships in students' learning and cognitive activities during the study of chemistry, along with the conditions for its implementation. When creating a methodology for using cause-and-effect relationships in the process of teaching chemistry, reliance on systemic, activity-based, and comprehensive approaches makes it possible to significantly improve the quality of subject mastery and the level of students' intellectual development.

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Rezyume: *Mazkur maqolada determinizm tamoyillaridan kimyo ta'limida olamni ilmiy manzarasini shakllantirish vositasi sifatida foydalanish imkoniyatlari tahliliy bayon etilgan. Unda sabab-oqibat munosabatlari asosida yondashuvning kimyo ta'limidagi imkoniyatlari, turlariga urg'u berilgan. Sabab-oqibat munosabatlarini o'rnatish asosida yondashuv tahliliy, kritik, kreativ fikrlash, ilmiy bashorat qilish qobiliyatlarini shakllantirishga yordam berishi asoslangan.*

Резюме: *В данной статье аналитически рассмотрены возможности использования принципов детерминизма в обучении химии как средства формирования научной картины мира. В ней акцентируется внимание на возможностях и видах подхода, основанного на причинно-следственных связях, в химическом образовании. Обосновано, что подход, основанный на установлении причинно-следственных отношений, способствует формированию аналитического, критического и креативного мышления, а также способности к научному прогнозированию.*

Kalit so'zlar: *determinizm, dialektik munosabatlar, differensial yondashuv, induktiv yondashuv, deduktiv yondashuv, kognitiv kompetensiya, eksperiment*

Ключевые слова: *детерминизм, диалектические отношения, дифференцированный подход, индуктивный подход, дедуктивный подход, когнитивная компетенция, эксперимент*

PEDAGOGICAL CONDITIONS FOR DEVELOPING FUTURE TEACHERS' COMPETENCE IN CREATING ELECTRONIC EDUCATIONAL RESOURCES

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Summary: *Today, the digitalization of the higher education system involves the widespread introduction of digital technologies in all areas of the educational institution and requires the appropriate professional training of future teachers, the formation and assessment of their digital competence. The main focus is on the development of digital literacy of future teachers. The integration of digital technologies into the educational process is significant in that it is aimed at developing pedagogical methods and approaches, opening up new opportunities in terms of personalizing the learning process.*

Keywords: *Creating a high-tech digital learning environment in higher education organizational conditions, pedagogical conditions, practice of digital technologies. Ensuring the educational process and implementing pedagogical activities*

Introduction The digital competences of future teachers are considered in the modern scientific heritage as a result of the evolutionary development of their digital competences, which are declared in the professional standard of the teacher as an integral feature of the teacher in modern conditions. This is the basis for the development of digital literacy of future teachers in higher education institutions. The teacher should play an important role in adapting digital innovations to improve the quality of learning. The tendency to create a high-tech digital learning environment in higher education predetermines the important role of the teacher, who "fills this environment, predetermines its dynamic nature, adapts new tools to achieve didactic goals." In this case, the determining principle is the digital competence of the teacher**.**

The purpose of the study is to determine the current state of digital competence of future teachers based on the analysis of empirical data obtained during the survey of current prospective teachers on the use of digital technologies in the educational process. In the context of the digitalization of the educational environment of higher education, teachers must solve a number of tasks in the process of studying their digital competence. These analyses describe the manifestation of digital competences. Conducting a survey to determine the digital competence of future teachers, drawing conclusions about the current state of digital competence of future teachers, and identifying research prospects in the field of digital competence of future engineering teachers. We believe that the professional preparation of future teachers and the full functioning of the digital competence system can only be effective if the following organizational and pedagogical conditions are provided.

Review of Related Literature. Many studies have already been conducted on the digital competencies of teachers, including from our country by A.A. Abdukodirov, R.Kh. Dzhuraev, U.Yu. Yuldashev, N.A. Kayumova, from the CIS by L.A. Dunayeva, A.A. Kuznesov, I.N. Pogozhina; Yu.M. Zubareva, A.V. Timova; I.V. Sergeyeva and at the international level by V.A. Starodubsev, L. Ilomaki, G. Falloon, B.R. Mandel, the main features of the manifestation of digital competencies have been revealed. Digital competence is still being touted as a new important component of a teacher's qualification category, but the methodology for assessing it has not yet been developed in detail in practice.

A teacher with an advanced level of digital competence is given the role of a digital facilitator, an expert in promoting digital innovations in educational settings. Moreover, it is precisely such a teacher who will need to implement deep meaningful changes to improve his quality. At the same time, it includes interactivity of the educational process, maximum involvement of future teachers in joint activities, cross-platform communicative interaction, individualization of educational trajectories, etc.

Academician G.U. Soldatova conducted research on digital competence and presented the results of her research in her scientific works. However, the rapid development of digital technologies and their increasing role in education can be considered as the starting point for digital competence. The scope of the concept is determined in proportion to the dynamics of the development of digital technologies. At the same time, scientists include knowledge, skills, motivation and responsibility in the composition of digital competence, which is implemented in four areas (content, communication, consumption and technosphere). In this regard, in our study, the digital competence of future teachers is considered as the ability of the teacher's personality to reliably, effectively, critically and safely select and apply information and communication technologies and digital technologies in various areas of life. Digital competencies:

1) working with content (creation, search, selection, critical evaluation of content);

2) communication (creation, development, maintaining relationships, identity, reputation, self-expression);

3) consumption (using the Internet for consumer purposes - orders, services, purchases, etc.);

4) technosphere (computer and software skills), as well as the teacher's readiness for such activities. In UNESCO terminology, it is recommended to talk about their development in the classroom of the teacher's general user, general pedagogical and subject-pedagogical digital competencies, taking into account the groups of competences of information and communication technologies. Digital competences are described based on the European model of digital competences for education, while teachers' digital competences are not assessed. At the same time, it is necessary to determine the current state of teachers' digital competences, their ability to work with modern information and communication technologies. assessment of readiness and teachers' willingness to use digital technologies in the educational process after the mandatory rapid development of digital tools and services, as well as the widespread implementation of digital innovations during the pandemic[107].

Future teachers should use services for working with digital educational content in the conditions of modern information and telecommunications and technological infrastructure of higher education institutions, master electronic (online) advanced training programs. Conducting lessons using digital educational content, as well as laboratory and practical work using interactive electronic educational materials, including virtual laboratories, simulators, etc. All this implies updating the teacher's didactic digital tools, designing the environment of digital educational technologies.

The research methodology was carried out to study the digital competence of future teachers. Today, most future engineer-pedagogues and most teachers are already working with digital technologies, while the rest are just getting acquainted and gaining experience. Various digital tools and services that may be useful for future teachers in studying the subject “Technologies for creating digital educational resources” were considered. This subject is taught in the 5th semester of the 3rd year of the “Professional education in the field of information and communication technologies” direction. Long-term practice of working with future teachers shows that for many the content of the subject program is of interest, it is required for practical training in new, higher educational institutions. In most cases, according to the results of a survey among trainees and students, future teachers use only a fraction of the digital tools and services offered.

Analysis and Results. The results of the assessment of digital competence of future teachers presented in the study are of practical importance in planning the modernization of the content of educational subjects related to the use of information and communication technologies in teaching, in developing continuing education and training programs. They identify problem areas and allow for a critical analysis of the actions of future teachers in various pedagogical situations, and to assess the rationality of choosing and using digital tools and services to solve pedagogical problems.

Conclusion and Recommendations. So, summing up the above, we can conclude that, despite the apparent absolute perfection and effectiveness of the digital education system, there are also negative aspects. It is impossible not to emphasize the negative impact of digitalization on health and physical development. In our opinion, digital technologies should be used in education in such a

way that they do not harm anyone. The ideal formula for effective education is the tandem of digital technologies and teachers**.**

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Rezyume. *Bugungi kunda oliy ta’lim tizimini raqamlashtirish ta’lim muassasasining barcha yo‘nalishlarida raqamli texnologiyalarni keng joriy etishni nazarda tutadi va bo‘lajak o‘qituvchilarning tegishli kasbiy tayyorgarligini, ularning raqamli kompetensiyasini shakllantirish va baholashni talab qiladi. Bo‘lajak o‘qituvchilarning raqamli savodxonligini oshirishga asosiy e’tibor qaratilgan. Raqamli texnologiyalarning o‘quv jarayoniga integratsiyalashuvi pedagogik uslub va yondashuvlarni ishlab chiqish, o‘quv jarayonini shaxsiylashtirish nuqtai nazaridan yangi imkoniyatlar ochishga qaratilgani bilan ahamiyatlidir.*

Резюме. *Сегодня цифровизация системы высшего образования предполагает широкое внедрение цифровых технологий во все сферы деятельности учебных заведений и требует соответствующей профессиональной подготовки будущих преподавателей, формирования и оценки их цифровой компетентности. Основное внимание уделяется повышению цифровой грамотности будущих преподавателей. Интеграция цифровых технологий в образовательный процесс важна, поскольку открывает новые возможности в плане развития педагогических методов и подходов, персонализации образовательного процесса.*

Kalit so‘zlar: *Oliy ta’limda yuqori texnologiyali raqamli ta’lim muhitini yaratish, tashkiliy sharoitlar, pedagogik shart-sharoitlar va raqamli texnologiyalardan amaliy foydalanish. Ta'lim jarayonini qo'llab-quvvatlash va pedagogik faoliyatni amalga oshirish.*

Ключевые слова*: Создание высокотехнологичной цифровой среды обучения в высшем образовании, организационные условия, педагогические условия, практика использования цифровых технологий. Обеспечение образовательного процесса и реализация педагогических мероприятий.*

BENEFITS OF USING ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN EDUCATION

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Summary: *This article discusses the theoretical foundations, practical possibilities, methodological approaches, as well as ethical and pedagogical issues of using artificial intelligence (AI) technologies in the educational process. The approaches to individualizing education, adaptive assessment, creating educational content, and optimizing the learning process based on AI are analyzed.*

Keywords: *artificial intelligence, generative AI, educational technologies, STEAM, digital competence, adaptive learning, learning analytics, smart learning.*

The 21st century is an era of rapidly developing information and communication technologies, and artificial intelligence (AI) is deeply penetrating all areas of human activity, in particular the field of education. A number of international organizations, such as UNESCO, are evaluating AI technologies in education as a strategic direction for training competitive personnel. AI-based educational systems allow not only to automate the educational process, but also to individualize it, conduct a deep analysis of student competencies, and predict educational outcomes.

In Uzbekistan, like all sectors, the education system is undergoing rapid digitalization. The "Digital Uzbekistan – 2030" strategy, presidential decrees, and programs for the modernization of higher education set the integration of IS technologies into the educational process as a priority. Therefore, scientific research on the impact of IS on education, its methodological foundations, capabilities, and limitations is relevant.

SI is a set of technologies that ensure the implementation of human mental activity by a machine, such as analysis, decision-making, learning, and problem-solving. In the educational process, SI performs a number of tasks, such as: automating the educational process, analyzing student activity, creating educational resources, forming adaptive learning systems, automating communication (chatbots), and improving the assessment process. To implement such tasks, of course, the transformation of the pedagogical process with SI is important. SI transfers the educational process from a classical system to a modern, digital, and analytical learning model, and this process is manifested as follows: the didactic model changes - the student is considered the central subject, the role of the teacher is updated - he becomes not a source of knowledge, but a mentor who manages the educational process, teaching methods are modernized - adaptive, competency-based, interactive, and analytical approaches are expanded.

Examples of key areas of artificial intelligence in education include adaptive learning systems, adaptive learning technologies that automatically adapt tasks, tests, and learning paths based on the student's level of knowledge. Such systems are important in building competencies that meet the requirements of PISA and TIMSS.

There are also methods for creating generative AI and educational content in education, in which the teacher is assisted by generative AI tools such as ChatGPT, Gemini, Claude, which perform the following tasks: create texts, tests, slides, essays, abstracts for students, simplify and explain complex concepts, develop lesson plans, trainings and projects, analyze scientific texts and data. This process reduces the teacher's workload and increases the efficiency of the teaching process.

AI also greatly assists teachers in monitoring and analyzing the learning process. In terms of this approach, AI performs the following tasks: AI-based Learning Analytics technologies automatically determine student activity, task completion speed, error patterns, and growth dynamics across disciplines. This allows teachers to develop individual and corrective strategies for the learning process.

The advantages of using artificial intelligence in education can be summarized as follows: it is worth noting that the quality of education increases, the learning process becomes analytical and

fact-based, students are more motivated to think independently, the explanation of complex topics becomes faster, and the teacher's work becomes easier.

With the help of SI, the teacher can quickly create a number of tasks, such as lesson plans, tests, automate the assessment system, and easily monitor students. At the same time, the possibility of individualizing the educational process expands. As we all know, individualizing education is the process of adapting the educational process to each student's personal abilities, needs, interests, learning pace, and psychological characteristics. That is, it is not "the same lesson for everyone", but creating a comfortable and effective learning environment for each student.

Along with the positive aspects of each object used, there are also negative aspects. In particular, the risks and problems of using artificial intelligence are seen in the following: the problem of academic integrity, the ease of automatic creation of abstracts, term papers, essays and tests from generative AI

increases the risk of false knowledge and academic dishonesty. Excessive reliance on AI by teachers and students leads to problems such as a decrease in creative thinking, students' dependence on ready-made content. Issues such as ethical and legal risks, personal data security, incorrect assessments as a result of AI errors, algorithmic discrimination need to be addressed.

The prospects for using AI in the education system of Uzbekistan can be seen in improving digital learning platforms, integrating AI into the national “E-ma’lumot”, “UzEdu”, LMS systems, effective and fast implementation of educational process monitoring, test generation, content analysis.

To develop teachers' digital competencies, it is necessary to organize continuous professional development courses for teachers on the basics of SI, working with generative AI, and digital pedagogy.

If grants and incubation programs are created for local startups to support educational AI startups, Uzbekistan can become competitive in the AI education market.

As methodological recommendations for the effective use of artificial intelligence, it is necessary to study the functional capabilities of each AI tool in advance in preparation for the lesson, re-analyze the lesson materials created by AI from a pedagogical point of view, check the created content based on the criteria of relevance to the topic, scientificity, accuracy, and logical consistency, and during the lesson, correctly set the time standard when using AI recommendations, explain to students how AI algorithms work, and combine tasks that encourage independent thinking with AI.

It is important to correctly determine the time standard for using SI recommendations in the lesson so that the teacher does not lose his main role. When organizing independent learning, it is necessary to teach students the skills of using SI tools safely and appropriately, to require independent tasks to analyze not ready-made texts through SI, but the process of creation, to provide explanations on compliance with the rules of academic honesty, and during the assessment process, it is necessary to ensure that tests and tasks created using SI are finally approved by the teacher, and when checking student work through SI, the results must be reviewed by a person, and the assessment must be fair, transparent and consistent. At the same time, in order for the teacher to use SI effectively and rationally, it is advisable for him to participate in ongoing training courses on working with SI, use SI tools moderately in lessons (up to 20–30% of the lesson), protect students from becoming addicted to SI tools, systematically integrate traditional teaching methods with SI technologies, and constantly check the accuracy of SI results during the learning process.

Interdisciplinary integration is one of the modern trends in the education system, which serves to form students' complex thinking, analytical skills and real-life problem-solving competencies. Artificial intelligence (AI) technologies take this integration to a new level, strengthening the harmony between STEAM disciplines, natural sciences, humanities and social sciences. With the help of AI, the learning process becomes more visual, analytical, interactive and person-oriented. In particular, since Geography is rich in information, AI integration is one of the most effective areas. GIS and AI integration - artificial intelligence, together with geographic information systems, automatically detects changes on the earth's surface, climate change forecast - an AI model predicts future temperature, precipitation, wind speed, population geography - creates graphical analytical models through AI on demographic growth, urbanization, migration dynamics.

AI-based interdisciplinary integration will profoundly change the educational process, dramatically increasing analytical thinking, creativity, and problem-solving skills in various areas such as STEAM and geography. Analyzing learning outcomes in graphical, visual, statistical, and predictive forms using AI will allow teachers to make pedagogical decisions on a scientific basis.

The use of artificial intelligence in the education system is becoming a major trend in modern pedagogy. It facilitates the teacher's work, individualizes the learning process, improves the quality of education, and strengthens the competency-based approach. However, the process of using AI must be carried out carefully, based on pedagogical, mature, and legal requirements.

The widespread introduction of AI technologies in the Uzbek education system will help bring education up to international standards and increase the global competitiveness of students. Therefore, the prospects for modernizing education based on AI are of great scientific and practical importance.

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Rezyume: *ushbu maqolada ta’lim jarayonida sun’iy intellekt (SI) texnologiyalaridan foydalanishning nazariy asoslari, amaliy imkoniyatlari, metodik yondashuvlari, shuningdek, etik va pedagogik masalalari yoritilgan. SI asosida ta’limni individuallashtirish, adaptiv baholash, ta’limiy kontent yaratish va o‘quv jarayonini optimallashtirish bo‘yicha yondashuvlar tahlil qilinadi.*

Резюме: *В статье рассматриваются теоретические основы, практические возможности, методические подходы, а также этические и педагогические вопросы использования технологий искусственного интеллекта (ИИ) в образовательном процессе. Анализируются подходы к индивидуализации образования, адаптивному оцениванию, созданию образовательного контента и оптимизации процесса обучения на основе ИИ.*

Kalit so’zlar: *sun’iy intellekt, generativ AI, ta’lim texnologiyalari, STEAM, raqamli kompetensiya, adaptiv o‘qitish, o‘quv tahlili, smart ta’lim.*

Ключевые слова: *искусственный интеллект, генеративный ИИ, образовательные технологии, STEAM, цифровые компетенции, адаптивное обучение, учебная аналитика, умное обучение.*

THE HISTORY OF THE FORMATION OF ADVERTISING AGENCIES IN UZBEKISTAN AFTER INDEPENDENCE

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Summary: *The article examines the formation of Uzbekistan's advertising industry in the period following the country's independence. Special attention is given to the first advertising agencies that played a key role in the development of the market: their areas of specialization, their contribution to the establishment of the industry, and their influence on shaping a professional advertising environment. The analysis makes it possible to identify the main stages of the market's evolution and to understand how the early agencies set the direction for modern advertising practices.*

Keywords: *advertising market of Uzbekistan, advertising agencies of Uzbekistan, SIYMO, Potent Servis, ORIAT, Passtrans Media, Medialux, Patent Servis.*

The formation of Uzbekistan's advertising market began in the early years following the country's independence. During this period, the nation was gradually transitioning from a planned economy to market relations, which facilitated the emergence of new forms of entrepreneurship, including advertising activities. However, in the early 1990s, the industry was still in its formative stage: there were no established standards, specialized agencies, or trained professionals. The first companies emerged mainly as small workshops producing signage, printed materials, and outdoor boards. Over time, these enterprises became the foundation for the development of full-fledged advertising agencies and production studios.



Fig. 1. ORIAT company logo

One of the first companies to begin its activities as an advertising agency was LLC "Patent Servis." It was established in 1995 under the Patent Office of the Republic of Uzbekistan. The founders of "PS" were the state, the Patent Office of the Republic of Uzbekistan, Director Azimov A.A., and LLC "BLIC," Director Shimolin S.M. The main activity of LLC "PS" was the development and registration of trademarks for enterprises and organizations. The chief designer of LLC "PS" was Dmitrieva I.V. In 1996, Abkerimov S.A. was appointed as the director of LLC "PS." The company employed 8–9 people, mostly students from the "Industrial Design" department of Beruni TGTU. The firm operated for 13 years.

Fig. 2. Patent servis company logo

Another advertising company was ORIAT, which began its activities in 1996. This organization is considered one of the pioneers of outdoor advertising in Uzbekistan. ORIAT played a key role in popularizing the modern billboard format and made a significant contribution to shaping the visual urban environment in the late 1990s and early 2000s. Over time, the company expanded its operations by launching its own radio stations and participating in international advertising festivals. This allowed ORIAT to become one of the most influential brands in the early history of the national advertising industry.

Fig. 3. SIYMO company logo

Another important representative of the early stage is the advertising and production company SIYMO, which has been operating in the market since the late 1990s. The company started as a printing and design studio, specializing in outdoor advertising, large-format printing, and corporate identity. SIYMO became one of the production companies that helped establish the basic level of local advertising infrastructure, providing businesses with professional visual solutions at a time when imported services were largely inaccessible.

Passtrans Media also holds a significant place in the development of the industry, having emerged in the early 2000s. It became one of the first agencies to work systematically with transit advertising—placing ads in the metro and branding buses and minibuses. In the context of rapidly growing urban mobility, this advertising format quickly became in demand, and Passtrans Media became one of the key players in the transit media communication segment.

In addition to large companies, numerous small studios and advertising-production workshops, such as BOMOND, Buyuk Dizayn, and other local enterprises, made a significant contribution to the development of the industry. They began their activities by producing signs, banners, and printed materials in the early 2000s, gradually expanding their range of services to the

level of full-service agencies. These firms formed the foundation of the advertising services market, providing branding and visual design accessibility for small and medium-sized businesses.



Fig. 4. BOMOND company logo

Thus, the development of Uzbekistan's advertising industry from 1991 to the early 2000s is characterized by a gradual transition from small production workshops to the formation of a network of professional agencies. Companies such as ORIAT, SIYMO, Passtrans Media, and several others became key players in the early stage, laying the foundation for the modern advertising market and determining the direction of its further growth. Their activities contributed to the emergence of new technologies, media formats, and professional standards, which subsequently shaped a stable and competitive advertising environment in the country.

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Rezyume: *Ushbu maqolada O‘zbekistonning reklama industriyasi mustaqillikdan keyingi davrda shakllanish jarayoni ko‘rib chiqiladi. Dastlabki reklama agentliklariga alohida e’tibor qaratilib, ularning bozor rivojlanishidagi o‘rni, ixtisoslashuvi, sohaga qo‘shgan hissasi hamda professional reklama muhitining shakllanishiga ta’siri tahlil qilinadi. Analiz orqali bozor evolyutsiyasining asosiy bosqichlarini aniqlash va ilk agentliklar zamonaviy reklama amaliyotlari yo‘nalishini qanday belgilab berganini tushunish mumkin.*

Резюме: *В статье рассматривается процесс формирования рекламной индустрии Узбекистана в период после обретения независимости. Особое внимание уделено первым рекламным агентствам, сыгравшим ключевую роль в развитии рынка: их специализациям, вкладу в становление отрасли и влиянию на формирование профессиональной рекламной среды. Анализ позволяет выявить основные этапы эволюции рынка и понять, каким образом ранние агентства задали направление для современных рекламных практик.*

Kalit so‘zlar: *O‘zbekiston reklama bozori, O‘zbekiston reklama agentliklari, SIYMO, Potent Servis, ORIAT, Passtrans Media, Medialux, Patent Servis.*

Ключевые слова: *рекламный рынок Узбекистана, рекламные агентства Узбекистана, SIYMO, Potent servis, ORIAT, Passtrans Media, Medialux, Patent Servis.*

ORGANIZATION OF INDEPENDENT WORK RUSSIAN AS A FOREIGN LANGUAGE IN THE KARAKALPAK AUDIENCE

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Summary: *Article is devoted to discussion of the problems related to the organization of self-studying by Russian as foreign language in training of Karakalpak's students. An essential role in the organization of such work plays on Russian operating conditions in Uzbekistan, considering which it is necessary to look for ways of improve various forms efficiency of self-studying based on set of requirements to carry it out. An important role in the organization of this work play conditions for the functioning of the Russian language in Uzbekistan, given that you need to look for ways to improve the effectiveness of various forms of self-study based on a set of requirements to carry it out.*

Keywords: *self-studying of students, training Russian as a foreign, Russian in Uzbekistan, organization self-studying.*

Currently, significant changes are taking place in the field of education regarding the strengthening of an individual approach to learning, the development of students' creative abilities, and many others. However, the main requirements for the educational process in higher education are associated with a serious increase in the share of independent work of students in almost all disciplines. As for language education, learning a foreign language has always been accompanied by independent work, most often understood as a) doing homework and b) reading authentic fiction in the target language (so-called home reading).

If we are talking about Russian as a foreign language studied in the former Soviet republics, then we should pay attention to the fact that the situation with the Russian language, or more precisely, with its functioning, has changed radically there.

Firstly, the Russian language has changed its status as a language of interethnic communication. For example, in Uzbekistan, of which Karakalpakstan is a part, it has no legal status at all; nothing is said about the Russian language, since Article 4 of the law "On the state language of the Republic of Uzbekistan" we are talking about the possibility of ensuring respect for the languages, customs and traditions of nations and nationalities living on its territory, and creating conditions for their development [3].

Secondly, there has naturally been a reduction in the language environment, and if in cities the Russian language is still used at the everyday level, then in rural areas there is practically no language environment for it.

Thirdly, the study of the Russian language was complicated by the transition of the Uzbek and Karakalpak languages to the Latin alphabet and, finally.

Fourthly, Russian has become the second foreign language after English [1].

In such conditions, the study of Russian as a non-native language in universities, given the reduction in hours for this discipline, requires a serious restructuring of all components of the educational process, and first of all, the organization of independent work of students.

In the standards of higher professional education, only 60 hours are allocated for independent work in the course of Russian as a foreign language. However, in the main classes held in the classroom, you can find the opportunity to use techniques for students' independent work. In other words, there is time for independent work in the educational process: the question is how to organize it in order to use it effectively.

As U.A. Bekmuratova notes that: "Students' independent work (SWS) is effective when it is a) focused on achieving a set goal and b) subject to self-control, since only the knowledge that the student has acquired independently, through his own language learning experience, become truly effective self-education. Let us pay attention to the fact that in the educational process, the organization of self-learning work is managed by the teacher; it is he who sets the goal of independent

work, its duration, encourages the student to complete it, and also monitors and evaluates its progress and the results obtained.

Thus, it is the teacher who is responsible for correct and methodologically effective independent work of students in the practical development of Russian as a foreign language.

Based on this, we will name the obvious actions of a teacher of Russian as a foreign language within the framework of the organization of various forms of SRL, making it effective:

• offer students special teaching aids on SRS, containing clear and precise guidelines for their implementation;

• teach students to use dictionaries and literary sources, which not only can act as teaching aids or reference books, but also require the development of translation skills, searching for the necessary information, allowing them to independently use the received linguistic or cultural information;

• teach students to work with texts: highlight the main thing in what they read, be able to clearly formulate the main idea, be able to generalize and draw conclusions from what they read, etc.;

• teach students to use computer technology and Internet resources, which in modern conditions undoubtedly helps to increase the efficiency of independent work in mastering the Russian language;

• pay great attention to writing and written speech, ranging from the formation of Cyrillic writing skills to the ability to use free writing.

Experience with Karakalpak students has shown the following: most students have a fairly low level of grammatical knowledge, a poor vocabulary, and demonstrate a lack of independent work skills. In addition, among the students entering the university, there are those who do not speak Russian at all. It is clear that it is always quite difficult for first-year students to cope with the academic load and organize their independent work. Moreover, when organizing SRS, the teacher needs to focus on the real level of knowledge of students and gradually begin working with the book and dictionary, work on practical mastery of the Russian language, develop oral speech, using already mastered grammatical forms and vocabulary of the Russian language in speech, read and retell what you read. Students do not master these skills immediately, and it is not possible to develop them at a sufficient level within the allotted time in classroom classes. Therefore, the practice of independent work should be organized so that students can gradually cope with the above-mentioned difficulties, showing more independence in achieving their goal - mastering the Russian language. Let us note that the younger generation in Karakalpakstan wants to master the Russian language, speak it, and almost every student is ready for additional individual lessons.

One of the proven forms of work on language acquisition is extracurricular activities in Russian, the organization of which is given great attention at Berdakh Karakalpak State University. Russian language teachers conduct so-called Russian evenings, art festivals, competitions for knowledge of the Russian language and literature, Russian holidays (note that Karakalpak students love to read Krylov's fables, presenting them in Russian with talent and artistry).

Modern requirements for the skills and abilities of students directly relate to their ability not only to communicate in a foreign (Russian) language, but also to be able to express their opinions, be an active participant in dialogue, etc. Karakalpak students, being modest, even very shy, are not accustomed to actively expressing their opinions, since they were brought up in the tradition of always only listening to the teacher, they still strictly observe the hierarchy in relations with elders. This creates certain problems for a teacher of Russian as a foreign language, since in the classroom forms of group work are often used to solve problematic problems in collaboration between the teacher and students. Thus, the teacher takes on the role of organizer of students' educational and cognitive activities, placing emphasis on students' independent work. Of course, at first students succeed in this with difficulty, but then they gradually get used to it and learn such skills, although it should be noted that this is a very long process.

SRS in the Russian language is partially performed outside of class time, but always in the presence of a teacher, since students without the help and control of a teacher, as practice has shown, cannot work on completing tasks without encouragement "from above", which indicates that they

lack sufficient motivation to independently study the Russian language. At the same time, students who have a good command of the Russian language are willing to engage, for example, in translating excerpts from the works of Karakalpak writers into Russian, editing their work under the guidance of a Russian language teacher.

Homework is one of the most disliked tasks among students. In our opinion, this situation may be due to the fact that not all teachers know how to do this correctly, without creating additional difficulties for the student during such work. The teacher must give a specific instruction that is clear and understandable to students so that they do not have any difficulties in carrying it out independently. According to V.V. Dobrovolskaya, there are certain rules/requirements that a teacher should know:

- observe the principle of correlation of the proposed homework with classroom work or, more precisely, with a specific task or tasks that students performed in the classroom;
- provide sufficient wording for all types of homework without exception;
- calculate the student's time for completing homework;
- when presenting a task, indicate where it should be performed: at home, in the speaking laboratory, in the language lab, in the computer lab, etc.
- when presenting a task for independent work, determine in advance the forms of its verification during the next or subsequent classes [2].

As follows from all that has been said, managing the independent activities of students is a very responsible job, and the effectiveness of SRS largely depends on the teacher, including on his professional competence.

Organizing independent work on Russian as a foreign language for Karakalpak students at the stage of university professional training is not just a necessity, it is a serious opportunity for students to gain high-quality and lasting knowledge, and the skillful guidance of a teacher in such activities will allow the student to develop an interest in constant self-development and self-education.

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Rezyume: *Maqola qoraqalpoq talabalariga rus tilini chet tili sifatida o'qitishda mustaqil ishlarni tashkil etish bilan bog'liq muammolar muhokamasiga bag'ishlangan. Bunday ishlarni tashkil etishda O'zbekistonda rus tilining faoliyat ko'rsatish sharoitlari muhim rol o'ynaydi, buni hisobga olgan holda bir qator talablar asosida mustaqil ishning turli shakllari samaradorligini oshirish yo'llarini izlash zarur. uni amalga oshirish uchun.*

Резюме: *Статья посвящена обсуждению проблем, связанных с организацией самостоятельной работы по русскому языку как иностранному в обучении студентов-каракалпаков. Существенную роль в организации такой работы играют условия функционирования русского языка в Узбекистане, учитывая которые необходимо искать способы повышения эффективности различных форм самостоятельной работы на основе комплекса требований к ее проведению.*

Kalit so'zlar: *talabalarning mustaqil ishi, rus tilini chet tili sifatida o'qitish, O'zbekistonda rus tili, mustaqil ishlarni tashkil etish.*

Ключевые слова: *самостоятельная работа студентов, обучение русскому как иностранному, русский язык в Узбекистане, организация самостоятельной работы.*

METHODOLOGY OF APPLYING GROUP AND INDIVIDUAL FORMS OF WORK IN MUSIC LESSONS

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Summary: *This article explores the pedagogical methodology for integrating group and individual forms of work in music lessons, emphasizing their complementary role in developing students' musical, creative, and communicative competencies. The study highlights how differentiated instruction, cooperative learning, and personalized guidance enhance learners' performance, motivation, and musical literacy. Special attention is given to methodological approaches that balance collective music-making with individualized vocal, instrumental, and theoretical training. The research also provides practical recommendations for organizing group and individual tasks, selecting appropriate instructional strategies, and ensuring continuous assessment in music education.*

Key words: *Group work, Individual learning, Music education, Teaching methodology, Differentiated instruction, Cooperative learning, Musical competence, Creative development, Student engagement, Performance skills.*

Introduction

Modern music education increasingly requires flexible and student-centered pedagogical approaches that address the diverse needs, abilities, and learning styles of pupils. Group and individual forms of work, when applied methodically, provide a balanced environment for fostering both collaborative creativity and personal mastery in music lessons. Group activities encourage social interaction, ensemble skills, and collective problem-solving, while individual instruction supports focused skill development, self-expression, and independent learning. Methodically integrating these approaches ensures the formation of holistic musical competencies and equips students with practical and artistic abilities essential for their cognitive, emotional, and aesthetic growth.

Pedagogical foundations of group and individual work in music education. The pedagogical foundations of applying group and individual work in music education are rooted in the understanding that musical learning is both a collective cultural experience and a deeply personal artistic process. Contemporary music pedagogy emphasizes that effective teaching must balance these two dimensions by integrating social interaction with individualized cognitive and creative development. Historically, music has been transmitted through shared artistic practices—ensembles, choirs, orchestras, and community performances—demonstrating the natural place of group learning in musical culture [1]. At the same time, the mastery of vocal and instrumental skills has always required individualized attention, reflective practice, and personal musical interpretation. Therefore, modern pedagogical theory recognizes group and individual work not as opposing approaches but as complementary components of a unified instructional system.

From a psychological and developmental perspective, group work in music education aligns with social constructivist theories that highlight the importance of collaborative learning and peer interaction in building knowledge. Vygotsky's concept of the "zone of proximal development" illustrates that learners frequently achieve higher levels of understanding and performance when engaged with peers or guided by a more knowledgeable partner. In music lessons, ensemble singing, rhythmic exercises, and collaborative composition activities create opportunities for learners to negotiate meaning, provide mutual feedback, and develop shared artistic interpretations. Such interactions enhance motivation, strengthen communication skills, and cultivate a sense of belonging—key factors supporting sustained engagement in music education. Furthermore, group work nurtures essential ensemble skills such as listening to others, synchronizing rhythmically, balancing dynamics, and responding musically within a collective soundscape.

Individual work, however, is equally fundamental because musical proficiency ultimately develops within the learner's personal cognitive and psycho-motor space. According to humanistic

pedagogy, each student possesses unique artistic potential, learning pace, emotional expression, and psychophysiological characteristics. Individualized instruction respects these differences by providing tailored guidance, targeted technical exercises, and personalized musical repertoire. This approach supports metacognitive development as learners learn to set goals, monitor progress, and reflect on their artistic growth. In vocal and instrumental training, individualized attention allows teachers to address specific issues such as breath control, intonation, fingering, articulation, posture, and interpretative choices—elements that are often impossible to refine in a group setting. Moreover, individual work increases learner responsibility and self-confidence, empowering students to take ownership of their musical identity and creative expression [2].

A strong pedagogical foundation emerges when group and individual approaches are integrated within a holistic framework that promotes balanced musical development. Scholars argue that hybrid instructional models—where ensemble-based activities alternate with one-on-one or small-group coaching—create an optimal environment for fostering both social musicianship and personal mastery. Through group tasks, students experience music as a communal language that requires cooperation, empathy, and shared responsibility. Through individual tasks, they refine the technical and expressive capabilities necessary for advanced performance. This complementarity reflects a core principle of modern pedagogy: that meaningful learning occurs when instruction simultaneously addresses cognitive, affective, social, and creative dimensions.

Furthermore, music education research shows that the pedagogical foundations of group and individual work are supported by assessment theory. Group activities help teachers evaluate collaborative competencies, ensemble accuracy, musical communication, and creative problem-solving. Individual assessments, meanwhile, allow for precise measurement of technical skills, interpretive abilities, vocal or instrumental progress, and independent musicianship. When used together, these assessments guide instructional planning and ensure that each learner receives appropriate support and challenges.

In conclusion, the pedagogical foundations of group and individual work in music education rest upon the principles of learner-centeredness, differentiated instruction, social collaboration, and artistic individuality. By embracing both collective and personal modes of learning, music educators create dynamic, inclusive, and pedagogically sound environments where students develop not only technical and artistic skills but also the social, emotional, and cognitive competencies essential for a lifelong engagement with music.

Methodological approaches to organizing group activities in music lessons. Methodological approaches to organizing group activities in music lessons are founded on the principle that collective musical engagement fosters deep learning, social interaction, and creative collaboration among students. In contemporary pedagogical theory, group work represents not merely a classroom arrangement but a pedagogically purposeful model that stimulates cooperative learning, ensemble thinking, and shared artistic responsibility. Effective group activity in music lessons is grounded in the integration of psychological, didactic, and artistic principles that ensure both social development and musical competence. Central to these approaches is the understanding that music, by its very nature, is a social art form—choral singing, ensemble performance, and collective improvisation all embody the essence of cooperative artistic creation. Therefore, the methodological organization of group activities must aim at structuring learning environments where students can meaningfully interact, listen to one another, and construct musical meaning as a community.

One of the key methodological foundations is the application of **collaborative learning strategies**, which position learners as active participants in generating knowledge through musical interaction [3]. These strategies rely on structured group tasks such as ensemble singing, rhythmic circles, small-group instrument practice, and collaborative composition projects. Teachers serve as facilitators who guide students in negotiating roles, coordinating actions, and achieving common artistic goals. Collaborative learning methodologies emphasize peer-assisted learning, where stronger students support those who need additional help, thus enhancing overall group cohesion. This process aligns with socio-constructivist theories suggesting that learning becomes more effective when it occurs in a shared social context.

Another essential methodological approach is **differentiated grouping**, which ensures that group activities are tailored to students' skill levels, prior knowledge, and learning styles. Music classes often include learners with varying degrees of musical aptitude; therefore, the teacher must organize groups in a way that balances heterogeneity with functional learning dynamics. Heterogeneous groups promote peer learning, while homogeneous groups allow for focused skill development. Both structures can be employed depending on the learning objectives, whether they involve expressive interpretation, technical performance, or creative exploration. Differentiation also involves assigning roles within groups—such as leader, rhythm-keeper, harmonizer, or recorder—to promote responsibility and encourage active participation. This role-based distribution transforms the group from a passive formation into an interactive and goal-oriented musical ensemble.

A further methodological principle relates to **active learning and experiential pedagogy**, which highlight the importance of engaging students in hands-on musical experiences. Group activities must encourage exploration, improvisation, and experimentation, enabling learners to construct musical understanding through direct artistic engagement. Tasks such as group improvisation, body percussion ensembles, and collective rhythm production help cultivate musical intuition, coordination, and sensory awareness. These experiential approaches allow students to internalize musical concepts through participation rather than through abstract instruction alone. Moreover, active learning approaches nurture creativity, spontaneous musical expression, and emotional communication, which are central to artistic development.

Equally important is the **integration of technology**, which expands the possibilities for group interaction and collaborative creativity. Digital music platforms, virtual ensemble tools, rhythm-based applications, and collaborative notation software enable students to create, edit, and perform music together in real time or asynchronously. These technological resources support inclusive and motivational learning environments, allowing students who may feel hesitant in traditional ensemble settings to participate more confidently through digital means. Technology-enhanced group activities also develop digital literacy, a skill increasingly relevant in modern music education.

The methodological organization of group activities must also address **classroom management and group dynamics**, ensuring that interactions remain constructive, disciplined, and musically productive. Teachers must establish clear expectations, structured routines, and supportive communication norms. Effective management includes modeling ensemble etiquette, facilitating respectful dialogue, and providing formative feedback that guides both individual and collective improvement. Understanding group psychology is essential; teachers must recognize the social roles that emerge within groups, the motivational factors influencing participation, and the potential conflicts that may arise. Through skillful facilitation, teachers can transform group activities into a harmonious and cooperative learning environment.

Lastly, **assessment within group activities** requires thoughtful methodological planning. Evaluating group performances involves examining not only the final musical output but also the processes of collaboration, problem-solving, and artistic decision-making. Authentic assessment strategies such as peer evaluation, self-reflection, process documentation, and performance-based assessment provide a multidimensional understanding of students' musical and social development. When assessment is integrated into group work, it encourages accountability, mutual support, and continuous improvement [4].

In essence, methodological approaches to organizing group activities in music lessons are complex, integrative, and deeply rooted in pedagogical, psychological, and artistic principles. They aim to create dynamic learning environments in which students experience music as a collaborative endeavor while simultaneously developing technical, cognitive, and interpersonal skills. When group activities are methodically structured and pedagogically sound, they foster not only musical excellence but also social cohesion, emotional expression, and lifelong appreciation for collective music-making.

Strategies for individual instruction and personalized learning in music classes. Strategies for individual instruction and personalized learning in music classes are rooted in pedagogical principles that recognize each learner's unique artistic, cognitive, and emotional

development. Unlike group-based instruction, which emphasizes collective interaction, individual instruction prioritizes tailored guidance, personal growth trajectories, and focused skill acquisition. In the context of modern music education, personalized learning represents a holistic approach that aligns instructional methods with students' abilities, interests, prior musical experiences, and long-term artistic goals. This approach is grounded in humanistic and learner-centered educational theories, which propose that meaningful musical development occurs when instruction addresses the learner's individuality and supports autonomous engagement with the artistic process.

A core strategy for individualized instruction is the development of diagnostic assessment practices that allow the teacher to understand the student's technical level, musical preferences, learning styles, and psychological characteristics. Effective individual instruction begins with systematically identifying students' strengths and areas for improvement, whether in vocal intonation, rhythmic coordination, instrumental technique, sight-reading, or expressive interpretation. This diagnostic process informs instructional decisions and ensures that learning activities are relevant, achievable, and aligned with the student's personal needs. Diagnostic assessment also aids in setting realistic yet challenging goals, which serve as motivational anchors throughout the learning journey [5].

Another fundamental strategy involves the use of differentiated instruction, whereby the teacher adapts instructional methods, repertoire, and practice tasks to the student's specific learning profile. Differentiation may include adjusting the complexity of musical pieces, modifying technical exercises, offering alternative notational representations, or varying the level of teacher scaffolding. For example, a beginner may require simplified rhythmic patterns or step-by-step fingering support, while an advanced student might benefit from interpretive autonomy, stylistic exploration, or improvisational tasks. Differentiated instruction ensures that each student progresses at an optimal pace and avoids both cognitive overload and disengagement.

Central to personalized learning is the cultivation of metacognitive strategies that encourage students to reflect on their own learning processes. In individual instruction, teachers guide learners in setting short-term and long-term goals, monitoring their own progress, identifying obstacles, and evaluating performance outcomes. Metacognitive strategies enhance self-regulation, practice discipline, and independent problem-solving—skills essential for sustained success in music. By teaching students how to practice effectively, organize their rehearsal time, and evaluate their artistic choices, educators empower them to become autonomous musicians capable of continued development outside the classroom.

Emotional and motivational factors also play a critical role in personalizing music instruction. Teachers must cultivate a supportive atmosphere that acknowledges students' emotional experiences and fosters artistic confidence. This may include providing constructive, individualized feedback that highlights progress, encourages risk-taking, and validates creative expression. Personalized instruction requires sensitivity to students' psychological states—recognizing when anxiety, fear of failure, or perfectionism inhibits learning and offering strategies that promote resilience and positive engagement with musical challenges. Such strategies may involve relaxation techniques, gradual task exposure, or selecting repertoire that aligns with the learner's emotional readiness.

Another effective strategy involves the integration of individualized repertoire selection, which aligns musical tasks with the student's artistic interests and cultural background. When learners engage with music that resonates with their personal identity—whether classical, folk, contemporary, or culturally specific genres—they demonstrate heightened motivation, deeper emotional involvement, and stronger interpretive commitment. Personalized repertoire also strengthens cultural relevance in music education and validates diverse musical identities within the learning environment.

Technology-enhanced personalization has also become a significant component of individualized instruction. Digital tools such as adaptive practice applications, virtual accompaniment platforms, audio analysis software, and personalized learning management systems allow students to engage in self-directed learning tailored to their pace and preferences. These technological resources support independent practice, provide instant feedback, and enhance the teacher's ability to monitor

progress outside scheduled lessons. When used thoughtfully, technology expands the reach of individualized instruction and deepens the student's connection to both practice and performance.

Moreover, personalized learning in music classes benefits from flexible instructional formats, such as one-on-one coaching sessions, sectional rehearsals, rotating workstations, and independent learning modules. These structures provide students with opportunities for focused attention while enabling teachers to allocate time equitably across diverse learners. The integration of reflective journaling, personalized practice logs, and audio self-recordings further strengthens the individualized learning process by encouraging students to engage critically with their own development.

In essence, strategies for individual instruction and personalized learning in music classes encompass diagnostic assessment, differentiated instruction, metacognitive development, emotional support, culturally responsive repertoire choices, and technology-enhanced self-directed learning. These strategies collectively ensure that music instruction becomes a deeply individualized journey—one that respects the learner's uniqueness, nurtures artistic potential, and fosters a lifelong commitment to musical growth. When implemented effectively, personalized learning transforms music education into a dynamic, responsive, and highly meaningful experience for every student.

Integrative models combining group and individual work for effective music teaching. Integrative models that combine group and individual work in music teaching represent a sophisticated pedagogical framework designed to harmonize the social, cognitive, and artistic dimensions of musical learning. These models acknowledge that music is simultaneously a collective cultural expression and a highly personal artistic practice. As such, effective music education must bridge ensemble-based collaboration with individualized skill development, ensuring that students acquire both the technical mastery and the communal musicianship necessary for comprehensive artistic growth. The essence of integrative instruction lies in strategically blending these modes of learning so that each reinforces and enriches the other, creating a dynamic and multidimensional educational environment.

At the heart of integrative models is the recognition that group and individual instruction address different yet complementary facets of musical competence. Group activities cultivate ensemble awareness, coordinated listening, rhythmic synchronization, and cooperative problem-solving, enabling students to engage in collective meaning-making. Individual instruction, in contrast, focuses on the refinement of personal technique, expressive interpretation, and self-regulated practice habits. Integrative models therefore aim not to alternate these approaches arbitrarily, but to create purposeful interdependence between them, where skills developed individually are applied in ensemble contexts and ensemble experiences stimulate deeper individual reflection and technical advancement.

One of the most effective integrative approaches is the cycle-based model, in which learning alternates systematically between group rehearsals and individualized coaching. In this structure, students first explore musical concepts collectively—such as harmony, phrasing, or rhythmic patterns—and then refine these concepts during one-on-one or small-group sessions that target each learner's specific needs. This cyclical interaction enhances transfer of learning, as students apply individually acquired skills directly within ensemble performance, thereby strengthening both personal competence and collective cohesion. Such a model aligns with constructivist learning theories, which assert that knowledge deepens through repeated reconstruction across diverse contexts.

Another widely used integrative approach is the layered-instruction model, where group and individual learning occur simultaneously within the same lesson environment. For example, while the ensemble rehearses a section of a piece, the teacher may temporarily provide individual feedback to selected students, rotate through instrument groups, or assign differentiated micro-tasks that cater to learners' varying skill levels. This flexible structure mirrors the natural functioning of professional ensembles—such as orchestras or choirs—where musicians perform collectively yet continually refine their personal technique within the group setting. Layered instruction also supports inclusivity,

allowing each student to engage in appropriately challenging tasks while still contributing to the ensemble's artistic objectives.

A further integrative strategy is the project-based model, wherein group and individual learning converge around creative musical projects. Collaborative composition tasks, thematic performances, multicultural repertoire studies, or interdisciplinary STEAM-based music projects allow students to develop shared artistic visions while also engaging in individual research, practice, and creative tasks. This model fosters autonomy, initiative, and innovation, as students balance personal creativity with collective responsibility. Additionally, project-based integration encourages learners to develop leadership skills, negotiation strategies, and artistic decision-making abilities—competencies essential for functioning within contemporary musical ecosystems.

Technology-enhanced integrative models further expand the pedagogical possibilities of combining group and individual learning. Digital tools enable students to rehearse ensemble parts independently, analyze their own recordings, collaborate virtually with peers, and receive individualized feedback from teachers outside traditional class time. Virtual ensembles, multi-track recording platforms, and collaborative notation software make it possible to merge personal and collective work in ways that transcend physical classroom boundaries. These hybrid learning environments democratize participation, strengthen student agency, and deepen engagement for diverse learners.

Another important dimension of integrative models lies in assessment practices that unify group and individual evaluation. Holistic assessment frameworks consider both the student's personal technical development and their contribution to ensemble performance. Self-assessment and peer feedback become essential components, helping students internalize standards of musical quality and understand their role within the ensemble. Reflective journals, audio portfolios, and performance critiques serve as bridges between individual and group learning, encouraging analytical thinking and sustained improvement.

Ultimately, integrative models emphasize that the most effective music teaching emerges when the strengths of group and individual instruction are woven into a coherent pedagogical system. This integrated approach fosters comprehensive musicianship by nurturing technical proficiency, expressive sensitivity, cooperative skills, and artistic independence. It transforms the music classroom into a dynamic environment where learners experience music as both a personal journey and a shared cultural endeavor. By embracing integrative models, educators ensure that music teaching becomes more adaptive, inclusive, and responsive to the complex realities of contemporary learners, thereby supporting lifelong engagement with the art of music.

Conclusion

The methodological application of group and individual forms of work significantly enriches the quality and effectiveness of music lessons. Group activities cultivate ensemble sensitivity, cooperative learning, and social creativity, allowing students to experience music as a collective art. Individual work, on the other hand, strengthens technical mastery, interpretive skills, and personalized artistic development. When these approaches are thoughtfully integrated, music teaching becomes more dynamic, inclusive, and responsive to student needs. Such a balanced methodology not only enhances musical competence but also develops essential soft skills such as self-confidence, critical thinking, and communication. Ultimately, the synergy of group and individual learning forms creates a pedagogically efficient environment that supports meaningful and sustainable musical growth.

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Rezyume: *Maqolada musiqa darslarida guruhli va individual ishlash shakllarini integratsiyalash metodikasi yoritilib, ularning o‘quvchilarning musiqiy, ijodiy va kommunikativ kompetensiyalarini rivojlantirishdagi o‘zaro bir-birini to‘ldiruvchi ahamiyati ta’kidlanadi. Tadqiqotda differensial yondashuv, hamkorlikda o‘qitish va shaxsiylashtirilgan yo‘naltirish o‘quvchilarning natijadorligi, motivatsiyasi va musiqiy savodxonligini oshirishga qanday xizmat qilishi ko‘rsatib berilgan. Shuningdek, kollektiv musiqiy ijod jarayonini individual vokal, instrumental va nazariy tayyorgarlik bilan uyg‘unlashtirishga imkon beruvchi metodik yondashuvlarga alohida e’tibor qaratilgan. Maqolada guruhli va individual topshiriqlarni tashkil etish, samarali pedagogik strategiyalarni tanlash hamda musiqa ta’limida uzluksiz baholashni ta’minlash bo‘yicha amaliy tavsiyalar ham berilgan.*

Резюме: *В статье рассматривается педагогическая методология интеграции групповых и индивидуальных форм работы на музыкальных уроках, подчёркивая их взаимодополняющую роль в развитии музыкальных, творческих и коммуникативных компетенций учащихся. Исследование показывает, что дифференцированное обучение, коллективные формы взаимодействия и персонализированное наставничество способствуют повышению учебных результатов, мотивации и музыкальной грамотности. Особое внимание уделяется методическим подходам, обеспечивающим баланс между коллективным музицированием и индивидуальной вокальной, инструментальной и теоретической подготовкой. В работе также приведены практические рекомендации по организации групповых и индивидуальных заданий, выбору эффективных методических стратегий и обеспечению непрерывной оценки в системе музыкального образования.*

Kalit so‘zlar: *Guruhli ish, Individual ta’lim, Musiqa ta’limi, O‘qitish metodikasi, Differensial yondashuv, Hamkorlikda o‘qitish, Musiqiy kompetensiya, Ijodiy rivojlanish, O‘quvchi faolligi, Ijrochilik ko‘nikmalari*

Ключевые слова: *Групповая работа, Индивидуальное обучение, Музыкальное образование, Методика преподавания, Дифференцированное обучение, Кооперативное обучение, Музыкальная компетентность, Творческое развитие, Активность учащихся, Исполнительские навыки*

MECHANISMS OF USING MODERN IT TOOLS IN DEVELOPING ARTISTIC AND AESTHETIC MASTERY

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Summary: *This article examines the mechanisms of using modern IT tools to enhance artistic and aesthetic mastery in contemporary education. The study analyzes how digital technologies—such as virtual creative platforms, multimedia applications, interactive design tools, and AI-based creative systems—contribute to the development of students' artistic perception, expressive abilities, and aesthetic thinking. Special attention is given to pedagogical strategies that integrate IT resources into creative learning, including personalized digital environments, online collaboration, and technology-supported artistic experimentation. The research highlights the transformative impact of IT on creativity, engagement, and self-expression, and proposes methodological recommendations for organizing technology-enhanced artistic learning processes.*

Key words: *Modern IT tools, Artistic mastery, Aesthetic development, Digital creativity, Multimedia technologies, Interactive learning, Creative pedagogy, Visual arts education, Technology integration, Digital expression.*

Introduction

In the era of rapid digital transformation, the role of modern information technologies in artistic and aesthetic development has become increasingly significant. Contemporary learners interact with visual, auditory, and multimedia content daily, shaping their creative perception and expressive potential. Therefore, integrating IT tools into the development of artistic-aesthetic mastery is no longer optional—it is an essential component of modern pedagogical practice. Digital platforms allow students to visualize abstract concepts, experiment with artistic forms, and create complex compositions with unprecedented freedom. Furthermore, IT tools expand access to global artistic resources, enabling learners to study diverse cultural expressions and engage with professional creative environments. As a result, technology-supported learning not only strengthens artistic skills but also cultivates analytical thinking, digital literacy, and imaginative exploration. The development of artistic-aesthetic mastery through IT thus requires a system of pedagogical, methodological, and technological mechanisms that work together to enhance students' creativity, autonomy, and appreciation of beauty in the digital age.

Conceptual foundations of artistic and aesthetic mastery in the digital age. The conceptual foundations of artistic and aesthetic mastery in the digital age are rooted in an expanded understanding of creativity, perception, and cultural expression shaped by rapidly evolving technological environments. In contemporary society, digital media have become integral to the ways individuals experience, interpret, and produce artistic content. This shift requires a reconceptualization of artistic-aesthetic development, where mastery is not limited to traditional forms of artistic skill but extends to new competencies such as digital creativity, multimodal communication, and interactive aesthetic engagement. In this context, aesthetic experience emerges from an interplay between sensory perception, technological mediation, and interpretive cognition, forming a complex landscape in which learners construct meaning through both physical and virtual artistic encounters.

At the core of artistic and aesthetic mastery in the digital era is the idea that creativity is increasingly influenced by multimodal stimuli—visual, auditory, textual, and interactive elements combined through digital technologies. These multimodal environments encourage learners to explore creative expression in non-linear, experimental ways, thereby expanding their aesthetic awareness. Digital platforms allow for immediate manipulation of color, texture, sound, movement, and spatial composition, giving students the opportunity to internalize artistic principles through active experimentation rather than passive observation. This aligns with constructivist theories of

learning, which emphasize that mastery develops when learners are actively engaged in constructing knowledge through meaningful, experiential processes [1].

Another essential conceptual foundation concerns the democratization of artistic creation. Digital technologies eliminate many barriers associated with access to traditional artistic tools, enabling a wider range of learners to participate in creative processes. Mobile applications, online editing platforms, virtual studios, and smart devices provide accessible and user-friendly environments for producing artistic works. As a result, artistic-aesthetic mastery becomes inclusive, allowing students from diverse backgrounds to engage with art at their own pace, level, and expressive capacity. This inclusivity affords learners a greater sense of ownership and identity formation within the artistic process, thereby enriching the depth and authenticity of their aesthetic experiences.

Furthermore, the digital age introduces new dimensions to aesthetic perception. Traditional artistic appreciation relied heavily on direct sensory encounters with physical artworks, whereas digital experiences involve mediation through screens, algorithms, and interactive interfaces. This alters not only how art is consumed but also how meaning is constructed. Aesthetic judgment becomes shaped by digital literacy: the ability to interpret hyperlinked content, understand visual coding, navigate layered multimedia structures, and evaluate digitally enhanced imagery. The expansion of aesthetic literacy requires educators to guide learners in critically engaging with digital representations, fostering the ability to differentiate between simulation, abstraction, and artistic intention.

Cultural dynamics also play a significant role in shaping artistic and aesthetic mastery in contemporary digital contexts. Global networks expose learners to diverse artistic traditions, styles, and narratives, enriching their understanding of aesthetic diversity. Digital connectivity allows real-time interaction with international artistic communities, enabling students to broaden their aesthetic horizons and integrate multicultural influences into their creative identities. This interconnectedness supports the development of aesthetic pluralism, where mastery is defined not by adherence to a singular artistic canon but by the ability to appreciate, analyze, and synthesize diverse artistic forms.

Additionally, the emergence of AI-driven creative tools prompts a re-examination of agency and originality in the artistic process. Artificial intelligence can generate images, sounds, or designs, acting as both a collaborator and a catalyst for human creativity. This raises philosophical and pedagogical questions about the nature of aesthetic mastery: whether it lies in the creation of original content, the ability to direct intelligent systems, or the interpretation of technologically mediated artistic forms. Ultimately, artistic mastery in the digital age involves navigating the interplay between human imagination and algorithmic processes, understanding the possibilities and limitations of digital collaboration [2].

A final conceptual element involves the development of reflective and affective capacities. Artistic-aesthetic mastery extends beyond technical skill to include emotional intelligence, imaginative sensitivity, and reflective judgment. Digital environments, with their immersive and interactive qualities, offer new avenues for emotional engagement and introspective exploration. Learners can visualize abstract emotions, simulate artistic spaces, and express aesthetic ideas with a heightened sense of immediacy. This fusion of emotional and technological dimensions enriches the learner's holistic artistic development and deepens aesthetic understanding.

In essence, the conceptual foundations of artistic and aesthetic mastery in the digital age encompass multimodal creativity, democratized access to artistic tools, technologically mediated perception, multicultural aesthetic engagement, AI-augmented creativity, and reflective emotional growth. Together, these dimensions form a comprehensive framework through which learners develop the skills, sensibilities, and intellectual capacities necessary to thrive as artists and aesthetic thinkers in an increasingly digital world.

Pedagogical mechanisms for integrating modern IT tools into creative education. The integration of modern IT tools into creative education represents a transformative pedagogical shift that expands the boundaries of artistic expression, instructional design, and learner engagement. In contemporary educational environments, digital technologies function not merely as auxiliary

instruments but as core mediators of creative thinking, aesthetic development, and interactive learning. Effective pedagogical mechanisms for such integration begin with a clear understanding of how digital platforms support multimodal creativity, enabling students to move fluidly between audio, visual, textual, and performative forms of artistic production. By embedding IT resources within constructivist and socio-cultural learning frameworks, educators can cultivate environments where students explore, experiment, and co-create knowledge through digital means.

A key mechanism lies in reconfiguring the teacher's role from knowledge transmitter to facilitator of digital creativity. This shift requires instructors to design learning experiences in which modern IT tools serve as catalysts for inquiry-based and project-based artistic tasks. Digital audio workstations, virtual studios, interactive design applications, and AI-assisted creative tools empower students to generate artistic content autonomously, promoting intrinsic motivation and deep engagement. At the same time, pedagogical scaffolding remains essential: teachers guide students in selecting appropriate tools, interpreting digital outputs, and developing their artistic and aesthetic judgment within a technologically saturated learning space.

Another important mechanism is the use of adaptive and personalized learning supported by intelligent educational technologies. Learning analytics, digital portfolios, and AI-driven feedback systems enable the continuous assessment of students' creative progress. These tools allow teachers to identify individual strengths, diagnose challenges, and tailor instruction accordingly. Personalized creative tasks—such as digital composition, multimedia storytelling, or virtual performance—help learners develop mastery at their own pace while nurturing originality and critical reflection.

Collaborative creativity represents a further dimension enriched by IT integration. Modern digital tools facilitate synchronous and asynchronous cooperation, allowing learners to engage in collective artistic projects regardless of time or location. Cloud-based platforms, shared digital canvases, and interactive multimedia systems support collaborative decision-making, artistic dialogue, and the construction of shared creative products. Such environments foster communication skills, collective problem-solving, and the capacity to negotiate artistic meaning within a community of practice.

In addition, pedagogical mechanisms must incorporate the development of digital literacy and ethical awareness. As students increasingly rely on IT tools for artistic purposes, they must understand intellectual property, digital authorship, and the cultural implications of algorithmic creativity. Teachers play a critical role in helping learners critically evaluate digital media, recognize the expressive limitations and affordances of technological tools, and cultivate responsible digital citizenship [3].

Ultimately, the integration of modern IT tools into creative education is most effective when embedded within a holistic pedagogical system that balances technological innovation with artistic sensitivity, cognitive development with emotional expression, and individual creativity with collaborative engagement. Through strategic pedagogical design, educators can harness digital technologies not only to enhance creative skills but also to expand learners' aesthetic horizons, enabling them to participate fully in the artistic culture of the digital age.

Interactive and multimedia technologies for enhancing artistic perception and expression. Interactive and multimedia technologies have become pivotal in shaping the development of artistic perception and expression in contemporary education, offering unprecedented opportunities for learners to engage with art in dynamic, multisensory ways. Unlike traditional instructional tools, these technologies integrate visual, auditory, and kinesthetic modalities, providing immersive experiences that stimulate perception, enhance cognitive processing, and expand the expressive capacities of students. The pedagogical potential of interactive and multimedia tools lies in their ability to transform passive observation into active participation, enabling learners to manipulate, experiment with, and reinterpret artistic elements in real time.

Multimedia technologies, encompassing digital imagery, video, sound, animation, and virtual reality, create environments where learners can perceive artistic concepts holistically. For instance, virtual galleries allow students to navigate curated artworks, examining composition, color schemes, and spatial relationships with interactive zooming and annotation capabilities. Digital audio-visual

tools enable real-time experimentation with soundscapes, harmonic structures, and rhythmic patterns, fostering both technical understanding and aesthetic sensitivity. By providing immediate visual and auditory feedback, these platforms cultivate perceptual acuity and reinforce the connection between artistic intention and sensory experience [4].

Interactive technologies further deepen learning by encouraging active experimentation and co-creation. Tools such as digital drawing tablets, motion-sensitive interfaces, and interactive music software allow learners to manipulate elements of their work directly, promoting a sense of agency and creative autonomy. Through iterative exploration, students develop a nuanced understanding of artistic principles, learning to translate abstract ideas into tangible creative outputs. This hands-on approach aligns with constructivist learning theories, which posit that knowledge and skill are most effectively internalized when learners actively engage in meaningful, contextually rich tasks.

In addition, interactive and multimedia technologies foster collaborative creativity, allowing students to work collectively on shared projects in both synchronous and asynchronous formats. Cloud-based platforms, digital storytelling applications, and online animation tools enable learners to combine their individual contributions into cohesive artistic products, promoting negotiation of ideas, aesthetic decision-making, and collective problem-solving. Collaborative digital environments also cultivate critical thinking, as students evaluate their own and peers' work, integrate feedback, and refine their expressive techniques to achieve a unified artistic vision.

The pedagogical value of these technologies extends beyond technical skill development to the cultivation of aesthetic literacy and reflective practice. Interactive platforms encourage learners to analyze compositional structures, explore stylistic conventions, and experiment with innovative modes of expression. Multimedia tools allow for the simulation of real-world artistic processes, enabling students to visualize the impact of color, form, rhythm, and spatial arrangement before committing to final works. This reflective engagement nurtures critical aesthetic judgment, supporting both the intellectual and emotional dimensions of artistic mastery.

Furthermore, these technologies enhance inclusivity by accommodating diverse learning styles and abilities. Students with different cognitive, sensory, or motor profiles can access tailored digital interfaces, adaptive controls, and multimodal feedback, ensuring equitable opportunities for creative participation. This adaptability strengthens learners' confidence, fosters motivation, and encourages sustained engagement in artistic exploration.

Ultimately, interactive and multimedia technologies serve as both instruments and environments for enhancing artistic perception and expression. By integrating sensory-rich experiences, real-time interactivity, and collaborative opportunities, these tools allow learners to develop deeper perceptual sensitivity, refined expressive skills, and sophisticated aesthetic understanding. In contemporary education, the use of interactive and multimedia technologies is not merely a technical enhancement but a fundamental pedagogical strategy that reshapes how students perceive, interpret, and create art, preparing them to participate fully in the evolving landscape of digital and traditional artistic culture.

Methodological recommendations for effective IT-supported artistic and aesthetic development. The effective integration of information technology into artistic and aesthetic development requires a systematic, research-informed approach that balances technological innovation with pedagogical rigor and artistic sensibility. Modern IT tools—ranging from multimedia platforms, virtual studios, and interactive applications to AI-assisted design and composition software—offer unprecedented opportunities for creativity, yet their educational potential is maximized only when guided by coherent methodological strategies. Effective IT-supported artistic development involves designing learning environments, instructional practices, and assessment mechanisms that foster both technical proficiency and aesthetic growth, while maintaining student engagement and creative autonomy.

A foundational recommendation is the deliberate alignment of technology with pedagogical objectives. IT tools should be selected and deployed not merely for novelty or entertainment value, but to support specific learning outcomes in artistic perception, creative expression, and aesthetic reasoning. For instance, digital painting applications can be used to teach principles of color theory,

spatial composition, and stylistic experimentation, while music software can scaffold understanding of harmony, rhythm, and timbre. By connecting technology to clear artistic and educational goals, teachers ensure that IT serves as a meaningful mediator of learning rather than a distracting adjunct [5].

Scaffolding and guided exploration represent another crucial methodological principle. While modern IT platforms enable autonomous experimentation, students benefit from structured guidance that helps them navigate complex digital environments, interpret feedback, and refine creative outputs. This can include step-by-step tutorials, scaffolded assignments, exemplar works for analysis, and incremental challenges that gradually increase in complexity. Guided exploration ensures that learners develop both confidence and competence, transforming technology from a tool of passive consumption into a medium for active, reflective, and intentional creation.

Personalization and differentiated instruction are also essential for effective IT-supported artistic development. Digital tools allow educators to tailor learning experiences to individual skill levels, artistic interests, and cognitive profiles. Adaptive software, customizable interfaces, and AI-driven feedback systems enable teachers to provide targeted support and challenge, promoting optimal learning trajectories for each student. Personalization nurtures intrinsic motivation, enhances self-directed practice, and encourages the development of a unique artistic voice, ensuring that technology contributes to both skill acquisition and personal aesthetic growth.

Collaboration and peer learning should be deliberately integrated into IT-supported methodologies. Cloud-based platforms, virtual studios, and interactive multimedia applications provide opportunities for students to co-create, critique, and refine artistic projects collectively. Collaborative engagement fosters communication skills, problem-solving abilities, and shared artistic responsibility, while allowing learners to compare diverse perspectives and expand their aesthetic horizons. Methodologically, educators should design tasks that balance individual exploration with group interaction, creating dynamic learning experiences where students benefit from both personal and collective creativity.

Assessment strategies form a vital component of methodological recommendations. IT-supported artistic development benefits from continuous, multidimensional evaluation that captures both technical proficiency and aesthetic sophistication. Digital portfolios, self-reflective journals, and iterative project submissions provide mechanisms for formative feedback, allowing students to monitor progress and refine their work systematically. Peer review and teacher-guided evaluation of digitally created art or performances further reinforce critical aesthetic judgment and promote a culture of reflective practice.

Finally, educators should cultivate digital literacy, ethical awareness, and reflective thinking as part of the methodological framework. Students must understand the affordances and limitations of IT tools, the principles of responsible digital authorship, and the ways technology mediates artistic creation. Integrating discussions on intellectual property, AI-generated art, and ethical use of multimedia resources enhances students' critical perspective, ensuring that technological proficiency is accompanied by thoughtful artistic and ethical judgment.

In conclusion, effective IT-supported artistic and aesthetic development relies on an integrated methodological approach that aligns technology with pedagogical objectives, scaffolds guided exploration, personalizes learning, encourages collaboration, and implements continuous reflective assessment. By adhering to these principles, educators can leverage the full potential of digital technologies to enhance creative expression, refine aesthetic perception, and cultivate the holistic artistic competence of learners. When implemented thoughtfully, IT becomes not merely a tool but a transformative medium for enriching both the technical and expressive dimensions of artistic education in the modern era.

Conclusion

The integration of modern IT tools into the development of artistic and aesthetic mastery represents a transformative approach to creative education. Digital technologies enable learners to explore artistic concepts more deeply, experiment with expressive forms, and cultivate aesthetic sensitivity in innovative ways. By combining traditional artistic practices with interactive digital

environments, educators can create inclusive, engaging, and personalized learning experiences that foster both creativity and aesthetic appreciation. The use of multimedia applications, virtual studios, AI-assisted design tools, and collaborative online platforms broadens students' artistic horizons while strengthening their digital competence. To maximize the benefits of IT integration, educators must adopt pedagogically sound strategies, ensure technological accessibility, and promote reflective creative practices. Ultimately, modern IT tools serve not only as technical resources but as powerful catalysts for enriching artistic imagination and developing holistic aesthetic mastery.

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Rezyume: *Maqolada zamonaviy IT vositalaridan foydalanish mexanizmlari orqali zamonaviy ta'limda badiiy va estetik mahoratni rivojlantirish masalalari o'rganiladi. Tadqiqotda virtual ijodiy platformalar, multimedia ilovalari, interaktiv dizayn vositalari va sun'iy intellekt asosidagi ijodiy tizimlar kabi raqamli texnologiyalarning o'quvchilarning badiiy idrokini, ifodaviy qobiliyatlarini va estetik fikrlashini rivojlantirishga qanday hissa qo'shishi tahlil qilinadi. Maxsus e'tibor IT resurslarini ijodiy o'quv jarayoniga integratsiyalash bo'yicha pedagogik strategiyalarga qaratilgan, jumladan, shaxsiylashtirilgan raqamli muhitlar, onlayn hamkorlik va texnologiya yordamida ijodiy tajribalar. Tadqiqot ITning ijodkorlik, faollik va o'zini ifodalashga bo'lgan transformatsion ta'sirini yoritadi va texnologiya bilan boyitilgan badiiy o'quv jarayonlarini tashkil etish bo'yicha metodik tavsiyalarni taklif qiladi.*

Резюме: *В статье рассматриваются механизмы использования современных ИТ-инструментов для повышения художественного и эстетического мастерства в современном образовании. Исследование анализирует, как цифровые технологии — такие как виртуальные творческие платформы, мультимедийные приложения, интерактивные инструменты дизайна и системы на базе искусственного интеллекта — способствуют развитию художественного восприятия, выразительных способностей и эстетического мышления учащихся. Особое внимание уделено педагогическим стратегиям, интегрирующим ИТ-ресурсы в творческое обучение, включая персонализированные цифровые среды, онлайн-сотрудничество и экспериментирование с поддержкой технологий. Работа подчеркивает трансформирующее влияние ИТ на творчество, вовлечённость и самовыражение, а также предлагает методические рекомендации по организации процессов обучения с использованием технологий.*

Kalit so'zlar: *Zamonaviy IT vositalari, Badiiy mahorat, Estetik rivojlanish, Raqamli ijodkorlik, Multimedia texnologiyalari, Interaktiv o'quv, Ijodiy pedagogika, Tasviriy san'at ta'limi, Texnologiyalarni integratsiya qilish, Raqamli ifoda.*

Ключевые слова: *Современные ИТ-инструменты, Художественное мастерство, Эстетическое развитие, Цифровое творчество, Мультимедийные технологии, Интерактивное обучение, Творческая педагогика, Образование в области изобразительного искусства, Интеграция технологий, Цифровое самовыражение.*

FEATURES OF RECOGNIZING A CITIZEN AS MISSING AND DECLARING A CITIZEN DECEASED UNDER MODERN CONDITIONS

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Summary: *This article examines the legal features of recognizing a citizen as missing and declaring him or her deceased under modern conditions. Based on the provisions of the Civil Code and the Civil Procedure Code of the Republic of Uzbekistan, the study identifies key theoretical and practical challenges in the application of this legal institution. Particular attention is paid to the effectiveness of search measures, the ambiguity of the concept of an "interested person," the insufficient protection of creditors' rights, and the lack of legal clarity in the mechanism of trust management of the missing person's property. In addition, the article critically analyzes procedural obstacles to the restoration of property rights when a person declared deceased later returns. The study proposes scientifically grounded recommendations aimed at improving civil legislation and enhancing the protection of property rights.*

Keywords: *missing person, declaration of death, interested party, creditors' rights, trust management, property rights.*

The institution of recognizing a person as missing and declaring a person deceased constitutes one of the fundamental foundations of civil law. Its primary purpose is to ensure the legal protection of the rights and interests of the missing person, persons dependent on him or her, as well as property-related interested parties (heirs and creditors).

These legal relations are regulated by Articles 33–37 of the Civil Code[32] of the Republic of Uzbekistan and Chapter 30 of the Civil Procedure Code[33]. However, in the context of globalization, migration processes, and technological development, the practical application of this institution gives rise to a number of theoretical and practical problems. In particular, the scope of interested parties, the justification of statutory time limits, the effectiveness of trust management of property, and mechanisms for restoring the rights of a person who has returned remain pressing issues of academic debate.

Recognizing a citizen as missing is an initial procedural act that serves as a legal basis for declaring that citizen deceased. According to Article 33 of the Civil Code of the Republic of Uzbekistan: "If there is no information about the whereabouts of a citizen at his or her place of residence for a period of one year, the court may, upon the application of interested persons, recognize such citizen as missing."

A one-year period is considered sufficiently short to protect a citizen's property rights, including the management of property, repayment of debts, and provision of maintenance. However, academic sources indicate that there are cases in which a person deliberately conceals his or her whereabouts or evades the court, which may nevertheless serve as grounds for recognizing the person as missing.

In our view, although the primary purpose of recognizing a citizen as missing is to determine his or her legal status, this process should be inextricably linked to effective search measures.

Article 306 of the Civil Procedure Code authorizes a judge, when preparing a case for trial, to request "available information" from internal affairs bodies. However, this provision does not establish clear requirements regarding the scope or results of search measures. Therefore, in order to ensure the substantiation of judicial decisions, it is proposed to supplement the first part of Article

[32] *CIVIL CODE OF THE REPUBLIC OF UZBEKISTAN* dated December 21, 1995 No. 163-I. (As amended by the Laws of the Republic of Uzbekistan dated May 1, 1998 No. 621-I. Bulletin of the Oliy Majlis of the Republic of Uzbekistan, 1996, Supplement to No. 2; 1997, No. 2, Art. 56; 1998, Nos. 5–6, Art. 102, No. 1, Art. 20, No. 9, Art. 229; 2001, Nos. 1–2, Art. 23. https://lex.uz/docs/111181 [23]

[33] Civil procedure code of the Republic of Uzbekistan/National Legal Database of Legislation, January 23, 2018, No. 02/18/GPK/0612; October 12, 2018, No. 03/18/496/2043. https://lex.uz/docs/3517334 [49]

306 of the Civil Procedure Code as follows: “The judge shall also require internal affairs bodies to submit a certificate on the results of the search measures conducted in respect of the citizen and on their official suspension.”

Such a requirement would allow the court to base its decision not on the interests of the applicant (such as managing the property), but on the actual fact of disappearance, and would prevent the emergence of incorrect legal consequences in cases of deliberate concealment.

Under the legislation of the Republic of Uzbekistan (Articles 33 and 36 of the Civil Code and Article 305 of the Civil Procedure Code), the right to initiate proceedings for recognizing a citizen as missing or declaring a citizen deceased is granted to “interested persons.” However, the legislation does not establish a specific list or clear criteria for defining the concept of an “interested person.”

As also noted in academic sources, due to the absence of a clearly defined list of interested persons in civil legislation, applicants who are not close relatives are required to substantiate their “interest.”[34]. Such ambiguity complicates the exercise of the right and, in some cases, even obstructs its realization.

One of the most significant issues within this legal institution is the protection of the rights of creditors of a missing person. In practice, if a missing person has outstanding debts, their relatives (heirs) may deliberately refrain from filing a petition to declare the person missing or deceased in order to continue exercising ownership and use of the property. This situation seriously infringes upon the legitimate rights of creditors.

For this reason, the debate on whether a creditor should have the right to initiate proceedings as a party interested in recovering debts from the property of a missing person remains highly relevant. This would enable them to place the property under reliable management and resolve the debts in a lawful manner.

To address the issues outlined above, ensure legal clarity, and strengthen the protection of creditors’ rights, it is proposed to introduce the following amendment to the relevant articles of the Civil Code of the Republic of Uzbekistan:

Amendment to Articles 33 and 36 of the Civil Code:

"Among the interested parties referred to in these articles, the creditors of a person who is petitioned to be declared missing or deceased shall also be included if the person’s financial obligations have been affected."

This proposal provides creditors with a procedural basis to lawfully enforce their claims against the property of a missing person, thereby enhancing the fairness and validity of court proceedings.

One of the primary legal consequences of declaring a person missing or deceased is the determination of the legal status of their property.

Once a person is declared missing, a mechanism of reliable management is applied to preserve and utilize their property (Article 34, Civil Code of the Republic of Uzbekistan). In the current Article 34, the necessity to place property under reliable management is defined by the vague expression "if it is necessary to manage it on a permanent basis." The legal clarity of this phrase is low, and in practice there is no uniform criterion regarding which types of property—such as commercial assets, shares, production equipment, or securities—require “permanent management.” This leads to differing approaches by guardianship and trusteeship authorities. To prevent depreciation of the property and ensure its effective preservation, it is necessary to establish a legally defined list of such types of property.

After a person is declared deceased, their property may pass to heirs or third parties. If the person returns, the court annuls the previous decision and initiates the process of restoring their property rights (Article 37, Civil Code of the Republic of Uzbekistan).

[34] Гаркуша И.В. Особенности признания гражданина безвестно отсутствующим или объявления гражданина умершим в современных реалиях // Вестник ТИУиЭ. 2024. №2 (42). URL: https://cyberleninka.ru/article/n/osobennosti-priznaniya-grazhdanina-bezvestno-otsutstvuyuschim-ili-obyavleniya-grazhdanina-umershim-v-sovremennyh-realiyah (дата обращения: 27.11.2025). [43]

Under the current procedure, the restoration of property rights for a returning person is directly connected with the norms of vindication—lawfully reclaiming property from unlawful possession by another. If the property is not returned, the person is compelled to file a vindication claim in court[2].

In particular, the rule established in Article 37 of the Civil Code regarding contracts concluded for consideration requires that a returning person prove that the new purchaser acquired the property knowing that the original owner was alive. This burden of proof, in practice, poses a significant procedural obstacle for the returning individual. Such an approach excessively protects the interests of the bona fide purchaser while hindering the effective restoration of the returning person's rights.

In the practice of some countries, the death of a person who perished due to military actions is registered not by a court decision, but based on a certificate issued by the relevant state authority[35].

According to Article 1146 of the Civil Code of the Republic of Uzbekistan, the general term for entering into inheritance is six months, counting from the day the inheritance is opened (the date of death or the date the court decision becomes legally binding). If the death is registered based on an administrative document rather than a court decision, ambiguity arises in calculating the term for opening the inheritance. In such cases, heirs may miss the deadline and be forced to apply to the court to restore their inheritance rights, which significantly delays the inheritance process and infringes on the rights of the heirs.

There are no strict legal requirements to verify the effectiveness of search activities in the process of declaring a person missing. This can reduce the validity of court decisions and lead to incorrect legal consequences in cases of deliberate concealment of a person.

The broad and vague concept of "interested person" hinders the effective protection of creditors' lawful property rights. The lack of clarity in property management—specifically, the undefined notion of "property that needs to be managed on a permanent basis"—impedes the effective application of the reliable management mechanism.

When a person declared deceased returns, the burden of proof for reclaiming property from a bona fide purchaser complicates the restoration process and contradicts the principle of effective protection of human rights.

To address the above issues and enhance the legal effectiveness of this institution, it is appropriate to introduce the following key amendments and additions to the Civil Code of the Republic of Uzbekistan:

Amendment to Articles 33 and 36: Include creditors of a person petitioned to be declared missing or deceased within the scope of "interested persons."

Amendment to Article 34: Specify the notion of "property that needs to be managed on a permanent basis" by referring to concrete objects such as commercial assets, securities, and production equipment.

Amendment to Article 37: Facilitate the burden of proof regarding the bad faith of the purchaser when a person declared deceased returns, or strengthen mechanisms for the restoration of rights.

Implementation of these proposals will strengthen the civil rights protection system, enhance the validity of court proceedings, and comprehensively safeguard the property interests of missing persons.

Резюме: *Ушбу мақолада фуқарони бедарак йўқолган деб топиш ва вафот этган деб эълон қилиш институтининг замонавий шароитдаги ҳуқуқий хусусиятлари таҳлил қилинган. Ўзбекистон Республикаси Фуқаролик кодекси ва Фуқаролик процессуал кодекси нормалари асосида мазкур институтни қўллашда юзага келаётган назарий ва амалий муаммолар очиб берилган. Хусусан, қидирув тадбирларининг самарадорлиги, "манфаатдор шахс" тушунчасининг ноаниқлиги, кредиторлар ҳуқуқларининг етарли даражада ҳимоя*

[35] Об утверждении Правил выдачи справки об обстоятельствах исчезновения гражданина и справки об обстоятельствах исчезновения или возможной гибели гражданина, Правил выдачи справки о смерти гражданина, формы справки об обстоятельствах исчезновения гражданина, формы справки об обстоятельствах исчезновения или возможной гибели гражданина, формы справки о смерти гражданина. https://normativ.kontur.ru/document?moduleId=1&documentId=469806 [104]

қилинмаганлиги, шунингдек, бедарак йўқолган шахс мол-мулкини ишончли бошқариш механизмининг ҳуқуқий аниқ эмаслиги масалаларига алоҳида эътибор қаратилган. Шунингдек, вафот этган деб эълон қилинган фуқаро қайтиб келганда унинг мулкий ҳуқуқларини тиклаш жараёнидаги процессуал тўсиқлар танқидий таҳлил қилинган. Мақолада амалдаги қонунчиликни такомиллаштиришга қаратилган илмий асосланган таклиф ва тавсиялар илгари сурилган.

***Резюме**: В статье анализируются правовые особенности института признания гражданина безвестно отсутствующим и объявления его умершим в современных условиях. На основе норм Гражданского кодекса и Гражданского процессуального кодекса Республики Узбекистан раскрываются основные теоретические и практические проблемы применения данного института. Особое внимание уделяется эффективности розыскных мероприятий, неопределённости понятия «заинтересованное лицо», недостаточной защите прав кредиторов, а также отсутствию правовой определённости в механизме доверительного управления имуществом безвестно отсутствующего лица. Кроме того, критически рассматриваются процессуальные сложности восстановления имущественных прав гражданина в случае его возвращения после объявления умершим. По результатам исследования сформулированы научно обоснованные предложения по совершенствованию действующего гражданского законодательства.*

***Калит сўзлар:** бедарак йўқолган фуқаро, вафот этган деб эълон қилиш, манфаатдор шахс, кредиторлар ҳуқуқлари, ишончли бошқарув, мулкий ҳуқуқлар.*

***Ключевые слова:** безвестно отсутствующий гражданин, объявление умершим, заинтересованное лицо, права кредиторов, доверительное управление, имущественные права.*

THE LANDSCAPE GENRE - LEVITAN'S WORKS AND THEIR SIGNIFICANCE IN THE DEVELOPMENT OF AESTHETIC TASTE

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Summary: This article describes the life and stages of creative formation, as well as his unique style, of the great Isaac Ilyich Levitan, whose works left their mark on the Russian landscape genre with their subtle approach. In particular, Levitan's works reveal the harmony between the beauty of nature and the spiritual state of man. The artist's landscape works, combining realism and an emotional approach, established a new stage in Russian art. The article discusses how his life and creative legacy served as a school and source of inspiration for young artists, with their own style and character.

Key words: nature, creative, colors, art, *beauty,* style, artist, landscape, reverberation

Nature is a part of humanity, and there are so many beauties in it that sometimes the human eye is delighted and their mood rises when they see these beauties. If this beauty is viewed through the eyes of a creative person, the diversity of colors in it will certainly inspire the artist to create, and this will create a unique perspective and feeling in his eyes. Nature is the creative artist's teacher and source of inspiration. Isaac Ilyich Levitan is one of the greatest Russian landscape painters of the 19th century, who revealed to his contemporaries the simple beauty of Russian nature. Under Savrasov's guidance, Levitan underwent a complete transformation. The complex, difficult life of an aspiring artist did not turn into accusatory stories, on the contrary, his nature turned him into a man of delicate lyrical feeling and contemplation. That's exactly what Savrasov demanded of him: "..write, learn, but most importantly, feel"!". And the young artist read and felt, and of course in 1879, on one of the gloomy autumn days, his wonderful work dedicated to Sokolniki Park appeared.



The nineteen-year-old student of the Moscow School of Painting, Sculpture and Architecture immediately attracted the attention of the public, and most importantly, of Pavel Tretyakov. Under Savrasov's guidance, Levitan underwent a complete transformation. The complex, difficult life of a novice artist transformed him into a lyrical, emotional, and reflective artist, finding his own way to create colorful works. The keen eye of this famous Russian patron of art, Pavel Tretyakov, did not miss a single important work, especially "Autumn Day in Sokolniki", which reflected not only technique, but also color, plot, truth and poetry of the soul. It met all these parameters, therefore, it is not surprising that he purchased the work directly from a student exhibition, which immediately brought public attention to its author. Levitan soon surpassed his teachers, forever cementing his name in the pantheon of Russian culture, capturing the simple beauties of nature that had escaped the attention of other artists with his subtle sense of touch and unique approach to nature. For a long time, it was believed in Russia that there was no nature in its land that could inspire admiration and serve as a subject for serious work, instead there was only a gloomy, faceless, gray, and endless landscape resembling human sorrow. It seemed as if Levitan was not only showing people the true beauty of nature in order to dispel such misconceptions, but also encouraging them to look at nature with different eyes.

The works of Russian landscape painters of that period were more like copies of the works of Italian and French artists, in which the brightness of the artistic language and its impact on the person were valued above all. Levitan avoided depicting spectacular places in appearance, and this was not

what he neededThe artist, like no one else, knew how to find in the image of a simple village something familiar and infinitely close, which had such an irresistible effect on the soul of a Russian person, forcing him to return to the work again and again. There are no "natural beauties" here. To the lonely wanderer, wandering along the endless Russian roads from city to city, from village to village, only that "divine something that is spread throughout everything, but which not everyone can see, which cannot even be called in words, is visible. “It is not subject to reason and analysis, but is understood only by love”. Only the vast expanses of Russia, with their gloomy lakes, barren fields and gloomy huts under the blue sky, as if mocking all nationalists in the delicate state of nature, revealed the secret of Russian nature to the poor Jewish young man who condemned his origin until the end of his life. He said that Levitan filled our poor landscape with emotions, and now no one could turn away from central Russia, and this was because the artist listened to his heart. What led the artist to fame was his strong love for nature, his ability to see nature differently, and his ability to convey the beauty he saw to the viewer in his works. Both novice and experienced artists can find something to their liking in his works, because Levitan was one of those rare artists who did not have deep philosophy in his works, but rather depicted beauty in a simple, uncomplicated way that even a person unfamiliar with art could understand. Isaac Levitan did not receive a full artistic education, but his works replenished the collection of Pavel Tretyakov and appeared in Traveling Exhibitions and the World Exhibition in Paris. One of his famous works was the work "Night ringing".



According to art critic Alexei Fedorov Davydov, in "Night ringing", Levitan managed to achieve the impression of the totality and unity of the image, the harmony of the parts as a whole.[36]

Levitan's 1892 painting "Night ringing" can be considered the most brilliant work of the artist's career. The painting depicts nature at a bend in the river and a monastery bathed in the evening sun. Some researchers consider "Night ringing" to be a variant of "A Quiet Place" written in 1890. The idea to create a painting depicting the view of the monastery under the rays of the setting sun came to Levitan in 1887, when he was living in Slobodka near Zvenigorod, and he was looking at the Savvino-Storozhevsky Monastery at sunset. Two years later, Levitan went to Yuryevets in search of new motifs for paintings, and not far from there he saw a small monastery. This revived his desire to paint this landscape. According to art critic Vladimir Petrov: „One of Levitan's best, artistically perfect works“[37]. Levitan's creative path lasted only twenty years, but during these years he created more than any other Russian landscape painter. It is without exaggeration to say that after Levitan, the Russian landscape became different. Levitan died in 1900, becoming the last brilliant figure of the golden age of Russian culture, as if completing the quest of the greatest Russian explorer of that time.

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PROSPECTS FOR THE DEVELOPMENT OF THE CONSTITUTIONAL CONTROL SYSTEM IN THE REPUBLIC OF KARAKALPAKSTAN

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Abstract: This article provides a comprehensive analysis of the issues of improving the organizational and legal framework of the constitutional control institution in the Republic of Karakalpakstan. The study reveals the role and importance of constitutional control within the framework of the constitutional and legal reforms implemented in the Republic of Uzbekistan in recent years, in particular, the "Development Strategy of New Uzbekistan" and the "Uzbekistan - 2030" strategy. The author analyzes the legal status, powers and mechanisms of activity of the Constitutional Control Committee of the Republic of Karakalpakstan from the point of view of the principle of separation of powers, and justifies the need to make it institutionally and functionally independent from the Supreme Council. Also, the experience of foreign countries (specific aspects of European and American models) is analyzed, and scientific and practical proposals are put forward to expand the range of subjects applying to constitutional control bodies, increase the legal force of committee acts, and strengthen the effectiveness of constitutional control in protecting human rights and freedoms.

Keywords: Constitutional control, principle of separation of powers, rule of law, constitutional legitimacy, human rights.

In recent years, under the leadership of the President of the Republic of Uzbekistan, Sh.M. Mirziyoyev, large-scale reforms aimed at advancing human interests and ensuring human rights have been accelerated. In order to achieve these lofty goals, state strategies aimed at developing the country have been adopted. On their basis, relevant tasks have been defined, and legislative documents have been further developed.

In turn, special attention was paid to the importance of implementing the constitutional principle of the supremacy of the Constitution and the law in ensuring human interests. Special attention was paid to increasing the role and effectiveness of the constitutional control factor as one of the directions of reforms to effectively address this problem.

At the same time, constitutional control in the Republic of Uzbekistan is carried out as a special body by the Constitutional Court of the Republic of Uzbekistan and in the Republic of Karakalpakstan by the Constitutional Control Committee. Accordingly, reforms are being implemented to further improve the legal status of these bodies and develop the organizational and legal framework for their activities.

In particular, on October 21, 2016, the Decree of the President of the Republic of Uzbekistan "On measures to further reform the judicial system and strengthen guarantees for reliable protection of citizens' rights and freedoms" was adopted. This decree set the goals of reforming the judicial sphere based on the requirements of democracy, further liberalizing it, increasing the efficiency of the activities of the judiciary and law enforcement, as well as supervisory bodies, further increasing the population's confidence in the Constitution and the rule of law, strengthening the rule of law in society, as well as relevant tasks aimed at implementing these goals.

In particular, the following aspects were identified as determining the priorities of state policy in this area, including the main tasks of constitutional control bodies:

preventing interference in the activities of constitutional control bodies and strengthening responsibility for this;

preventing violations of citizens' constitutional rights and freedoms and taking prompt measures;

Decree of the President of the Republic of Uzbekistan "On measures to further reform the judicial system and strengthen guarantees for reliable protection of the rights and freedoms of citizens".

October 21, 2016 // https://lex.uz/docs/-3050491

increase attention to appeals from individuals and legal entities, ensure timely response and resolution, and take firm measures against violations in this regard;

ensuring transparency in the activities of constitutional oversight bodies and activating and expanding the involvement of non-governmental non-profit organizations and other civil society institutions in this work, creating appropriate cooperation mechanisms for this purpose;

In organizing activities, the main focus should be on law enforcement practices and identifying and eliminating the factors that cause violations; preventing various violations and abuses among employees, strengthening service control over them and measures to influence compliance with ethical requirements;

Accelerate the selection and placement of qualified, advanced, and mature personnel and further improve this system;

In solving the task of increasing the effectiveness of constitutional oversight activities, special attention should be paid to the use of modern forms and methods of organizing the work of the bodies carrying out this activity and their implementation in practice.

Thus, the principles for organizing the activities of the Constitutional Control Committee are of great importance, and E.S. Buturlina emphasizes this: "The importance of the principles of the activities of the constitutional control body is that they give unity and integrity to the process of the activities of this body, create a certain order, guide the actions of all its members, and determine its fairness."

One can agree with I.A. Kravets's opinion about the importance of these principles: "The legality of the activities of a constitutional body is guaranteed by the principle of publicity and, accordingly, transparency."

Buturlina E.S. Principy konstitutsionnogo sudoproizvodstva: ponyatie, sistema i znachenie // Leningradsky yuridichesky journal, 2013. – S. 135.

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In turn, one of the next important factors influencing the need to improve the activities of constitutional control in the Republic of Karakalpakstan, further increase its effectiveness, role and significance is the Decree of the President of the Republic of Uzbekistan No. PF-60 dated January 28, 2022 "On the Development Strategy of New Uzbekistan for 2022-2026". This Development Strategy of New Uzbekistan was developed based on the principle of "From a Strategy of Actions to a Strategy of Development", and in its second priority direction, which provides for further strengthening of constitutional control, it sets the following task: "to make the principles of justice and the rule of law the most basic and necessary condition for development in our country".

Thus, in the second part of the Development Strategy of New Uzbekistan, approved by this decree, Goal 14, entitled "To make the principles of justice and the rule of law the most basic and necessary condition for development in our country," specific tasks aimed at further intensifying constitutional control have been defined. In particular, the idea of this goal is stated in the following content: "Ensuring the rule of law and constitutional legitimacy and establishing human dignity as the main criterion of this process."

Here, inspired by the ideas of the development strategy of New Uzbekistan, in solving the task of further developing constitutional control in the Republic of Karakalpakstan, the idea that, first of all, the value of prioritizing human dignity, its rights and freedoms, and legitimate interests as a priority approach, and the essence of reforms in this area should be focused on this goal, should serve.

In turn, based on the requirements of these ideas, one of the main factors in further developing the organizational and legal aspects of constitutional control in the Republic of Karakalpakstan should be the goal of successfully solving the task of ensuring the rule of law and constitutional legitimacy.

Decree of the President of the Republic of Uzbekistan "On the Development Strategy of New Uzbekistan for 2022-2026". PF-60 No. January 28, 2022 // https://lex.uz/docs/5841063

The main tasks set to achieve this goal indicate that the reform of constitutional control activities in the Republic of Karakalpakstan should be aimed at resolving the following situations:

Firstly, from an ideological point of view, the activities of the Constitutional Control Committee of the Republic of Karakalpakstan should be organized based on the requirements of the norm established in Article 11 of the Constitution of the Republic of Karakalpakstan, which states that "The system of state power of the Republic of Karakalpakstan is based on the principle of the separation of powers into legislative, executive and judicial branches" and further adjusted to this principle.

Secondly, from an institutional perspective, based on the requirements of the principle of separation of powers, it is appropriate to take measures to remove the Supreme Council from the strong influence of the Supreme Council in the formation of the Constitutional Oversight Committee of the Republic of Karakalpakstan. To do this, it is necessary to strengthen the role of the Chairman of the Supreme Council in the process of forming the Committee.

To achieve this, it is appropriate to transfer partial powers of the Supreme Council related to the formation of the Committee to the Chairman of the Supreme Council, in accordance with the norm of Article 80 of the Constitution of the Republic of Karakalpakstan, which states that "The Chairman of the Supreme Council of the Republic of Karakalpakstan is the Head of the Republic of Karakalpakstan and the highest official of the Republic of Karakalpakstan." This approach contains mixed elements of the formation of a constitutional control body, which is used in the experience of developed foreign countries. According to it, the participation of not only the parliament, but also the head of state, as well as other branches of government, is taken into account in the formation of a constitutional control body. Such experience is used, for example, in the formation of the Constitutional Court in countries such as France, Spain, Italy, Austria, Romania, Slovakia, the Czech Republic, Moldova, and Turkey.

As a result, organizational conditions are created for the emergence of an institutional guarantee that is necessary for the effective functioning of constitutional control in the relations between the Supreme Council and its chairman to observe the principle of mutual restraint and balance.

Thirdly, in terms of functionality, it is necessary to expand the independence of the Constitutional Control Committee of the Republic of Karakalpakstan from the powers of the Supreme Council in accordance with its powers. In this case, the Committee should carry out its control activities not on the basis of the instructions of the Supreme Council, but in the form of an appeal to other subjects in a single case. Otherwise, the Supreme Council will be both an employer and a controlled entity in relation to the Constitutional Control Committee.

Fourth, it is advisable to strengthen the independence of the acts of the Constitutional Oversight Committee from the Jokorgi Kenes and their legal status. To this end, in order to ensure the independence of the acts of the Committee from the Jokorgi Kenes, it is advisable to eliminate the procedure for their annulment by the Jokorgi Kenes and introduce a procedure for resolving this conflict in court. Also, in order to strengthen the legal status of the acts of the Constitutional Oversight Committee, it is advisable to designate them as "decisions" rather than "conclusions".

In addition, in accordance with Article 36 of the Law "On the Constitutional Oversight Committee of the Republic of Karakalpakstan", the conclusions of the Committee can be considered by the Supreme Council only if the relevant committee of the Supreme Council adopts a positive decision on this and then includes it on the agenda. Accordingly, it is appropriate to cancel this procedure and change it to one according to which the conclusions of the Committee must be considered by the Supreme Council in any case without any conditions.

Regulation of the Republic of Karakalpakstan "On the Constitutional Security Committee of the Republic of Karakalpakstan" // https://jogargikenes.uz/qr/documents/109/

The introduction of these proposed organizational and legal measures into the legislation of the Republic of Karakalpakstan can directly contribute to solving the priority tasks of "ensuring the

rule of law and constitutional legitimacy and establishing human dignity as the main criterion of this process" set out in the Development Strategy of New Uzbekistan. In turn, another important political and legal document that should be encouraged to further increase the effectiveness of the activities of Constitutional Control in the Republic of Karakalpakstan is the Decree of the President of the Republic of Uzbekistan No. PF-158 dated September 11, 2023 "On the Strategy "Uzbekistan - 2030".

Section 4 of the Strategy approved by this Decree, entitled "Ensuring the rule of law, organizing public administration at the service of the people",

paragraph 4.2, dedicated to the issue of "Ensuring the rule of law and reforms in the judicial and legal system", defines priority tasks for increasing the role and significance of constitutional control activities and intended for 2030.

It is worth noting that the strategic ideas put forward in Uzbekistan for development are consistent with the experience of developed democratic states. In particular, the legal systems of foreign countries in the field of constitutional control indicate that the features of the constitutional control mechanism formed in this area have been taken into account in the strategic goals of the reforms being carried out in Uzbekistan and have been implemented on the basis of generally accepted democratic principles.

The conceptual idea of constitutional control in foreign countries is based on the fact that the concept of constitutionalism states that all processes in the state should be carried out in accordance with the constitution. It is recognized that the content of the constitution is not always properly implemented. Therefore, the state creates a system and mechanism for protecting the constitution.

In turn, in a broad sense, constitutional control is carried out by many public authorities. This is the head of state, parliament, government, court, prosecutor's office, self-government bodies. However, the most effective way to conduct constitutional control is to establish a special state body. In Uzbekistan, this is the Constitutional Court, in Karakalpakstan - the Constitutional Control Committee. In the experience of foreign countries, two models of constitutional control have been formed: the first is the European model, the second is the American model. The European model is practiced in countries such as Germany, Spain, Italy, France, Austria, Greece, Poland, Portugal. The American model is in the USA, Argentina, Mexico, Brazil, Japan, Iceland, the Netherlands, Finland, and similar countries. The European model, like Uzbekistan and Karakalpakstan, provides for the existence of a special body that carries out constitutional control. The American model does not provide for the establishment of a separate special body to monitor the constitutionality of legislation, and constitutional control in it is carried out by courts of general jurisdiction.

In Karakalpakstan, like the European model, the Constitutional Control Committee can conduct control on its own initiative, but according to the American model, control is carried out only upon application.

In this regard, the positive side of the European model is:

firstly, any person can apply to the constitutional control body if his constitutional rights and freedoms are violated;

secondly, the members of the constitutional control body are constitutional law experts, which means that the decisions issued are qualified and legally clear.

However, in the experience of Karakalpakstan, unlike the European model and Uzbekistan, there is no possibility for any person to apply to the Constitutional Review Committee. It is advisable to introduce such a right in Karakalpakstan as well.

In turn, based on the analysis of the experience of foreign countries, it can be concluded that two main directions have clearly been reflected in the evolution of the world model of constitutional review: the first is an increase in the scope of review of legal norms for their constitutionality, and the second is an expansion of the scope and capabilities of subjects applying to this constitutional review body.

At the same time, taking into account the positive assessment of the trends that have emerged in the world in this regard, expanding the circle of subjects who have the right to apply to the Constitutional Control Committee in the constitutional control mechanism of the Republic of

Karakalpakstan and thereby increasing their opportunities to protect their rights can be considered one of the urgent issues of today.

Based on this foreign experience, as well as taking into account the experience of the Republic of Uzbekistan, the existence of the authority of the Constitutional Control Committee of the Republic of Karakalpakstan to review the constitutionality of legal acts on its own initiative cannot be considered a positive approach to organizing the activities of the Committee, and considering the issue of its removal can be considered a noteworthy situation.

Based on the above analysis, it can be concluded that in further developing the activities of Constitutional Oversight in the Republic of Karakalpakstan, it is important to apply the strategic priority ideas of the democratic reforms being carried out in Uzbekistan, further deepening the implementation of the principle of separation of powers, as well as taking into account the positive experience of advanced foreign countries in this area.

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CITY TRANSPORT INFRASTRUCTURE AND ENVIRONMENTAL, SANITARY AND HYGIENIC PROBLEMS IN CITIES

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Summary: *This article covers the processes of urban planning, construction, and reconstruction, their management, and modern trends in economic development. Also, problems related to urban transport infrastructure and ways to eliminate them, environmental and sanitary-hygienic problems arising in cities are analyzed, and solutions are proposed.*

Key words: *Urbanization, smart city, transport, population, ecology, industrial waste, climate, extreme, green energy.*

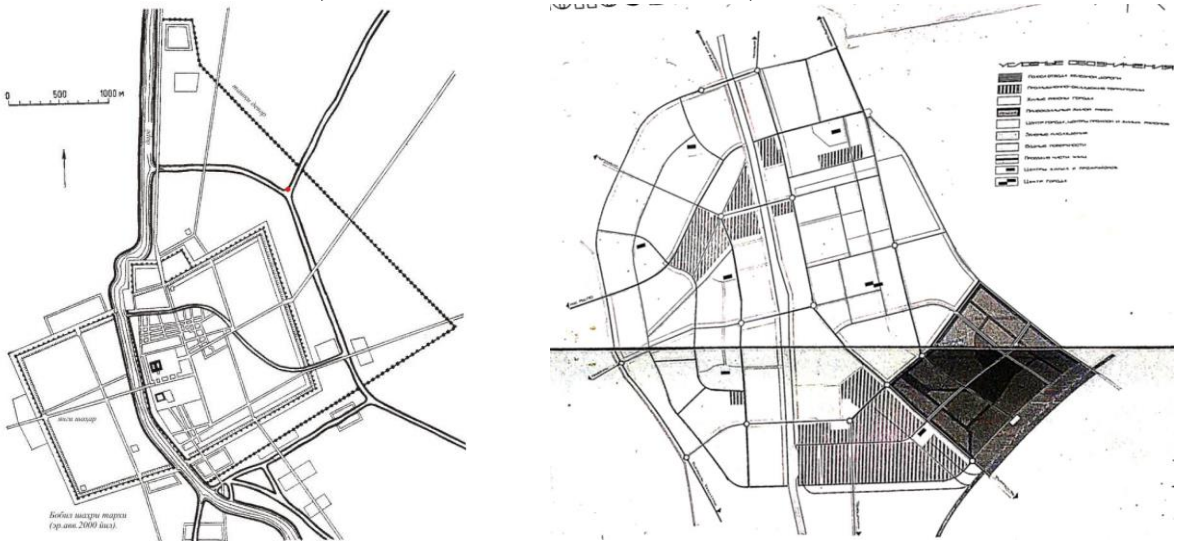
Introduction. In the 21st century, urbanization processes are developing at a rapid pace. Population growth, migration, and the expansion of production and services require the sustainable development of urban planning. In this regard, issues of urban planning, construction, reconstruction, and management are relevant. In particular, the modernization of transport infrastructure, reducing environmental problems, and ensuring sanitary and hygienic requirements play an important role in improving the quality of life of the population. In particular, not only economic, but also environmental and social factors are important in the urban planning process. Sustainable urban development serves to improve the standard of living of the population, ensure economic growth, and reduce environmental problems.

The first cities were formed as a result of the development of the division of labor in society, when crafts began to form as a separate component of human activity. Cities began to form as military cities (fortress cities) and trading settlements. Over time, in the process of development, cities changed their form in accordance with the requirements of society.

MAIN SECTION. The formation of the city, in turn, influences the lifestyle of society and the worldview of the population.

Along with social and functional conditions, the geographical environment and climate also became important factors in urban formation.[1]

a) **b)**



The planning scheme of the cities of Babylon and Nukus (BC. 2000).

Urban planning is the process of purposeful organization of the territory, improvement of living conditions of the population, and ensuring the rational use of economic resources. When planning, attention is paid to the following factors:

- Forecasting population and demographic growth;
- Proportional location of residential areas, industrial zones, and green spaces;
- Development of transport and communication networks;
- Use of energy-saving and environmentally friendly technologies.

Modern architectural solutions, "smart city" concepts, and digital management systems are widely used in the construction of new cities. In this process, the capabilities of digital technologies and artificial intelligence are used. However, in many cities, there is an old housing stock and industrial buildings, the reconstruction of which is an important task.

- Reconstruction serves:
- - Restoration of old buildings and structures based on energy-saving technologies;
- - Adaptation to new architectural requirements;
- Transport infrastructure is the "blood vessel" of urban life and plays an important role in the economic and social environment. However, many cities still have the following problems: Expanding environmentally friendly transport (electric buses, subways, bicycle paths);
- Increased traffic congestion;



Disadvantages of city streets

- Insufficient development of public transport services.

For their prevention and development, the following measures can be taken:

- Construction of new and wide 4- or 5-lane roads for road traffic;
- Implementation of smart traffic light and monitoring systems for traffic flow management;
- Construction of modern roads or road bridges connecting suburban areas with the center;

Expansion of green zones and public spaces. [2]

With the rational use of the above-mentioned statements, any state or city will inevitably have a negative impact on the number of problems in development and the way of life of the population.

At the same time, the development of many cities and the increase in the number of vehicles exacerbate environmental problems.

Main environmental problems:

- Pollution of atmospheric air by vehicle emissions;
- Weakness of the household and industrial waste processing system;
- Noise pollution caused by traffic noise;
- Reduction of green areas as a result of construction;
- Pollution of water resources due to a malfunction of the sewerage system.

It is advisable to build and use "green energy" sources, such as solar and wind energy, in appropriate places, in areas not close to cities. Especially if waste collection and recycling

technologies are widely implemented, we will prevent the spread of unpleasant odors to cities and residential areas.



Pollution by industrial and municipal waste

The health of the city's population depends on the proper organization of sanitary and hygienic conditions. Currently, one of the problems encountered in many cities and settlements is the lack of clean drinking water and supply, as well as the deterioration of sewage systems.

In addition, we face many problems in the collection and disposal of waste. Non-compliance with sanitary rules in food trade and public places undermines the cleanliness of our cities.

Taking this into account, the modernization of water supply and sewerage systems, the construction of waste processing plants, and the strengthening of sanitary control will contribute to the creation of a healthy environmental environment in urban planning.

CONCLUSION. In conclusion, ensuring economic, environmental, and social stability in the process of planning, construction, and management of cities is an urgent task. By developing urban transport infrastructure, solving environmental problems, and improving sanitary and hygienic conditions, it is possible to create a comfortable and safe living environment for the population. At the same time, the use of digital management and innovative solutions is the main trend of cities of the future.

The shortcomings and recommendations studied in this article are recommended for use in cities located in the extreme zone of Nukus and Karakalpakstan and can serve as a basis for reducing environmental problems.

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***Rezyume**: Ushbu maqolada shaharlarni rejalashtirish, qurish va rekonstruksiyalash jarayonlari, ularni boshqarish hamda iqtisodiyotni rivojlantirishning zamonaviy tendensiyalari yoritiladi. Shuningdek, shahar transport infratuzilmasi bilan bog‘liq muammolar va ularni bartaraf etish yo‘llari, shaharlarda yuzaga kelayotgan ekologik hamda sanitar-gigienik muammolar tahlil qilinib, ularning yechimlari taklif etiladi.*

***Резюме:** В данной статье освещаются процессы планирования, строительства и реконструкции городов, их управления и современные тенденции развития экономики. Также будут проанализированы проблемы, связанные с городской транспортной инфраструктурой и пути их решения, экологические и санитарно-гигиенические проблемы, возникающие в городах, и предложены пути их решения.*

Kalit so'zlar: *Urbanizatsiya, aqilli shahar, transport, aholi, ekologiya, sanoat chiqindilari, iqlim, ekstremal, yashil energetika.*

Ключевые слова: *Урбанизация, умный город, транспорт, население, экология, промышленные отходы, климат, экстремальная, зеленная энергетика.*

HUMANITIES SCIENCES

THE FATE OF AN UNCLAIMED PUBLIC FIGURE (THE FATE OF THE KARAKALPAK PUBLIC FIGURE AND COMMANDER UBAYDULLA BAHAUDDINOV)

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Summary: *The article examines the prominent figure in the history of the Karakalpaks of the Southern Aral Sea region, Ubaydulla Bahauaiddinov (Bagautdinov), known colloquially as "Khan maxsum."*

The article analyzes the biography, especially the work activities of Khan Maxsum. According to eyewitnesses, Khan Maxsum gathered a popular militia in July-August 1918 with a total of 12,500 guards. Khan Mahsum's guards, as the elderly recall, continued to actively participate in the struggle against other invaders - the Red Guards - during the early years of Soviet rule. However, after the adoption of the first Constitution of the new state (1922), and realizing the futility of further resistance, Khan Mahsum's "wild division" was disbanded.

Key words: *public figure, commander, Ubaydulla Bahauddinov, guards, memory*

Modern historians in our country are paying great attention to restoring the names of historical figures unjustly forgotten by the former regime, whose life and activities can serve as an example for the younger generation in new conditions. One of such prominent figures in the history of the Karakalpaks of the Southern Aral Sea region is, undoubtedly, the name of Ubaydulla Bahauaaddinov (Bagautdinov), known colloquially as "Khan maxsum," that is, "the bearer of the khan title of religious origin" (Maxsum, maxdum in Arabic "messenger of Allah"). The name of Khan Maxsum has taken its rightful place in the new history of Uzbekistan, as well as in the works of the local creative intelligentsia, as well as in folk legends.

At the same time, the biography of Khan Maxsum, especially his work activities, remains poorly researched from a scientific point of view, which can cause various twists and turns. In the written sources of the old historiography, he was presented as a religious fan and the leader of the local Basmachi gang formation. In oral traditions, people who knew him during his lifetime speak of him as a leader of the people's militia who faithfully fulfilled his social duty to society. So, who was he really? We will try to present the materials collected by the author of this article over the past years to the public.

Ubaydulla Bahauaaddinov, as known from various sources, was born in 1887 as a subject of Tsarist Russia, in the territory of the present-day "Eshon kapa" village (now the "Kyzyl uy" rural citizens' assembly of Kegeyli district of the Republic of Karakalpakstan) among religious figures.

Father - Pari Ishan (Bahuauddin Ishan, 1838-1912). He owned a private religious school, and concurrently worked as a teacher (mudarris) at his father's madrasa, which was an integral part of the religious and educational center. In the people's memory, the name of Pari Ishan is identified with the reformer of the educational process in the madrasa, where, along with traditional religious subjects, Russian language and arithmetic were taught. The acquired knowledge contributed to their position among the local officials of Tsarist Russia as secretaries of volost administrators, translators, hydraulic engineers, etc.

Consequently, such an origin of Khan Maxsum could not but be reflected in the young man's understanding of his surroundings and the formation of his worldview, and in his subsequent fate. He received religious education - first at the primary school, then at his father's madrasah. However, contrary to family traditions, he chose a secular profession, working as a small technician, then as the head of a large irrigation network. He supervised the construction of irrigation networks of local importance. He nominated himself for the post of volost administrator in the elections of May 30, 1920, although the results were unsuccessful.

The revolutionary upheavals of 1917 forced Ubaydulla to make adjustments to his own life activities. In the conditions where the entire right bank of present-day Karakalpakstan, where, according to the Karakalpak historian B. Koschanov, "complete powerlessness was bestowed (December 1917-November 1918)," the threat of external aggression from the Khan of Khiva intensified, organized crime - bandits (baspashi), robbers (karakshy), cattle thieves, and simply thieves - rose within the region. This circumstance forced the former rulers, nobles, and religious figures of all eight volosts of the Chimbay district of the Amu Darya Department of the Turkestan Governorate to gather for a congress, where from three alternative candidates, a thirty-one-year-old Ubaydulla Bahauddinov was elected ruler on a democratic basis.

The young commander, according to eyewitnesses, gathered a popular militia in July-August 1918 with a total number of 12.5 thousand nukers, that is, one dzhigit for each of the five families, and established partnerships with the Muynak elders - the Ural Cossacks led by ataman Filchev.

Khan Mahsum's guards, as the elderly recall, further actively participated in the struggle against other invaders - Red Guards - during the first years of Soviet rule, including three battles - in the areas of Shagal, Kupyr, Nazarkhan, and the siege of the Nukus garrison fortress. Red Guards However, after the adoption of the first Constitution of the new state (1922), and realizing the futility of further resistance, according to the head of the Red Army detachment, N.A. Shaydakov, Khan Maxsum's "wild division" was disbanded. At the same time, the disbandment process proceeded civilizedly, with the conclusion of a treaty stipulating that the former nukers, including himself, would not be persecuted.

Nevertheless, the leader of the Red Army, as can be seen from the further fate of Khan Maxsum, did not keep his promises. On false accusations by the Khan, Maxsum was prosecuted twice - in 1922-1924 and 1929-1931. His family and relatives' attempts to leave the country were unsuccessful. His elder brother Iniyat ishan (1884-1929), his father's brothers - Khalila akhun (1844-1928) and Najim ishan (1873-1928) - were arrested and executed without trial and investigation as ideological mentors of popular uprisings.

Despite being unclaimed in the new conditions, Ubaydulla Bahauddinov had the desire to serve the new social order. He was elected a member of the Council of the Provisional Government in Chimbay, and there is his signature on the reached peace agreement and the treaty concluded between the representatives of the people's power and the Soviet government on February 18, 1920. In 1934-1937, by decision of local authorities, his family was exiled to the village of "Amirobod," now the Ellikkala district of the Republic of Karakalpakstan, without the right to travel abroad ("aq uyli"). To support his family, he engaged in making and selling children's carriages ("adak arba") at the Turtkul market.

Due to the endless persecution by local law enforcement agencies, Khan Maxsum was forced to hide far from his native hearth, alone, in the village of "Katty oy" of Kubatag district, Tashauz region, Turkmenistan, in his final years (1937-1956). He is buried there in the "Miskin Ata" cemetery, where the remains of Imam eshon's father - Kaipnazar biy, and the last wife of Khan maxsum, his second son - Duisek, and grandson - Kurbanazar rest.

Ubaydulla Bahauddinov's sons - Muptilla, Duisek, and Rametulla - were participants in the Second World War, where his youngest son, Begdulla, also went missing. Daughters - Abadan, Saule, and Bijan worked in various spheres of the former regime.

The name of Khan Maxsum, due to the absence of a crime in his actions, was finally rehabilitated and recognized as innocent before the Soviet government by the decision of the competent authorities of July 29, 1989. The above data, in our opinion, is quite sufficient for making appropriate decisions at the state level to immortalize the memory of one of the bright historical figures of Karakalpakstan.

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Rezyume: *Maqolada Janubiy Orolbo‘yi qoraqalpoqlari tarixida xalq tilida "Xon maxsum" deb atalgan yorqin shaxs Ubaydulla Baxauaddinov (Bagautdinov) haqida so‘z boradi.*

Maqolada Xon maxsumning tarjimayi holi, ayniqsa, mehnat faoliyati tahlil qilingan. Guvohlarning so‘zlariga ko‘ra, Xon maxsum 1918-yil iyul-avgust oylarida umumiy soni 12,5 ming nafar bo‘lgan xalq lashkarini to‘plagan. Xon maxsumning navkarlari, keksalarning eslashicha, sovet hokimiyatining dastlabki yillarida boshqa bosqinchilar - qizil gvardiyachilarga qarshi kurashda faol ishtirok etishgan. Biroq, yangi davlatning birinchi Konstitutsiyasi qabul qilingandan so‘ng (1922 y.) va bundan keyin qarshilik ko‘rsatish befoydaligini anglab, Xon maxsumning "yovvoyi diviziyasi" tarqatib yuborildi.

Резюме: *В статье рассматривается яркая личность в истории каракалпаков Южного Приаралья Убайдуллы Бахауаддинова (Багаутдинова), именуемый в просторечии «Хан махсум».*

В статье анализируется биография, особенно трудовая деятельность Хана махсума. Хан махсум, по словам очевидцев, в июле- августе 1918- года собрал народное ополчение с общей численностью 12,5 тысячи нукеров. Нукеры Хана махсума, как помнят старожилы, далее принимали активное участие в борьбе в первые годы советской власти с другими захватчиками – красногвардейцами. Однако после принятия первой Конституции нового государства (1922 г.) и осознав бесполезность дальнейшего сопротивления, «дикая дивизия» Хана махсума была расформирована.

Kalit so‘zlar: *jamoat arbobi, sarkarda, Ubaydulla Bahouddinov, navkarlar, xotira*

Ключевые слова: *общественный деятель, полководец, Убайдулла Бахауаддинов, нукеры, память*

THE ROLE OF INFORMATION TECHNOLOGIES IN MODERN PHILOLOGICAL EDUCATION

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Summary: *The article shows the importance of information technologies (IT) in modern philological education. The article reveals the advantages of IT, its areas of application, its role in improving the quality of education and its prospects, thereby demonstrating the potential of these technologies to enrich and develop the educational process in the field of philology. The analysis of the problems of implementing IT and their solutions increases the practical significance of the article and provides an impetus for further research in this area. The article can be a valuable resource for those interested in studying modern trends in the use of technologies in the field of philological education.*

Key words: *Information technology, (IT), technologies, programm, platforms, education, skills, artificial intelligence (AI)*

Nowadays, education is unimaginable without information technologies, which is why we all started using the term “new pedagogical technologies”. For example, the personal computer has completely changed the possibilities of education. The Internet and laptops have created even greater opportunities for the implementation of new pedagogical technologies in the educational system. In the conditions of Uzbekistan’s independence, the reform of the education system is primarily associated with the introduction of advanced information technologies into the education and upbringing system [1.158]

Information technology (or **IT**) is a word referring to all forms of innovation used to create, store, exchange and use knowledge in its various forms, such as facts, opinions, prints, discussions, photographs, moving, pictures, mixed-media presentations. [2.159]

The work of O. V. Iakovleva and E.P. Shmakova has shown that ICT (information and communication technologies) contribute to the development of skills of dialogue building between students and teachers, effective use of terminology and communicative strategies in educational activities. According to D. D. Egamberganova, Innovative technologies in the pedagogical process, introduction of innovations, changes in activities, interactive in its implementation requires the use of various methods. [3.271]

The emergence of the information technologies led to revolutionary changes in several professional fields, such as education, science, art, computer training, advertising, technology, medicine, mathematics, business, and scientific research. Although the idea of using computers in the education system appeared much earlier, the application of information technologies in all areas of the education system began to be fully implemented after the emergence of computers equipped with multimedia devices. The use of multimedia tools in education allows:

- ensuring the humanization of education;
- increasing the effectiveness of the educational process;
- development of the learner's personal qualities (acquisition, thirst for knowledge, ability for independent learning, self-education, self-improvement, creative abilities, the ability to apply acquired knowledge in practice, interest in learning, attitude to work)
- taking into account the personal experience and individual characteristics of the student;
- conducting independent learning activities, in which the student studies independently and develops;
- to develop in students, the skills of using modern educational technologies that help them adapt to the current rapidly changing social conditions for the successful fulfillment of their professional task. [4.394]

The role of technologies in linguistic education is very essential. It can be justified with the following points:

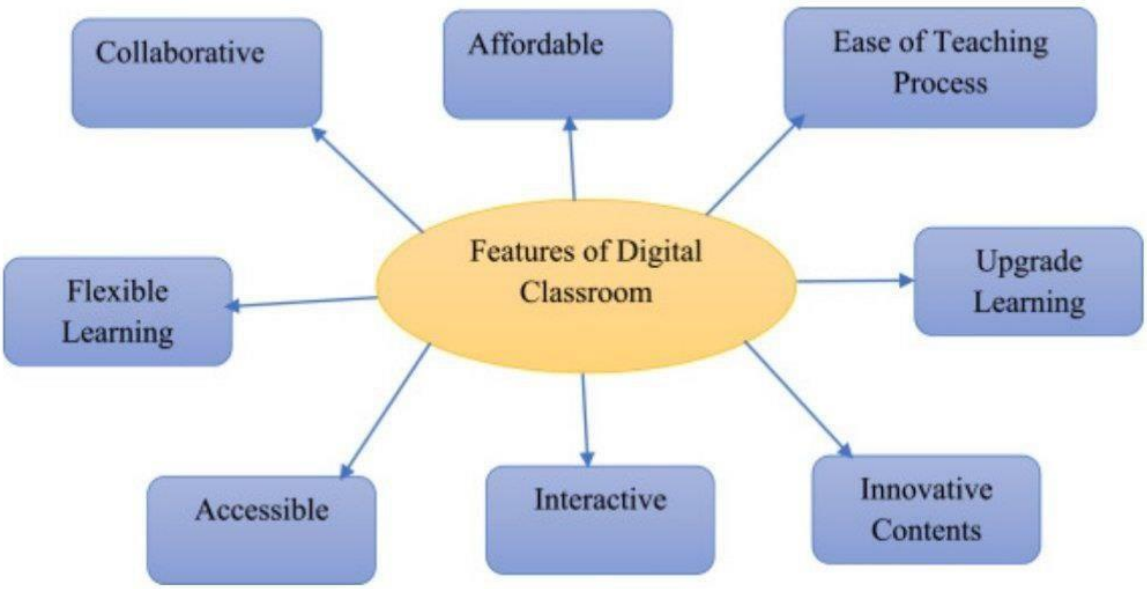
1. *Resource accessibility*: Students and teachers can easily access various resources such as e-books, scientific articles, dictionaries, audio-video materials via the internet. This enriches the learning process and reduces the time spent searching for information.
2. *Interactivity:* Interactive whiteboards, online tests, virtual laboratories make lessons interesting and effective. Students can actively participate, answer questions, and work in groups.
3. *Distance learning*: Technologies remove geographical limitations. Students can attend classes of famous professors and teachers study online courses from anywhere in the world.
4. *Research capabilities*: Databases and electronic libraries help students conduct research. They can find sources in different languages, analyze them, and publish their research.
5. *Development of language practice:* Special programs and platforms provide students with the opportunity to apply a foreign language in practice. They can talk to each other, write, learn grammar, and improve their pronunciation.
6. *Creative opportunities*: Technologies allow students to implement various creative projects. They can create websites, blog, shoot videos, create podcasts, and showcase their work to the world. [5.422]

It should be noted here, that digital technologies and various gadgets are currently making a significant contribution to improving the quality of education in educational institutions.

Digital classrooms are characterized by the incorporation of electronic tools or systems like social networking sites, various media forms, and smartphones in the educational process. The integration of digital technology into education has led to a positive transformation and enhanced the current educational setting. Digital learning is an educational approach that leverages technology to execute the complete educational plan and facilitates efficient and accelerated learning for students. The primary focus of the digital classroom is on instruction carried out through technological means. Learners utilize technological tools with internet access, such as laptops, tablets, and Chromebooks, among others. Rather than manually writing notes on the material presented by the instructor, the majority of the educational content is provided to students digitally using an absorbing and dynamic online setting. Regardless of its complexity, education is essentially a form of conveying information. The emergence of the internet has created innovative channels for communication, thereby broadening the methods for disseminating and receiving educational materials.

These technological resources and online platforms function as educational enablers.

The diagram illustrates several attributes of an electronic educational setting:



Digital platforms and online resources are integrated into contemporary classrooms to help students enhance their educational journey. The use of technology and the implementation of feedback mechanisms are two indispensable features of a technologically advanced classroom environment. The incorporation of feedback loops is crucial for students as it allows them to promptly receive insightful commentary and evaluations from their instructors. Teachers can leverage these feedback loops to offer tailored guidance, considering various elements like the individual student, specific lesson, collaborative group dynamics, and more. The incorporation of methods such as PowerPoint presentations, streamed videos, digital education modules, virtual learning programs, and other tech-driven solutions are becoming increasingly common in pedagogical practices. Consequently, instructional methods in the classroom are evolving towards greater engagement and interactivity. With the aid of web-based materials and virtual classrooms, students now possess the ability to independently explore a diverse array of subjects. Visual aids like color-coded charts, comprehensive graphs, and illustrative models serve to showcase the most effective teaching practices with in educational institutions. Nonetheless, these approaches are currently perceived as outdated ways of imparting knowledge. Classroom learning has evolved beyond merely involving the perusal of texts, utilizing chalkboards for elucidating lessons and ideas, and jotting down information in notebooks. [6.277]

It is worth mentioning, that while digital technologies and various gadgets have made the learning process more effective and modern, artificial intelligence (AI) has been helping to implement it more conveniently, simply, and quickly.

Artificial intelligence (AI) is revolutionizing education. AI-based tools, such as adaptive learning systems, provide tailored educational content based on students' knowledge levels. These systems identify students' strengths and weaknesses, creating personalized learning plans.

Platforms such as Khan Academy and Duolingo utilize AI to offer personalized learning experiences. Moreover, AI helps reduce the workload for teachers. Automated grading tools allow for swift and unbiased assessment of exams and written assignments, while AI-driven chatbots provide immediate answers to student inquiries, alleviating pressure on educators. Nevertheless, the incorporation of AI in education brings about challenges, including worries about data privacy, the risk of AI systems making faulty judgments, and the preparedness of teachers to integrate AI tools. These concerns necessitate careful evaluation.

The incorporation of digital technologies in philology presents a mix of both advantages and difficulties. While AI and digital methodologies can enhance the ease of linguistic preservation and analysis, if not approached thoughtfully, they risk diminishing traditional skills. Since its inception, this field has undergone numerous transformations, prompting philologists to navigate the innovations introduced while upholding the essential principles of their discipline to find a suitable balance. [7.455]

Literature Review: In recent decades, scholars have explored the role of digital technologies within the humanities, specifically focusing on philology. For example, Smith emphasizes the benefits of digitizing manuscripts and utilizing computational linguistics for textual analysis of such materials. He argues that these tools expand the potential for linguistic investigations of languages previously considered extinct and unreachable. Additionally, Johnson and Lee examine the use of artificial intelligence as a means to substitute traditional linguistic studies of ancient languages, suggesting that machine learning enhances the tools available to conventional linguists. However, this evolution has faced criticism, particularly concerning an over-reliance on technology. According to Taylor's explanation in 2023, it is also quite possible that the concern about whether employing digital tools will diminish standard abilities and perhaps cause a decline in the number of philologists acting as interpreters of background and society is legitimate. [8.51].

Ultimately, the role of information technology in modern philological education is that of a powerful catalyst. It is enabling the discipline to expand its reach, enrich its methodologies, and remain acutely relevant in an increasingly digitized world. By embracing these advancements while upholding its foundational principles, philological education can continue to cultivate scholars who

are not only deeply rooted in linguistic and literary heritage but also adept at navigating, interpreting, and contributing to the digital frontiers of knowledge.

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Resume: *Maqolada zamonaviy filologik ta'limda axborot texnologiyalarining (AT) ahamiyati ko'rsatilgan. Maqolada ITning afzalliklari, qo'llanilish sohalari, ta'lim sifatini oshirishdagi o'rni va uning istiqbollari ochib berilgan, shu orqali ushbu texnologiyalarning filologiya sohasidagi ta'lim jarayonini boyitish va rivojlantirish imkoniyatlari ko'rsatilgan. ITni joriy etish muammolari va ularning yechimlari tahlili maqolaning amaliy ahamiyatini oshiradi va ushbu sohadagi keyingi tadqiqotlarga turtki beradi. Maqola filologik ta'lim sohasida texnologiyalardan foydalanishning zamonaviy tendensiyalarini o'rganishga qiziquvchilar uchun qimmatli manba bo'la oladi.*

Резюме: *В статье показано значение информационных технологий (ИТ) в современном филологическом образовании. В статье раскрываются преимущества IT, области его применения, его роль в повышении качества образования и его перспективы, тем самым демонстрируя потенциал этих технологий для обогащения и развития образовательного процесса в области филологии. Анализ проблем внедрения IT и их решений повышает практическую значимость статьи и даёт импульс для дальнейших исследований в этой области. Статья может стать ценным ресурсом для тех, кто интересуется изучением современных тенденций в использовании технологий в области филологического образования.*

Kalit so'zlar: *Axborot texnologiyalari, (IT), texnologiyalar, dastur, platformalar, ta'lim, ko'nikmalar, sun'iy intellect (SI) .*

Ключевые слово: *Информационные технологии, (IT), технологии, программы, платформы, образования, навыки, искусственный интеллект (ИИ).*

UDC: 82.09

NICKNAMES AND THEIR FUNCTION IN LITERARY WORKS

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Summary. *The purpose of the article is to determine the artistic function of nickname units used in Sh.Seitov's literary works as a method of image creation by studying their structural features and semantic peculiarities. It has been determined that the very high degree of implementation of the socio-pragmatic composition of nicknames is reflected in single-component terms. The author's literary texts analyze nicknames based on a person's past, appearance (height, skin, and demeanor), character and habit features, differences in speech, the name of their profession or occupation reflecting their social status, and ethnicity.*

Key words: *writer, novel, image, character, nickname*

Introduction. We include informal anthroponymic units in the category of nicknames, their emergence is motivated by the individualizing qualities and characteristics of a person, is associated with oral speech processes and certain communicative situations related to informal interpersonal communication, and as a result, performs a characterizing, emotional-expressive, and evaluative function. At the same time, nicknames, which are an integral part of the artistic onomastic space, especially among representatives of a certain linguocultural community, clearly reflect the national-cultural specifics of informal interpersonal relations. Paying attention to the study of such units alongside anthroponyms, which constitute the system of official terms, allows for the modeling of the social and national-cultural space of artistic reality, which can be identical to objective reality or even broader, and this determines the relevance of the work being carried out. The purpose of the article is to determine the structural features of nickname units used in Sh. Seytov's literary works, the specificity of their semantic filling, and their sociopragmatic informativeness. The object of research is the context units given through the anthroponymic category "nickname." The factual materials of the article consists of nicknames selected from the author's literary works.

Literature Review. A nickname is a name given in connection with a person's individual characteristics, behavior, and behavioral traits. In everyday life, the distinctive features, habits, behaviors, characteristics, and professions of some people serve as the basis for their nicknames/

Nicknames have been specifically studied as part of onomastics by Turkologist scholars from a linguistic perspective [1]. The traditions and customs of nicknaming among the Karakalpak people, their causes, and circumstances were studied in Karakalpak linguistics by Yu.N. Khojalepesova [3].

In scientific literature and explanatory dictionaries, nicknames are given the following definitions and explanations: "A nickname is a name given to a person as a joke or for some reason" [2] That is, nicknames are additional names added to a person's real name. There are reasons why this additional name is given: it's not just a nickname for any person, but rather related to their individual character, psychological and physiological features, flaws, and habits.

It should also be noted that one should not confuse the nicknames of people in everyday life with the literary nicknames of any writer or poet. A pseudonym (from the Greek "pseudonymos," meaning a false name) is a name chosen by the author in fiction. In literary works, however, writers, in individualizing the portrayed characters, use their nicknames alongside the characters' names as one of the artistic devices. In world literary studies, scholars are more interested in the names of characters in literary works. Hero nicknames have been studied using the example of folklore works. In these studies, the semantics and functions of hero names and nicknames in literary works are studied.

Materials and methods. In a literary work, writers can reveal hero’s character and psychological traits: behavior, portraiture, and habits through the character's name and nicknames. However, many writers lack the skill to use the hero’s nicknames alongside their names. This can

also be seen in the example of Karakalpak prose. In Karakalpak prose, in A.Shamuratov's story "Eski mektepte (In the Old School)" (Sharipbay Kalpe), in M.Daribayev's "Min'lardin' biri (One of the Thousands)" (Erjan Siypan), in A.Begimov's novel "Baliqshinin' qizi (The Fisherman's Daughter)" (Ernazar kelte), in T.Kayipbergenov's novellas and novels (in the story "Mug'allimge raxmet (Thank the Teacher)" Duysen mulla, in the novel "Qaraqalpaq qizi (Karakalpak's Girl)" Tangirbergen mashinshi), nicknames are used along with the names of some heroes. The aforementioned heroic nicknames failed to serve an artistic purpose in revealing their bearers' characters. Writers gave nicknames only to negative characters in their works. Just as in real life, the owner of inappropriate behavior, actions, and habits is given a nickname, so too are writers, just like in real life, directly given nicknames only to negative characters. For example, A. Shamuratov describes only the negative actions of Sharipbay, the rich man's son, and calls him by the nickname "qalpa." However, no characteristic or quality specific to the hero's image is expressed through the word "qalpa." Similarly, the heroes' nicknames used in the aforementioned works cannot perform an artistic function in character creation.

Shawdirbai Seitov was a writer who effectively used nicknames in Karakalpak literature and effectively imbued them with a distinct artistic function. He first uses the character's nickname (Menlibai Soylak) in his novel "Ig'bal soqpaqlari (Paths of Fortune)." However, even in this novel, the nickname doesn't function as a technique in character creation. The purposeful use of this artistic device was successful in the writer's novel-tetralogy "Khalkabad." It should also be noted that in recent times, followers of Sh.Seitov have also been gaining experience in using nicknames in creating artistic images. For example, in O. Satbaev's work "O'mir tolg'anislari (Thoughts of Life)," written in the genre of a poem close to a novel, and in Kh. Dawletnazarov's poetic works, nicknames are skillfully and effectively used to create artistic images.

Results. In Sh. Seitov's novel-tetralogy "Khalkabad," almost all characters' nicknames are added to their names or used directly without mentioning their names. As in everyday life, there is a history of the use of nicknames by the writer. Based on the meaning of these nicknames, they can be classified as follows in this work, and based on this, the artistic function of nicknames can be determined. In analyzing the semantics of nicknames, we considered the context that encompasses information about the emergence and usage of nicknames and their function in literary works. In this regard, based on semantic dominants, we have classified the nicknames used in Sh. Seitov's works into the following semantic groups:

1. Nicknames given based on their appearance: Mádiyar dáw, Murat hákkelek, Izbasqan qotır, Bazarbay qılıy, Joldas qara, Abdulla tompaq, Toyman túyteńki, Juman kál, Aman sarı, Reyimbay qotır, Abdulla tompaq, Eshbay tórt kóz, Náziyra soqır, Turdımurat pákene, Erimbet taylaq, Joldasbay qızılbet, Bayniyaz iymek.

A) Depending on height: dáw, sozanay, tapal, pákene, shúllik, tompaq (giant, long-legged, short, dwarf, short, plump).

B) By type and color: sarı, qara, qotır, qızılbet (yellow, black, scabies, ruby).

C) depending on walking: hákkelek, iymek, (sturgeon, crooked),

2. Depending on the characters' psychology: biybala, suwdır, qabaq, dańǵır, shaǵal, loqetek.

3. Based on physiological characteristics: soqır, solaqay, qatınek (blind, left-handed, flawed).

4. Depending on the speech characteristics of the characters: shundıy, hańqalı.

5. Based on the characters' professions: aqsaqal, sharbaqshı, muǵallim, usta, nanbay, shoshqashı, buxgalter, sot. (elder, gardener, teacher, craftsman, baker, pigsmith, accountant, judge).

6. By social or ethnic origin: maqsım, diyўana, xoja, qańlı, qıpshaq.

Discussion. Nicknames in writer Sh.Seitov's novels reveal distinct characteristics specific to the characters. The characters' nicknames have a certain artistic function in the novel.

1. Nicknames are given based on the character traits, appearance, facial features, and profession of negative characters. Although they appear as character traits of the characters, they mainly reflect their main character traits. These are the characters from the novel: Tolıbay tasmańlay, Esbergen qabaq, Izbasqan qotır, Jamal sot, Eshbay tórtkóz, Orazbay loqetek, Nazarbay qatınek and others. For example, in the first book of the novel-tetralogy, events related to the image of Tolıbay

tasmańlay are described. His nickname is tasmańlay. This is, firstly, a nickname given to a hard-headed person. Secondly, nicknames are associated with the character of the owner and are given to ungrateful, miserly people. The character of Tolıbay, depicted in the novel-tetralogy, possesses both of these traits. Tolıbay earned the nickname "tasmańlay" for competing with Azerbaijan for a hundred tenge and splitting a bowl of butter on his forehead. Trading for the hundred coins he earned from this competition, Tolıbay amassed a fortune. He is depicted in the novel as a materialistic, miserly character.

In the novel, Esbergen, one of the main characters, receiving the nickname "qabaq," is explained as follows:

" Siz shın mánisinde qabaqlıq etip, Qunnazar aqsaqaldı sabayman dep, bizge kerek, paydalı jerińizdi jortaǵa tapsırdıńız. Taǵı da sonday gúdireklep, bul hámelińizdi de tapsırıp qoysańız, bizge bir tıyınǵa keregińiz joq! Onda usı aqırǵı diydar kóriskenimiz bolǵay. Ózim bir bolǵanım menen shaqam mıń, …. Xan maqsımdı qamatqan Jáliy maqsım ekenin siz geshshe ele túsinbeysiz. Onı túsingendey gelle bolǵanda siz «Qabaq» atanbas edińiz [4: p. 144-145). (You've truly frowned, claiming to beat Qunnazar aksakal, and deliberately handed over the necessary, beneficial part of yours to us. If you're so eager to hand over this position, we won't need you for a penny! Then let this be our last meeting. Even though I'm one, I have a thousand shoulders. You still don't understand that it was Jaliy Maksim who imprisoned Khan Maqsim. If you had a mind to understand it, you wouldn't have been called "Kabak").

Esbergen is a high-ranking official. However, due to his impulsiveness, he often makes mistakes in the work process. Knowing his character, Izbaskan used him to carry out his plan.

Izbaskan was nicknamed "Qotir" because of his wrinkled face. This trait not only indicates the ugliness of his appearance but also signifies his inherent cruelty and malice. He interfered in all organizational matters and undermined the formation of the new government.

Jamal works as a judge. His adoption of the nickname sot (judge) is connected both with his workplace and with the harshness and cruelty of this hero's character.

2. The positive characters in the novel also have nicknames. For example, the words "aqsaqal" (elder) (Qunnazar) or "biybala" (Allanazar) were used to refer to an official who led a segment of society before the establishment of Soviet power. Because he was a respected elder throughout his life (even after the establishment of Soviet power), and as a respected elder throughout the entire village, Qunnazar, the protagonist of the novel, was given the nickname "aqsaqal" (elder). The nickname "aqsaqal" (elder) reveals the hero's social standing and individual characteristics. The nickname Biybala was used not only in connection with the position held by the novel's protagonist, Allanazar, but also in connection with his individual characteristics (his leadership, authority, eloquence). From a young age, Allanazar was able to resolve disputes and conflicts among the people with justice. Therefore, the people respected Allanazar Biybala among the elderly biys who governed the people even in his youth. In the novel, the writer "creates" this character's past history through this single word - the familiar nickname "biybala." Even during the Soviet era, Allanazar Biybala actively participated in state affairs and earned the trust of government leaders. He is respected among the people as a just and compassionate leader who cared for the people.

In the tetralogy, some characters are called only by nicknames not mentioning their names. It’s the novel's hero, Xudaybergen Shundiy's wife, Urqiya. But in the work, her fellow villagers call her Sozanay sheshey. She was nicknamed Sozanay because she was tall and worked slowly. As can be seen from the analyses, nicknames in this work reveal the character of the hero. Writer Sh. Seitov skillfully used this artistic device in his novel-tetralogy "Xalqabad."

In the novel-tetralogy "Xalqabad," the author incorporates, albeit briefly, the events surrounding each character's adoption of a nickname into the composition of the work. The circumstances, events, and reasons for giving nicknames to heroes vary. For example, Qudaybergen, the hero of the novel "Xalqabad," was nicknamed "Shundiy" by the people. The reason he is called Shundiy is that he lived among the Uzbeks for many years, adding "shu" and "shundiy boladi" to each of his words. That's why the village brides call him "Shundiy qaynağa." On this basis, all the people call him Xudaybergen Shundiy or Shundiy.

The novel also tells the story of Qudaybergen, nicknamed han'qali. This is the name of an ancient settlement. Due to a lack of trade, the owner moved to higher cities. This is mentioned in the memoirs of Elder Qunnazar.

Suwdir is a nickname given to someone who tells a lot of lies. In the novel, Sayimbet is given the nickname Suwdir. But Sayimbet is not a liar, not a swindler, but a government official in the village. They are constantly informed about the latest socio-political and scientific-technical developments in the country. If he told his fellow villagers about them, they wouldn't believe him. Because of his telling unbelievable things his fellow villagers called Sayimbet "suvdir".

Janabay Dan'g'ir - nicknamed for being talkative and mischievous. 2) A nickname given to a person who keeps talking loudly and shouting. In the novel, Janaboy is nicknamed "dan'g'ir" for his frankness and naivety.

The nicknames Nurdúken shoshqashı, Dáweke muǵallim, Qurban usta, Baltamurat buxgalter, Sapar jamanawız are given in connection with their occupations, and they also reflect the characteristics related to their professions. Among these, the current meaning of the nickname jamanawız is somewhat different. During the period depicted in the novel, there were people who galloped from village to village delivering government news. They proclaimed both joyous and sad news among the villagers. During the war years, the people called them jamanawız for delivering horrifying and tragic news. In the novel, the nickname jamanawız is given to Sapar not because of his individual character or habits, but because of his primary duty.

These given nicknames convey their owners' psychology (suwdir, qabaq, dan'g'ir, shagal, loqetek), appearance (tasman'lay, qiliy, to'rtko'z), speech (shundiy), height (da'w, sozanay, tapal, pa'kene, shu'llik, tompaq), skin (sari, qara, qotir, qizilbet), behavior (ha'kkelek, iymek), physiological characteristics (soqir, solaqay), profession (mug'allim, usta, nanbay, shoshqashi, buxgalter), social (maqsim, diywana), or ethnic origin (qan'li, qipshaq), and other characteristics in one word.

Nicknames also serve the function of depicting characters' portraits. The characteristics of the novel's characters' appearance are depicted through their nicknames: dáw (large-bodied), sozanay (tall), tapal (short, plump), pákene (dwarf), and shúllik (thin). The writer depicted the image of women more accurately and deeply through their nicknames. Especially, he uses nicknames based on the characteristic traits of some women - their verbose nature, their unhurried and leisurely actions when trying to do something, as well as their facial features and body type (thin or plump). For example, Toyman túyteńki, Qatsha qaltańbas qatın, Patpa pátátiw, Sozanay sheshey, Aytgúl aqqatın and so on.

If the characters' nicknames were removed and used only with their own names, their characters would not have been portrayed as interesting and attractive. As a result, the work's artistry would have suffered a certain degree of flaw. Because in these simple words (i.e., nicknames), the person live with the inner world of a person (character), their humorous language, and their way of life.

In the first and second books of the "Xalqabad" novel-tetralogy, adding nicknames to characters has become a common practice. While nicknames are a distinct phenomenon in the literary lexicon of these books, adding nicknames is rare in later books. This is likely connected to the social life of the depicted period and the changes in the psychology of the characters. Furthermore, while the writer avoids describing the characters' social origins, individual traits, and occupations one by one in the first and second books, using their nicknames, in subsequent books, by presenting the dialogues and monologues of these characters and their stories about themselves or other characters, he conveys their worldview, perspectives, that is, their psychology, and the stability of their character. We will now share the feelings they experience in their spiritual world: their joys and sorrows. Thus, in creating characters in novels, Sh.Seitov also assigns an artistic function to the hero's nicknames.

Thus, the nickname, as an informal, expressive-figurative, or emotionally evaluative name, has great potential in Sh. Seitov's literary works: through them, the author vividly demonstrates their irony and even sarcasm towards the character, and can also indicate the participant's belonging to various national, social, or dialectal subgroups. Furthermore, it can be said that from the writer's early works to his later works, the tendency to increase the frequency of nicknames, as well as their

emotional and expressive load, intensified, and the writer transformed this group of anthroponyms into a way of creating imagery.

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Rezyume. *Maqolaning maqsadi Sh.Seytov badiiy asarlarida qo‘llanilayotgan laqab birliklarining struktural xususiyatlarini, semantik xususiyatlarining o‘ziga xosligini o‘rganish orqali obraz yaratishning bir usuli sifatida badiiy funksiya bajarishini aniqlashdan iborat. Laqablarning sotsiopragmatik tarkibining juda yuqori darajada voqelanishi bir komponentli nomlarda namoyon bo‘lishi aniqlandi. Muallifning badiiy matnlarida insonning o‘tmishi, tashqi ko‘rinishi (bo‘y-basti, yuz-ko‘rinishi, yurish-turishi), fe’l-atvori va odatlarining xususiyatlari, nutqidagi o‘ziga xosliklar, ijtimoiy holati va etnik kelib chiqishini aks ettiruvchi kasb yoki faoliyat turining nomi asosida berilgan laqablar tahlil qilinadi.*

Резюме. *Цель статьи - определить художественную функцию прозвищ, используемых в художественных произведениях Ш. Сеитова, как способ создания образа, путем изучения их структурных и семантических особенностей. Выявлено, что очень высокий уровень реализации социально-прагматического состава прозвищ проявляется в однокомпонентных терминах. В художественных текстах автора анализируются прозвища, данные на основе названий профессий или видов деятельности, отражающих прошлое человека, внешность (рост, черты лица, манеры), особенности поведения и привычек, особенности речи, социальное положение и этническое происхождение.*

Kalit so‘zlar*: yozuvchi, roman, obraz, personaj, laqab*

Ключевые слова: *писатель, роман, образ, персонаж, прозвище*

UDC: 82.09

ECOPOETIC PHENOMENA IN MODERN KARAKALPAK LYRICS (ON THE EXAMPLE OF THE WORKS OF K. KARIMOV AND J. IZBASKANOV)

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Summary: *In the article the Aral Sea problem, which arose as a result of the mismanagement of nature during the Soviet era, and its origins are discussed. In the history of our society, the interaction between humanity and nature, namely in the Central Asian region, aiming to achieve high cotton yields, led to the excessive cultivation of virgin lands, resulting in waterlogging of the Aral Sea and a sharp change in the region's natural climate, led to the emergence of an ecological problem. This problem, which poses a threat to the future of our people, has become one of the main themes of literature and has become one of the main trends in fiction. As a result, a number of phenomena have emerged in literature that reflects the root of these problems. One such phenomenon is the ecopoetic phenomenon, which has been studied using the example of Karakalpak poetry.*

Key words: *Karakalpak literature. Karakalpak lyrics, Ecopoetic phenomena, ecological problem, lyrical hero*

Introduction.

In literature, eco-poetics, that is, the emergence of the ecological problem in a literary work and the reflection of its manifestations in nature emerged as a distinct trend. This phenomenon, which began with T. Kaipbergenov's novel "Kózdiń qarashıǵı," is later particularly evident in the poetic and prose works of T. Kaipberganov, I. Yusupov, Sh. Seitov, T. Matmuratov, O. Abdirakhmanov, A. Atajanov, K. Allambergenov, O. Otewliev, S. Ismaylov, K. Karimov, J. Izbasqanov, B. Genjemuratov, Sh. Ayapov, and other writers. The term "ecopoetics" originated to denote a specific French-language approach to the topic of "literature and ecology." The etymology of this term is also important, because "poiein" is a Greek verb meaning "to create", while "oikos" translates to "house," in this case referring to Earth. Here, in contrast to ecology, special attention is paid to the word "poiein," which later gave rise to the word "poésie" (from the French "poetry"). So, eco-poetics is the depiction of this place, that is, nature, in poetry, more broadly, in poetry, in prose, and in literature in general." (Romestaing Alain, 2015).

In this article, we aim to explore ecopoetic phenomena - the reflection of ecological problems, the deplorable state of nature, the attitude towards nature, and the critical views of the lyrical hero on it through the works of contemporary Karakalpak poetry representatives K. Karimov and J. Izbasqanov. Because both poets have their place in contemporary Karakalpak poetry and are considered poets who have made a special contribution to the formation of eco-poetics in Karakalpak poetry.

Main part.

K. Karimov, as a forward-thinking son of his people, was also concerned about the ecological disaster that has occurred in our country and its consequences, as well as the future of his people. He has been artistically portraying this issue in several of his poems.

The poet's poems in the cycle "Saǵınǵan Aral" and a number of poems in the cycle "Kewlimdegi ırǵaqlar" are dedicated to the theme of ecology. The poems "Dialog," "Diykhan", "Ana dárya tolǵawı," "Teńiz," "Suw tasıwshı," "Araldan keldim" are based on the tragedy of the Aral Sea. These poems reflect the lyrical hero's grief and worries about the fate of the Aral Sea and the future of our people suffering from the ecological disaster.

In the works of poets of the years of independence, the problems of the Aral Sea, water, and ecology found their reflection through tragic pathos. This is undoubtedly the tragedy of the era, the integration of the contradictions of the era and the portrayal of human destiny into the literary process, and the elevation of journalistic lyricism to the level of a literary phenomenon. (Ayapov. 2010)

In Karakalpak poetry, the unique explorations and paths of each poet are clearly evident in their portrayal of ecological problems, the problems of nature and humanity. In I. Yusupov's works lyrical meditation is stronger, in Sh. Seitov's boldness, depth of realism, sharp thinking, and acuity are more noticeable, in T. Matmuratov's deep lyricism and thoughtfulness, in B. Genjemuratov's the impact of the Aral Sea and Amu disasters on the spiritual psychology of the population is more noticeable.

K.Karimov also conducted unique research in depicting the ecological disaster and its manifestations in our nature.

In the poem "Dialog" the lyrical hero's concern about the Aral Sea disaster is built on the dialogue between the poet and an ordinary citizen. In this poem, a simple farmer asks a question to the poet, and the poet responds. Through questions, the causes and consequences of disasters are explored, and through answers, the lyrical hero's painful experiences and worries are poured out.

Гражданин:	Citizen:
– Бунша көп суўықдур мына гәпиңиз,	- Why is your speech so cold?
Я мәзи айтылған болжаўлар деңиз,	Or just say the assumptions.
Қалай тартылады мың жыллық дәрья?	How is a thousand-year-old river dr How is the
Қалай тартылады мын жыллық теңиз?	thousand-year-old sea drawn?
Шайыр:	Poet:
…Тентек Жәйҳун ишин алған шортандай	A fool Amu Darya like a pike cut inside,
Мүлайымсып қалды Аралға тамбай,	He became gentle, not falling into the Aral
Талай жыллар саратанның ишинде,	Sea.
Дийханшылық суўдан тарықты сондай.	For many years in the heat,
	Agriculture was so deprived of water.

In the poem, to convey the contradictions within the poet's inner spiritual world and convey conflicting thoughts, he uses the method of self-conversation, that is, conversation and dialogue.

Шайырлар айыпкер. Мен айыпкермен.	Poets are to blame. I am guilty.
Әмиў-Арал ҳалдан тайған күнлерде,	In the days when Amu Darya and Aral Sea
Олпы-солпы қосығыма қуўанып,	weakened,
Орын тәме етип жүргенмен төрден.	Rejoicing in my capricious song,
Кимлер тил қатпады қорқып басынан,	I've been seeking a place in the place of honor.
Кимлер қорықты жумсақ креслосынан.	Who didn't speak out of fear?
(Каримов.1991)	Some worried of their soft armchairs.

In the poem, the lyrical hero searches for the culprits of the Aral Sea disaster and reflects on the bitter realities of the time. In this poem of the poet, feelings, reflection, thinking, drawing a certain conclusion, rhetorical questions, and rhetorical appeals occupy a predominant place.

In the poems "Ana dárya tolǵawı" and "Teńiz" tragedy, sorrow, and grief are further intensified. In these two poems, their pitiful appearance is depicted through the language of the river and sea. River and sea tell their pain to people, the poet then moves from dialogue to monologue, pouring out the lyrical hero's inner turmoil, sorrows, pains, and reflections.

Барлығын ал,	Take all,
Саған керек болмаса,	If you don't need it,
Керек емес енди маған ғәзийне,	I don't need a treasure anymore.
Жыйғанымды алмасаң	If you don't take my savings
Қайтараман тәбияттың өзине,	I will return to nature itself.

Қумларымды әкетеди самаллар,	The winds carry away my sands,
Дузларымды әкетеди самаллар,	The winds carry away my salt.
Ықтият бол көзиңе. (Каримов.1991)	Be careful with your eyes.

In the poem, through the rhetorical method of address, a one-sided, "just taking" approach to nature is expressed with poetic sharpness, using the language of the sea. The salty dust and atmospheric pollution in the Aral Sea region are negatively impacting people's health, leading to tragic consequences. People who have reached the seabed for years, saying, "There are pearls on the seabed," are now worried about their own survival. The tragic consequences of this Aral tragedy are artistically depicted by the poet through the rhetorical address "Be careful with your eyes."

The ecopoetic phenomena in the poet's lyrics are clearly reflected in his conveyance of meaning through artistic details. For example, in the poet's poem "Trees Die Standing straight," the detail "Trees Died Standing straight" performs a special poetic function, embodying a profound symbolic and philosophical meaning.

Бир күни әжелдиң алдында	One day on the eve of death
Қәддим дал боладур. Бирақта,	My stature is straight. But
Тик турып өледи дарақлар. (Каримов. 2005)	The trees die standing straight.

The detail of "the standing dead trees" portrays nature, suffering like a "sickness" after being separated from its flooded rivers and seas attractively and effectively.

The poem "Suwdıń dámi" is also a journalistic lyric dedicated to environmental issues. Especially in the following lines, this tragic situation reaches its peak:

Тепсең тебренбес қара жер,	If you kick, the black earth won't shake.
Дузлы суўды симирип үнсиз,	Silently sipping salt water,
Қайтып дузлар қуспақта үнсиз. (Каримов.2005)	The salt returns silently.

The salty dust rising from the Aral Sea has completely engulfed every particle of nature. The earth is salty, the air is dusty, mixed with salt, the water is salty. This very problem, which threatens our lives, stirs the poet's inner world. The lines of the poem, composed of the lyrical hero's heartfelt feelings and sorrowful reflections, leave a strong impression on the reader.

In the poem "Boljaw," the lyrical hero, despite his apprehension about the current state of the Aral Sea and the Amu Darya, believes in their future flooding and the renewed flourishing of our nature. Through this, the poet, while developing optimistic thoughts, strives to awaken feelings of spiritual support, solidarity, and hope for the future in the people. In this poem, the theme of ecology is enriched with optimistic thoughts, while in the poem "Ómiriniń arbası igri jollardan" feelings of love for one's native land are combined with the idea of patriotism.

Аралдан исрапыл желлери есер,	The wasteful winds low from the Aral Sea.
Талай әрманлардың қанатын кесер,	It cuts the wings of many dreams.
Биразлар: өзге журт излесек десер,	Some say, "Let's seek a another land."
Қарақалпақстан өзге Ўатан табылмас.	There is no other homeland beside Karakalpakstan.

The lyrical hero's reflections on the concerns of the time and life, the fate of the nation, people, and homeland, give the reader pause for thought. In the poem, not only the ecological problem, but also human qualities and philosophical thoughts are harmoniously blended. As a result, they put

forward the idea that no matter how much our nature suffers, no matter how saline our climate and land are, we need no other homeland. The idea of the song is reminiscent of I. Yusupov's poem "Bul jer ele zor boladi." This, in our opinion, is likely due to the spiritual closeness of the poets who created under the same conditions and lived in a teacher-student relationship, as well as the harmony of their civic duties as human beings.

The depiction of natural landscapes and the connection between nature and humanity, society, has been one of the leading phenomena of poetry. In contemporary Karakalpak poetry, J. Izbaskanov is known for his inclination towards descriptive lyricism and his mastery of natural lyricism.

In J. Izbaskanov's lyrics, the problem of humanity and nature is reflected in a unique way. The renowned literary scholar S. Akhmetov expressed the following opinion about J. Izbaskanov's works: "Certainly, they can remain a long-standing secret of their readers only if they are sung with high civic pathos, and if the thoughts and reflections on the problems of man and nature are depicted with remarkable artistry." In J. Izbaskanov's lyrics, the problem of humanity and nature is portrayed with great artistry. In most of his poems, the poet conveys the thoughts and emotional experiences of the lyrical hero through depictions of nature. (Akhmetov. 1988)

The poet conveys artistic content through landscape scenes in his works about his homeland, love, or journalistic content. Through this, the poet depicts the inseparable integrity of humanity, nature, and society, as well as the inherent laws of their development. "The sensitive and artistic poet J. Izbaskanov does not limit himself to seeing the natural appearance of his native village only in frozen narrow exotic scenes, but he sees it in living action, in movement, in the flow of his entire life" (Esenov.2008).

In the poet's landscape lyrics, he not only creates beautiful aesthetic scenes from natural landscapes but also expresses concern for nature's current state and the issues of humanity's attitude towards nature through landscape depictions.

The poet's poem "Bolmasa" is created putting on rhythm of the poems of the same name by Maktumkuli and Ajiniyaz. The poem prioritizes the current state of our motherland, land and water, and the Aral Sea problem. The poet connects these issues with the fate of the nation, putting them into verse in the style of classical poets.

Тоғай-таллар...Түп тамырдан кестик биз, “Әмиў тасқын. Қурымайды”,–дестик биз. Пахта ушын барлығынан кештик биз. Сыйлық, атақ алғанларың болмаса. Еки тустан үстимизге қарар қум, Бир тәреп тен қуйылмақта Арал қум, Шар тәреп тен изей алып барар тың, Орпаң топырақ қалмағаны болмаса. (Избасқанов.1993)	Forests and willows...We cut at the root, "The Amu is flooded. "It won't dry up," we said. We gave up everything for cotton. Unless you've received titles, award. From two directions, sand gazes on us. On one side, the Aral sand flows, From all directions, ditch spreads, If only there wasn't any soil left.

These lines depict the emotions arising from the ecological disaster in the lyrical hero's inner world. The poet boldly speaks about the causes of the disaster, presenting the bitter truth of the times. The consequences of reckless actions, aimed at obtaining a bountiful cotton harvest and gaining prestige during the period of degradation, led to irreparable losses in nature. The lyrical hero is concerned about the Aral Sea turning into sand. The fact that the meliorative condition of the land has been severely damaged, changed and destroyed is the reality of our life that is unfolding before our eyes. This is the truth that the poet sings passionately, following the path of master poets.

The lyrical hero's love for his native land and the feeling of love for the land where he grew up are reflected in the poem "Tuwilg’an jer tolg’awi." The poet's unique exploration in conveying thought and his creative approach to using traditional form are evident in the poem. The poetic form reminds us of the folk genre of tolg’aw (historical poem). The word "tolg'aw" is derived from the

word "tolg'aniw (to mourn)." Thus, the pain in a person's heart, the pain that bursts from the heart....The rhythm of the historical poem should not exceed 7-8 syllables. The main reason for this is likely the subordination of the rhythm of historical poem to the kobiz melodies" (Mambetov. 1995).

The rhythm characteristic of the historical poem in the poem is perfectly suited to its elegiac content and sorrowful, painful experiences. The following lines offer the poet's painful trials on the current state of his native land's nature:

Дузлы тозаң шөккен жер, Мен тиккен ақ таллар жоқ, Орпаң топырақ жоллар жоқ, Бираз жәбир шеккен жер. (Избасқанов.1993)	A place where salty dust settled. There is no white willows I planted. No bumpy dirt roads. A place that suffered a bit.

The lyrical hero was pity with the "suffered" nature of his homeland and worried. His soul trembled as the white willows withered, and the rough soil turned to salty dust. The poet portrays this state of the lyrical hero through the method of lamentation, the method of pouring out his reflections. In essence, the theme of the poem is love for one's homeland, which the poet connects with the current deplorable state of the native land. Thus, in contemporary Karakalpak lyric poetry, feelings of patriotism and love for one's homeland are depicted inextricably intertwined with feelings of compassion for the current state of nature suffering from ecological disaster. Concern for the fate of our motherland, our saline land, our saline air, and its impact on the future of our people has become a civic duty today.

The poet's poems on pressing issues of today, such as the ecological disaster, ideological threats, global unrest, and other issues, reflect the spirit of the present day in the character of the lyrical hero. His poem "Jan'a jil tilegi" written in 2003, reflects the lyrical hero's worry against a number of contemporary problems.

Жер шарымыз бойлап Ҳаўа нурланған Күшинде әсирдиң Аллергиясы Дуз тозаңы көшер ҳәтте қумлардан Кулпыра алмайды соннан гиясы! Небир ғәреметлер инсан басында, Жер силкиниў қәўпи барар асқынып! (Избасқанов.2014)	Across the globe The air was radiant. Allergy of the century in force Salt dust moves even from the sands It can't bloom because of that! What hardships befall a person? The threat of earthquake's intensifying!

The poem depicts the lyrical hero's anxious experiences and inner struggles regarding terrorism, drug addiction, corruption, the global militant movement, and especially the environmental problem, which have become global issues today. In the poem, the lyrical hero is portrayed as an intellectual individual who addresses not only the problems of their own society but also worldly and universal human problems, expressing their own perspective and value, broad-minded, and thinking on a global scale. In the above lines, the lyrical hero's emotional anguish and anxious thoughts arising from the ecological disaster are conveyed through his address to the approaching new year and his confession with the new year. This poem resonates with I. Yusupov's "Jan'a a'sirge" and Sh. Ayapov's "A'sir menen da'rtlesiw" in terms of its method of conveying thought. The lyrical hero's anguish with worldly problems is presented in the poem we are analyzing as a confession with the year, a lament, while in the poems of I. Yusupov and Sh. Ayapov, it is presented as a confession with the century.

In one of his scientific articles, the renowned literary scholar P. Nurjanov stated, "At present, the problem of environmental protection cannot be separated from the issue of conscience. Because only now, when people rely on their conscience and act, can we firstly preserve ourselves and our environment, Mother Nature," (Nurjanov.1993). Indeed, when we studied the reflection of the

ecological issue in J. Izbaskanov's lyrics, we observed that the poet's problem of humanity and nature cannot be separated from issues of conscience and humanity.

In the poet's poem "Sahranin' su'wreti," the lyrical hero's emotional experiences are conveyed through his sharing secrets with the desert.

Үнсиз құдиретиңе кеткенбиз көнип,	We adapted to your silent power,
Шырайы шықпады талай пасылдың,	Many seasons remained unfavorable,
Қанша тарийх бетин қойғансаң көмип,	You've buried so many pages of history.
Зулымлық, даңқ, апат... бәрин жасырдың.	Tyranny, glory, disaster... you hid it all.
Ал, мен бир тилекти тилеймен көптен,	Well, I have a long-standing wish.
Ул-қызларым ҳаққы зәрре шегин деп,	For the sake of my sons and daughters,
От ҳәм суў бәлеси, қыйратып кетпең,	slightly.
Жаңа эрамыздың келешегин деп.	Fire and water trouble, don't destroy.
(Избасқанов.1993)	For the future of our new era.

Through the lyrical hero's thoughts and experiences, his character becomes clearer. He/She is familiar with the nature and history of his/her birthplace. The land where he lives - the desert - has endured so much tyranny, vanity, and disaster from the people. The lyrical hero, as a pure-hearted, truthful person, desires the desert to retreat and worries about our land turning into sand.

In poet's poems "Qumlar," "Turan. XXI a'sir a'rmani," "Na'ylajliq," "Xalqim," and others, the ecological problem is depicted in a mixture of publicisrm and elegiac thoughts.

In the poem "Qumlar," he uses sands as a figurative detail to convey the lyrical hero's reflections on the ecological disaster.

Әсирлерден пинҳамы сақлап,	Keeping secret from centuries,
Сырларыңды аян етпейсең,	You don't reveal your secrets.
Я өтмиштен азғана датлап,	A little bit from the past,
Халық тарийхын баян етпейсең.	You don't tell the history of the people.
Сөйтип баян етеди бәрин,	Thus he explains everything.
Жағалай ел қонғанын бунда,	The people settled here along the shore.
Жәйҳун дәрья бурып аңғарын,	The Amu Darya, turning its direction,
Елдиң бүлгин болғанын бунда.	This is where the destruction of the land lies.
(Избасқанов.2014)	

The poem presents the lyrical hero's thoughts on the origins of today's ecological disaster. The lyrical hero, "conversing" with the sands, artistically reflects on how the diversion of the Amu Darya's waters into the sands led to such great destruction.

Бул әтирапта – суў емес, еспе қум толған,	Surrounding wasn't water, but drifting sand.
Бәрибир аңсайман бәҳәрдиң паслын,	Still, I long for the spring season,
Саҳрайы кеңликлер, бийүмит болмаң,	Desert expanses, don't despair,
Түсиңизге енип қанатлы тасқын.	A winged flood entering your dream.
(Избасқанов.2014)	

The poem concisely expresses the poet's current turbulent feelings regarding the ecological disaster in short lines. In these short lines, the lyrical hero's hopes and worries for the future of the people are reflected. Through the line "I still long for the spring season," the poet conveys the lyrical hero's optimistic thoughts about the future.

Күнине мың рет қыйнап тәғдириң,	Torture your fate a thousand times a day.
Қыялымды ар-сар қыласаң, халқым,	You disturb my thoughts, my people.
Дузлы тозаң жутып бүгин ҳәр бириң,	Each of you, swallowing salty dust today,

Әттең, нәйлаж иштен тынасаң, халқым . (Избасқанов.2014)	Alas, you’ve no choice but to rest from within, my people.

These lines, taken from the poem " Xalqim," express the lyrical hero's anxious thoughts about the fate and future of the people with profound thoughtfulness and bold depiction of the realities of life. The poem artistically depicts the description of the era, its pressing issues and problems, high aesthetic feelings, and reflections on the problems of humanity and nature. In conveying lyrical content, the detail "salty dust" was successfully chosen and performed a special poetic function.

We observed that the rhetorical question method was most effectively used in the poet's poems on the theme of ecology. In our opinion, the reason for this is likely that the poems on this topic were primarily created with the desire to make act the wider public and give readers insight. One of the artistic methods that encourages readers to think and explore is the rhetorical question method.

Шөлистанға келди адамлар, Ҳәм қумларды таслады серпип, Деди: суўға ынтық булманлар, суўды ашты, суўды ашты. Батпақлыққа айландырғанша. Енди қумлар уйтқып сорайды меннен, Батпақлықта жасай аласаң ба? Оған не деп жуўап беремен? (Каримов.1991)	People came to the desert, And they scattered the sands, He said, "Don't yearn for water. opened the water opened the water. Until it turns into a swamp. Now the sands swirl and ask me, Can you live in a swamp? What should I say to that?

The poet's poem titled "Na’ylajliq" reflects the feelings of pity for the fate of the people and future generations related to the ecological disaster.

Мәкан басқан Аралқумның қасында, Бүгин тамшы суўға зар бул қарекең, Әлем жаралғалы инсан басында, Усы нәйлажлық деген бар екен. Нәйлаж болғаным бар өткен күнлерде, Өзим ҳәм улымнан айырылып қалып, Арзымды айтарман енди кимлерге? Енди өмирим бойы өтермен налып… Аралынан айрылған халық – МЕН! (Избасқанов.2014)	Near the settled Aralkum, Today, this people yearn for a drop of water. Since the creation of the universe, on humankind’s head. There's such a thing as helplessness. I have been helpless in the past days. Having lost myself and my son, Who will I tell my plea now? Now I'll spend my whole life lamenting... The people lost Aral are ME!

A special type of artistic device, synecdoche, is used in the poem. Through synecdoche, the poet portrays the entire people lost the Aral Sea through the lyrical hero's "I." Through this, he transfers the sorrows and pains of the entire people to the lyrical hero, transforming them into a figure living with this pain, a bearer of the people's pain. In embellishing the content of the poem, the poet uses such a technique that he psychologically parallels the tragedy in the lyrical hero's personal life, that is, the tragedy of losing a child, with the tragedy of losing nature. As a result, the poet elevates the Aral Sea problem to the level of each person's personal suffering.

Conclusion

Our poets, promptly addressing the ecological problem in their poems, continue to raise awareness among the wider public about the consequences of the disaster. Furthermore, poets, through their poems on this theme, provide spiritual support to our people and fulfill aesthetic functions such as inspiring confidence and hope for the future. Among the poets who have diligently fulfilled this civic duty, paved by I. Yusupov, are K. Karimov and J. Izbaskanov.

In K. Karimov's lyrics, the depiction of social contradictions in society is deepened through the combination of lyrical and journalistic methods in his poems on the theme of ecology. This is

evident in the deepening of the tragedy in the poem's content, the sharpening of meditative thinking, and its elegiac nature.

The poet J. Izbaskanov, who is closer to nature in terms of artistic thinking and a confidant of nature, also has his own signature in depicting the theme of ecology. In a series of poems, the poet reflects the emotional turmoil of the lyrical hero caused by the ecological disaster. The poet boldly speaks about the causes of the disaster, presenting the bitter truth of the times.

The artistic explorations of our poets in reflecting the environmental problem are also noteworthy. In K. Karimov's lyrics, mostly, methods of giving attractive lyrical plot, and conveying thought, and artistic details serve to effectively convey the tragic state of the lyrical hero's inner world and feelings of loss. The artistic explorations in J. Izbaskanov's poems also play an important role in revealing the image of the lyrical hero and deepening the journalistic spirit.

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Rezyume: *Maqolada sovet davrida tabiatdan noto‘g‘ri foydalanish natijasida yuzaga kelgan Orol muammosi va uning kelib chiqishi haqida so‘z boradi. Jamiyatimiz tarixida inson va tabiatning o‘zaro ta’siri, ya’ni O‘rta Osiyo mintaqasida paxtadan yuqori hosil olish maqsadida yerlarning haddan tashqari o‘zlashtirilishi natijasida Orol dengizining qurishi va mintaqa tabiiy iqlimining keskin o‘zgarishi ekologik muammoning kelib chiqishiga sabab bo‘ldi. Xalqimiz kelajagiga tahdid solayotgan bu muammo adabiyotning asosiy mavzularidan biriga aylandi. Natijada adabiyotda ushbu muammolarning ildizini aks ettiruvchi hodisalardan biri ekopoetik bo‘lib u qoraqalpoq she’riyati misolida o‘rganildi.*

Резюме: *В статье обсуждается проблема Аральского моря, возникшая в результате неправильного управления природой в советское время, и ее истоки. Взаимодействие человека и природы в истории нашего общества, то есть чрезмерное освоение земель с целью получения высоких урожаев хлопка в Среднеазиатском регионе, в результате высыхания Аральского моря и резкого изменения природного климата региона стали причиной возникновения экологической проблемы. Эта проблема, угрожающая будущему нашего народа, стала одной из главных тем литературы. В результате одним из явлений, отражающих корень этих проблем в литературе, стало экопоэтическое явление, которое было изучено на примере каракалпакской поэзии.*

Kalit so‘zlar: *Qoraqalpoq adabiyoti, qoraqalpoq lirikasi, ekopoetik hodisalar, ekologik muammo, lirik qahramon.*

Ключевые слова: *Каракалпакская литература, каракалпакская поэзия, экопоэтические явления, экологическая проблема, лирический герой*

REFLECTION OF EMOTIONAL UNITS IN SYNTACTIC AND PRAGMATIC STRUCTURES OF ENGLISH AND KARAKALPAK LANGUAGES

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Summary: *This article deals with the reflection of linguistic units within the syntactic and pragmatic structures of the Karakalpak and English languages. Through comparative and descriptive methods, it investigates how meaning is constructed via sentence organization and pragmatic features. The results indicate that Karakalpak employs morphological markers and flexible word order to express pragmatic meaning, whereas English relies on fixed word order and prosody. Overall, both languages demonstrate universal principles connecting syntax and pragmatics, while reflecting their distinct cultural and cognitive frameworks.*

Key words: *Karakalpak language, English language, syntax, pragmatics, comparative linguistics*

This article thoroughly analyzes how emotional units are formed at the syntactic and pragmatic levels, their role in communicative processes, and their functional capabilities. Having determined in what verbal forms emotions are expressed in phonetic and lexico-semantic systems, this paragraph reveals their structure at the sentence level and their function in the context of communication. At the syntactic level, emotionally charged sentences (emotional sentences): rhetorical questions, repetitions, inversions, exclamatory sentences, syntactic constructions that enhance expressiveness (for example, "What a wonderful day it was!"), the influence of emotionality on the structure of the sentence (emotional component at the beginning of the sentence, stressing means) are studied.

From a pragmatic perspective, these are emotional expressions related to the speaker's and listener's psychological state, differentiated expression of emotionality based on context, and ways of conveying emotional states through pragmatic tools such as expressiveness, manipulation, and empathy in the communication process.

This paragraph analyzes the high-level communicative functions of emotional units in the previously analyzed phonetic and lexical systems, thereby completing the theory of the integration of emotional units into an integral system in language. At the same time, it is closely related to pragmalinguistic, stylistic, and discourse analysis and can serve as a theoretical source.

The emotive possibilities of language are widely expressed not only at the lexico-semantic and phonetic levels, but also in syntactic and pragmatic structures. This process, formed at the intersection of linguistics, cognitive linguistics, and psycholinguistics, requires the study of how a person's inner world is expressed in language. At the syntactic level, emotions are expressed through sentence structures, grammatical devices, intonational changes, inversions, rhetorical and elliptical constructions.[1] For example, exclamatory sentences or repetitions in speech are grammatical verbalization of feelings, moods, and personal feelings. These constructions, in addition to directly conveying emotional content, also acquire aesthetic and stylistic value.

In pragmatic structures, however, emotional units are manifested in the context of communication, in the goals and conditions of interpersonal communication. At this level, feelings, social status, cultural code, and communicative intention are inextricably linked. Pragmatics studies the expression of emotions through speech acts (question, command, desire, promise), speech functions (information exchange, evaluation, influence), as well as intonation, pauses, and tempo. Within the pragmatic approach, emotional units are defined not only as tools of the language system but also as a complex system of signs expressing a person's psychological state, social position, and cultural competence.

The expression of emotionality in syntactic structures manifests itself in structural forms, where the state of feeling is reflected not only through grammatical norms in the language, but also in harmony with the social and cultural contexts of the speech structure:

Interjections such as "Oh!," "Oh, if only!," and "Oh, my heart!" are direct expressions of emotional state. As noted by L.K. Parsiyeva (2009), such units often have an interactive (i.e., directed at expressing emotion) character.[2.84-89]

Rhetorical questions and repetition - although these forms are syntactically simple sentences, they are distinguished by high emotional meaning: "Do I really need to do that?"

Syntactic inversions - that is, emphasis through a change in the usual word order, for example: "He left, he took my heart away..."

Elliptical sentences serve to intensify emotional states: "So..." I... I can't even find the words.

Compound sentences and short dialogues - especially in fiction, the expression of emotions through dialogue is common. For example: "Is that you?" he said, trembling.

O.V. Aleksandrova notes that expressive syntactic devices, such as exclamatory sentences, rhetorical forms, repetitions, and inversions, are particularly actively used in literary texts because they not only semantically describe the author's or character's emotional state but also deeply reflect it stylistically and aesthetically.[3] Through these tools, language conveys sensory experiences not directly, but through connotative, that is, hidden, contextual meanings, thereby evoking a strong psychological resonance in the reader. Therefore, expressive syntax is considered one of the main constructive elements that enhances the emotional coloring of artistic speech.

Pragmatically, the expression of emotions arises in the context of communication. In this case, the necessary aspect is the identification of intonational and social signals, the perception of emotional meaning through communicative intention and speech function.[4] For example, a pause in a sentence, a low tone in pronunciation, or the speaker's facial expression, or a body movement act as pragmatic components that enhance emotion. A simple syntactic unit in a sentence, such as "Are you leaving?!" can take on the meanings of surprise, anxiety, or even warning, depending on the intonation and context. The given example is a simple syntactic unit expressing emotional richness, the interpretation of which is based on intonation and context. Although this sentence structure is a simple interrogative sentence, there are several reasons why it takes on an emotional tone:

Yapirmay: If the stress falls on the word "sen" (you) in the sentence and the connection of sounds is elevated, this means "yapirmay" in response to an unexpected situation.

For example: If someone usually never comes out in the evening, they might ask, "Are you leaving?!"

Anxiety: If the intonation is soft and low, this indicates anxiety or unease.

For example: When someone close to you is leaving, and it happens unexpectedly, at an inappropriate time, there is a sense of anxiety: "Are you leaving?!" - that is, "Why are you leaving right now, why are you leaving?"

Warning / anger: If the rhymes are high, sharp, and sung with pauses, this sentence can express a warning or displeasure.

For example: When someone gets up without permission and asks, "Are you leaving?!" the meaning "Who gave you permission?" is hidden.

This example demonstrates the pragmatic and intonational features of language. That is, the same syntactic structure can express different emotional meanings. Therefore, when analyzing emotional units, it is necessary to consider factors such as context, intonation, and the participation of communicants. This is one of the main directions of emotive pragmatics in linguistics.

This situation becomes even more complex within the framework of international or intercultural communication. Because in every culture there are specific verbal and nonverbal normative forms of expressing emotion. E.V. Dimitrova indicates that the Russian emotional concept "Тоска" does not have a full French equivalent. Because the Russian word "Тоска" has deep psychological and cultural layers, it encompasses many feelings, such as loneliness, sadness, life's anxiety, and even philosophical emptiness[5]. In French, these different components are expressed in a distinct form through words like "tristesse," "chagrin," and "angoisse." This means that the pragmatic meaning of emotional units is always directly related to context and cultural reason.

At the same time, emotional expression often finds its expression through speech acts (question, command, wish, promise). For example, a sentence expressing desire, such as "Please,

listen to me," or the imperative sentence "Don't do this to anyone else!," is not just a grammatical tool, but also arises on the basis of emotional space. The speaker's mood, characteristic social role, and psychological state enrich the semantics of the speech act. In particular, interrogative sentences like "Why didn't you forgive me?" or "Is that all?" convey not only a question but also pain, despair, or warning.

Request: Please, just listen to me.

Although this sentence is syntactically a simple sentence expressing a request, in that case it expresses a feeling of hope, sorrow, or anxiety. Depending on the context, this statement is also considered a request or a last resort.

Command (Order): Never do that again!

This imperative sentence, controlling grammatical norms, may indicate anger, resentment, or taking control. This is not just a warning, but a response to a feeling.

Question: Why didn't you forgive me?

Although this sentence is grammatically a simple question form, it mainly expresses regret, pain, or despair. The pragmatic power of a speech act lies in its emotional context.

Is it really over between us?

This question also signifies distrust, hope, or disappointment. At the same time, this is not a simple knowledge of a fact, but a reflection of a mental state.

Promise/Hope (Promises/intentions): I will never hurt you again.

This sentence not only uses the grammatical meaning of "promise" in the future tense but also expresses regret, apology, and emotional loyalty. The power of the speech act lies not only in the content but also in the emotional intention.

These examples of speech acts are often expanded semantically based not only on grammatical categories but also on psychological conditions, social context, and personal circumstances.

In the research of V.I. Shakhovsky and N.A. Bagdasarova (2004), through pragmatic content, emotions participate as a means of interpersonal influence, that is, their significance as a means of social manipulation, empathy, and conflict management is shown. That is, emotional speech acts are used in communication to attract the listener's feelings from one side, to influence them, to evoke sympathy, or to change attitudes. For example, in the sentence "You never understood me!" there is not only disagreement, but also a feeling of guilt and anguish. This demonstrates that speech acts perform not only a communicative but also a psychological and sociocultural function.[6]

Another important aspect of pragmatic expression is intonational pragmatemes. Intonation, that is, the way the speaker speaks, pauses, changes in pitch, rhythm, and tempo, is an essential tool for conveying emotions. Through this, the speaker can express their psychological state, attitude, or inner feelings directly or indirectly. For example, the harmony of sounds in the sentence "Have you come?!" can indicate a slight surprise, but if the pitch is raised, it is perceived as anger or displeasure.[7.93-98]

In a state of anger, words are spoken sharply, quickly, sometimes with a pause: "I said it! Why did you make another mistake?" - in such speech, emotion is expressed through loudness, speed, and rhetorical emphasis. In joyful moments, the pitch of the voice increases, the harmony of sounds rises, and the speech becomes soft and melodious: "Oh, what wonderful news!" - in this case, the intonation introduces a sense of surprise and cheerfulness into the speech.

Below are examples in English used for the two states you described - anger and joy. In each example, the emotional state is enriched with intonation, speed, pauses, and stylistic devices.

In case of anger (Anger):

Example: "I told you already! Why did you do it again?!

In this sentence, intonation is high, rapid, and usually conveyed with pauses (especially in the phrase "I told you - already!").

In the question "Why did you do it again?!" the rhythm and stress are strong.

Such sentences reflect emotional reactions such as anger, displeasure, and control.

At the same time, the sentence is in the form of a rhetorical question, expressing accusation and anxiety.

Joy/Excitement

Example: "Wow, what an amazing piece of news!

"Wow" at the beginning of a sentence intensifies emotion through intonation and a high tone of voice.

The phrase "What an amazing piece of news!" has a melodic, soft voice, and a positive intonation.

Here, the intonation is raised, the sentence is spoken in harmony with musical sounds, which reflects a state of surprise and joy.

The connection of sounds between words signifies peace and tranquility.

Although these examples are simple in sentence structure in English, they possess a deep emotional meaning through intonational and stylistic devices. In particular, rhetorical questions, intonational stresses, and phonetically elongated words enhance the emotional impact.

Thus, intonational pragmatemes are linguistic tools that are not semantically expressed but carry a rich pragmatic meaning. They directly affect not only the content of the sentence, but also the effectiveness of communication, the recipient's reaction, and the entire communication process.

Emotional units are not only units within the language system, but they also come alive in context. In her research, philologist N.A. Bagdasarova analyzes emotions based on regulated (i.e., consciously expressed, controlled situations) and unregulated (instinctive, reflexively occurring) psychophysiological components and examines their resulting reactions at the sentence level from a pragmatic perspective.[8] For example, in the sentence "I got scared!," subjective emotional experience is formed through the evaluation mechanism of events, where the speaker's inner state is expressed as a response to a feeling of reality.

At the same time, "He/She/It has come again..." In sentences like "Uf!," emotion is expressed not only through the lexical device "Uf," but also through ellipsis (abbreviation of a sentence), pause, and context. Through such examples, it can be seen that emotional units are based not only on lexical elements in language but also on a system of contextual and psychological features. Or, the pause in the sentence "Everything is finished..." serves as a pragmatic tool for expressing a depressed state. Simple structural units within a sentence primarily possess a deep emotional connotation. This demonstrates how emotional units come to life not only within the language system but also within human psychology and communication culture.

Specifically, interactive units like "ah!," "oha!," "voy!," "uff!," "oho!," "uh!," and "bravo!" are direct signals of emotion. In most cases, they are independent sentences within the structure of speech, serving as direct expressions of emotional states.[9.522-525] For example, "Oh, my heart!" - this means not only physical pain, but also psychological impact, feeling, and surprise. "Oh, what have you done?!" - a sudden negative attitude towards the situation; "Ugh, I'm tired" is a nonverbal expression of fatigue and impatience. Such units change the semantic color of the sentence, strengthening its expressive and pragmatic meaning.

According to O.V. Ordulini, such units are emotional operators that influence the overall semantic connotation of a sentence, enriching it with the context of feeling. Their phonetic form - prolongation, repetition, or intonation - also increases the intensity of emotion: for example, "O-ho-ho!" - surprise, "I-i-i!" - anxiety or disgust, "Uff!" - fatigue or displeasure. At the same time, they also have a social connotation and can be understood ironically, mockingly, or sincerely, depending on the context. The stylistic role of these units is highly valued in artistic, dramatic, and literary genres.

Thus, the syntactic and pragmatic expression of emotional units is a high-level, multifaceted manifestation of emotionality in language. In syntactic structures, they express a person's mental state, subjective evaluation, and inner feelings through grammatical devices such as exclamatory sentences, rhetorical questions, inversions, repetitions, and elliptical structures. These structures perform not only logical but also stylistic and expressive functions. At the pragmatic level, emotional units are formed through the context of communication, speech function, communicative intention, intonation, pause, and interpersonal social relations.

These forms of expression demonstrate the dependence of the speech process not only on the language system but also on human psychology, cultural experience, and thinking. Interjective tools,

culturally defined emotional stereotypes, and evaluative forms of speech characteristic of the national mentality all contribute to conveying emotional content within the framework of syntax and pragmatics. When analyzing emotional units, it is necessary to approach them at the intersection of philology, cultural studies, sociology, psychology, and cognitive sciences. This demonstrates the interdisciplinary nature of this phenomenon, its universal and national characteristics.

In conclusion, this comparative analysis reveals that while English and Karakalpak employ distinct syntactic and pragmatic structures, they share a universal goal: the effective encoding and communication of emotional units. The differences, rooted in their unique grammatical systems and cultural contexts, highlight the profound connection between language structure and the expression of human emotion.

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Rezyume: *Maqolada Qoraqalpoq va ingliz tillarining sintaktik va pragmatik tuzilmalarida lisoniy birliklarning aks yetishi haqida so‘z boradi. Qiyosiy va tavsiflovchi usullar yordamida jumlalarni tashkil etish va pragmatik xususiyatlar orqali ma’no qanday tuzilishini o‘rganadi. Natijalar shuni ko‘rsatadiki, Qoraqalpoq tilida pragmatik ma’noni ifodalash uchun morfologik belgilar va moslashuvchan so‘z tartibi qo‘llaniladi, ingliz tili esa qat’iy so‘z tartibi va prosodiyaga tayanadi. Umuman olganda, ikkala til ham sintaksis va pragmatikani bog‘laydigan universal prinsiplarni namoyish etadi, shu bilan birga ularning madaniy va kognitiv asoslarini aks ettiradi.*

Резюме: *В данной статье рассматривается отражение языковых единиц в синтаксических и прагматических структурах каракалпакского и английского языков.*

С помощью сравнительного и описательного методов исследуется, как формируется значение помощью организации предложения и прагматических особенностей. Результаты показывают, что каракалпакский язык использует морфологические маркеры и гибкий порядок слов для выражения прагматического значения, в то время как английский язык полагается на фиксированный порядок слов и просодию. В целом, оба языка демонстрируют универсальные принципы, связывающие синтаксис и прагматику, и в то же время отражают различные культурные и когнитивные рамки.

Kalit so‘zlar*: Qoraqalpoq tili, ingliz tili, sintaksis, pragmatika, qiyosiy tilshunoslik*

Ключевые слова: *каракалпакский язык, английский язык, синтаксис, прагматика, сравнительная лингвистика.*

THE MAIN THEORETICAL PRINCIPLES OF LINGUOCULTUROLOGY

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Summery: *The article explores the main theoretical principles of linguoculturology as an independent discipline at the intersection of linguistics and cultural studies. It examines the fundamental concepts of the interrelation between language and culture presented in the works of W. von Humboldt, E. Sapir, B. Whorf, A. Wierzbicka, and others. The study emphasizes that language functions not only as a means of communication but also as a vital instrument for preserving and transmitting cultural values. Linguoculturology is defined as a field that investigates the ways in which culture is reflected in language and how linguistic worldviews are formed.*

Key words: *linguoculturology, language and culture, national worldview, cultural code, concept, intercultural communication, value orientations, linguistic personality, ethnoculture, semiotics of culture.*

The problem of the interrelation between language and culture is one of the central issues in linguistics. Attempts to address this problem can already be found in the works of prominent linguists such as W. von Humboldt, A. A. Potebnya, Ch. Bally, J. Vandries, I. A. Baudouin de Courtenay, R. O. Jakobson, and others. According to W. von Humboldt's concept, "material and spiritual culture are embodied in language; the national character is manifested in language through a specific worldview. Every nation's language possesses its own inner form, which serves as an expression of the 'national spirit.'"

E. Sapir, in turn, notes that "the system of cultural models of a given civilization is fixed in the language that expresses this civilization" [6; 117].

The issues of interaction between language and culture have been developed in the works of such well-known scholars as Yu. M. Lotman, E. M. Vereshchagin, V. G. Kostomarov, C. Lévi-Strauss, Yu. N. Karaulov, V. A. Maslova, V. N. Toporov, as well as in the studies of L. G. Sayakhova, L. M. Zaynullina, and S. V. Ivanova.

The problem of the relationship between language and culture was also addressed by Russian scholars such as S. A. Atapovsky, G. A. Brutyan, E. I. Kukushkin, and E. S. Markaryan. The influence of culture on language is evident; however, the question of the reverse influence of language on culture remains open. Prominent scholars of the 19th century, such as W. von Humboldt and A. A. Potebnya, viewed language as a spiritual force.

Within this framework, the problem was explored by the school of E. Sapir and B. Whorf, as well as by various neo-Humboldtian schools, which developed the so-called *hypothesis of linguistic relativity*. The central tenet of this hypothesis is the belief that people perceive the world through the prism of their native language.

From this approach emerged a new field in linguistics — *ethnolinguistics* — which arose in the first third of the 20th century and is associated with the names of F. Boas and E. Sapir, who studied the languages and cultures of Native American peoples lacking a written tradition. The hypothesis of linguistic relativity was further developed in L. Weisgerber's theory, particularly in his concept of language as an "intermediate world."

Linguistic units that possess cultural and national specificity have their own ways of reflecting it in language, while concepts, stereotypes, standards, symbols, and mythologemes serve as signs of universal human culture as assimilated by the people who speak the language. Thus, culture and language are forms of consciousness that reflect a person's worldview.

According to V. N. Teliya, "culture is a kind of historical memory of a people" [12; 226]. Owing to its cumulative function, language preserves this memory, ensuring a dialogue between generations from the past to the present. The phraseological system of a language embodies the cultural and national worldview. In this light, phraseological units acquire the role of cultural stereotypes.

Researchers also include the paremiological corpus among such stereotypes, since proverbs can be regarded as expressions of a people's collective self-awareness. Proverbs represent the age-old language of everyday culture, which concisely reflects the categories and principles of a people's life philosophy—the philosophy of the speakers of the language.

Thus, proverbs constitute a kind of "treasury of wisdom" of a people, preserving and reproducing their mentality and, consequently, their culture.

Proverbs and sayings are the subject of study for many linguists engaged in comparative research in phraseology, such as V. G. Gak, D. O. Dobrovolsky, A. V. Kunin, A. G. Nazaryan, Yu. P. Solodub, E. M. Solodukho, and G. Z. Cherdantseva.

In recent decades, there has been a growing tendency to study Russian-language material in order to identify the specific features of the worldview reflected in phraseology. In this regard, the present work attempts to model a fragment of the linguistic worldview based on paremiological material from German, English, Russian, Bashkir, and Tatar languages.

The formation of paremiology as a scientific discipline dates back to the beginning of the last century and is primarily associated with the name of A. Taylor, who left behind an enormous theoretical legacy presented in 120 books, articles, and notes on proverbs, sayings, wellerisms, comparisons, and idioms.

It is difficult to trace the further development of paremiology as an independent field, since it was largely shaped by the study of proverbial material from folkloric, cultural-historical, and linguistic perspectives. Among the scholars who have studied paremiological material are M. Kuusi in Finland, G. L. Permyakov, L. Rüdrich and W. Mieder in Germany, and A. Krikmann in Estonia.

"Due to the compression of social experience in proverbs, the national and cultural specificity of a language, as well as its connection with the material and spiritual life of the people and their history, is manifested most vividly. These 'ordinary' expressions, according to F. I. Buslaev, are peculiar microcosms that contain both moral law and common sense, expressed in concise sayings that the ancestors bequeathed to guide their descendants" [11; 27].

The attention given in modern linguistics to the reflection of human cognitive activity in language has led researchers to study proverbs, which embody the social, historical, and everyday experience of the people who speak the language.

The cognitive approach to the study of language distinguishes the works of prominent scholars from Bashkir State University—T. A. Kildibekova, L. M. Vasiliev, R. F. Gazizova, V. I. Ubiiko, and R. A. Karimova. The result of their fruitful research includes publications devoted to the development of the functional-semantic sphere, the systematization of lexical systems in ideographic dictionaries, and the creation of a functional-cognitive dictionary.

The value of employing this new approach in the study of linguistic systems lies in its applicability to the comparative analysis of languages of different structures.

The issue of the correlation and interrelation between language and culture has always attracted considerable interest among linguists who, despite the diversity of their approaches, view culture and language in constant interaction. Modern linguistics seeks to comprehend the cultural consciousness of a particular nation through linguistic means. Most linguists agree that language, as a social phenomenon, should be examined not only from a purely linguistic perspective but, most importantly, from an extralinguistic or cultural standpoint, since language itself is both a part of culture and a "mirror" reflecting its uniqueness and richness.

The complexity of describing the linguistic mechanism arises from the heterogeneity and ambiguity of the language system itself. Language combines the concrete and the abstract, the subjective and the objective, the individual and the collective, the national and the universal. Language helps to understand the uniqueness of human nature. "Language reveals the spiritual essence present in man" [1; 19], and this spiritual essence, as is well known, is connected with culture, conditioned by it, and inseparable from it.

The emergence of linguoculturology as a scientific discipline is primarily driven by the desire to comprehend the phenomenon of culture as a specific form of human and societal existence in the world. Furthermore, the turn to linguocultural studies is motivated by scholars' aspiration to better

understand language in its functioning across all spheres of human activity, particularly in its relationship to culture.

The fundamental principles of the "language–culture" relationship were formulated in the works of W. von Humboldt, L. Weisgerber, F. Boas, E. Sapir, and B. Whorf. These studies served as the foundation for the emergence of linguoculturology as an independent field and are primarily related to philosophy and ethnolinguistics.

The philosophical problem of the interconnection between human thought, language, and culture first received linguistic interpretation in the works of W. von Humboldt. In defining the link between language and culture, Humboldt emphasized their close intertwining with the spiritual development of humanity. Language accompanies humankind at every stage of its development, reflecting each level of culture [5; 48]. However, according to Humboldt, the primary function of language lies not in communication or thought but in its role as an "intermediary" between "the world of external phenomena and the inner world of man" [5; 304].

Following W. von Humboldt, the American linguists E. Sapir and B. Whorf wrote about the determining role of language in the cognition of reality. The "linguistic relativity hypothesis" of Sapir and Whorf — more precisely, its "weak" version — represents one of the theoretical premises underlying linguoculturology. In their works, the relationship between language and culture is characterized by mutual interpenetration — a feature typical of modern linguistic science — yet this relationship is neither straightforward nor symmetrical.

The term *linguoculturology* was possibly first used by one of the founders of cognitive linguistics, Ronald Langacker, who in his statement emphasized the interconnection between cultural knowledge and grammar. He argued that "the emergence of cognitive linguistics can be seen as a return to the linguistics of culture." Central to Palmer's proposition was the idea that "language is a play of verbal symbols based on imagery" [7; 3], and that these images are culturally created.

The research of Anna Wierzbicka continues the long-standing debates on the relationship between language and culture. In this context, Wierzbicka positions herself as a supporter of the Sapir-Whorf theory, since, in her view, each language serves as a unique means of expressing human experience, representing "the best evidence of the reality of culture" [2; 289], and "linguistic data prove decisive in identifying fundamental patterns of thought in different groups of people" [2; 291–292]. By affirming her adherence to Sapir's ideas, Wierzbicka aligns with the scholar's assertions that (1) "language is a symbolic guide to understanding culture," (2) "vocabulary is a highly sensitive indicator of a people's culture," and (3) linguistics "has strategic significance for the methodology of the social sciences" [2; 263]. One of the principles that Wierzbicka formulates in describing lexical semantics is that the development of a language's lexical layer is, among other factors, determined by culture.

In the present study, the most accurate characterization of linguocultural connections is that of mutual interpenetration. This is supported by the shared ontological features of language and culture: "their objective-subjective determination, their connection with human activity, and their link to the historical development of society" [4; 34].

The principle of interdependence and mutual influence of the two systems is manifested in the fact that language is inseparably linked with culture: culture determines the content of linguistic units, which, in turn, shape the behavior of speakers of a given culture [7; 200].

Thus, the concept of the interrelation between language and culture aligns the interests of many human sciences. Transposing Y. N. Karaulov's statement about the linguistic personality to the phenomenon under study, one can say that "this is the overarching idea which, as the experience of its analysis and description shows, permeates all aspects of language study while simultaneously dissolving the boundaries between disciplines that study humans, since it is impossible to study [language] in isolation."

The theoretical possibility of productively synthesizing knowledge about culture, as expressed through language, and of revealing its deeper meaning is provided by the science of linguoculturology. It is in linguocultural studies that culture and language are brought to an equivalent

level, where culture is understood as content and language as the form through which this content exists.

As an independent branch of linguistics directly connected to culture, linguoculturology was established in the 1990s. The previously posed question in linguistics about the relationship between language and culture, according to Émile Benveniste's forecast, takes the form of the triad "language – culture – human personality" in linguoculturology, with the distinction that the last component of this triad is interpreted within linguoculturology as the "linguistic personality."

By its nature, linguoculturology is a "borderline science, positioned at the intersection" of linguistics, ethnography, folklore studies, cultural studies, and sociology, "relying heavily on their sources and achievements and employing, like many other modern scientific disciplines, interdisciplinary methods." In a similar vein, V. V. Vorobyev defines this field in linguistics as a complex, synthetic scientific discipline that reflects the interaction of language and culture as "an integrated structure of units in the unity of their linguistic and extralinguistic (cultural) content" [3; 36]. Moreover, Vorobyev specifies his definition by noting that linguocultural research employs systematic methods and is oriented toward "contemporary priorities and cultural norms (a system of standards and universal human values)" (ibid.).

The object of linguoculturology, in the expressive words of V. V. Krasnykh, is "language as a reflection and fixation of culture, and culture through the prism of language" [8; 12]. However, while cultural studies investigates human self-consciousness in its relation to nature, society, history, art, and other spheres of social and cultural existence, and linguistics examines the worldview encoded in language in the form of mental models of the linguistic picture of the world, linguoculturology places language and culture on an equal footing in their dialogic interaction. Focusing on the manifestations of the interplay between language and culture, linguoculturology, as a philological discipline, studies the "pre-selected set of spiritual values and the experience of the linguistic personality of a given national-cultural community" [8; 41].

Thus, the subject of investigation in linguoculturology consists of "units of language and discourse possessing culturally significant content, serving as the 'channel' through which we can access the cultural-historical layer of the mental-linguistic complex" [9; 12]. These may include language units that have acquired symbolic or figurative-metaphorical significance in culture and that generalize the results of human consciousness recorded in myths, legends, rituals, proverbs, and also in poetic and prose literary texts [10; 36].

The goal of linguoculturology is to study and describe the cultural space "through the prism of language and discourse" [9; 13]. Using linguistic data as its basis, linguoculturology is "tasked with establishing the fundamental oppositions of culture encoded in language and manifested in discourse; the representations of humanly-cultivated spheres—spatial, temporal, activity-related, etc.—reflected in the mirror of language; and the most ancient ideas, emerging through the prism of language, which correspond to cultural archetypes" [9; 13].

An important task of linguoculturology is not so much to identify which cultural facts are expressed through language, but to determine the ways in which language develops to express culture. In other words, linguoculturology seeks to study the methods of "lexicalization" [2; 57] through which "language embodies, preserves, and transmits culture" [10; 30], focusing on how the diverse forms of cultural existence of various ethnic groups are reflected and codified in language. In this approach, language is understood both as a product of culture and as its producer, as an essential component of culture, and as a factor in the formation of cultural codes. In other words, language functions as one of the fundamental foundations for the existence and functioning of culture.

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Rezyume: *Maqolada tilshunoslik va madaniyatshunoslik kesishgan nuqtasida shakllangan mustaqil fan sohasi — lingvokulturologiyaning asosiy nazariy tamoyillari tahlil qilinadi. V. fon Gumboldt, E. Sepir, B. Uorf, A. Vejbitskaya va boshqa olimlarning til va madaniyat o‘zaro bog‘liqligi haqidagi nazariyalari o‘rganiladi. Til faqat aloqa vositasi emas, balki madaniy qadriyatlarni saqlash va uzatishning muhim mexanizmi sifatida talqin qilinadi. Lingvokulturologiya til orqali madaniyatning qanday ifodalanishini va milliy dunyo manzarasining shakllanish xususiyatlarini o‘rganadigan fan sifatida yoritiladi.*

Резюме: *В статье рассматриваются ключевые теоретические основы лингвокультурологии как самостоятельного научного направления, находящегося на стыке лингвистики и культурологии. Анализируются основные концепции взаимосвязи языка и культуры, представленные в трудах В. фон Гумбольдта, Э. Сепира, Б. Уорфа, А. Вежбицкой и других ученых. Отмечается, что язык выступает не только средством общения, но и важнейшим механизмом хранения и передачи культурных ценностей. Лингвокультурология трактуется как наука, исследующая способы отражения культуры в языке и особенности формирования языковой картины мира.*

Kalit so‘zlar: *lingvokulturologiya, til va madaniyat, milliy dunyo manzarasi, madaniy kod, konsept, madaniyatlararo muloqot, qadriyat yo‘nalishlari, til shaxsiyati, etnomadaniyat, madaniyat semiotikasi.*

Ключевые слова: *лингвокультурология, язык и культура, национальная картина мира, культурный код, концепт, межкультурная коммуникация, ценностные ориентиры, языковая личность, этнокультура, семиотика культуры.*

MORPHOLOGICAL STRUCTURE OF ENGLISH BORROWINGS IN THE RUSSIAN AND KARAKALPAK LANGUAGES

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Summary: *The article analyzes the morphological and word-formation structure of Anglicisms borrowed by the Russian and Karakalpak languages. The study aims to identify the peculiarities of their adaptation and assimilation within the systems of the recipient languages. Special attention is given to derivational mechanisms, types of affixation, and word-formation models characteristic of each language system.*

Key words: *anglicisms, borrowing, word-formation structure, derivation, affixation, Russian language, Karakalpak language.*

Introduction. Each language, using its inherent capabilities, forms new lexical units, which over time enrich its vocabulary. The process of creating new words occurs through certain methods and regularities. Comparing the word-formation methods of two languages, one can observe correspondences: (a) morphological and lexico-syntactic methods in Russian and morphological and morpho-syntactic methods in Karakalpak; (b) morpho-syntactic and lexico-semantic methods in Russian and lexico-semantic methods in Karakalpak.

Despite the similarity of word-formation methods, each of the two languages exhibits its own characteristic differences, which can be traced in the study of the parts of speech in each language.

Methods. The study employed the following methods: comparative, morphological, etymological, descriptive, linguistic observation and generalization, as well as contextual analysis.

Analysis. In Russian, the formation of nouns using suffixes is a productive phenomenon. Borrowed English words acquire new semantic meanings through the word-formation and inflectional suffixes of Russian and Karakalpak. Below, we will examine the word-formation systems of the two languages comparatively and attempt to reveal their characteristic aspects.

- The Russian suffixes *-чик, -щик* correspond in Karakalpak to the noun-forming suffixes *-шы, -ши* (it should be noted that some words retain their original form as in Russian): бульдозерщик – бульдозершы, инстаграмщик – инстаграмшы.
- The Russian suffixes *-ист, -ик, -ец, -инец, -евец, -овец, -ник* are rendered in Karakalpak with the suffixes *-шы, -ши*: конгрессионалист – конгрессионалистшы, лейборист – лейбористшы, диэлектрик – диэлеуктрикшы, etc. (some words may also be used without translation, e.g., бейджик – бейджик).
- In forming the feminine gender or in naming male professions, Russian uses suffixes *-щиц(а), -чиц(а), -(н)иц(а), -к(а), -овк(а)*. Karakalpak, however, does not have grammatical gender.
- Russian suffixes *-ств(о), -еств(о)*, indicating state or service, are translated into Karakalpak with *-лық/лик*, e.g., лидерство – лидерлик, дилерство – дилерлик.
- Words with the suffix *-изм*, denoting socio-political terms and movements in Russian, remain unchanged in Karakalpak, e.g., гомосексуализм, модернизм, etc.
- Russian nouns are formed not only through suffixes but also with foreign prefixes such as *ультра-, экстра-* and native prefixes *сверх-, раз-/рас-*, e.g., ультра-комфорт, ультра-хит, экстра-шоу. These words generally remain unchanged in Karakalpak.
- Foreign prefixes in Russian such as *дез-/де-, контр-, анти-*, which indicate opposition, are replaced in Karakalpak by non-derivative affixes or calqued words, e.g., дезинформация, антивирус, нерезидент.

Before proceeding to the adaptation of adjectives, it is useful to briefly outline the general characteristics of Karakalpak adjectives and adjectives borrowed from Russian-English lexical sources without word-formation processing.

In Karakalpak, as in other related Turkic languages, adjectives are semantically weakly differentiated in relation to nouns and adverbs, which "previously formed a single lexical category of nouns, later divided grammatically into three categories: (a) the substantival, which subsequently emerged as an independent part of speech (nouns); (b) the determinative attributive, which later became an independent part of speech (adjectives); and (c) the circumstantial attributive, which also developed into a separate part of speech (adverbs)" [2, p. 127].

To date, the influence of English borrowings on the development of Karakalpak adjectives has not been thoroughly examined, although a large number of adjectives formed in Karakalpak on the basis of borrowed words contributes to further differentiation and enriches their quantitative composition.

Our research shows that some adjectives are borrowed without any modifications. Such borrowed adjectives can be conditionally divided into two groups: the first group includes words that have fallen out of use, i.e., replaced by Karakalpak equivalents or whose Russian endings have been replaced with Karakalpak affixes; the second group consists of words widely used in modern Karakalpak in their Russian form.

Adjectives in the first group, related to military, administrative, and socio-political concepts, were mostly borrowed in the late 20th century, e.g., венчурный (venture), парламентарный (parliamentary), суперсегментный (super-segmental), etc. Some of these adjectives are currently subjected to word-formation processes, with the Russian endings replaced by Karakalpak affixes, e.g., венчурный – венчурлы, парламентарный – парламентлы, суперсегментный – суперсегментлы, etc.

The second group includes adjectives widely used in contemporary Karakalpak without modification and retaining their affixes, e.g., комплексный (complex), комфортный (comfortable), офисный (office), кофейный (coffee-related), etc.

Observations indicate that the number of adjectives borrowed without modification is limited and significantly smaller than that of adjectives formed using Karakalpak word-formation elements based on borrowed words.

The formation of adjectives from borrowed word stems follows patterns similar to the word-formation models of native Karakalpak adjectives. In Karakalpak, two traditional methods of adjective formation are recognized: morphological (synthetic) and syntactic (analytic). N. A. Baskakov also identifies a third method – lexical. Without delving into the full classification of adjective-formation methods, we will focus on the main ways adjectives are formed from borrowings. In the formation of adjectives, as with nouns derived from English words, the morphological method predominates, i.e., new adjectives are formed using Karakalpak affixes or by truncating Russian suffixes and endings [7, p. 126].

In the formation of adjectives from borrowings, the most productive word-formation affixes of Karakalpak are involved. The bases for affixally formed new Karakalpak adjectives are borrowed English nouns.

The most productive method for forming adjectives from borrowings is the affixal method. In our study, we analyzed the Russian and Karakalpak affixes that actively participate in the word-formation adaptation of Anglicisms.

In Russian, adjectives are formed from nouns using suffixes such as *-н*, *-ск*, *-ан/-ян*, *-ист*, *-аст*, *-ат*, *-ов*, *-ин*, *-ий*, etc. However, not all of these suffixes are employed in forming adjectives based on Anglicisms. The main productive Russian suffix for forming adjectives from Anglicisms is *-н*. Depending on its meaning, its Karakalpak equivalents are the suffixes *-лы*, *-ли*, *-қы/-қи*, *-ғы/-ғи*. In some cases, when the suffix *-н* indicates possession or relation, it is replaced in Karakalpak by the genitive form (izafet) of the first noun:

- офшорная зона – офшор зонасы (offshore zone)
- сервисный центр – сервис центры (service center)
- чартерный рейс – чартер рейсы (charter flight)

In Russian, relational adjectives are formed using suffixes *-ск*, *-ческ*, *-овск*, *-инск*. In Karakalpak, these are replaced either by the izafet form or by the suffixes *-лық/-лик*:

- боксерский турнир – боксерлық турнир (boxing tournament)
- диджейский пульт – диджей пульты (DJ console)

Suffixes *-ов/-ев*, which indicate possession or relation, are replaced in Karakalpak by *-лық/-лик* or by the izafet form, e.g.:

- допинговый контроль – допинг контроли (doping control)
- тренинговый центр – тренинг центры (training center)

Verbs in Russian are formed from different parts of speech using the following methods: prefixal, suffixal, prefixal-suffixal, and suffixal-postfixal. In Karakalpak, verbs are formed through affixation and the analytic method.

Conclusion. Our generalized analysis shows that, in forming verbs from English words, Russian actively uses the suffixes *-ова, -ева, -ить* as well as the prefixes *-пре, -по, -за*. In Karakalpak, the most productive forms are the affixes *-лаў/-леў, -ла/-ле*. Examples include:

копировать – копиялаў (to copy)
сканировать – сканерлеў (to scan)
имплантировать – имплант ислеў (to implant)
импортировать – импортластырў (to import)
хейтить – хейтлаў (to hate)
чатиться – чатта жазисиў (to chat)
загуглить – гуглда излеу (to google)
запостить – пост койў (to post)

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Rezyume: *Maqolada rus va qoraqalpoq tillariga o‘zlashtirilgan inglizcha so‘zlarning morfologik hamda so‘z yasovchi tuzilmalari tahlil qilingan. Tadqiqot ushbu so‘zlarning qabul qiluvchi tillar tizimidagi moslashuv va assimilyatsiya xususiyatlarini aniqlashga qaratilgan. Ayniqsa, derivatsion mexanizmlar, affiksatsiyaning turlari va har bir til tizimiga xos so‘z yasash modellari alohida e’tibor bilan yoritilgan.*

Резюме: *В статье проводится анализ морфологической и словообразовательной организации англицизмов, заимствованных русским и каракалпакским языками. Исследование направлено на выявление особенностей их адаптации и ассимиляции в структурах*

принимающих языков. Особый акцент сделан на деривационных механизмах, разновидностях аффиксации и моделях словообразования, характерных для данных языковых систем.

Kalit so‘zlar: *anglicizmlar, o'zlashtirish, so'z yasalish tuzilishi, derivaciya, affiksaciya, rus tili, qaraqalpoq tili.*

Ключевые слова: *англицизмы, заимствование, словообразовательная структура, деривация, аффиксация, русский язык, каракалпакский язык.*

COMPARATIVE STUDY OF STYLISTIC AND PRAGMATIC FEATURES OF FAIRY TALES IN ENGLISH AND KARAKALPAK LANGUAGES

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Summary: *This paper explores the stylistic and pragmatic features of fairy-tale texts in English and Karakalpak languages from a comparative linguistic perspective. Drawing upon the theoretical frameworks of pragmalinguistics and stylistics, the study investigates the ways in which linguistic and stylistic devices function as communicative and aesthetic tools within the structure of traditional folk narratives.*

Key words: *fairy tale, pragmalinguistics, stylistics, discourse, speech act, comparative linguistics, Karakalpak, English folklore.*

Fairy tales, as one of the oldest genres of oral folklore, embody the collective worldview, values, and traditions of a nation. Beyond their artistic and moral content, fairy tales represent a rich field for linguistic analysis, revealing the mechanisms through which language conveys cultural meanings and emotional effects. In recent decades, linguists have increasingly focused on pragmatic and stylistic aspects of folklore texts, emphasizing the role of communicative intention, speech acts, and stylistic devices in shaping the narrative and influencing the listener.

The current study is devoted to a comparative linguistic analysis of English and Karakalpak fairy tales, aiming to identify their stylistic and pragmatic commonalities and distinctions. The research contributes to the fields of pragmalinguistics, stylistics, and comparative typology, expanding the understanding of how folklore reflects language-specific and universal communicative patterns.

The theoretical foundation of this study lies in the works of T.A. van Dijk on discourse analysis, H.P. Grice on conversational implicature, and J.R. Searle on the theory of speech acts. According to these scholars, language is not only a system of signs but also a tool for achieving pragmatic goals—expressing intentions, influencing others, and creating social and cultural meaning.

In stylistic terms, the study follows the traditions of G. Leech, I.R. Galperin, and V.A. Kukharenko, who emphasize the artistic function of linguistic devices such as metaphor, epithet, repetition, and alliteration in shaping the aesthetic dimension of texts. Combining pragmatic and stylistic approaches allows for a holistic view of fairy-tale discourse as a dynamic communicative and cultural phenomenon.

The research corpus consists of 100 fairy tales—50 in English and 50 in Karakalpak. The English corpus was drawn from Joseph Jacobs' English Fairy Tales (PSU, 2005) and More English Fairy Tales (Global Grey, 2018). The Karakalpak corpus was compiled from Qaraqalpaq Xalq Ertekleri (Volumes 1–2, Nukus, 2010–2015). The tales were selected based on the following criteria:

Genre: classical magical and everyday tales;

Length: 5–15 pages per story;

Period: 19th–20th centuries.

Both quantitative and qualitative methods were used. The stylistic analysis focused on phonostylistic, lexical, and syntactic devices, while the pragmatic analysis examined speech acts, implicatures, presuppositions, and politeness strategies. Statistical tables were used to identify frequency patterns, and contextual interpretation was applied to evaluate communicative and cultural meaning.

1. Stylistic Devices in English and Karakalpak Fairy Tales

Phonostylistic tools such as alliteration and onomatopoeia occur frequently in both corpora, contributing to rhythm, euphony, and mnemonic effect. However, their frequency and function vary: English tales often employ alliteration for humor and emphasis (e.g., "fee-fi-fo-fum"), whereas Karakalpak tales use it to enhance narrative harmony and oral rhythm.

Lexical-stylistic devices such as similes, epithets, and metaphors are present in both languages but differ in cultural connotation. For example, English tales often use similes related to nature and domestic life ("as quick as a fox," "as white as snow"), while Karakalpak tales reflect steppe imagery and collective values ("strong as an eagle," "faithful as the camel").

Syntactic devices like repetition and inversion also play significant roles. Repetition in both languages emphasizes moral lessons and creates rhythmic cohesion; inversion in English often adds dramatic effect, while in Karakalpak it tends to mark oral performance and traditional formulaic openings ("Bir zamanlarda…" — "Once upon a time…").

2. Pragmatic Features and Speech Acts

The pragmatic structure of fairy-tale discourse reveals the presence of all three types of speech acts defined by J.R. Searle: locutionary, illocutionary, and perlocutionary acts. In both languages, narrators and characters use directive acts (commands, requests), commissive acts (promises, vows), and expressive acts (gratitude, anger, surprise) to shape interaction.

English fairy tales often employ indirect speech acts for politeness and irony ("Would you be so kind as to…"), while Karakalpak tales favor direct expressions reflecting collective norms and respect for hierarchy. The study also identifies culturally specific implicatures — for instance, humility and patience in Karakalpak tales, or cleverness and wit in English ones — which correspond to national communicative values.

3. Pragmatic Intention and Title Semantics

An important aspect of pragmatic analysis is the semantic and functional role of fairy-tale titles. Titles in both languages perform a dual role: they summarize the content and attract attention. English titles often rely on proper names (Jack and the Beanstalk, Tom Tit Tot), while Karakalpak titles highlight moral or thematic elements (Maqtanshaq tıshqan — The Boastful Mouse, Aǵash at — The Wooden Horse). The pragmatic intention behind titles is to frame expectations and establish an emotional connection with the audience.

4. Cultural Symbolism and Conceptual Metaphors

One of the most productive fields of stylistic–pragmatic comparison is the analysis of culturally marked conceptual metaphors. While English fairy tales often rely on metaphorical models rooted in Christian-imagery, European chivalric culture, or medieval social hierarchy (e.g., light vs darkness as moral binary, crown as symbol of legitimate power), Karakalpak fairy tales draw on nomadic worldview, the steppe ecosystem, and Turkic ethical values.

For example, metaphorical conceptualization of SPACE in English tales is frequently vertical: "higher" = better / spiritual reward (go up to the sky, kingdom at the top of the hill). In Karakalpak tales, spatial metaphor is predominantly horizontal: steppe, road, sapar, "way/path" = fate / destiny. This reflects the role of geographic living environment in shaping worldview–lexicon interaction.

Similarly, ANIMAL metaphors carry different semiotic loads: fox = cunning trickster in both traditions, but camel = loyalty and resilience in Karakalpak context, which has no close analogue in English folktale symbolism. Therefore metaphors function not only as aesthetic devices but as cognitive-cultural carriers of ethnosemantics.

5. Narrative Pragmatics and Listener Positioning

Another crucial pragmatic factor is the positioning of the listener. English fairy tales, particularly in Jacobs' editions, are oriented to a child reader/listener, where the narrator often pretends to be humorous or ironic, creating distance. Karakalpak fairy tales presuppose an adult or mixed-age audience — historically the storyteller performs before community — therefore the narrator often assumes authoritative, didactic persona.

6. Translator's Challenge and Interlinguistic Transfer Issues

The study also has translational implications. Many stylistic and pragmatic signals in the source language do not have direct equivalents. In Karakalpak tales, culturally dense units such as aqsaqal, bata, qonaq, duwa represent complex socio-pragmatic frames (hospitality, seniority hierarchy, blessing rituals). In English, these often get neutralized into general words (wise man, guest, blessing) which weaken pragmatic intensity. Conversely, English indirect polite forms may

seem redundant when translated literally into Karakalpak, because the local culture prefers direct clarity in narrative instruction.

7. Cross-Genre Influence and Interdiscursivity

Another dimension that deserves analytical attention is the interaction of fairy-tale discourse with neighbouring folklore and literary genres. English fairy tales often intersect with nursery rhymes, ballads, and medieval romance motifs. For example, rhyme-patterned interjections such as "Fee-fi-fo-fum!" or the rhythmic formulae of traditional riddles reveal how oral poetic structures penetrate prose narrative. Conversely, Karakalpak fairy tales demonstrate intertextual integration with qıssa, batır jırı, and ethnographic narratives. In many tales the heroic ethos, genealogical memory, and tribal history are subtly embedded, creating a hybrid model at the border of fiction and historical myth. This phenomenon confirms Bakhtin's concept of heteroglossia — multiple voices and registers coexist within a single text, shaping pragmatic attitude and narrative evaluation.

Furthermore, fairy-tale discourse triggers a meta-pragmatic expectation: the listener assumes that "truth is not literal but culturally true." This creates a special inferential logic: the audience does not evaluate propositions by factual parameters but by their moral plausibility. In English, this manifests in ironic hyperbole and witty exaggeration; in Karakalpak, in ethnically coded generalizations which legitimate socially desirable behaviour. Thus the "truth effect" itself is stylistically constructed and pragmatically coordinated.

Finally, one should note the diachronic evolution of fairy-tale stylistics under modern media. English fairy tales today circulate mostly in printed or digital forms; their stylistic patterning is therefore more text-oriented. Karakalpak fairy tales remain relatively closer to oral performance, which preserves live intonation, rhythm, pauses, and embodied gesture — pragmatic features that cannot be fully encoded in written syntax. This is why Karakalpak stylistics still exhibits oral formulaicity at a higher rate. Future comparative research must therefore include multimodal pragmatic analysis, since prosody and performance too are semiotic layers of stylistic meaning.

Conclusion

The comparative investigation confirms that English and Karakalpak fairy tales share universal stylistic patterns (alliteration, metaphor, repetition, formulaic openings) and universal pragmatic mechanics (speech acts, implicatures, presuppositions). However, their semantic density and communicative purpose are culturally specific. English texts tend toward individualism, irony, playful indirectness; Karakalpak texts emphasize ethical collectivism, social hierarchy, and pedagogical intentionality.

The comparative analysis demonstrates that English and Karakalpak fairy tales share universal stylistic and pragmatic mechanisms characteristic of oral folklore, yet they differ significantly in their linguistic realization and cultural orientation. Both corpora display rich stylistic diversity and a deep interconnection between language, thought, and culture.

Stylistic devices serve not only to embellish the narrative but also to transmit national worldview and values, while pragmatic features ensure communicative effectiveness and audience engagement. The findings contribute to further development of comparative pragmalinguistics and stylistics and may be applied in teaching, translation studies, and cross-cultural communication.

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Rezyume: *Maqolada ingliz va qoraqalpoq tillaridagi ertak matnlarining stilistik va pragmatik xususiyatlari qiyosiy lingvistik nuqtayi nazardan o‘rganilgan. Tadqiqotda pragmalingvistika va stilistikaning nazariy asoslariga tayangan holda, an’anaviy xalq rivoyatlari tarkibida lingvistik va stilistik vositalarning kommunikativ va estetik vosita vazifasini bajarish usullari o‘rganilgan.*

Резюме: *В данной работе рассматриваются стилистические и прагматические особенности сказочных текстов на английском и каракалпакском языках с точки зрения сравнительной лингвистики. Опираясь на теоретические основы прагмалингвистики и стилистики, исследователь исследует способы функционирования языковых и стилистических средств как коммуникативных и эстетических средств в структуре традиционных народных сказаний.*

Kalit so‘zlar: *ertak, pragmalingvistika, stilistika, diskurs, nutqiy akt, qiyosiy tilshunoslik, qoraqalpoq, ingliz folklori.*

Ключевые слова: *сказка, прагмалингвистика, стилистика, дискурс, речевой акт, сравнительная лингвистика, каракалпакский, английский фольклор.*

THE INTERRELATIONSHIP OF THE OGHUZ AND QIPCHAK DIALECTS IN MUQADDIMAT UL-ADAB

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Summary: *This article analyzes the history of creation, linguistic composition, and lexicographical characteristics of Mahmud al-Zamakhshari's Muqaddimat ul-adab. It examines the process by which the work evolved from a bilingual (Arabic–Persian) lexicon into a trilingual (Arabic–Persian–Turkic) dictionary and highlights the elements of the Oghuz and Qipchak dialects of the Khorezm region reflected in the text. Furthermore, the etymology of the word böräk is analyzed as an example of the lexical interaction between Turkic and Persian languages. The article evaluates Muqaddimat ul-adab as a significant source for studying the history of the Uzbek language and the dialectal features of the Oghuz and Qipchak vernaculars in 12th-century Khorezm.*

Key words: *Mahmud al-Zamakhshari, Muqaddimat ul-adab, Uzbek language, Qipchak dialect, Oghuz dialect, Khorezm Turkic, böräk, chuchvara.*

The great encyclopedic scholar of Khorezm, Mahmud al-Zamakhshari (1075–1144), has long been highly esteemed in the Islamic world for his vast scholarly legacy. His contributions—particularly in the fields of tafsir, hadith, fiqh, and Arabic grammar and lexicography—have been extensively studied by both Eastern and Western scholars.

Various perspectives exist regarding the compilation and linguistic layers of al-Zamakhshari's Muqaddimat ul-adab. The most widely accepted view holds that the work was initially composed as a bilingual Arabic–Persian lexicon.[1, 17] Given al-Zamakhshari's mastery of both Arabic and Persian, as well as his profound command of his native Turkic tongue (often referred to in sources as Khorezm Turkic)[2, 39], it was only natural for him to produce such a sophisticated and high-quality dictionary. Its rapid popularity among Persian speakers learning Arabic subsequently led to its translation into other languages.

As scholars have noted, Muqaddimat ul-adab was soon translated into the Turkic language spoken in Khorezm—an idiom characterized by a mixture of Oghuz and Qipchak features—thus becoming a trilingual (Arabic–Persian–Turkic) lexicon.[1, 17] According to some sources, including the renowned Iranian lexicographer Ali Akbar Dehkhoda, this Turkic translation may have been prepared by al-Zamakhshari himself.[3, 277] While this claim appears plausible—since the author would have been most qualified to translate his own work into his mother tongue—it lacks definitive textual or historical proof. Other scholars suggest that the Turkic layer may have been produced by al-Zamakhshari's students or contemporary Khorezmian scholars. In any case, the Turkic component represents an invaluable monument of 12th-century Khorezm Turkic.

Following the Mongol invasions, as the Mongolian language gained prominence across Central Asia and the Dasht-i Qipchak, Muqaddimat ul-adab was also translated into Mongolian. Consequently, certain manuscripts of the work became quadrilingual (Arabic–Persian–Turkic–Mongolian). The study of the Mongolian glosses owes much to the work of N. N. Poppe.

A particularly significant discovery was made in 1897 by the orientalist and archaeologist V. L. Vyatkin, who found a manuscript of Muqaddimat al-adab in Samarkand and presented it to the Imperial Academy of Sciences of Russia. This manuscript provides valuable insights into the dissemination and preservation of the text in Central Asia. Although incomplete and undated, its unique paleographic and linguistic features make it an important source for comparative analysis with other extant copies. The fact that it was found in Samarkand suggests that the work was also widely used throughout Transoxiana.

The value of Muqaddimat ul-adab for studying the Qipchak layer of the Uzbek language can be illustrated through the example of the word *böräk* ("dumpling"). The form بورک (*böräk*) recorded in the text is compared with its Persian equivalents *khushbira* (or *khushbirä*) and the modern Uzbek *chuchvara*. Al-Zamakhshari associates *böräk* with terms such as *sambusak* (سمبوسك, "samosa") and

qataif (قطائف), indicating a category of stuffed pastries. The word *böräk* is widespread in Turkic languages and is generally derived from the verbs *bögre-* ("to fold") or *büri-* ("to wrap, to cover"), combined with the nominal suffix *-k* or *-äk*,[4, 65] conveying the sense of "something folded" or "wrapped." Across Turkic-speaking regions, *böräk* and its variants (*börek, börik, bäliş*) refer to various baked or fried pastries filled with minced meat or other ingredients—such as Turkish *börek*, Tatar *bäleş*, Kazakh *bälïsh*, and others. The term even spread into the Balkan languages as *burek*.

The possible connection between Turkic *böräk* and Persian *khushbira* remains uncertain. The latter is rarely attested in Persian and its etymology is obscure, suggesting that the resemblance between the two words may be coincidental rather than genealogical. Similarly, the etymology of *chuchvara* is debated. The most widely accepted theory traces it to Persian *jushpara* (or *dushvara*), literally meaning "boiled piece."[5, 388] Although *böräk* and *chuchvara* are semantically related—both referring to stuffed dough-based dishes—they denote different cooking methods: *böräk* generally refers to baked or fried pastries, while *chuchvara* designates boiled dumplings.

The assumption that *chuchvara* is referred to as *böräk* in Qipchak dialects also requires clarification. In contemporary Qipchak languages (Kazakh, Tatar, Kyrgyz, Bashkir, etc.), *börek*, *bälesh*, or *bärik* typically refer to baked or fried pastries, whereas dishes resembling Uzbek *chuchvara* are more often called *tushpara*, *pilman* (from Russian *pelmen*), or *manti*. Nevertheless, in certain local dialects, *böräk* may be used in a broader sense to denote various types of dumplings, though this is not a general rule.

Given that Khorezm historically served as a contact zone between Turkic (Qipchak and Oghuz) and Iranian (Persian and Khorezmian) cultures, the coexistence of culinary terms from both linguistic traditions in its dialects is unsurprising. Thus, in Khorezm vernaculars, *böräk* may refer either to pastries or, in some cases, to dishes resembling *chuchvara*. As al-Zamakhshari himself was a native of Khorezm, it is reasonable to assume that the form *böräk* in his lexicon reflects its local usage in 12th-century Khorezm.

In conclusion, a thorough understanding of the creation, translation, structure, and manuscript tradition of Muqaddimat ul-adab is crucial for accurately interpreting its Turkic glosses—particularly those representing the mixed Oghuz–Qipchak dialect of Khorezm—and for employing this material effectively in the historical study of the Qipchak dialect group.

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Rezyume: *Ushbu maqolada Mahmud Zamaxshariyning "Muqaddimat ul-adab" asarining yaratilish tarixi, til tarkibi va leksikografik xususiyatlari tahlilga tortilgan. Asarning arabcha–forscha shakldan uch tilli (arabcha–forscha–turkiycha) ko'rinishga o'tish jarayoni hamda uning Xorazm vohasidagi o'g'uz va qipchoq lahjasi unsurlari yoritiladi. Shuningdek, "böräk" so'zining etimologiyasi misolida turkiy va forsiy tillar o'rtasidagi leksik aloqalar tahlil qilinadi. Maqola "Muqaddimat ul-adab"ni o'zbek tili tarixi va XII asr Xorazm vohasidagi o'g'uz va qipchoq lahjasi unsurlarini o'rganishda muhim manba sifatida baholanadi.*

Резюме: *В статье рассматриваются история создания, языковой состав и лексикографические особенности произведения Махмуда Замахшари «Мукаддимат ал-адаб». Анализируется процесс перехода труда от арабо-персидской формы к трёхъязычному (арабско-персидско-тюркскому) варианту, а также отражение в нём элементов огузского и кипчакского диалектов, характерных для Хорезмского региона. Особое внимание уделяется исследованию лексических связей между тюркскими и персидскими языками на примере*

этимологии слова börek. *Статья оценивается как значимый источник для изучения истории узбекского языка, а также огузских и кипчакских диалектных элементов, распространённых в Хорезмском регионе XII века.*

Kalit so‘zlar: *Mahmud Zamaxshariy, “Muqaddimat ul-adab”, o‘zbek tili, qipchoq* lahjasi, *o‘g‘uz* lahjasi, *Xorazm vohasi o‘zbek tili, bo‘rak, chuchvara.*

Ключевые слова: *Махмуд Замахшари,* Мукаддимат ал-адаб, *узбекский язык, кипчакский диалект, огузский диалект, хорезмский регион,* бөрек, чучвара.

GAMIFICATION IN EFL CLASSROOMS: MOTIVATING LEARNERS THROUGH DIGITAL TOOLS

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Summary: *Motivation plays a vital role in the effectiveness of learning English as a Foreign Language (EFL). Traditional approaches frequently fail to keep student interest, resulting in reduced educational results. This paper discusses the incorporation of gamification in EFL classrooms, highlighting how digital resources can boost motivation and learning outcomes. The conversation emphasizes the benefits and difficulties of applying gamification in EFL environments, offering perspectives for teachers aiming to create a more interactive and inspiring educational atmosphere.*

Key words: *gamification, EFL (English as a Foreign Language), motivation, digital tools, digital badges, language learning, student engagement, game-based learning*

INTRODUCTION

Gamification in learning is a modern teaching method that applies features from games, such as points, levels, and rewards, that helps to make studying more exciting and dynamic. It serves as a way to change the learning process from something passive into an active experience where students are asked for an active participation, to explore, and achieve goals in language learning. For example, teachers can turn lessons into small missions or challenges where students have an opportunity to earn points for correct answers or teamwork. This approach helps to keep learners motivated and interested, especially in subjects that may seem tough or boring. By adding fun and competition, gamification helps students enjoy learning, remember information better, and develop problem-solving skills.

Gamification has developed into a useful educational method in various fields. Kogan (2026) highlights that games promote experiential learning, motivating students to experiment, safely make mistakes, and actively interact with the material. In language learning, games and gamified activities transfer abstract linguistic tasks into engaging experiences, improving both understanding and enthusiasm skills.

According to Karl M. Kapp (2012) in The Gamification of Learning and Instruction, gamification in education means using game-based mechanics, aesthetics, and thinking to engage learners, motivate behavior, and enhance knowledge retention. Kapp emphasizes that gamification is not about simply adding points, badges, or leaderboards, but rather integrating meaningful game elements—such as goals, feedback, challenges, rewards, and narratives—into instructional design to support language learning. He argues that when learners face with interactive, goal-oriented space that mirror the engagement of games, they become more motivated and active participants in the whole learning process.

Below are the essential elements that contribute to the effectiveness of gamified language learning:

1. A rise in engagement and motivation: The capacity of gamification to develop both intrinsic and extrinsic motivation is one of its main benefits. Learners become more engaged and enthusiastic. Students remain actively engaged in learning assignments when classes are expected to include aspects of competition, rewards, and progress tracking, because they feel a feeling of accomplishment when they earn points or complete stages. In EFL classrooms, where it can frequently be observed to be difficult to keep students interested in language work, this motivational support is very helpful.

2. Increased Independence of Learners: Students are encouraged to take charge of their own development via gamified learning. Numerous gamified systems help students select tasks, establish objectives, and track their progress. This independence promotes self-regulated learning abilities. Learners are more likely to stick with difficult assignments and show a sustained interest in language learning when they have agency over their educational path.

3. Real-time Feedback and Monitoring of Progress: Instant and proper feedback is a common feature of games and gamified systems in education, which serves students as a powerful tool to assess their performance in real time. Students are able to see mistakes, consider their approaches, and get better more quickly because to this ongoing feedback. Gamification provides an efficient and non-threatening method of evaluation in EFL contexts, where providing corrected feedback is considered to be essential for learning grammar, vocabulary, and pronunciation.

4. Cooperation and Social Engagement: In order to encourage student collaboration, gamification frequently incorporates peer competitions, team-based quests, and group challenges. These kinds of activities help students improve cooperation, negotiation, and making up communication in English—skills that are critical for using the language in everyday situations. Language learning then becomes a dynamic, engaging experience that fosters meaningful communication thanks to the social component of gamification.

5. Less Stress and More Self-Belief: It is normal when anxiety occasionally arises in traditional language learning settings, especially while speaking or writing. In contrast, gamified activities strengthen a more laid-back environment where making mistakes are seen as a necessary aspect of the game rather than a sign of failure. Learners can feel more freely and confidently to express themselves in the target language when affective obstacles are reduced.

6. Better Learning and Retention Results: Better memory retention can result from gamification's emphasis on rewards, repetition, and contextual learning. Students are more likely to retain and apply what they have learnt when language structures or terminology are strongly linked to interactive experiences. Research indicates that, in contrast to conventional teaching techniques, gamified training can improve language information retention over the short and long terms.

According to Su and Cheng (2015) in their study A Mobile Gamification Learning System for Improving the Learning Motivation and Achievements, gamification has a significant positive impact on students' learning outcomes and motivation. The authors found that incorporating game-based elements such as points, challenges, and feedback into a mobile learning environment enhanced learners' engagement and sustained their attention throughout the learning process. Students who participated in the gamified mobile learning activities demonstrated higher academic achievement and stronger motivation compared to those in non-gamified or traditional learning atmosphere.

According to Sabina Ismoilova, while gamification offers many benefits in language learning, it also comes with certain challenges and limitations. Educators and learners should be aware of these challenges to ensure that gamification is used effectively.

Below are some key challenges and considerations:

Excessive Focus on External Rewards: heavy dependence on badges or points might impact negatively on intrinsic motivation in the long run.

Resource Constraints: not every school has access to essential digital tools or consistent internet connection that may lead to the failure or unsuccessful implication of gamification process.

Implementation Complexity: analogically crafted gamified experiences might perplex learners or not achieve educational goals.

The risk of superficial learning: learners may focus on quick rewards (points, badges) rather than deep language understanding.

Over-emphasis on rewards: learners might become motivated by the gamified incentives rather than intrinsic interest in the language itself, which may reduce long-term motivation.

Potential for distraction from core learning objectives: the game-elements might overshadow the actual language skills to be learned.

To enhance the advantages of gamification, it is suggestible to:

- Coordinate Game Mechanics with Learning Goals: Make certain each activity directly supports language learning.
- Harmonize Extrinsic and Intrinsic Motivation: Employ incentives to strengthen effort while highlighting both skill development and self-improvement.
- Foster Contemplation: Incorporate self-evaluation and peer input during gaming components.

- Encourage Teamwork: Integrate collective tasks to develop social learning and strengthen communication abilities.
- Track Advancement: Regularly assess the efficiency of gamified tasks and modify accordingly

To demonstrate the application of gamification in actual classrooms, we can consider these examples:

Vocabulary Challenges: Learners collect points or digital badges for mastering new sets of vocabulary. For example, upon finishing a "Travel Vocabulary Challenge," a student might earn a "Travel Badge," which refers to the mastery in that subject. This encourages students to engage in learning while enabling educators to monitor advancement effortlessly

Grammar Leaderboards: Educators can set up a leaderboard for grammar activities, giving students an access to accumulate points for correct responses in online quizzes or classroom challenges. For instance, learners taking part in a "Past Tense Challenge" can view their standings live, promoting a spirit of friendly rivalry and motivating regular practice (Kogan, 2026).

Team Challenges with Digital Platforms: By utilizing tools such as Kahoot. Quizlet Live, or Classcraft, students work together in groups to solve language puzzles or respond to comprehension inquiries. Achieving challenges unlocks digital rewards, promoting collaboration and learning.

Effective integration of gamification in EFL classrooms requires careful pedagogical planning to ensure that game elements serve meaningful learning goals rather than just entertaining. Teachers must carefully design gamified activities that align with are the same with the objectives, language skills, and learners' proficiency levels. One key strategy is to incorporate task-based learning into gamified contexts—students can complete quests or missions that involve authentic language use, such as interviewing classmates, solving riddles, or writing short dialogues to earn points or badges. Gamification should also support formative assessment, allowing teachers to monitor progress through immediate feedback systems built into games, leaderboards, or achievement levels. For instance, apps like Kahoot! Quizizz, or Wordwall enable teachers to evaluate vocabulary and grammar comprehension in an engaging way while providing instant feedback to students. Additionally, collaborative challenges and team-based competitions foster communicative competence, encouraging students to negotiate meaning, cooperate, and use English purposefully in interactive contexts. The teacher's role shifts from a transmitter of knowledge to a facilitator and game designer, guiding students through levels of language mastery while maintaining motivation and fairness. To ensure balance, educators should integrate both intrinsic motivators (like curiosity, mastery, and social interaction) and extrinsic motivators (like badges, scores, or rewards). Ultimately, successful classroom integration of gamification depends on thoughtful design—creating meaningful, goal-oriented experiences that combine fun and pedagogy to enhance students' engagement, confidence, and language acquisition.

In a gamified EFL classroom, the teacher plays a crucial role as a facilitator, motivator, and designer of learning experiences rather than a traditional authority figure. Teachers are responsible for selecting appropriate game elements—such as points, levels, leaderboards, or challenges—and adapting them to fit specific linguistic goals and learners' needs. Their perspective is essential because effective gamification requires balancing educational value and enjoyment, ensuring that gameplay supports real language development rather than distracting from it. Teachers must design tasks that encourage communication, creativity, and critical thinking while maintaining a supportive and inclusive classroom atmosphere. From a pedagogical standpoint, educators need to continuously monitor student engagement and progress, adjusting difficulty levels and reward systems to keep motivation consistent across different proficiency groups. Moreover, teachers often serve as mediators of competition and collaboration, helping students view challenges as opportunities for learning rather than sources of pressure. Another important aspect of the teacher's role is technical and pedagogical readiness—understanding how to use gamified tools and platforms effectively, manage digital resources, and integrate them into lesson plans. Teachers' positive attitudes toward gamification strongly influence student engagement and learning outcomes, as enthusiasm and creativity tend to inspire students to participate more actively. Therefore, professional development

and institutional support are vital to empower team work. Students' perceptions and attitudes toward gamification in EFL classrooms play a vital role in determining its overall effectiveness. Numerous studies have shown that learners generally respond positively to gamified learning environments, describing them as more engaging, enjoyable, and motivating compared to traditional instruction. Gamification introduces a sense of play and curiosity, which helps reduce the anxiety often associated with foreign language learning and encourages students to take risks when speaking or writing in English. Many students appreciate the interactive and dynamic nature of gamified tasks, as these activities often promote active participation, collaboration, and friendly competition. The immediate feedback and visible rewards, such as badges or points, provide learners with a tangible sense of progress and achievement, reinforcing their motivation to continue learning.

According to Umarova Z., however, not all responses are uniformly positive—some students report feeling pressure or stress from competitive elements, especially when leaderboards are publicly displayed or when tasks become overly challenging. Others may view extrinsic rewards as superficial if they are not connected to meaningful learning outcomes. Therefore, while most students perceive gamification as a fun and effective approach to language learning, teachers must design it thoughtfully, balancing competition with cooperation and ensuring that the focus remains on personal growth, collaboration, and communicative competence. Overall, learners tend to value gamified environments when they feel supported, challenged, and recognized for their individual progress.

CONCLUSION

To sum up, gamification has become a powerful tool in modern education considering the fact that it turns traditional lessons into fun, interactive experiences. By including elements such as points, challenges, and rewards, teachers can make learning more engaging and help students stay motivated for longer periods. This method encourages participation, teamwork, and creativity while helping learners remember what they study in a more natural way. Overall, gamification not only improves academic results but also boosts confidence, curiosity, and a positive attitude toward learning. When students enjoy the learning process, they are more likely to take an active role in their education and to reach higher goals. It also helps teachers create a lively and supportive classroom environment where every student feels involved and active. As technology continues to grow, gamification will likely play an even bigger role in shaping the future of education, making it more enjoyable and effective for all types of learners.

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Ingliz tilini chet tili sifatida o'rganish (EFL) samaradorligida motivatsiya muhim rol o'ynaydi. An'anaviy yondashuvlar ko'pincha o'quvchilarning qiziqishini saqlab qololmaydi, natijada ta'lim natijalari pasayadi. Ushbu maqolada EFL sinflarida geymifikatsiyani joriy etish muhokama qilinadi, raqamli resurslar motivatsiya va o'quv natijalarini qanday oshirishi mumkinligi ta'kidlanadi. Suhbatda EFL muhitida geymifikatsiyani qo'llashning afzalliklari va qiyinchiliklari ta'kidlanib, yanada interaktiv va ilhomlantiruvchi ta'lim muhitini yaratishni maqsad qilgan o'qituvchilar uchun istiqbollar taklif etiladi.

Резюме: *Мотивация играет важную роль в эффективности изучения английского языка как иностранного (EFL). Традиционные подходы часто не удерживают интерес*

учащихся, что приводит к снижению результатов обучения. В данной работе обсуждается внедрение геймификации в классах EFL, подчеркивается, как цифровые ресурсы могут повысить мотивацию и результаты обучения. В беседе подчеркиваются преимущества и трудности применения геймификации в условиях EFL, предлагая перспективы для учителей, стремящихся создать более интерактивную и вдохновляющую образовательную атмосферу

Kalit so‘zlar: *geymifikatsiya, EFL (ingliz tili chet tili sifatida), motivatsiya, raqamli vositalar, raqamli nishonlar, til o‘rganish, o‘quvchilarni jalb qilish, o‘yinli ta’lim*

Ключевые слова: *геймификация, английский как иностранный (EFL), мотивация, цифровые инструменты, цифровые значки, изучение языка, вовлеченность студентов, игровое обучение*

PRAGMATIC ANALYSIS OF VOCATIVES IN ENGLISH AND UZBEK LITERARY TEXTS

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Summary: *This article examines the pragmatic functions of vocatives in English and Uzbek literary texts, highlighting their role in mediating interpersonal relationships, reflecting social hierarchy, and expressing emotional intensity. Vocatives, as speech acts that directly address interlocutors, function as essential instruments in both everyday and literary discourse (Leech, 1983; Brown & Levinson, 1987)By analyzing selected works of William Shakespeare (Hamlet and Romeo and Juliet) and prominent Uzbek authors such as Abdulla Qodiriy (O'tkan kunlar) and Oybek (Navoiy), the research investigates structural patterns, semantic nuances, and context-dependent pragmatic effects of vocative expressions.*

Key words: *Vocative, pragmatics, literary discourse, English literature, Uzbek literature, cross-cultural communication.*

1. Introduction. Vocatives are linguistic elements used to attract the attention of an interlocutor or indicate the addressee within a discourse. In literary contexts, their functions extend beyond mere referential or nominal purposes, encompassing pragmatic roles such as expressing politeness, conveying emotional states, and signaling social hierarchy (6, p. 33-49; 10, pp.88-97]. From a pragmatic perspective, vocatives can be considered as performative speech acts that engage both the speaker and the addressee in a dynamic communicative interaction [1, p. 5; 9, p. 28].

In English literature, particularly in the works of Shakespeare, vocatives serve diverse functions. For instance, in Hamlet, the protagonist's address forms—ranging from formal titles to intimate first names—reflect complex social relationships and psychological states [3, p. 115].. Similarly, Romeo and Juliet exemplifies the use of vocatives to convey affection, urgency, and social alignment within the dialogue [2, p. 62]). The strategic employment of vocatives thus contributes to both character development and the pragmatics of literary discourse.

Uzbek literary texts, represented by Abdulla Qodiriy's O'tkan kunlar and Oybek's Navoiy, exhibit culturally specific vocative practices that mirror traditional social norms and linguistic politeness strategies [7, p. 55; 6, p. 82]. In these texts, vocatives are not merely nominal markers but serve as instruments for regulating interpersonal relationships, reinforcing hierarchical structures, and expressing emotional intensity within the narrative.

Despite substantial research on vocatives in either English or Uzbek separately, comparatively few studies have addressed their cross-linguistic and cross-cultural dimensions in literary texts. Addressing this gap, the present study adopts a contrastive pragmatic approach, aiming to elucidate the following research questions:

1. What are the primary pragmatic functions of vocatives in English and Uzbek literary texts?
2. How do structural and semantic features of vocatives differ between the two languages?
3. To what extent do cultural and literary conventions influence the use of vocatives in English and Uzbek literary discourse?

Methods. This study adopts a qualitative, contrastive-pragmatic research design to provide a comprehensive analysis of vocatives in English and Uzbek literary texts. The selected corpus includes canonical English texts, namely Shakespeare's Hamlet and Romeo and Juliet, as well as prominent Uzbek literary works by Abdulla Qodiriy (O'tkan kunlar) and Oybek (Navoiy). The texts were chosen based on their linguistic richness and representativeness in displaying vocative usage in different communicative contexts.

The research methodology involves several steps: extraction of vocatives from the literary texts, classification based on structural type (formal titles, first names, kinship terms, honorifics, and emotive expressions), and coding according to pragmatic functions: politeness, intimacy, emotional intensification, and directive attention [8, p. 18; 6, p. 82]. A detailed contrastive analysis was then

conducted to identify cross-linguistic patterns and divergences, particularly focusing on cultural specificity and functional variation.

The analytical framework combines pragmatic-functional analysis with contrastive literature study, allowing for systematic identification of vocative patterns, their semantic nuances, and their contextual impact. This multi-layered approach ensures rigor in data interpretation and facilitates cross-cultural comparison.

Results. The analysis of Shakespearean texts revealed a wide spectrum of vocative forms serving multiple pragmatic functions. Examples include:

- Formal politeness: “Good my lord, I am right sorry…” (Hamlet, Act 1, Scene 2)
- Emotive/intimate: “O, Ophelia, I am slain!” (Hamlet, Act 5, Scene 2)
- Affectionate: “Juliet, sweet Juliet!” (Romeo and Juliet, Act 2, Scene 2)
- Directive/emphatic: “Romeo, Romeo! Wherefore art thou Romeo?” (Romeo and Juliet, Act 2, Scene 2)
- Additional examples: “My lord Hamlet, what news?” (formal/polite), “Sweet Romeo, my heart longs for thee!” (intimate/affective)

These findings indicate that English vocatives operate across multiple layers: hierarchical regulation, emotional expression, solidarity marking, and dramatic intensification.

In Uzbek literature, vocatives frequently convey respect and social hierarchy. Examples from Qodiriy and Oybek include:

- Kinship/intimate: “O‘g‘lim, kel menga yordam ber!” (Qodiriy, 2015)
- Solidarity: “Do‘stim, qani, gapir!”
- Honorific/polite: “Hurmatli Navoiy, qarang bu ishga!” (Oybek, 2018)
- Emotive: “Aziz do‘stim, eshiting so‘zimni!”
- Additional examples: “Oka, qo‘shiqni tinglaysizmi?” (familiar/informal), “Hurmatli domla, iltimos, maslahat bering!” (formal/polite)

These illustrate that Uzbek vocatives are often lexically and morphologically marked to signal respect, relational closeness, and emotional involvement.

A comparison between English and Uzbek texts highlights both similarities and differences:

- Similarity: Multifunctional use in regulating social interaction, signaling emotional states, and marking intimacy or solidarity.
- Difference: English texts utilize syntactic repetition, lexical creativity, and exclamatory forms for emphasis, while Uzbek texts show extensive use of kinship terms, honorifics, and culturally specific markers of respect (Leech, 1983; Karimova, 2015).

Discussion. The findings demonstrate that vocatives are pivotal pragmatic devices in literary discourse. English literary vocatives often prioritize dramatic and emotive effect, employing syntactic repetition and lexical variation to enhance character dynamics and narrative tension. In contrast, Uzbek literary vocatives emphasize social hierarchy, relational closeness, and culturally sanctioned politeness, reflecting the collectivist orientation of Uzbek society.

Emotional functions are encoded differently across languages: English texts exploit exclamatory repetition and stylistic diversity, whereas Uzbek texts employ honorifics, kinship terms, and morphologically marked expressions to convey affective intensity. Additional examples reinforce these observations: “Fair Ophelia, lend me thine ear!” (English emotive), “Aziz opa, yordam bering!” (Uzbek affective) demonstrate the culturally nuanced deployment of vocatives.

Despite these differences, universal pragmatic functions—politeness, intimacy, emotional signaling—are evident in both corpora, illustrating the interplay between linguistic form, pragmatic function, and cultural norms [2, p. 55; 5, p. 33-49]. These observations underscore the importance of considering both linguistic and cultural factors in the pragmatic analysis of literary vocatives. The study contributes to cross-cultural pragmatics and provides insights into how literary vocatives facilitate character interaction, emotional engagement, and narrative coherence.

Conclusion. This study has shown that vocatives in English and Uzbek literary texts serve as multifunctional pragmatic devices. They not only attract the addressee’s attention but also convey politeness, intimacy, emotional intensity, and social hierarchy. English texts, such as Shakespeare’s

works, often employ vocatives to enhance dramatic and emotive effect through repetition, exclamatory forms, and lexical variation. In contrast, Uzbek literary texts utilize kinship terms, honorifics, and culturally specific markers of respect, reflecting social norms and relational closeness.

Overall, vocatives function as essential linguistic tools that shape character interaction, narrative dynamics, and cultural expression in literature. Cross-cultural comparison highlights both universal pragmatic functions, such as politeness and emotional signaling, and language-specific realizations shaped by cultural norms. Future research could explore vocatives in other literary genres or languages to further examine their pragmatic and cultural significance.

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Rezyume: *Ushbu maqolada ingliz va o'zbek badiiy matnlarida undalmalarning pragmatik funksiyalari tahlil qilinadi. Tadqiqotda undalmalarning shaxslararo munosabatlarni vositalashdagi o'rni, ijtimoiy iyerarxiyani aks ettirishi hamda hissiy intensivlikni ifodalashdagi roli yoritilgan. Undalmalar, muloqot ishtirokchilariga bevosita murojaat qiluvchi nutq aktlari sifatida, kundalik hamda badiiy diskursda muhim vosita bo'lib xizmat qiladi (Leech, 1983; Brown & Levinson, 1987). Uilyam Shekspirning ("Hamlet" va "Romeo va Julyetta") hamda o'zbek adabiyotining yirik vakillari — Abdulla Qodiriy ("O'tkan kunlar") va Oybek ("Navoiy") asarlari tahlili asosida undalmalarning tuzilma modellari, semantik nozikliklari va kontekstga bog'liq pragmatik ta'siri o'rganiladi.*

Резюме: *В данной статье рассматриваются прагматические функции обращений в английских и узбекских художественных текстах, подчеркивается их роль в посредничестве межличностных отношений, отражении социальной иерархии и выражении эмоциональной интенсивности. Обращения, как речевые акты, направленные непосредственно к собеседнику, служат важным инструментом как в повседневном, так и в художественном дискурсе (Leech, 1983; Brown & Levinson, 1987). На основе анализа избранных произведений Уильяма Шекспира («Гамлет» и «Ромео и Джульетта») и известных узбекских писателей — Абдуллы Кадыри («Прошлые дни») и Айбека («Навои») — исследуются структурные модели, семантические оттенки и контекстуально-зависимые прагматические эффекты обращений.*

Kalit so'zlar: *undalma, pragmatika, badiiy diskurs, ingliz adabiyoti, o'zbek adabiyoti, madaniyatlararo kommunikatsiya.*

Ключевые слова: *обращение, прагматика, художественный дискурс, английская литература, узбекская литература, межкультурная коммуникация.*

THE ROLE OF GAME TECHNOLOGIES IN DEVELOPING STUDENTS' IDIOMATIC COMPETENCE

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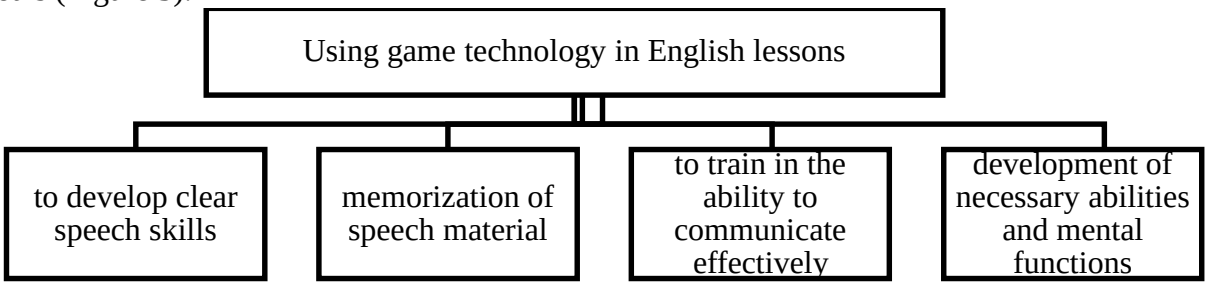
Summary: *The article discusses the theoretical and practical approaches to the assessment of knowledge and qualification through the integration of game technologies in teaching English.*

Key words: *game technologies, idiomatic competence, phraseological competence, English teaching, A1 level, motivation*

In modern society, the education system is focused on developing phraseological competence to achieve the highest level of development in A1 level English. The updated English language teaching system utilizes the broad possibilities of game technologies to enhance students' idiomatic competence.

The leading condition for the formation of phraseological competence is the active participation of all types of speech activity. The possibility of implementing this condition is formed in the process of learning games, the effective use of which in teaching includes speaking and listening, as well as reading and writing, and creates a positive emotional experience of communication, which contributes to assimilation.

Therefore, when using game technology in English lessons, it is necessary to set the following goals (Figure 3).



Play activities in the classroom contribute to the formation of phraseological competence by increasing interest in learning, developing cognitive activity, and enhancing positive emotions. Effective mastery of the topic, involving students in various situations and multifaceted activities related to language, effective exchange of ideas, and speech lead to a change in behavioral stereotypes.

In the context of game technologies, creating problem-solving tasks combines diverse ideas, resulting in a synthesized, new, and original solution. Gaming technologies always involve decision-making. This situation enhances students' intellectual activity.

Vygotsky emphasized that play "is a source of development, creating a zone of proximal development." Acting in an imaginary field, in an imaginary state, independently creating intentions, forming a life plan, desired motives - all of this arises in the mind and elevates it to the highest level of development.

The effectiveness of using games in English lessons is linked to an increase in initial motivation to learn English, acquire phraseological competence skills, and create opportunities for students' individual development.

V.A. Sukhomlinsky said: "Without play, complete intellect cannot exist or develop." Play is a large, bright window into a child's psychological world.

In his research, F. Schiller demonstrated that through play, the student develops both themselves and the world around them, and that through play, they can become a well-rounded, developed individual.Modern pedagogy creates ample opportunities for the use of game technologies for the development of phraseological competence.

Analysis of educational and methodological literature on teaching English based on game technologies has shown that games are divided into groups according to their purpose of use (dictionary, grammar, translation, country studies), functional significance (speech skills). Game technologies include instrumental games, role-playing games, business games, etc. In a number of studies, there is a significant difference between game content and its author's classification, which leads to the content of game technologies. A more accurate conclusion through game tasks is determined by an internally organized mechanism.

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Game technologies are used as an experiment in the formation of phraseological competence in students. Through this, it plays an important role in the formation of oral communication in students during the lesson process. Based on these technologies, it can be not just a speech exercise, but its core. Therefore, game technology should not be contrary to the main part of the lesson.

Researcher V. Ramazanova sets two requirements for the teacher's composition of the game method in foreign language teaching: the first is the requirements for the game as a separate type of speech activity; the second set of requirements is the specification. Certainly, in this type of activity, A1 level students use their foreign language communication skills as a leading role in the game for a small reserve of non-local vocabulary. Through play, real objects and direct perception of the game, especially specific speech-motor sensations, help to memorize and recall the speech pattern.

According to the researcher S.A. Gorbanalinejadrudsari, notes that game technologies are one of the rare forms of learning that make it possible to make not only students' creative and research activities, but also the daily stages of studying academic subjects, interesting and exciting. The entertaining nature of the traditional game world positively and emotionally enhances the monotonous activity of memorizing, repeating, consolidating, or assimilating information, and it has been noted that the sensitivity of play activity activates all the child's intellectual processes and functions. Another positive aspect of the game is that it helps to use knowledge in a new situation, that is, the material assimilated by the students introduces diversity and interest into the learning process.

In the process of analyzing game technology, D.B.Elko comes to the following conclusion: game is an activity that reproduces social relations in society

According to D.B. Elkonin, the main components of the game are distinguished as follows:

- role assumed by the players;
- relationships given in the plot and game (taken from life).
- increasing the number of adults and games;
- rules of the game that players follow.

We need to define three main stages of the methodological organization of game technologies in English lessons (Figure 4)

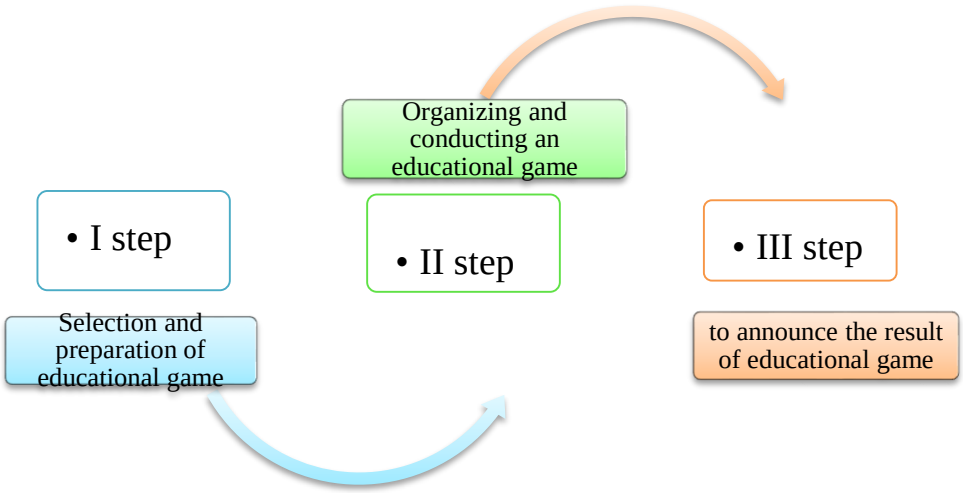


Figure 4 Main stages of methodological organization of game technologies in English lessons

Stage I: selection and preparation of a learning game;
Stage II: Organizing and conducting a learning game.
Stage III: Announcing the results of the educational game.

When conducting the game, the teacher should keep in mind that the game should solve possible tasks for the students, but tasks that are not easy to perform cannot be excluded. Students should have a good understanding of the content and essence of the game, its rules and operations, and know the idea of each game role. Moreover, the content of the game should be pedagogical, and its selection depends on the players' age, their physical development, and worldview.

Scholar V. Ramazanova notes that game technology, like other means of educational influence on students, requires caution. Play is an essential tool for development and upbringing, a vibrant and joyful tool. He noted in his work that the educational value of games is reflected in their rules.

The importance of game technologies in the formation of students' phraseological competence leads to the following skills:

1. Grammatical games recreate a natural situation; students learn to use speech by developing grammatical difficulties, patterns, independent work, and creative activity using a specific speech pattern.

2. Lexical games teach students to use vocabulary in various situations, introduce them to new phrases close to reality, and develop schoolchildren's speech reactions, speech, and thinking skills.

3. Phonetic games allow students to develop their speaking skills through practice.

4. Writing English words through orthographic games. The game may be designed to teach memorization, and students will pay attention to complex lexical units in their written work.

5. Creative games teach understanding the meaning of the presentation and highlighting the main points, allowing for the development of speaking and listening skills.

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Rezyume: *Maqolada ingliz tilini o'qitishda o'yin texnologiyalarini integratsiyalash orqali bilim va malakani baholashning nazariy va amaliy yondashuvlari muhokama qilinadi.*

Резюме: *В статье рассматриваются теоретические и практические подходы к оценке знаний и квалификации посредством интеграции игровых технологий в обучение английскому языку.*

Kalit so‘zlar: *o'yin texnologiyalari, idiomatik kompetensiya, frazeologik kompetensiya, ingliz tilini o'qitish, A1 darajasi, motivatsiya*

Ключевые слова: *игровые технологии, идиоматическая компетенция, фразеологическая компетенция, обучение английскому языку, уровень A1, мотивация,*

METHODS OF MASTERING PAINTING TECHNIQUES AND TECHNOLOGIES AS AN EFFECTIVE MEANS OF DEVELOPING THE QUALITY OF STUDENTS' PROFESSIONAL ARTISTIC TRAINING

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Summary: *The article is dedicated to studying the professional and technical methods of visual arts aimed at enabling university students to carry out creative work in various types and genres of visual art.The article presents the results of a special project on the history, techniques, and technology of painting, which provides students with the opportunity to study the history of painting and practical exercises necessary for professional artistic practice.*

Key words: *artistic and pedagogical education, approach, oil painting technology, learning, diversity of color, integrity of thinking, color materials, means of visual expression, quality of artistic training, artistic mastery.*

The success of a university graduate's professional, pedagogical, artistic-creative, and research activities depends on the quality of their training at the Faculty of Art. Today, an art teacher is required to possess broad knowledge and mastery of painting techniques. A modern artist-pedagogue must pay attention to the development of contemporary art, correctly evaluate the significance of ancient heritage, be familiar with art history terminology, have deep theoretical knowledge as well as practical experience and skills, be able to work with various artistic materials, and master painting techniques across different forms and genres.Traditionally, the system of professional artistic training gives leading importance to subjects such as drawing, painting, composition, sculpture, and art history. The integration of educational content, interdisciplinary approaches, and the emergence of new courses in visual arts represent modern trends. Painting, as a core academic discipline, plays a crucial role in the professional training of skilled artist-pedagogues who achieve a high level of artistic mastery. During the process of training professional artists at higher educational institutions, the design and implementation of courses such as *"Portrait Painting," "Decorative Painting," "Painting Techniques,"* and *"The Art of Copying"* serve as vivid examples of integrating and enriching the content of the *"Painting"* discipline.In higher education, attention is focused on guiding students toward the technical aspects of creating paintings, since the color characteristics of a picture largely depend on professional use of materials and their possibilities. The concept of "painting technique" includes the skills, methods, and approaches used in the creation of a work of art.When speaking about the importance of the creative process in painting technique, the famous Russian artist K. F. Yuon wrote:"A single work can astonish the viewer solely by its technical perfection, even without speaking of its content. During the working process, the artist's emotions are directed not only toward contemplating the external world, but also toward understanding the quality and properties of materials and tools, as well as all the characteristics that may be utilized when necessary."[1.44].

As a result, the quality of a painting is closely related to the artist's skill — that is, to how well they master the chosen material. Moreover, the ability to use materials skillfully depends on the artist's capacity to perceive the depicted object and its overall form as a unified and expressive whole, to disregard secondary and excessive details, and to select only what is most essential for conveying the creative intent. In painting technique, the ability to apply paint to the surface, to skillfully convey the form and color of depicted objects, and to achieve a particular texture of the color field plays a significant role. These aspects largely depend on the artist's temperament, experience, and manner of applying color to the pictorial surface. The characteristics of the pictorial surface and its texture influence the intensity of color, the individuality of the depicted objects, and the overall color harmony of the composition. The field of painting technique also encompasses the purposeful use of color, including the transmission of contrasts and harmonies of tones required in different situations, as well as the skillful use of varying degrees of paint layer drying on the surface (whether

working “wet-on-wet” or “dry”). When an artist discovers the appropriate methods and confidently applies them through precise movements of the hand across the surface—successfully resolving both distinct and subtle color forms—they can convince the viewer of the correctness of their chosen approach and take satisfaction in their creative process. However, an artist’s interest in technique alone cannot yield truly positive results in artistic creation. Technical skill should serve to define the artistic intent and expressiveness of all the plastic and coloristic means of painting. The chosen method of applying paint also plays an important role in conveying the artist’s creative idea, since whether the paint is applied thickly, densely, or in transparent layers — even when using the same pigments — it slightly alters the viewer’s perception of color. The character of the painted surface and its orientation relative to the light source can produce variations in color. The choice of technical method is often determined by the nature of the depicted object itself. For instance, it may depend on whether the composition includes the heavy mass of a figure, the flatness of a body of water, the soft blurring of distant views, or the folds of fabric, and so on. In the coloristic solution of a painting, texture — along with the interrelation of colors — holds a particularly important place, as it enhances the emotional expressiveness of the artwork. The expressiveness and emotional impact of color diversity in the image are determined by the unity of the artistic means employed by the painter and the effectiveness with which the qualitative characteristics of the depicted objects are conveyed.

By comprehending the meaning of what he observes, the artist transitions to an aesthetic understanding of reality, selecting and expressively depicting those elements that define the compositional structure and generalize the diversity of light and color in the world. The artist does not merely copy what he sees or the color properties of objects but reveals their essence and the distinctive characteristics that emerge in the process of working from nature. Here, the individuality of the artist, his practical experience, and his unique methods of solving compositional and color problems become apparent. Ultimately, this reflects the artist’s creative tendency and direction. [2.68].

Mastering professional skill is a highly complex task. Achieving high levels of mastery and technical perfection in painting may require an artist’s entire lifetime. In our view, higher art-pedagogical institutions must provide the necessary educational foundation to develop the painting skills of creative young artists. Students entering higher educational institutions represent various artistic professions — designers, decorative-applied artists, art historians, and visual art teachers. Although the general level of their professional artistic preparation is relatively high, in some cases their works reveal insufficient expressiveness in execution and a lack of mastery in painting technology. This is often due to the fact that the study of painting techniques and technologies in many educational institutions is not pursued in sufficient depth. Technical methods and visual means are usually studied separately from their historical context. Graduates of general art schools often lack sufficient knowledge of the technical traditions of European painting and are unfamiliar with the finer aspects of painterly mastery. Observation of students’ artistic practice at higher education institutions shows that many of them are influenced by the techniques characteristic of renowned masters. However, this interest in the works of great artists often stems from a fascination with their external manner of painting rather than from a deep study of their working methods and overall creative path. Naturally, mere imitation and superficial copying can only distract from the true depiction of nature and prevent young artists from discovering their own unique artistic language. Mastery in painting, in addition to proficiency with diverse materials, also depends on the artist’s visual perception — that is, the ability to envision the future composition and its overall color harmony before beginning to paint. The capacity for holistic artistic thinking is largely determined by the experience accumulated through practice. In artistic thinking, visual expressiveness develops in close connection with the mastery of professional painting tools, which includes knowledge of materials and various technical methods of using certain pigments. As students acquire painting skills, they learn to perceive and anticipate the colors that will appear on the canvas when mixed and applied from the palette. Raw paint organically transforms into color that harmoniously blends with the overall tone of the painting.

Students of painting, by using relationships between colors, are able to convincingly express the appearance of objects through color, defining their volumetric form, materiality, spatial depth, and many other characteristics of the observed nature. When working with paints, the tonal scale can be determined by the specific tasks set in the students' practical assignments. Speaking about the difficulties of using local colors in painting, it should be noted that everything here depends on practical experience, since on a flat surface of any colorful material, it is quite challenging to achieve the desired result simply by applying pure color.

In nature, colors are largely harmonized and unified through the atmosphere. An experienced artist, making use of the possibilities offered by various visual art techniques, selects in each case — whether it be a landscape, still life, portrait, or figurative composition — a specific system of relationships necessary to convey the creative idea expressively. A professional artist possesses the ability to perceive and prioritize the most essential aspects of incoming visual information while disregarding secondary forms and excessive details that lie beyond the main pictorial task.

This intellectual quality enables the artist to encompass all the intended motifs simultaneously and achieve the necessary unity for a harmonious and aesthetically complete composition. A lack of understanding of thematic depiction often stems from students' inability to grasp the laws governing the representation of space in art. Many students lack sufficient experience in purposeful observation of nature — an observation based on analyzing the essence of objects or natural scenes affected by light and atmospheric conditions. Even if a painting student is able to perceive color and tonal gradations well in nature, this does not necessarily mean that they can reproduce them professionally in a painting, as they may still convey tonal transitions that do not function effectively within the composition. Therefore, the professional use of visual means must be developed in close connection with the cultivation of holistic artistic and creative thinking in students. When observing nature, young artists should be able to envision the potential solution of a future landscape composition in a specific medium — for example, watercolor, gouache, tempera, or oil paint. Thus, mastering painting techniques plays a vital role in developing the professional artistic skills of university students. Today, the educational potential of ancient artistic heritage is not given sufficient attention in the learning process. There is a lack of focus on studying the history of painting practices, the formation of techniques, and the mastery of traditional methods and tools used by old masters. In our view, teaching through the study and example of renowned artist-pedagogues serves as one of the most essential means of fostering students' creative development and professional formation. All of this has led to the development of new interdisciplinary university courses such as *"History, Technique, and Technology of Oil Painting"* and *"History and Technique of Watercolor."* The design of such courses is carried out under the influence of two main trends in the development of modern higher art and pedagogical education. *"Art History"* and *"Painting"* are closely related disciplines, and it is not difficult to identify their deep internal connections. In the courses we have proposed, a set of theoretical topics on the history, techniques, and technologies of visual arts is practically applied. These topics are studied both during lectures and seminars, as well as through independent research conducted by university students in libraries and art museums. Students' mastery of the course content is effectively achieved through individual projects that involve studying the technical and artistic possibilities of oil and watercolor paints while copying works of old masters. The independent work of university students consists of creating an analytical copy of a classical painting and preparing a report that outlines the sequence and results of their research. A thorough study of famous works of painting enables young artist-educators studying at higher education institutions not only to understand the individual technical methods and tools of the great masters of the past, but also to fully comprehend the secrets of ancient techniques by effectively applying them in their own creative practice. For copying exercises, it is recommended that students use outstanding works by the great masters of the past—those that demonstrate a high artistic quality, distinctive style, individuality, and a rich variety of technical approaches and tools. The development of visual art techniques and technologies is studied within a historical context, which allows students to anticipate future trends in their evolution. In his *Treatise on Painting*, Leonardo da Vinci emphasized the necessity of copying in the training of young artists. Copying serves as an effective method for teaching students the secrets

and subtleties of artistic mastery, allowing them to gradually prepare for professional activity while improving and developing the quality of their own work. In the process of copying, students use modern materials; however, these must be carefully selected in order to achieve results as close as possible to the original. [3.75].

Fulfilling each task of this rule helps students understand the essence and uniqueness of copying the works of famous master artists and contributes to developing their comprehension of the subtle aspects of the master's technique. The choice of a painting or a specific fragment for copying is a matter of personal preference. Successfully completing a complex work by a master can evoke a deep sense of satisfaction and inspire confidence in one's own abilities. The academic courses include students' artistic practice both in the studio and in open-air settings (plein air), which ensures a continuous process of performing sequential assignments aimed at mastering painting techniques, with each subsequent task largely building upon the previous ones. In developing educational courses on visual art techniques, we took into account the necessity of encouraging students to practically master specific tasks to successfully acquire artistic skills and to guide them toward independently studying issues related to this subject. The structure of practical work is based on the consistent acquisition of skills through depicting various natural objects and motifs of differing complexity. Through expressing diverse relationships of color in solving forms, students master different methods that enrich their understanding of the material's potential. Moreover, in visual art, technical means are not mere external decoration in relation to pictorial expression but are organically interconnected, as the content of each artwork can only be conveyed through a clear artistic form. To develop their artistic mastery, students of art faculties are recommended to engage not only in long-term projects but also in short-term sketches and exercises that require capturing the full power of color in a single sitting. In some cases, color sketches are created without first drawing them in pencil. Short-term studies play a special role in the process of learning to draw. A sketch made in a short period of time (1–2 hours) helps the artist accurately observe and express the main color accents that define the characteristics of form. This skill is also important when working on long-term assignments [4.23].

At the same time, conveying compositional and pictorial approaches in large-scale works is much more challenging. Short-term studies using tempera or watercolor paints require mastery in conveying the color appearance of objects, generalizing their shapes, and emphasizing the most important aspects of the depicted subject. For example, working on a landscape involves studying the relationships between colors that characterize nature under various weather conditions and at different times of the year. These relationships should be clearly defined in a generalized outline.

The main focus should be on the importance of light and color masses in the overall coloristic structure. Regular practical work on copies enables students to gain confidence in using various means and methods of depiction based on the skills they have accumulated. The study of pictorial techniques cannot be carried out without active engagement in the creative process, as it contributes to the students' artistic development, enhances their individual approach to the use of visual tools, and inspires the desire to paint independently. During the educational process, the courses on painting techniques can be integrated as components of the general course *"History, Techniques, and Technologies of Painting"*, since they share a similar structure. They are built on a unified interdisciplinary principle, focusing on the essential historical-theoretical and technological-practical aspects of watercolor and oil painting. These courses can be effectively used as active learning modules.

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Rezyume: *Maqola oliy o‘quv yurti talabalari tomonidan tasviriy san’at turlari va janrlarida ijodiy ishlar olib borish maqsadida tasviriy san’atning professional usullari hamda texnik usullarini o‘rganish masalalariga bag‘ishlangan.Maqolada talabalarga rangtasvir tarixi va professional badiiy amaliyot uchun zarur bo‘lgan mashg‘ulotlarni o‘rganish imkonini beruvchi rangtasvir tarixi, texnikasi va texnologiyasining maxsus loyiha natijalari keltirilgan.*

Резюме: *Статья посвящена изучению профессиональных и технических методов изобразительного искусства, направленных на то, чтобы студенты высших учебных заведений могли выполнять творческие работы в различных видах и жанрах изобразительного искусства.В статье представлены результаты специального проекта по истории, технике и технологии живописи, который предоставляет студентам возможность изучать историю живописи и практические занятия, необходимые для профессиональной художественной практики.*

Kalit so‘zlar: *badiiy-pedagogik ta’lim, yondashuv moybo‘yoq rangtasvir texnologiyasi, o‘rganish, rang-barang, tafakkur yaxlitligi rangli material, tasvir vositalari, badiiy tayyorgarlik sifati, badiiy mahorat.*

Ключевые слова: *художественно-педагогическое образование, подход, технология масляной живописи, обучение, разноцветный, целостность мышления, цветной материал, изобразительные средства, качество художественной подготовки, художественное мастерство.*

EFFECTIVE TEN TECHNIQUES FOR SUCCESSFUL PRESENTATION

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Summary: *Strong presentation skills are essential for achieving success in academia, business, and education. This article consolidates evidence from global and regional sources—especially from Uzbekistan and Russia—regarding strategies that enhance presentation quality. Employing a qualitative, literature-based method, the study outlines ten effective tips for successful presentations: a clear structure, intentional use of visuals, confident nonverbal communication, engagement with the audience, practice, effective time management, storytelling, control of vocal delivery, incorporating feedback, and adjusting to the audience's context. The analysis combines insights from international journals and local research to demonstrate how cultural and educational settings impact presentation skills. Findings indicate that successful presenters exhibit shared behaviors such as thorough preparation, clarity, and awareness of the audience. The article concludes by discussing the educational implications of incorporating presentation-skill training into curricula and professional development initiatives.*

Key words: *presentation skills, communication, education, feedback, oral performance, Uzbekistan, Russia.*

Introduction

Presentations are one of the most powerful tools for disseminating knowledge, persuading audiences, and demonstrating professional competence. Whether in academic, corporate, or public contexts, a presentation is more than a transfer of information—it is a performance that combines verbal, visual and nonverbal elements. Research consistently shows that presentation skills contribute to academic and career success (Anderson, 2016; Gallo, 2014). The capability to express ideas with clarity and confidence has become vital in today's information-driven economy. Communication and presentation skills have been analyzed through various academic lenses, including linguistics, psychology, education, and management. Research conducted by Mehrabian (2017) and Duarte (2019) highlights the significant impact of nonverbal signals, slide aesthetics, and storytelling techniques on audience perception of messages. Recent studies (Reynolds, 2020; Kosslyn, 2011) focus on the cognitive factors influencing audience attention and recall, advocating for a clear structure and visual clarity. Nonetheless, despite extensive research from a Western perspective, there has been less focus on regional contexts—especially in Central Asia—where educational reforms are increasingly emphasizing the importance of oral communication skills. In Uzbekistan and Russia, educational modernization has included explicit goals to improve students' presentation and public-speaking abilities (Karimova, 2024; Sotlikova, 2023; Valleva & Polukhina, 2018).

However, educators and learners frequently do not have the necessary access to research-backed advice on the elements that contribute to an effective presentation. As a result, this article examines international and local research to pinpoint strategies that are supported by evidence—structured as ten "proven tips"—that improve presentation performance.

The objectives of this study are:

To synthesize international and regional research on effective presentation techniques;

To categorize best practices into ten actionable principles;

To discuss implications for educators and trainers developing presentation-skill curricula.

Materials and Methods

This article employs a qualitative literature-based approach to compile peer-reviewed and scholarly works that investigate effective practices in presentations. The process consists of three main stages:

Source Identification: Pertinent academic books, journal articles, and conference papers were gathered from databases such as Google Scholar, ResearchGate, and CyberLeninka, utilizing keywords like presentation skills, oral communication, public speaking training, and educational methodology.

Research published in English, Russian, and Uzbek between 2010 and 2024 was examined to encompass both global and regional viewpoints.

Evaluation and Classification: The contributions of each study to our knowledge of how presenters organize, create, and deliver impactful presentations were examined. To find recurrent tactics or "tips" linked to effective results, thematic coding was used.

Integration and Interpretation: Using data from theoretical and empirical works, the themes were combined into 10 useful principles.

This approach was inspired by integrative review techniques used in communication and educational research (Torraco, 2016). By including Uzbek and Russian subjects, possible cultural and pedagogical differences can be addressed through contextual comparison. Triangulation, or comparing findings from various educational systems and participant populations (e.g., students, teachers, and professionals), improved the dependability of the results.

The analysis of global and regional studies revealed ten key strategies consistently associated with effective presentation outcomes. These tips are presented below with supporting evidence.

1. Clear Structure and Organization

A presentation that is well-structured guarantees that the audience will understand and remember it. According to research by Kosslyn (2011) and Reynolds (2020), logical flow—an interesting introduction, a well-organized body, and a memorable conclusion—is essential to a presentation's effectiveness. According to Uzbek research, "Skills of presentation activities", can be divided into the following stages: 1. Planning a scientific presentation. 2. Design of the main parts of the scientific presentation. 3. Speech clichés for oral presentation in English. 4. Presentation of the presentation. (D. Sabirova , 2023)

2. Purposeful and Simple Visual Design

Visual materials enhance message clarity when used strategically. Duarte (2019) and Alley (2013) emphasize that slides should highlight—not repeat—spoken content. Uzbek research (Sotlikova, 2023) reports that visual contextualization helps learners grasp abstract vocabulary and improves audience engagement. Russian studies (Valleva & Polukhina, 2018) found that engineering students benefited from explicit instruction on slide design and layout consistency.

3. Confident Nonverbal Communication

Perceived credibility is significantly influenced by nonverbal clues like posture, facial expressions, and gestures. According to Mehrabian's (2017) communication model, body language accounts for as much as 55% of audience perception. According to local study, pupils who keep their posture open and maintain eye contact are perceived as more prepared and convincing (Karimova, 2024).

4. Audience Engagement and Interaction

Engagement changes a one-sided conversation into an interactive exchange. Gallo (2014) and Anderson (2016) recommend using rhetorical questions, narratives, or live polls as methods to sustain engagement. In Uzbek settings, Kosimova & O'ktamova (2024) showed that implementing role-play and discussions enhances fluency and diminishes anxiety for students acquiring English presentation skills.

5. Practice and Rehearsal

Rehearsal enhances fluency and diminishes anxiety. Research by Lucas (2019) and Prince (2022) shows that numerous practice sessions greatly enhance confidence and vocal management. Likewise, Uzbek educators (Sotlikova, 2023; Karimova, 2024) highlight the importance of practicing repeatedly with feedback, associating it with enhanced language skills and effective presentation delivery

6. Management of Time

Skilled speakers find a harmony between profundity and conciseness. Studies by Duarte (2019) and Reynolds (2020) indicate that going over the designated time decreases audience retention and assessment ratings. Students at technical universities in Russia (Valleva & Polukhina, 2018) showed enhanced performance following training with explicit time limits, highlighting the necessity for discipline in managing timing and pacing.

7. Narrative and Emotional Bonding

Storytelling components enhance the retention of information. Gallo (2014) discovered that narratives evoke empathy and improve memory retention. According to Dr. Indah Lestari, D.Kambarova and M. Isamukhamedova, presentations are an important interactive method in the development of students' oral speech. In this process, students express their opinions on a pre-prepared topic in front of the group. This activity allows them not only to improve the culture of speech, but also to form the skills of expressing their thoughts clearly, fluently, and logically.

8. Vocal Variation and Precision

Vocal variety—alterations in pitch, speed, and volume—enhances expressiveness. As stated by Lucas (2019), a monotone presentation results in loss of attention, whereas varied modulation keeps engagement. Karimova (2024) highlights the importance of educating students in articulation and breathing methods, demonstrating noticeable progress in clarity and self-assurance.

9. Input language feedback and contemplation

Pursuing and utilizing feedback improves skill advancement. Global studies (Brookfield, 2017; Prince, 2022) indicate that peer and instructor feedback are essential for ongoing enhancement. Collaboration with peers and receiving feedback are essential for improving students' oral communication abilities. Collaborative learning settings promote student interaction, idea sharing, and the exchange of constructive feedback regarding one another's communication skills. Peer feedback sessions, peer review tasks, and peer-led dialogues encourage reflection, self-evaluation, and ongoing enhancement in verbal communication skills.(Karimova, 2024)

10. Adjustment to Situation and Audience

Cultural and situational understanding affects the effectiveness of messages. Hofstede (2011) and Ting-Toomey (2017) emphasize the influence of cultural dimensions on presentation standards. Russian educators (Valleva & Polukhina, 2018) noted that tailoring content to the audience’s knowledge and cultural context enhanced engagement and minimized confusion.

Results and Discussions

The integration of global, Russian, and Uzbek research validates that presentation competence is a complex skill necessitating a blend of cognitive, linguistic, emotional, and technological capabilities. The ten validated strategies noted in the Results section indicate that successful presentation delivery relies not just on language skills but also on self-discipline, design insight, and responsiveness to audience needs.

Combining Global and Local Viewpoints

Worldwide, communication studies highlight universal presentation principles—clarity, engagement, and organization (Anderson, 2016; Gallo, 2014). Nonetheless, merging insights from Uzbekistan and Russia reveals significant contextual variations. For instance, research on Russian studies (Valleva & Polukhina, 2018) highlights the importance of training tailored to specific disciplines—students in engineering, linguistics, and education frequently need varied formats and terminology control.

In Uzbekistan, an education system that is quickly becoming international has emphasized English-language instruction and presentation skills as a way to integrate into the global academic community (Karimova, 2024). Nonetheless, cultural communication styles—like indirectness or formality—continue to influence how speakers tackle public speaking assignments.

This suggests that although global models (such as TED-style speaking and PowerPoint design standards) are beneficial, adjusting to local customs is essential for effective communication. Consequently, training programs for presentations ought to integrate universal best practices with culturally aware teaching meth *Pedagogical and Professional Implications*

The findings offer important advice for teachers and trainers creating communication programs. Incorporating these ten strategies into curricula motivates learners to:

Enhance both spoken and unspoken elements of communication;

Utilize reflective practice and feedback mechanisms;

Acknowledge the cross-cultural aspects of presentation.

Uzbek and Russian teachers have started to implement task-based methods, utilizing realistic presentation simulations and peer evaluations to enhance fluency and build confidence (Kosimova &

O'ktamova, 2024). Nonetheless, obstacles persist—restricted technological availability, variable evaluation standards, and insufficiently trained educators frequently impede organized advancement odds.

Conclusion

This article analyzed global, Russian, and Uzbek studies to pinpoint ten effective strategies for successful presentations. Regardless of context, common themes surfaced: successful presenters organize thoroughly, utilize visuals effectively, involve their audiences, and adjust to cultural and situational circumstances. The synthesis verifies that presentation skills can be taught and enhanced, relying on organized training and reflective practice. Thus, educational programs must emphasize the enhancement of presentation skills across various disciplines, merging international best practices with local educational objectives.

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Rezyume: *Ilmiy doiralarda, biznesda va ta'limda muvaffaqiyatga erishish uchun kuchli taqdimot qobiliyatlari zarur. Ushbu maqolada taqdimot sifatini oshiruvchi strategiyalar bo'yicha jahon va mintaqaviy manbalar, ayniqsa O'zbekiston va Rossiyadan olingan dalillar jamlangan. Adabiyotlarga asoslangan sifatli usuldan foydalangan holda, tadqiqot muvaffaqiyatli taqdimot uchun o'nta samarali maslahatni taqdim etadi: aniq tuzilma, vizual vositalardan maqsadli foydalanish, ishonchli noverbal muloqot, auditoriya bilan muloqot qilish, mashq qilish, vaqtni samarali boshqarish, hikoya qilish, ovoz ijrosini nazorat qilish, fikr-mulohazalarni o'z ichiga olish va*

auditoriya muhitiga moslashish. Tahlil madaniy va ta'lim muhitlari taqdimot ko'nikmalariga qanday ta'sir qilishini ko'rsatish uchun xalqaro jurnallar va mahalliy tadqiqotlardan olingan ma'lumotlarni birlashtiradi. Natijalar shuni ko'rsatadiki, muvaffaqiyatli boshlovchilar puxta tayyorgarlik, aniqlik va auditoriyani xabardor qilish kabi umumiy xatti-harakatlarni namoyish etadilar.

Резюме: *Сильные навыки презентации необходимы для достижения успеха в академических кругах, бизнесе и образовании. Эта статья объединяет доказательства из глобальных и региональных источников - особенно из Узбекистана и России - относительно стратегий, которые улучшают качество презентаций. Используя качественный, основанный на литературе метод, в исследовании представлены десять эффективных советов для успешной презентации: четкая структура, намеренное использование визуальных элементов, уверенная невербальная коммуникация, взаимодействие с аудиторией, практика, эффективное управление временем, повествование, контроль вокальной подачи, включение обратной связи и адаптация к контексту аудитории. Анализ объединяет информацию из международных журналов и местных исследований, чтобы продемонстрировать, как культурные и образовательные условия влияют на навыки презентации. Результаты показывают, что успешные докладчики демонстрируют общее поведение, такое как тщательная подготовка, ясность и осведомленность аудитории. Статья завершается обсуждением образовательных последствий включения презентационно-навыковой подготовки в учебные программы и инициативы по повышению квалификации.*

Kalit so'zlar: *taqdimot mahorati, muloqot, ta'lim, qayta aloqa, og'zaki nutq, O'zbekiston, Rossiya*

Ключевые слова: *презентационные навыки, коммуникация, образование, обратная связь, устное исполнение, Узбекистан, Россия.*

NATIONAL CULTURAL CHARACTERISTICS: ETHICAL CONCEPTS OF "JAQSÍLÍQ" (GOOD) AND "JAMANLÍQ" (BAD)

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Summary: Despite the difference between a concept and a category, it is necessary to show that the effects of categorization can also be included in the definition of the scope and content of a concept. For example, if the ethical concepts of «good» and «bad» are studied from the perspective of a cognitive category, then they can be included in the concept of «ethics» at a higher categorical level.

From a cognitive perspective, morality is essentially a higher-order category compared to the categories of «good» and «bad», which are intermediate and basic categories, as well as prototypes that are the best examples of their class.

***Key words*:** ethics, ethical concepts, linguoculturology, image, scheme, national-cultural.

INTRODUCTION

The linguocentric approach to the analysis of moral categories was first proposed within the framework of analytical philosophy by J.E. Moore, who placed the questions of what is good and bad, right and wrong, etc., not on the philosophical, but on the semantic plane [7; 1]. That is why today we can speak of good and bad as concepts.

Considering a concept as a collection of knowledge about the world also means that a concept is itself a format (quantum, unit) of encyclopedic knowledge about reality, therefore concepts are a mixture of national culture in the consciousness of native speakers [4; 42]. In this case, the concept, as a concept ingrained in culture, possesses emotionality and connotations, acquiring axiological and linguistic «nouns» [3; 39]. For example, the ethical concepts of «good» and «bad» are given various national cultural characteristics. The most prominent of these is the religious symbol reflected in the phraseology «the tree of knowledge of *good and bad*.» For concepts with such cultural connotations, it is very difficult to find correspondence in other linguistic representations of the world where Christianity is not the main religion and is not even universal: for example, in the Karakalpak worldview, the ethical concepts of «good» and «bad» have connotations directly related to the religions of «Islam.» V.A. Maslova, V.N. Teliya, N.D. Arutyunova, T.B. Radbil, Yu. It is worth noting that local researchers like S. Stepanov and others are paying close attention to the study of the cultural connotations of concepts.

It was previously indicated that the category image schema (topological structure) can be used to describe the concept structure. In general, the scientific paradigm of cognitive science has four models of topological structure: the basic validity model, the proximity algorithm, the mean-interval model, and the prototype model [9; 382-407]. The latter model is related to the theory of family similarity and the theory of basic categories. These are what are used in our research.

Family similarities usually refer to a network of similarities [11; 25], through which all members of one category unite and emerge. In other words, a member of any category simultaneously possesses at least one or more characteristics present in another and/or other members of the same category. Moreover, there are few characteristics common to all members of this category; at least, there are no common characteristics [8; 575]. In our case, the category of «ethics» serves as proof of the latter.

Prototypes are understood as the most typical members (best examples) of a category, which not only possess the maximum number of categorical features but also reveal the fundamental (core) meanings of the emergence of this category in the language within the language system. Around the prototypes are located the remaining members of the category with a lesser degree of similarity to «primary meanings» [9; 112].

In prototype theory, any concept consists of a core, typically the lexical meaning of a particular lexeme, the linguistic verbalization of that concept, and a periphery, which includes subjective

experience, various pragmatic components of the lexeme, connotations, and associations [3; 45]. In other words, the study of the scope and content of a concept cannot be carried out without considering the lexical meaning of the linguistic representation of this concept and the connotative meanings related to the representation in this language. For example, the core of the ethical concept of «goodness» is the lexical meaning of «the honest and beneficial good that the duty of a person, citizen, or family demands of us» [1; 455]. The semantic features of «goodness,» «honesty,» «utility,» and «duty» are, therefore, part of its core. Furthermore, for the ethical concept of «bad» the lexical meaning «bad and unpleasant, to do and do evil to others, harmful, lazy, contrary to good» [1; 706] serves as the core. It is not difficult to see that the words «bad» and «unpleasant,» together with the word «evil,» appear as a linguistic verbalization of the core of this concept, while signs such as «harmful,» «damaging,» etc., fall on the periphery.

In order to define the scope and content of a concept, it is necessary not only to determine the referent (defined) position in the use of words that are representatives of the concept, but also to pay attention to the etymology (origin) of words that are the linguistic representation of this concept, as well as to take into account the contexts in which these words are used [3; 45-46]. For example, to create conceptual metaphor and metonymy models of the concept of «goodness,» we chose the word «goodness» and its related words.

At the end of this section, it is necessary to say a few words about the connection between concept and concept [2]. In our view, the concept in philological sciences is not merely a thought-provoking structure, but rather a simple concept based solely on human empirical experience and encompassing encyclopedic knowledge that embodies the national characteristics of ethnic culture. In this regard, everything in a concept is included in its content, and ethnocultural characteristics are also added to it. Thus, a concept is not a short-term construct in an individual's operational memory [6; 86], but rather a minimal mental unit of long-term memory of ethnocultural individuals.

Now we move on to the accepted concept of good and bad, based on the ethical concepts of Moore and Wittgenstein. In our opinion, the general cognitive «section» that unites all the various aspects of understanding good and bad consists of the following:

(1) «good» is some kind of invariant that arises in the collective linguistic consciousness of native speakers within the framework of the main idea of the Russian language - «nuances of human relations»; this is a manifestation of subjective morality, the source of which is conscience; this is the highest positive member of the «good-bad» scale of values, reflecting precisely the moral type of values: good to another, or material, or psychological, and to oneself, bringing spiritual satisfaction;

(2) «bad» is also some kind of invariant that arises in the collective linguistic consciousness of native speakers within the framework of the basic idea of the Russian language «nuances of human relations»; this is a subjective moral manifestation, the source of which is conscience, but which has a negative sign (conscience does not accept); this is the extreme negative member of the «good-bad» scale of values, reflecting the moral form of values: harm to others, or material, or psychological harm, and mental discomfort to oneself.

Thus, the lexical unit «jaqsılıq» (goodness) as a linguistic objectification of the ethical concept of «jaqsılıq» initially had the meaning of «private property, things.» The lexeme «jaqsılıq» (goodness) is associated with the concepts «miyrimlilik», «mehribanlıq», which do not yet reflect ethical concepts in Old Karakalpak.

Unlike the lexeme «good,» the word «bad,» as a linguistic objectification of the ethical concept of «bad,» initially has the meaning of «behavior deviating from negative values and moral norms,» which is directly related to the moral consciousness of the people. More specifically, in Old Karakalpak, the lexeme «jamanlıq» (bad) was associated with the meanings of deviation, deviation from the right path, and consequently, «deception, lie, misguidance». In modern Karakalpak, the concept of «harm» is also associated with evil.

CONCLUSION

As a result, the concept of this study was substantiated, in which the ethical concepts of

«good» and «bad» are considered as concepts of the basic level of categorization in the hierarchy of ethics, and on this basis, the structure of the conceptual view of good and bad in the Karakalpak-language representation of the ethnic world is determined.

Studying the basic ethical concepts of an ethnic group, on the one hand, allows native speakers to gain a deeper understanding of their people's mentality and value system, and on the other hand, such study opens the way for speakers of other languages and representatives of other cultures to understand the spiritual world of the Karakalpak people. These considerations necessitated the involvement of the scientific tools of comparative linguistics in research. According to phraseology and paremiology, the national and cultural diversity of concepts of good and bad in Karakalpak culture is more pronounced compared to English linguoculture.

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***Rezyume**: Konsept va kategoriya o'rtasidagi farqqa qaramay, kategoriyalashtirishning ta'sirini ham tushunchaning hajmi va mazmunini aniqlashga kiritish mumkinligini ko'rsatish kerak. Masalan, "yaxshi" va "yomon" axloqiy tushunchalari kognitiv kategoriya nuqtayi nazaridan o'rganilsa, ularni yuqoriroq kategorial darajada "axloq" tushunchasiga kiritish mumkin.*

Kognitiv nuqtayi nazardan, axloq mohiyatan oraliq va asosiy toifalar bo'lgan "yaxshi" va "yomon" toifalariga, shuningdek, o'z sinfining eng yaxshi namunalari bo'lgan prototiplarga nisbatan yuqori darajadagi toifadir.

***Резюме:** Несмотря на разницу между концептом и категорией, необходимо показать, что эффекты категоризации также могут быть включены в определение объема и содержания понятия. Например, если этические понятия "хорошо" и "плохо" изучаются с точки зрения когнитивной категории, то их можно включить в понятие "этика" на более высоком категориальном уровне.*

С когнитивной точки зрения, мораль, по сути, является категорией более высокого порядка по сравнению с категориями "хороший" и "плохой," которые являются промежуточными и базовыми категориями, а также прототипами, которые являются лучшими примерами их класса.

***Kalit so'zlar:** etika, axloqiy tushunchalar, lingvomadaniyatshunoslik, obraz, sxema, milliy-madaniy.*

***Ключевые слова:** этика, этические концепции, лингвокультурология, образ, схема, национально-культурный.*

THE ARTISTIC EXPRESSION OF FOLK ORAL CREATIVITY IN SIROJIDDIN SAYYID'S WORKS

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Summary:*This article examines the reflection of folklore in Sirojiddin Sayyid's epics. The study analyzes examples of Uzbek poetry that, as successors of national oral and classical literary traditions, embody the continuity of national identity through the works of Sayyid. It is proven that folklore has exerted a productive creative influence on the development of both classical and modern literary art.*

Key words: *epic, folklore, poetry, tradition, literary influence, classical literature, aesthetic ideal.*

Since the influence of folklore on literary development is immeasurable, any artistic text, when analyzed from a particular perspective, inevitably requires examination in terms of its folkloric impact as well.

As academician Naim Karimov noted: *"The national character of any literature is determined by the living traditions of that people's folklore and classical literature, and by the real place and participation of these traditions in the literary process."* Indeed, rooted in national identity, Uzbek poetry — the modern heir to oral folklore and classical traditions — has constantly striven toward artistic perfection, exploring various ways to praise the Motherland and enrich poetic expression.

Folklore has had a fruitful creative impact on the development of both classical and modern literary art. With the emergence of written literature, folklore significantly influenced its forms, modes of expression, and artistic features. In essence, there is no creator who has not drawn nourishment or spiritual strength from the oral creativity of the people.

The influence of folklore can be clearly seen in the works of major figures of classical literature such as Mahmud Koshg'ariy, Yusuf Xos Hojib, Ahmad Yugnaki, Lutfiy, Atoyi, Alisher Navoi, Zahiriddin Bobur, Ogahiy, Muqimiy, and Furqat, as well as in the works of modern Uzbek writers like Abdulla Avloniy, Cho'lpon, Abdulla Qodiriy, Oybek, G'afur G'ulom, Hamid Olimjon, Mirtemir, Odil Yoqubov, Primqul Qodirov, Erkin Vohidov, and Abdulla Oripov.

In the post-independence period of Uzbek literature, many poets and writers have continued to study and creatively reinterpret the experiences of folk oral traditions, producing new forms of artistic thought. The works of Xurshid Do'stmuhammad, Nazar Eshonqul, Ulug'bek Hamdam, Luqmon Bo'rixon, Faxriyor, Sobir O'nar, Abduvali Qutbiddin, Matnazar Abdulhakim, and many others bear strong traces of the living influence of folklore.

As academician To'ra Mirzayev pointed out, under conditions of independence, the role and significance of folklore and artistic culture have grown even greater in ensuring the maturity of society, the depth of social consciousness, and the spiritual richness of the individual. Indeed, folklore embodies the living continuity between generations, reflecting the social and cultural life of the people. It helps every individual understand their nation, its history and future, and adopt high moral ideals as the foundation of practical life.

The creative influence of folklore on written literature lies in each author's ability to internalize oral traditions and artistically reinterpret them in their own unique way. This process has always been essential to the progress of written literature. In this regard, just as in the works of other writers, these traditions are consistently and meaningfully continued in the creative work of Sirojiddin Sayyid.

In Sayyid's poetry, the feelings of devotion to the homeland, patriotism, love for the people, and glorification of the nation are deeply intertwined with the national and universal ideas expressed in folk epics. These motifs form an integral part of the poet's artistic and spiritual outlook.

Dostonlar tilimni ravon qilurlar, Ravon
suvlar misol so'ylaydi tilim. Yuraklardan

tortib taqdirlargacha, Taqdirlardan tortib
yuraklargacha Oppoq navo yanglig‘
to‘shalgan
“Alpomish”ning satrlari –
bu mening yo‘lim. (3, 58)

Folk songs differ in content and stand out from other folklore genres by their unique manner of expression, performance style, melody, and emotional depth. The diversity of ideas expressed in them — especially those reflecting patriotism and love for the homeland — conveyed in a distinctly folk style, has been thoroughly studied in our literary scholarship.

The ideas of concern for the future of the homeland and its protection from enemies find vivid expression in the lyrical hero’s following address:

Alyor bo‘lsin-ay,
Xo‘jam yor bo,,lsin-ay.
Xo‘jam bergan bu davlatga Dushman
zor bo‘lsin-ay.

The poet, who grew up listening to such folk songs praising our motherland from his grandmother and mother, incorporates rhythmic harmony and thematic unity into his works, creating poems that are stylistically simple and fluent. Among the many of his poems imbued with a folk tone and masterfully depicting the image of the homeland, it is worth emphasizing that his poem **“**My Grandfather’s Homeland” stands out for its deep affinity with traditional folk songs.

Bobojonimning Vatani,
Otajonimning Vatani, Bolajonimning
Vatani,
Ko‘ksimni tog‘ qilib yurdim-ey, Boltalar
kesmagan murtim-ey.

In studying the poet’s wide-ranging poetry, we observe that his lyrical hero not only celebrates the joyful moments of his homeland with a heart full of pride and honor but also shares in the sorrows of the people and shoulders the grief of the nation. One clear example of this is his poem “Compassion,” in which the concerns of the nation and the people are expressed in a distinctly folk manner.

Bu safar men so‘z aytmayin baxtingdan,
O‘zingniki bo,,lgan toj-u taxtingdan, Jindakkina
bayon aylay dardingdan, Kech kuzlarda
zirqiragan belim-ay,
Belin ushlab elim degan elim-ay!

The poet deeply understood the spirit, melody, imagery, thoughts, and emotions of folk songs, as well as their modes of expression — and this is clearly reflected in his works.

Sirojiddin Sayyid skillfully and effectively made use of various genres of oral folk creativity. In particular, he masterfully incorporated the ideas expressed in folk proverbs into his poems through the method of **s**tylization, which testifies to the poet’s high level of artistic mastery.

O‘tar dunyo – biz mehmon,
Har giyohdan terdik don.
Eling omon bo,,lganda,
Yurting ham bo‘lar qo‘rg‘on.

The poet skillfully portrays the profound wisdom embodied in the proverb “If your land and people are safe, your face will never pale,**”** a saying that has taken shape over centuries of folk experience. His poem **“**Spoken from the Dombra” is dedicated to the bard Shoberdi Baxshi, and the emotional depth and artistic meaning conveyed in it are expressed with remarkable precision.

Let us now turn our attention to how the idea expressed in the proverb “As the nightingale loves the meadow, so a person loves his homeland” is reflected in the poet’s lyrical creativity.

Bulbul yashay olmas chamansiz, ona, Inson xor
bo‘ lgaydir Vatansiz, ona.
Vatan barchamizga buyuk Onadir,
Siz buyuk Vatansiz, Vatansiz, ona.

Just as a nightingale cannot live without a meadow, it is also extremely difficult for a person to live without a homeland. The poet emphasizes that the homeland, like a mother, is sacred and unique. These lines naturally inspire every reader to awaken, reflect, and contemplate deeply.

In particular, the poet’s effective use of folk proverbs in creating the poetic image of the homeland reflects not only his loving and profound view of life, but also his aspiration to help his contemporaries understand the diverse world around them. It also demonstrates his commitment to enhancing the emotional power of genuine human values and patriotic ideals within his own heart.

In the poem “Honored Is the One Who Brings Water,” the poet compares the act of bringing water to a place and making it prosperous to bringing peace and joy to countless hearts — once again highlighting that the welfare of the people and the prosperity of the nation are his foremost concerns:*If one place becomes prosperous, a thousand hearts are gladdened, As though from a thousand and one sorrows, a thousand hearts are freed.*

In conclusion, the strong creative influence of both oral folklore and early written sources is evident in literary works of all eras. Sirojiddin Sayyid’s exceptional mastery lies in his ability to artistically reinterpret the aesthetic ideas of folklore and classical sources according to modern artistic and intellectual criteria, thereby creating beautiful and timeless works of art.

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Rezyume: *Maqolada Sirojiddin Sayyid dostonlarida folklorning ifodalanishi masalasi tadqiq qilingan. Milliylik zamirida xalq og‘zaki ijodi va mumtoz an‘analarning bugungi vorisi bo‘lgan o‘zbek she‘riyati namunalari Sayyid she’rlari misolida bayon qilingan. Folklor namunalarining milliy mumtoz va zamonaviy so‘z san‘atining rivojlanishiga samarali ijodiy ta‘sir ko‘rsatishi isbotlangan.*

Резюме*: В статье исследуется проблема выражения фольклора в поэмах Сироджиддина Сайида. На примере стихотворений Сайида показаны образцы узбекской поэзии, являющиеся современными наследниками народного устного творчества и классических традиций в основе национальной идентичности. Доказано эффективное творческое влияние фольклорных образцов на развитие национального классического и современного литературного искусства*

Kalit so‘zlar: *doston, folklor, she’riyat, an’ana, adabiy ta’sir, mumtoz adabiyot, estetik ideal.*

Ключевые слова: *поэма, фольклор, поэзия, традиция, литературное влияние, классическая литература, эстетический идеал.*

THE CONCEPT OF HISTORICISM IN THE POETRY OF HALIMA KHUDOYBERDIYEVA

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Summary: *The article examines the concept of personality in the works of Halima Khudoyberdiyeva. It highlights the poet's mastery in portraying historical figures such as Tomiris, Nodira, Mohlaroyim, and Najmiddin Kubro, through which ideas of national identity, femininity, and spiritual revival are expressed poetically. The study reveals the harmony between historicism and artistic thinking, as well as the philosophical and aesthetic foundations of the human concept.*

Key words: *concept of personality, historicism, national identity, femininity, Halima Khudoyberdiyeva, poetic image, philosophical-aesthetic interpretation.*

In recent years, literary studies have seen active and productive research devoted to the artistic concept of the individual. In this regard, not only Uzbek but also Russian and other foreign scholars' studies are noteworthy. Since the second half of the 20th century, literary scholarship has increasingly focused on analyzing the relationship between the individual and society, history and consciousness, and this approach has secured a firm place in literary criticism.

In Uzbek literary studies, this trend began to take shape in the 1970s. Z. D. Nurmukhamedova (1974) explored the problem of fact and artistic fiction in creating the image of a historical figure. In subsequent years, the works of A. K. Zayniddinova (1981), I. E. Samandarov (1992), H. Karimov (1994), M. Q. Muhammadinov (1995), Z. J. Pardayeva (1995), A. J. Tangirov (1995), O. A. Akbarov (1997), H. O. Karimov (1999), A. N. Nosirov (1999), Sh. B. Isayeva (2001), O. A. Saidov (2002), M. O. Otajonova (2005), G. A. Yusupov (2005), and S. S. Matyoqubov (2005) addressed this issue in the context of various literary genres.

These studies, in general, aim to comprehend the unity of the individual, history, and society, and to analyze the artistic representation of the historical figure through the harmony of psychology, social environment, and philosophical essence. Although the scope, content, and methodology of these works vary, they are united by a common goal - the desire to reveal the artistic and philosophical essence of the concept of the individual.

It is evident that the artistic interpretation of the concept of the individual is extremely diverse in both geographical and methodological terms. In Russian, Uzbek, and world literary scholarship, the process of understanding and explaining the human being takes place across all literary types and genres. As a result, the issue of the individual is studied not only as an artistic image but also as a philosophical and aesthetic category.

From Halima Khudoyberdiyeva's early poems, it becomes clear that the central focus of her artistic thinking was closely linked with the history of the nation, the lives and destinies of great ancestors. From the very beginning of her creative path, the themes of the people and the homeland, as well as the spiritual and cultural connection between the past and the present, became dominant in her work. Her poetic destiny is deeply intertwined with the life of the people, national values, and historical memory — a quality that is especially evident in her appeal to historical images.

In many of her poems, ideas of national pride, historical memory, and self-awareness find their poetic embodiment. Through the image of Tomiris, the poetess internalizes the courage of her ancestors and the bravery and patriotism of a female hero. The symbols of the sword, shield, and scabbard represent not merely weapons of war, but also the spirit of a nation awakened to its freedom and loyal to the idea of independence.

Thus, from her earliest works, the poetess turns to the reality of the past not as a mere historical scene but as the spiritual and moral root, the intellectual foundation of contemporary life. In this regard, Halima Khudoyberdiyeva's understanding of historicity manifests not only as an aesthetic phenomenon but also as a philosophical and artistic conception of national identity.

By reimagining historical female figures such as Tomiris, Nodira, and Mohlaroyim as symbols of national identity, femininity, and patriotism, Halima Khudoyberdiyeva elevates the image of the Uzbek woman to the level of a historical hero, thereby creating artistic models of national consciousness in the female image.

The historical scenes and references to ancestors reflected in her poetry possess significance not only from a literary and artistic standpoint but also from a scholarly and historical perspective. For the poetess, the perception of history and the art of "recollecting" it through poetic reflection become a unique creative process.

Mashrab dorga ketdi. She'ri qoldi. Iz
She'r qoldi. Nodir ketdi, cho'kmay tiz.
Kimga suyanasan xalqi - nodonim.
Iymon asolari shoirlaringsiz.

In Halima Khudoyberdiyeva's poetry, the issues of historical memory and national identity are interpreted through a distinctive system of poetic imagery. In the poetess's lyrical discourse, the sense of history is manifested not merely as a recollection of past events but as a poetic form of perceiving national consciousness, feminine pride, and spiritual heritage.

Falak bolga doim zaxarni qotgan.
Ko'rdim… Temur shohlik sharobin tortgan.
Keyin Qo'qon. Keyin Nodira boshi,
Kundaga qo'yilgan, chopilayotgan.

The poetess aims not to depict historical reality directly but to convey it through a symbolic and figurative language system. Therefore, in Halima Khudoyberdiyeva's poetry, word-images and artistic symbols serve to express inner suffering, emotions, and movements of thought. Through the inner energy of words and the semantic waves of feelings, historical truth gains a renewed life in the poet's heart.

The images created by the poetess - Tomiris, Nodira Begim, and Mohlaroyim - represent examples where historical figures are elevated to the level of poetic concepts in Uzbek literature. Through these images, she not only remembers the heroines of the past but also creates a spiritually independent, morally strong, and proud image of the national woman. Thus, in Halima Khudoyberdiyeva's poetry, the image of woman intertwines with historicity, becoming a central element in the artistic comprehension of national identity.

These lines reveal Halima Khudoyberdiyeva's principle of spiritual and philosophical understanding of history. In the image of the historical figure Najmiddin Kubro, the poetess seeks the spiritual roots of the idea of national revival. The expression "to give one's life for the flag" symbolizes the people's devotion to freedom and faith, representing the spiritual continuity of historical progress. The line "the foundation of revival is born of sorrow and grief" embodies the poet's inner pain and emotional experience of national awakening.

Thus, Halima Khudoyberdiyeva perceives historicity not as a mere reflection of events but as a spiritual and national phenomenon. In her poetry, historical images — Tomiris, Nodira Begim, Najmiddin Kubro, and other sacred figures — become artistic codes of collective memory. The poetess constructs a system of images as a poetic model of national identity. Therefore, her poetic language possesses a distinctive artistic structure where semantic density, metaphorical richness, emotional intensity, and philosophical reflection merge harmoniously.

In this regard, Halima Khudoyberdiyeva's attitude toward the heritage of her predecessors manifests itself in three main stages:

1. Artistic portrayal of historical figures as symbols of national pride;
2. Continuation of their spiritual and philosophical ideas in a modern interpretation;
3. Aesthetic renewal of literary heritage through an approach rooted in spiritual wisdom.

The poet's aesthetic views harmonize with the folk spirit, moral purity, and spiritual perfection characteristic of Ahmad Yassavi's *hikmats* (wisdom poems). Her cycle *"Turtliklar"* (Quatrains), like Yassavi's *hikmats*, combines philosophical content, artistic simplicity, and spiritual depth.

In recent years, the study of the artistic concept of personality has become one of the key directions in analyzing the relationship between the individual and society, history and spirituality in literary studies. The experience of Russian, Uzbek, and world literary scholarship shows that the concept of the human being is interpreted not only at the level of artistic image but also as a philosophical and aesthetic phenomenon.

In Halima Khudoyberdiyeva's work, this tendency finds a unique poetic expression. In her poetry, historicity, national identity, and feminine pride harmoniously merge, artistically embodying the spiritual and cultural memory of the nation. Through the images of historical figures such as Tomiris, Nodira Begim, Mohlaroyim, Najmiddin Kubro, and Ahmad Yassavi, the poetess succeeds in expressing the spiritual power of Uzbek women, the people's devotion to the ideal of freedom, and the spirit of national revival.

Thus, Halima Khudoyberdiyeva's poetry stands out for its artistic and aesthetic interpretation of the concept of personality, creating a distinctive vision of national identity through historical imagery. In this respect, her creative legacy can be regarded as an artistic school in Uzbek literature that harmonizes historicity with modernity and is grounded in spiritual and philosophical reflection.

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Rezyume: *Maqolada Halima Xudoyberdiyeva ijodida shaxs konsepsiyasi masalasi tahlil qilinadi. Shoiraning To'maris, Nodira, Mohlaroyim, Najmiddin Kubro kabi tarixiy obrazlar orqali milliy o'zlik, ayollik timsoli va ma'naviy tiklanish g'oyalarini poetik tarzda ifodalash mahorati yoritilgan. Tadqiqotda tarixiylik va badiiy tafakkur uyg'unligi, shuningdek, inson konsepsiyasining falsafiy-estetik asoslari ochib berilgan.*

Резюме: *В статье рассматривается проблема концепции личности в творчестве Халимы Худойбердиевой. Раскрыто поэтическое мастерство поэтессы в изображении таких исторических образов, как Томирис, Нодира, Мохларойим, Наджмиддин Кубро, через которые выражаются идеи национальной самобытности, женственности и духовного возрождения. В исследовании освещено единство историзма и художественного мышления, а также философско-эстетические основы концепции человека.*

Kalit so'zlar: *shaxs konsepsiyasi, tarixiylik, milliy o'zlik, ayollik timsoli, Halima Xudoyberdiyeva, poetik obraz, falsafiy-estetik talqin.*

Ключевые слова: *концепция личности, историзм, национальная самобытность, женственность, Халима Худойбердиева, поэтический образ, философско-эстетическая интерпретация.*

ECOLOGICAL CULTURE IN ERKIN VOHIDOV'S POETRY

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Summary: *This article analyzes the formation of ecological poetic thinking in Uzbek poetry and its artistic and aesthetic features. It explores the spiritual and moral relationship between nature and human beings, the artistic expression of ecological issues, and the moral meaning of ecological motifs in the works of poets such as Erkin Vohidov.*

Key words: *Ecological poetics, nature and human, ecological balance, aesthetic consciousness, Aral tragedy, ecological awareness, warning in poetry.*

Poetry is the world of miracles that touches the delicate strings of the human soul and reflects the spirit of the age and the pains of society in its artistic lines. Within it resound the breath of the times, the sufferings of humanity, and the problems of life through the brilliance of artistic words. In every era, the thematic scope of poetry expands, and in response to significant social phenomena arising in human consciousness, new aesthetic directions emerge.

From the mid-20th century, the delicate balance between man and nature began to deteriorate. Industrial development, technological revolution, and the plundering of natural resources for economic interests led to ecological disasters. At this point, poetry emerged as a force that warned humanity the moral "conscience" of artistic consciousness. Poets shed light on the spiritual and moral crises behind ecological tragedies, calling humanity to treat nature with compassion.

The formation of ecological poetic thinking was influenced by humanity's growing awareness of its own mistakes realizing that nature is not a force to be conquered, but a "mother" to be cherished. In literature, this manifested as an artistic effort to restore the lost harmony of the technical age the spiritual reunion of man and nature.

Ecological ideas in poetry express the evolution of social consciousness. Indeed, indifference to nature is indifference to one's own roots and a violation of conscience. In this sense, ecological poetry is not merely praise of nature, but a moral warning and an artistic expression of spiritual crisis.

In Uzbek poetry, ecological motifs first resonated in the works of such masters as Erkin Vohidov, Abdulla Oripov, and Asqad Muxtor. In their poetry, nature is not merely a landscape, but a mirror of the human soul and a reflection of conscience.

For instance, Erkin Vohidov's works especially poems like *"Orol o'layotir"* ("The Aral Is Dying") became symbols of ecological awareness in poetry. These lines are not mere poetic melodies but the cry of the nation's conscience. When the poet raises the "great question," he urges humanity to recognize its crimes against nature and its own future. His words "the Aral will not fill with tears" symbolize that although tears cannot revive nature, this mourning marks the beginning of spiritual awakening.

In ecological poetry, poetic images not only depict natural scenes but also remind us of human responsibility. Symbols like trees, water, soil, and the sun acquire moral significance. The poet interprets nature not merely as an aesthetic subject, but as a moral being.

This approach reflects the philosophical depth of the poet's worldview. In modern ecological poetry, the *word* is not just description but a stance; the *image* is not just a scene but a sign of awareness. Ecological poetry increasingly becomes a force that spiritually unites man with nature and nature with man. Therefore, it must be studied as one of the most significant socio-aesthetic phenomena in literature.

Erkin Vohidov is one of the poets who most profoundly revealed the harmony between nature and man, conscience and responsibility, labor and creativity. His poem *"The Call from Qo'ng'irot"* embodies the philosophical-lyrical reflection on humanity's duty to nature and the artist's responsibility to society.

At the heart of this poem lies the idea of realizing one's moral, spiritual, and social debt to the land, water, nature, and people. Through his words, the poet calls not only to protect nature but also to purify the human soul.

The poem centers on the eternal bond between man and nature. The poet urges humans to be responsible for the blessings bestowed by nature the land, water, plants, and the miracle of life. The main idea is that humans must remain grateful to nature while never forgetting their duty toward it.

In this poem, the word *"debt"* becomes the core semantic symbol. Every person especially the creator who enjoys the beauty of nature must fulfill their obligation by preserving it, celebrating it, and passing it on to future generations.

Through the address form "Poet!", the poem creates a self-reflective dialogue with conscience. The lyrical hero represents not only the poet but humanity as a whole, calling both himself and the reader to accountability.

Vohidov's civic and creative position is clearly reflected in the poem. He views creation not merely as aesthetic expression but as a process of moral responsibility and spiritual purification:

"Has no water ever struck your land?
Have weeds not overgrown your field?"

These lines symbolically express moral decay and spiritual pollution. The images of "flooded land" and "foreign weeds" metaphorically depict the drying of conscience and the corruption of the soul.

Erkin Vohidov skillfully uses several metaphoric images:

1. The land symbolizes human conscience and spirit. In the lines *"Look at this soil," "Have you cultivated it so?"*, the land represents not just nature, but the human inner world.
2. The poet as a farmer — the poet equates himself with a farmer: just as the farmer sows seeds into the earth, the poet sows words into hearts. Thus, the philosophy of labor and creativity merge.
3. Salty water symbolizes impurity, moral corruption, and spiritual decay.
4. The seedling (sapling**)** stands for goodness, love, and compassion planted into the human heart.

In *"The Call from Qo'ng'irot"*, ecological motifs are not limited to external landscapes they merge with inner spiritual states. Speaking about the need to protect nature, the poet actually speaks about protecting humanity itself, since man and nature are inseparably connected.

"If we live a thousand years,
Write poems for a thousand years,
Tell the story of our hearts for a thousand years,
If we glorify the farmer's labor,
Turn every cotton bud into a poem —
Still, our debt remains unpaid."

This final stanza expresses the eternal responsibility of man the endless duty of creation. For the poet, no matter how much humanity serves nature, its debt to it will never end.

In general, Erkin Vohidov's *"The Call from Qo'ng'irot"* is a lyrical appeal about ecological culture, spiritual awakening, and human responsibility. The poet interprets the preservation of nature as the highest human duty and a measure of conscience. The notion of "indebtedness" in his poetry resonates not only ecologically but also morally and civically. The poem urges the reader not only to love nature but to understand, protect, and see it as part of themselves.

Thus, *"The Call from Qo'ng'irot"* stands as one of the highest artistic and philosophical peaks of Erkin Vohidov's poetry expressing the unity of nature, man, and the poet's conscience in a profoundly poetic form.

As a conclusion, it should be noted that the eternal harmony between man and nature is the source of life's balance. When this harmony is broken, not only nature but also the human soul suffers. Therefore, the artistic interpretation of ecological issues has gained particular relevance in modern literature. Among the major figures of Uzbek poetry, Erkin Vohidov stands out as a creator who

expressed this theme through deep philosophical contemplation. For him, nature is not merely a setting, but a symbol of human spirit, national values, conscience, and responsibility.

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Rezyume: *Mazkur maqolada o‘zbek she’riyatida ekologik poetik tafakkurning shakllanishi va uning badiiy-estetik xususiyatlari tahlil etiladi. Tabiat va inson o‘rtasidagi ruhiy-axloqiy bog‘liqlik, ekologik muammolarning badiiy ifodasi, Erkin Vohidov singari shoirlar ijodida ekologik motivlarning ma’naviy mazmuni yoritiladi.*

Резюме: *В данной статье рассматривается формирование экологического поэтического мышления в узбекской поэзии и его художественно-эстетические особенности. Анализируется духовно-нравственная связь между природой и человеком, художественное отражение экологических проблем, а также нравственное содержание экологических мотивов в творчестве таких поэтов, как Эркин Вохидов.*

Kalit so‘zlar: *Ekologik poetika, tabiat va inson, ekologik muvozanat, estetik ong, Orol fojiasi, ekologik ong, she’riyatda ogohlantiruvchanlik.*

Ключевые слова: *экологическая поэтика, природа и человек, экологическое равновесие, эстетическое сознание, аральская трагедия, экологическое сознание, предупреждающая функция поэзии.*

THE DIALECTAL LEXICON OF THE UZBEK DIALECTAL AREA IN KARAKALPAKSTAN

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Summary: *In the field of world linguistics, particularly in dialectology and areology, significant research has been conducted to provide a comprehensive description of dialectal–areal phenomena. Based on the materials collected from various world languages and dialects, numerous words related to the life and lifestyle of different peoples have been incorporated into national literary languages. These lexical units, as products of linguistic consciousness and thinking, are becoming a practical reality in modern usage.*

Key words: *Areal linguistics, linguistic geography, mapping, dialect, ethnocultural traditions,customs,dialectal,speech.*

It is well known that the linguistic–geographical analytical method of areal linguistics identifies linguistic phenomena distributed within a certain territory, studies their regional features, and demonstrates their location and boundaries through linguistic maps. Therefore, creating linguistic maps of particular dialects plays an important role in advancing the development of this field.

From historical sources, it is known that the nomadic Kipchaks had a significant influence on the formation of the Uzbek people as an ethnic group and nation. Due to various migration processes that took place throughout history, a number of local nomadic tribes settled in the territories inhabited by sedentary Turkic communities. As a result, the number of Uzbek dialects increased, leading to the emergence of various dialectal forms and multilingual tendencies within the Uzbek language. **Areal linguistics** is considered one of the main branches of modern linguistics, and this field continues to develop rapidly both scientifically and practically today. The primary task of areal linguistics is to map and investigate the geographical distribution of linguistic phenomena and to address the issues arising from these studies.

It is well known that every linguistic phenomenon in a living language has its own geographical boundaries and area of distribution. Similarly, the boundaries of ethnocultural lexical units are also limited to specific regions. In areas where closely related languages and dialects come into contact, active interactions often occur, and as a result, specific linguistic features may emerge along the intermediate borders between two regions. In such cases, a unique dialectal form appears that shares features of both adjacent dialects. This newly formed variety can be referred to as a **mixed dialect** or **hybrid language**. Dialectologists have provided numerous scientific examples of such linguistic intertwinings. A similar phenomenon can also be observed among the dialects spoken in the territory of the **Republic of Karakalpakstan**.This process can also be explained by the interaction of dialects and the formation of transitional zones. Transitional zones emerge not only between different languages but also among dialects and subdialects. For instance, the Oghuz dialectal areas of the Uzbek language mainly correspond to the territories of **Khiva, Qo‘shko‘pir, Urgench, Khazarasp, Shovot, and Khonqa districts** of **Khorezm region**, as well as the **Beruniy, To‘rtko‘l, and Ellikkala districts** of **Karakalpakstan**. However, dialectological studies have shown that this dialect is also found in the **Qorako‘l and Alat districts** of **Bukhara region**.

Karakalpakstan, located in the northern part of the Republic of Uzbekistan, is home to a population primarily composed of **Uzbeks, Karakalpaks, Kazakhs, and Turkmens**. This region is considered one of the oldest settled areas in Central Asia, with a history that dates back to ancient times. The dialects spoken here belong mainly to two major ancient ethnic groups of modern Uzbeks — **the Kipchak and Oghuz** — and share features with the **Karakalpak, Kazakh, and Turkmen** dialects. The dialectal area also includes representatives of other ethnic groups such as **Tajiks, Uyghurs, Kyrgyz, Russians, Tatars, and Turkmens**, who live together and contribute to the region’s rich linguistic and cultural diversity. In general, adopting a systematic approach and adhering to certain principles in the mapping of lexical isoglosses found in Uzbek dialects is of particular

importance. Therefore, mapping ethnocultural lexical units by thematic categories or grouping isophonemes (such as *j*-type, *y*-type, or diphthongal types) produces more accurate and productive results. Today, the rapid development of science and culture, the expansion of electronic communication, and its growing influence on the population, along with the ongoing efforts to urbanize rural areas, are all contributing to the increasing prestige of the literary language. As a result, phonetic, lexical, and grammatical changes are occurring in local dialects and subdialects. Today, the rapid development of science and culture, the expansion of electronic communication, and its growing influence on the population, along with the ongoing efforts to urbanize rural areas, are all contributing to the increasing prestige of the literary language. As a result, phonetic, lexical, and grammatical changes are occurring in local dialects and subdialects. For this reason, recording and documenting the lexical features specific to dialects and subdialects, and studying their linguistic characteristics through comparative and comparative-historical approaches, provide valuable practical and theoretical insights for understanding the development and history of the Uzbek literary language as well as the ethnography of the peoples who speak it.It can be concluded that the Uzbek dialects spoken in Karakalpakstan belong mainly to the **Kipchak** and **Oghuz** dialectal groups. Taking into account the historical and linguistic characteristics of the **dialectal area of Karakalpakstan** and considering the interaction with neighboring dialects, it is possible to classify them based on numerous scientific descriptions and typologies as follows: **Group of dialects belonging to the Kipchak dialect branch:**

a) the *"y"-type* group;

b) the *"j"-type* group — for example: *jur* (yur — walk), *jol* (yo‘l — road), *jenga* (yanga — sister-in-law), *shuytip* (shunday qilib — in this way).

The **Kipchaks** constitute one of the major components in the ethnogenesis of the Uzbek people. They also played a significant role in the formation of many Turkic peoples such as the **Kazakhs, Kyrgyz, Karakalpaks, Turkmens, Tatars, Bashkirs, Altaians**, and several **North Caucasian peoples** including the **Nogais, Kumyks, and Karachays**. As a result of ethnic mixing within Uzbekistan, Kipchak groups have gradually assimilated into the broader Uzbek population. Ancient and Old Kipchak written monuments have been preserved up to the present day, and these are being thoroughly studied by **archaeologists, ethnographers, and linguistic Turkologists**. The **Kipchak language**, along with the **Oghuz, Bulgar, and Karluk** languages, belongs to the **Western Hunnic group** of Turkic languages. It occupies an intermediate position between the Karluk and Oghuz languages, though it is closer to the Oghuz group. The **Kipchak dialectal zone** of the Uzbek language covers a vast territory and consists mainly of Uzbek tribal groups characterized by the *"j"-type* pronunciation. Kipchak dialects are found throughout all regions of Uzbekistan and even beyond its borders. Within their respective areal distributions, these dialects form not separate dialects but rather **dialectal zones** and **groups of subdialects** that share common features of the broader **Uzbek Kipchak areal**. The study of Uzbek Kipchak dialects began primarily in the **early 20 th century**.

The areal linguistic study of dialects provides valuable material not only for the history of a language but also for the history of its people. In world linguistics, extensive experience has been accumulated in studying dialects as the internal source of development for every national language, creating **dialectal atlases**, and conducting **linguo-areal research**, the results of which are actively applied in various branches of linguistic science.

According to the well-known Russian linguist **Bulakhovskiy**, the continuous enrichment of a literary language is largely due to **borrowed words**, which form one of its main sources of lexical growth. The ancient national layer that shapes the Uzbek literary language — particularly its dialects and subdialects — includes words and expressions connected with **traditional ceremonies, customs, beliefs, and family rituals**. The core of this layer is composed of **Common Turkic** and **pure Uzbek** lexemes and expressions. Among them are ethnographic terms such as *suyinshi* (gift for good news), *besik toy* (cradle ceremony), *ko‘zmonshaq* (amulet), *jaushi* (matchmaker), *bet ashar* (bride unveiling), *quda shaqiriq* (inviting in-laws), *shymildyq tutyu* (bridal canopy ritual), *patiya toy* (child's first step celebration), *qoniq beriu* (blood offering), *törkinletiu* (visiting bride's parents), *kenes toy* (wedding council), *qalyn maly* (bride price), *baqan tutyu* (cradle support), *jetisi* (seventh day ceremony), *qyrqy* (fortieth day ceremony), *juzy* (hundredth day), and *jyly* (annual commemoration). Such ethnographic

terms are also used among other Turkic-speaking peoples and share similar meanings across languages. Areal research on the Uzbek language and its dialects is gaining special significance in modern Uzbek linguistics. The **lexical composition of ethnographic vocabulary in the Karakalpak language** is not homogeneous; rather, it consists of native Karakalpak words alongside **Common Turkic**, **Persian-Tajik**, **Arabic**, and **Russian borrowings**. These same ethnographic terms are also widely used in the speech of Uzbeks living in **Karakalpakstan**, where many lexical items bear clear influence from the Karakalpak language. Moreover, the **customs, traditions, and rituals** of the peoples living in this region are remarkably similar, reflecting their shared historical and cultural background.

In conclusion**,** a part of the lexical units used in the Uzbek dialects of the Karakalpakstan region are shared phenomena, while others differ and are non-shared elements. Studying such lexical layers is valuable not only for areal linguistics but also for enriching the Uzbek literary language. The areal study of various linguistic features began quite early in world linguistics, and in recent years, this field has also become one of the important directions of Uzbek linguistics. The areal research of the Uzbek language and its dialects is gaining special importance in modern Uzbek linguistics. The lexical composition of Karakalpak ethnographisms is not uniform; rather, it consists of pure Karakalpak words as well as borrowings from Common Turkic, Persian-Tajik, Arabic, and Russian languages. The speech of Uzbeks living in Karakalpakstan also actively includes these words, showing a noticeable influence of the Karakalpak language. Furthermore, the customs, traditions, and rituals of the peoples living in this region are very similar, and close intermarriage ties (such as *quda–anda* relations) are widespread. Therefore, wedding and other ceremonial programs in this area are often conducted in a mixed form. It should also be noted that certain concepts are referred to differently in the cities of Karakalpakstan compared to its rural areas. For example, the wedding meal offered to guests is called *el qa'da, toy palov, or el oshi* in different places. In the Uzbek dialects of Karakalpakstan, *el qa'da* (a term used to refer to the meal served during a girl's wedding ceremony) is a distinct linguistic expression. All linguistic facts of the Turkic-speaking peoples clearly reflect that, throughout successive historical stages, their historical, socio-economic, and cultural lives have shared common national characteristics.

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Rezyume: *Bu maqolada areal lingvistika zamonaviy tilshunoslik sohasining asosiy yo'nalishlaridan biri ekanligi, bu soha bugungi kunda ham ilmiy ham amaliy jihatdan jadal rivojlanib borayotganligi aytiladi.*

Резюме: *В данной статье говорится, что ареальная лингвистика является одним из основных направлений современной лингвистики, и эта область быстро развивается как в научном, так и в практическом плане*

Kalit so'zlar: *Etnografizm,leksika,qavm-qarindosh,marosim, urf-odat, dastur, an'analar,lahja,atama,sheva.*

Ключевые слова*: Этнография, лексика, родство, ритуал, обычай, программа, традиции, диалект, термин, говор.*

STUDYING THE GENDER ISSUE IN KARAKALPAK LINGUISTICS

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Summary: *This article discusses the gradual study of gender issues in Karakalpak linguistics and their significance. The scientific works of researchers on the gender issue are analyzed, excerpts from them are cited, and the etymological history, semantic changes, and differences in speech practices of genderlets in these works are discussed. The article proves that gender linguistics has significant advancements and research opportunities.*

Key words: *gender, sex, gender linguistics, gender concept, gender stereotype, gender studies.*

Introduction. Today, the study of human sex not only from a biological point of view, but also from a gender perspective, has become one of the main issues. The term gender refers to the unity of actions and attitudes towards a person belonging to both the male and female sexes in society. At the center of the gender direction is the study of man and his speech. The gender perspective is based not on biological or physical differences between men and women, but on the cultural and social significance determined by society.

Literature analysis. «The concept of gender, along with a person's birth sex, also signifies the existence of a sociocultural sex, formed as a result of the influence of cultural institutions in society (language, family, education, etc.). While sex represents the biophysiological characteristics between people, gender is the social expression of women and men created by society. The English term "gender," denoting the grammatical category of gender, was removed from the linguistic context and initially became the object of study for other fields of science - social philosophy, sociology, history, and political science. Later, as the scope of gender research expanded, the term gender, which gained interdisciplinary status, entered linguistics in a new sense[38]». Gender linguistics studies the problems related to the role of representatives of a particular gender (male and female) in social processes. «Gender linguistics is a branch of linguistics that studies linguistic differences between people in relation to gender[39]». In this area, the differences between male and female languages are studied comparatively. For example, men frequently use slang that is not typical of literary language, while women frequently use literary, emotional, and figurative language. These are lexical differences between men's and women's languages. Similarly, there are also morphological and syntactic differences in the language of men and women, which are gender differences arising from their speech.

Gender linguistics refers to the use of a lexical term based on the speaker's gender and the presence of other characteristics. Scholars in the 17th century, while studying the language of new groups, noticed particularly noticeable differences in the speech activity of the sexes. This especially applies to women. The reason is that their speech is more orderly than that of men, so in scientific research, the word "female tongue" was first used[40].

Research Methodology. In this article, synchronous analysis, distributive, and comparative methods were used in the process of broadening the topic.

Analysis and results. Gender linguistics did not appear suddenly in linguistics. It is considered a trend that emerged as a result of researchers studying several fields together. Similarly, research on gender linguistics in Karakalpak linguistics gradually began to develop. Although such research was not initially applied under the name "Gender," several articles related to this field were published. First of all, Sh. Abdinazimov's[41] article provides information on the history of the origin of the word "hayal" the etymology of the words "Qatın", "Urag'ut", "Qunchuy", "Quduz", "Yutuz",

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"Kisi", "Tishi", "Ebchi", "Áwluk", "Awrat", "Hayal", "Zayıp", "Nashar", "Jawan", "Zán", "Qostar" denoting the concept of a woman in ancient written sources, as well as the semantic changes in the use of some words in the meaning of a woman in ancient written sources and in recent centuries. «The word "hayal" (woman) is not used in ancient Turkic written sources. Borrowed from Arabic-Persian languages in the Middle Ages. There are two different views among linguists regarding the etymology of this word. Some scholars believe that the word " hayal" (woman) originates from the Persian word "haya" , which means "honor, shame, decency." The word "hayalı" (wife) was formed by adding the suffix "-li" to it. In recent times, the "i" sound at the end of a word has been subjected to the phenomenon of elision. Thus, "wife" means "honorable, well-mannered, modest." Its antonym is "shameless, indecent," meaning "shameless, lack of manners, not humble." Some scholars indicate that " hayal" is a word borrowed from Arabic and believe it is used as "ayal" in modern Karakalpak literary language. From a scientific point of view, the latter is correct. In the 15th-century manuscript "Tafsir," we see that the word "ayal," borrowed from Arabic, is used in two different meanings: «Aytdı ayalıńǵa: uqlatqul uǵlanlarıńı-Ol óziniń hayalına ayttı: uqlatǵıl balalarıńdı; Adam wá anıń ayalları-Adam hám onıń násilleri, urpaqları[42]». In the second example, the word "woman" is used in the sense of "generation, lineage, offspring." The founder of the Karakalpak literary language, our ancestor Berdaq, creatively approached the proverb in our oral tradition, " Jigittiń atın qatın shıǵaradı, Qatınnıń atın otın shıǵaradı " saying, "A woman brings forth a man's name." From this, the word "woman" is confirmed in the Karakalpak literary language[43]. Currently, in gender linguistics, special attention is being paid to the linguistic features and specific characteristics of men and women. Therefore, many linguists are raising the issue of gender differences in language and suggesting a deeper study in various aspects. In all linguistics, the male and female concepts are considered universal concepts that occupy a special place. The specific stereotypical behavioral characteristics of both sexes share a common characteristic that defines femininity and masculinity. For example, qualities such as gentleness, shyness, modesty, sensitivity, obedience, patience, caution, adaptability, gentleness, and kindness are characteristic of women, and since this is related to their psychology and behavior, it directly affects their speech.

Scholar Z. Dawletmuratova[44], who studied kinship terms in Karakalpak linguistics, mentioned kinship terms related to the mother's side in her article. He also mentioned terms such as "bóle," which do not express sexual meaning. These materials also contributed to the development of the gender perspective in Karakalpak linguistics. Subsequently, the study of gender in Karakalpak linguistics began in comparison with other languages. D. Qurbanbaeva[45], in her article, conducted a comparative study of gender differentiation in English and Karakalpak. According to the grammatical method of gender/sex expression in English and Karakalpak languages, its lexico-semantic method is clear. The following nouns can be attributed to this: mother/father, daughter/son, sister/brother, bride/bridegroom, woman, etc.; father/mother, daughter/son, bride/groom, etc.

Speaking about the study of gender issues in general linguistics, F. Tórebaeva[46] states, "The development and introduction of gender issues into scientific discourse in the 20th century led to the transformation of this issue from biological determinism to social constructivism." If at the beginning of the 20th century gender was considered as a category defining the psychological and social difference between a woman and a man, which does not change, then at the beginning of the 20th century gender was considered as a category defining the psychological and social difference between a woman and a man. At the end of the 20th century, gender was studied as a formative category. These changes were caused by socio-historical changes and scientific achievements.

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In her scientific work, G. Usenova[47] states, "The paremiological fund in English and Karakalpak languages has various positive qualities that can reflect the image of mother and mother in a person's mind." In English and Karakalpak proverbs, the mother's love for her child and the readiness to sacrifice herself for their happiness, well-being, and carefree life are observed.

M. Chutpulatov[48] states, "The application of linguostatistical methods in the field of linguistic genderology allows for the discovery of new knowledge about the gender system and gender stereotypes by comparing various systematic languages, such as German (English), Slavic (Russian), and Turkish (Uzbek), as well as for determining their characteristics and/or frequency of occurrence in male and female speech. In linguistic genderology, which studies "male" and "female" groups, ensures the collection of valuable materials for linguoculturology based on the statistical analysis of gender linguistics». In this work, the author also noted that the differences between male and female speech are disappearing, and that in some professions, gender characteristics do not differ from each other.

G. Qıdırbaeva[49], in her research on the etymology of the word "adam," concludes that the origin of this word is linked to religious beliefs. He discussed words belonging to the conceptosphere of a person, primarily a number of words in the Karakalpak language denoting the seme of a person.

Z. Rzamuratova: "Gender characteristics are manifested in language as stereotypes. Gender stereotypes are views that are equally understandable to everyone about the behavior inherent in "masculinity" and "femininity," their purpose, social role, and function. Gender stereotypes in language are preserved in folk legends, customs, and traditions. Gender stereotypes are reflected in proverbs, idioms, and stable comparisons, which are masterpieces of our language.

Conclusion. In the modern era, the concept of gender has already become the object of research in many fields of science. This process continues to this day. However, in Karakalpak linguistics, the issue of gender stereotypes in Karakalpak folk epics was specifically studied only by Z. Rzamuratova[50]. As mentioned above, information on gender issues is found in the articles of several scholars before this work, and this indicates that the gender issue has not been left unstudied in our country. The issue of the gender concept in Karakalpak proverbs and sayings is one of the issues awaiting further research in Karakalpak linguistics.

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Rezyume: *Ushbu maqolada qoraqalpoq tilshunosligida gender masalalarining bosqichma-bosqich tadqiqi va uning ahamiyati haqida so‘z yuritiladi. Tadqiqotchilarning gender masalalariga bag‘ishlangan asarlari tahlil qilinib, ulardan parchalar keltirilgan va ushbu ishlarda genderlektlerdiń etimologik tarixi, semantik o‘zgarishlari, nutq amaliyotidagi farqlar haqida so‘z yuritilgan. Maqola gender lingvistikasi katta yutuqlarga va tadqiqot imkoniyatlariga ega ekanligini isbotlaydi.*

Резюме: *В данной статье обсуждается постепенное изучение гендерных вопросов в каракалпакском языкознании и их значение. В этих работах анализируются работы исследователей по гендерным вопросам, приводятся отрывки из них, обсуждаются этимологическая история, семантические изменения и различия в речевых практиках детей с разными полами. Статья доказывает, что гендерная лингвистика имеет значительные достижения и исследовательские возможности.*

Kalit so‘zlar: *gender, jins, gender lingvistikasi, gender konsept, gender stereotip, gender tadqiqotlar.*

Ключевые слова: *Ключевые слова: гендер, пол, гендерная лингвистика, гендерная концепция, гендерный стереотип, гендерные исследования.*

IMPROVEMENT OF THE USE OF ELECTRONIC COMMERCE TOOLS IN THE CONTEXT OF THE DIGITAL ECONOMY

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Summary: *The article analyzes the role of e-commerce as one of the key factors in modern socio-economic development. Global trends in online trade growth and forecasts of its impact on the global economy are considered. Special attention was paid to the process of forming the digital environment in Uzbekistan, developing the national programs "Digital Uzbekistan" and "Digital Government," as well as the "Uzbekistan - 2030" strategy. The necessity of improving digital infrastructure, introducing innovative technologies, and increasing the efficiency of internet commerce as an important direction of the country's sustainable economic growth is emphasized.*

Key words: *e-commerce, digital economy, internet technologies, digital transformation, online trade, innovative technologies, development.*

Introduction. The main driver of progressive foreign economic development is ensuring effective integration of all sectors of the economy with modern information and internet technologies with the policy of rapid and highly effective electronic commerce. Recognizing the unique advantages of the countries, there is a high level of e-commerce. In particular, according to the forecasts of the Forbes International Research Agency, global e-commerce in 2030 will amount to 8.3 trillion dollars and is expected to reach 50% of the total retail trade volume.

In international practice, special attention is paid to the research and development of innovative methods of commercial mechanisms adapted to the specifics of e-commerce functioning on the global Internet. Significant importance is attached to increasing efficiency through the large-scale use of information technologies, the Internet, and global digital platforms in various sectors of the economy. Scientific research aimed at creating new methods and tools for e-commerce, developing effective models for its organization, and improving economic and organizational mechanisms for optimizing trade activities is also being actively pursued. Additionally, approaches to adapting online platforms to user requests and needs, developing new applications using artificial intelligence, and enhancing the importance of e-commerce in the modern digital space are being studied.

Main part. E-commerce in Uzbekistan is gradually being introduced into economic practice, based on general principles and taking into account territorial characteristics. Active reforms are being carried out in the country aimed at developing infrastructure, expanding the geography of online trade, and improving consumers' digital literacy. Within the framework of the "Uzbekistan - 2030" strategy, approved by the Decree of the President of the Republic of Uzbekistan dated September 11, 2023 No. UP-158, an ambitious goal has been set to transform the country into a regional "IT-HUB" by actively developing digital technologies and increasing the volume of exports of IT services and software products to 5 billion US dollars. They are aimed at solving urgent problems in this area and contribute to its active development.

In the context of large-scale reforms, there is a need to improve the activities of real sector enterprises aimed at creating value through internal digital transformation and effective organization of e-commerce.

The formation of the digital environment in the country requires the development of e-commerce platforms, optimization of the digital customer service system, and the introduction of advanced methods and tools that allow for the widespread use of artificial intelligence technologies and the Internet of Things. Special attention is being paid to expanding and modernizing the activities of online trading platforms, ensuring their adaptation to modern market needs.

In modern conditions, the development of any enterprise is impossible without the introduction of e-commerce. This is due to the fact that the global Internet network significantly

increases the coverage of the target audience, contributes to the growth of sales volumes, and expands the distribution channels of products and services.

Research on e-commerce issues in modern conditions is relevant, as this method of selling goods and services is considered one of the most promising. E-commerce allows for overcoming the limitations characteristic of traditional trade, providing access to a wider audience, and simplifying the sales process. Thanks to this, it is possible to predict the further development of the sector and a noticeable increase in the number of companies using this trading format in their activities.

The electronic economy emerged as a response to the need to adapt economic relations to the digital environment. It represents a system of interactions in the sphere of production, distribution, exchange, and consumption of material values, formed and implemented using information and communication technologies (ICT).

Digital economy emerged as an integration concept that combines characteristics of various economic models such as information, creative, internet, and network economy. In addition, it possesses a number of unique features that determine its qualitative specificity. It includes the use of modern technologies to optimize business processes, the development of digital platforms and services, and the formation of new interaction models between market participants.

The digital economy is developing under the influence of several key trends:

- **Digital transformation** - the active implementation of digital technologies in various sectors of the economy, including industry, finance, healthcare, and education;
- **Development of artificial intelligence and big data** - the use of data analytics and machine learning to optimize business processes and make decisions;
- **Expansion of digital platforms** - growth of online services, marketplaces, and ecosystems that ensure convenient interaction between businesses and consumers;
- **Automation and robotization** - the introduction of intelligent systems and robotics to improve production and management efficiency;
- **Cybersecurity** - strengthening the protection of data and digital infrastructure in the context of growing cyber threats;
- **Development of digital currencies and blockchain technologies** - the emergence of new financial instruments such as cryptocurrencies and smart contracts;
- **Global digital integration** - the expansion of international cooperation in the field of digital technologies and regulation.

These trends shape the modern digital economy, contributing to its dynamic development and adaptation to new challenges.

The history of the concept of "digital economy", according to researchers, dates back to the American scientist Nicholas Negroponte of the Massachusetts Institute of Technology, who in 1995 used the metaphor for the process of processing atoms consisting of materials of physical substances to processes consisting of materials of software codes. Digital economy, according to Tapscott`s definition, represents a system based on the use of information and computer technologies. It influences business, public administration, and forms a digital environment where objects are presented in a digital format.

One of the important factors determining the future of e-commerce in Uzbekistan is the legislative regulation of the sector. In 2022, the Law on Electronic Commerce was adopted. The law ensures the legal protection of consumers, as well as entrepreneurs, establishes the procedure for carrying out electronic operations and the responsibility for offenses. The legislation on the implementation of the system plays a decisive role in the creation of a reliable and sustainable electronic commerce system. They ensure the protection and interest of all participants in the procurement process, as well as suppliers.

In 2019, the Law on Payment Systems and Payment Systems was adopted, which contributes to the development of the financial sector. Electronic payment is an integral part of online commerce, ensuring the convenience and safety of consumers and businesses.

One of the important roles of electronic commerce in the service sector is to increase the safety and security of transactions. Electronic subscriptions, secure payment services, and blockchain

technologies play a key role in ensuring the security of financial transactions, strengthening the confidence of clients and business partners. Online security services in Uzbekistan are also supported by the government, including the creation of a digital signature identification center and the improvement of personal data protection for users.

In Uzbekistan, the use of secure online payment systems, such as "Click," "Payme," and others, has been increasingly improving, but also reducing fraud. The creation of electronic payment systems and payment gateways is also a convenient way to increase confidence in electronic commerce and stimulate further development of the sector. This will also improve financial integration with foreign markets and attract foreign investors.

Figure 1 shows the dynamics of financial services development over the past five years.



Figure 1. Dynamic development of financial services

In Uzbekistan, there are electronic payment systems that facilitate online transactions. Judging by analytical studies conducted by the Center for Digital Economy Research, electronic commerce in Uzbekistan has become one of the key elements of the digital economy in recent years. The degree of development in the trans-digital economy, which is directly related to the level of development of information and communication technologies (ICT), is accepted to be assessed by various indicators: the share of the digital economy in GDP, the volume of investments in the ICT sector, the speed of internet, the availability and accessibility of land plots for use, the level of development of electronic commerce, the share of state services in the system of electronic governance, the provision of organizations with specialists in the field of ICT, etc. In addition, it is important to note the indicators in international ratings that assess the level of development of information technologies in the country.

In general, in the field of communication and informatization services, the largest volume of services in the Republic of Uzbekistan is provided by computer programs. In January-December 2024, the share was 40.7% (Figure 2).



Figure 2. Dynamics of communication and information services

In the last four years, the Uzbek market for electronic commerce has achieved significant success. The coronavirus pandemic and the adoption of the "Digital Uzbekistan-2030" strategy have significantly contributed to the rapid development of our economies.

Conclusion. Electronic commerce in Uzbekistan has a significant impact on the modernization of the service sector, improving the accessibility and quality of services, as well as contributing to the creation of innovative and effective business models. In the future, it is expected that the development of e-commerce and its profound impact on all sectors of the economy will continue.

For the further development of electronic commerce in Uzbekistan, it is necessary to take the following measures:

- develop and improve legislative norms and rules regulating electronic commerce;
- to develop broadband access to the internet and mobile communications to ensure higher accessibility and connection speed;
- develop logistics infrastructure, including warehouses, transport, and courier services, to ensure fast and reliable delivery of goods to the country;
- promoting the development of safe and convenient electronic payment systems, including electronic wallets, online payment gateways, and digital currencies;
- conduct information campaigns and educational programs for consumers and entrepreneurs;
- create a supportive environment for startups and small businesses in the field of e-commerce.

Implementation of these recommendations will allow Uzbekistan to develop e-commerce in the country, attract large investments, and create new jobs. This will contribute to economic cooperation, the development of the digital economy, and improve the level of consumer services.

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Rezyume: *Maqolada elektron tijoratning zamonaviy ijtimoiy-iqtisodiy rivojlanishning asosiy omillaridan biri sifatidagi o‘rni tahlil qilingan. Onlayn savdo o‘sishining global tendensiyalari va uning jahon iqtisodiyotiga ta’siri prognozlari ko‘rib chiqilgan. O‘zbekistonda raqamli muhitni shakllantirish jarayoni, "Raqamli O‘zbekiston" va "Raqamli hukumat" milliy dasturlari hamda "O‘zbekiston - 2030" strategiyasini ishlab chiqishga alohida e’tibor qaratildi. Mamlakat barqaror iqtisodiy o‘sishining muhim yo‘nalishi sifatida raqamli infratuzilmani takomillashtirish, innovatsion texnologiyalarni joriy etish va internet-tijorat samaradorligini oshirish zarurligi ta’kidlangan.*

Резюме: *В статье анализируется роль электронной коммерции как одного из ключевых факторов современного социально-экономического развития. Рассматриваются глобальные тенденции роста онлайн-торговли и прогнозы ее влияния на мировую экономику. Особое внимание было уделено процессу формирования цифровой среды в Узбекистане, разработке национальных программ "Цифровой Узбекистан" и "Цифровое правительство," а также стратегии "Узбекистан - 2030." Подчеркивается необходимость совершенствования цифровой инфраструктуры, внедрения инновационных технологий и повышения эффективности интернет-торговли как важного направления устойчивого экономического роста страны.*

Kalit so‘zlar: *elektron tijorat, raqamli iqtisodiyot, internet-texnologiyalar, raqamli transformatsiya, onlayn savdo, innovatsion texnologiyalar, rivojlanish.*

Ключевые слова: *электронная коммерция, цифровая экономика, интернет-технологии, цифровая трансформация, онлайн-торговля, инновационные технологии, развитие.*

HISTORICAL, ETHNOGRAPHIC, AND CULTURAL ANALYSIS OF TRADITIONAL FISHING AMONG THE PEOPLES OF THE SOUTHERN ARAL SEA REGION

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Summary: *The article presents a comprehensive historical, ethnographic, and cultural analysis of traditional fishing among the peoples of the Aral Sea region and Karakalpakstan. It examines the evolution of fishing methods and tools, as well as the specific practices of fish processing and storage shaped by the region's natural and climatic conditions. Special attention is given to the cultural significance of fisheries as an essential part of economic activity, spiritual practices, and the social life of the Karakalpaks and other local communities. The article highlights the ways traditional knowledge is preserved through folklore, rituals, and museum exhibitions, emphasizing the role of fishing in shaping national identity and the region's ecological culture. The ecological degradation of the Aral Sea is considered a factor influencing modern practices and the relevance of fisheries today. The materials contribute to understanding the historical experience of sustainable human-nature interaction and preserving the cultural heritage of the Aral Sea region.*

Key words: *Amu Darya, cultural motifs of the Aral region, evolution of fisheries, ethnographic aspect.*

Introduction

Fish farming represents one of the most ancient forms of human economic activity, having played a crucial role in shaping the cultural traditions, social organization, and economic development of the peoples inhabiting the Aral Sea region and Karakalpakstan. These territories, situated at the deltas of the Amu Darya and Syr Darya rivers and along the shores of the Aral Sea, have for centuries served as centers of fishing activity—a fact determined by their geographical location and natural environment.

This article offers a historical, ethnographic, and cultural analysis of the development of traditional fishing among the Karakalpaks and the peoples of the Aral region. It traces the evolution of fishing tools and techniques and examines how the cultural motifs of fish farming have been preserved within ethnographic sources.

As one of the oldest and most significant traditions of the Aral region's peoples, fishing not only fulfilled their material needs but also became an essential cultural and symbolic element. In the context of environmental transformations associated with the degradation of the Aral Sea, the role of fish farming acquires particular importance as historical evidence of sustainable human–nature interactions. Within the contemporary museum space, this tradition serves as a powerful resource for curatorial practice, educational initiatives, and the shaping of national identity.

Fish Farming as a Historical Symbol and Museum Representation

Historically, fishing and fish farming among the peoples of the Aral region embodied the harmony between humans and nature, reflecting human skill, adaptability, and resilience in the face of the region's harsh environmental conditions. Traditional methods of artificial fish breeding—such as the construction of ponds and reservoirs for cultivation—testify to the development of complex ecological knowledge and sustainable practices transmitted across generations. These practices became symbols of prudent resource management and a respectful attitude toward the natural environment.

Within the culture of the Karakalpaks and other peoples of the region, fish farming was perceived as a sacred activity intertwined with rituals of gratitude toward water spirits and natural forces. In this sense, it functioned not only as an economic practice but also as an integral part of spiritual culture, reflecting reverence for nature and its cyclical rhythms.

In museum exhibitions, traditional methods of fish farming may be represented through dioramas, models, photographs, and ethnographic artifacts such as nets, fishing tools, and protective

amulets. Of particular importance are exhibits illustrating the creation of artificial water bodies—ponds, channels, and irrigation systems—as well as materials documenting the technological features of fish breeding practices.

These exhibits allow visitors to grasp the historical significance of fish farming for the development of the region and its role in shaping the cultural traditions and economic systems of the peoples of the Aral area. Within both temporary exhibitions and permanent displays, reconstructions of ancient fish-breeding methods are presented, contributing to the preservation of traditional ecological knowledge and collective memory.

An equally important role is assigned to museum pedagogy. Educational programs in museums employ the theme of fish farming to cultivate visitors' understanding of the interaction between humans and nature, ecological responsibility, and the cultural heritage of the region. Examples of traditional tools and reconstructions of ancient techniques serve as practical means of teaching both children and adults the principles of environmental stewardship.

A particularly significant aspect lies in the use of interactive formats—such as workshops on crafting model reservoirs or simulations of traditional fishing using historical instruments. These activities enable visitors to more deeply comprehend the historical importance of fish farming in the life of the local peoples and its enduring relevance today.

Fish farming among the peoples of the Aral region represents not merely an economic practice of the past but also a powerful cultural symbol that embodies their spiritual values and adaptive relationship with the natural environment. In museum practice, it serves as an essential resource for curatorial design, educational programming, and the formation of national identity. Within the framework of contemporary museology, the theme of fish farming fosters the development of ecological awareness, encourages reflection on the historical lessons of sustainable human–nature interaction, and ensures the preservation of the region's rich heritage for future generations.

Herodotus—the Greek historian who lived in the fifth century BCE—referred to the ancestors of the Karakalpaks as the *Apasiacae* or "fishermen." Our ancestors skillfully utilized the natural resources of their homeland, practicing a complex form of subsistence that combined agriculture, animal husbandry, and fishing [Bartold, 1902: 5–8].

Historical sources indicate that fish farming among the Karakalpaks has deep roots extending back to antiquity. During the medieval period (9th–15th centuries), the Karakalpaks primarily engaged in hunting and fishing to meet their subsistence needs. At that time, the main tools used included nets made of plant fibers, fishing rods crafted from flexible branches, and traps woven from reeds. Fishing was carried out not only in the great rivers—the Amu Darya and Syr Darya—but also in numerous lakes and smaller bodies of water throughout the region, often using single-person reed kayaks.

With the development of agriculture and the transition to a sedentary lifestyle (16th–18th centuries), fishing practices became increasingly diversified. More complex instruments appeared, such as wooden-framed nets with larger mesh, tackle for catching large fish, and the use of specially designed bait. During the era of the Russian Empire (19th–early 20th centuries), industrial methods began to emerge: large-scale fishing using extensive nets, the introduction of boats, and the construction of specialized fishing facilities along the Amu Darya River.

By the twentieth century, traditional fishing had become an integral part of the regional economy. In the Soviet period, industrial fishing technologies expanded and mechanized methods were introduced. Nevertheless, many traditional practices persisted, preserved as vital elements of the community's cultural heritage.

The cultural significance of fishing extended far beyond its economic function: it was embedded in rituals, festivals, and communal traditions, strengthening social bonds within local communities. Fishing thus became an enduring component of the ethnocultural identity of the Karakalpak people.

The preservation of fish-farming culture among the peoples of the Aral region is richly reflected in ethnographic motifs. This cultural tradition has been maintained through oral narratives, ritual practices, and artisanal crafts. Folklore contains themes of gratitude to the deities of water for

abundant catches, initiation rituals for young fishermen, and legends concerning the origin of aquatic resources.

Ethnographic materials reveal a synthesis of ancient customs with later cultural forms—for instance, the use of water symbolism in rituals, in decorative patterns on clothing, and in household objects. Such motifs served as a medium for transmitting ecological knowledge—conveying understanding of water resources and the principles of their preservation.

Fishing in the Aral region occupies a distinctive place not only as a means of subsistence but also as a vital component of the cultural identity of its peoples, especially the Karakalpaks. Traditional methods of processing, storing, and consuming fish developed under the influence of environmental conditions, the ecological specificity of the region, and longstanding historical traditions. These practices are deeply interwoven with the people's culture, social customs, and worldview. The present study explores the distinctive features of these forms, their connection to Karakalpak culture, the ecological context of the region, and their role in social life and folklore.

In the challenging climate and limited natural conditions of the Aral region, traditional fish-processing methods included drying, smoking, salting in brine, and preservation. These techniques allowed fish to be stored for long periods and were closely associated with the cultural and social practices of the region's inhabitants, particularly the Karakalpaks. Clay and wooden vessels, as well as underground storage cellars, were commonly used for preservation.

Fish also held an important place in ritual and festive contexts, often served as dried or smoked dishes. Recipes featuring local spices held special cultural significance. Such practices reflect the ethnocultural identity, adaptability to the natural environment, and enduring values of collectivism and hospitality. Knowledge of these methods was transmitted orally, preserved as part of the intangible cultural heritage of the region.

Cultural Motifs and Environmental Influences in the Fish-Farming Traditions of the Aral Region

Cultural motifs are vividly manifested in rituals of gratitude to the water deities for successful catches, as well as in songs, legends, and oral narratives about fishing. Symbolic objects—such as amulets protecting the catch and talismans safeguarding fishermen—hold special significance within these traditions, serving both spiritual and practical purposes.

The ecological conditions of the Aral region had a profound impact on traditional methods of fish processing. The scarcity of water resources and the seasonal nature of fishing demanded a careful attitude toward natural reserves and the development of efficient preservation techniques to ensure food security. The hot summer climate facilitated rapid drying of fish, while the cold winters made preservation and salting indispensable.

The ecological degradation of the Aral Sea in the twentieth century led to a drastic decline in fish stocks and disrupted traditional practices, prompting the emergence of new methods of fish processing and storage.

Fishing also played an important social role, fostering communal unity through collective labor and shared rituals of thanksgiving to the spirits of the waters. Economically, it provided a source of livelihood for many families and contributed to the development of professional fishing, as well as to the establishment of trade relations among neighboring communities.

Fish Farming in Folk Beliefs, Oral Folklore, and Material Culture

In the oral folklore of the peoples of the Aral region, motifs related to fishing are widely represented: songs celebrating the skill of fishermen, tales about guardian spirits of the waters, legends describing the origins of lakes and rivers, and proverbs promoting a respectful attitude toward nature. The folklore of the Aral region constitutes a rich cultural heritage that traces its origins to the earliest civilizations of Central Asia.

A particularly prominent place belongs to the legend of the "fish eaters" — the Khorezmians, inhabitants of the Amu Darya riverbanks. According to the legend, in ancient times, a settlement arose amid the desert and along the river, which later became the prosperous city of *Khar Asm*— meaning "abundance of meat." The name reflects not only the plentiful presence of fish but also their

fundamental importance for the survival of the local inhabitants, for whom fish served as a vital source of nourishment and life energy.

This legend finds confirmation in archaeological discoveries—such as jars, ornaments, and wall paintings—depicting fish imagery. The fish symbol also appears throughout ethnographic art in the region: in embroidery, ornamental design, and wall decoration, reflecting both material prosperity and spiritual unity with nature.

The legend of the fish eaters functions as an important cultural code, symbolizing the profound interconnectedness between humans and the natural world. This folkloric heritage continues to live in the traditional crafts and practices of the region, reminding people of the enduring importance of preserving natural resources.

The etymological connection between the city's name and the theme of fishing remains open to scholarly discussion: neither Iranian nor Turkic etymological dictionaries provide direct confirmation. Nonetheless, the historical location of Khorezm in the Amu Darya delta—a region long known for its developed fishing culture—provides sufficient grounds to associate the local way of life and traditions with the fish motif, even if this relationship cannot be linguistically verified.

The Study of the Material Culture of the Peoples of the Aral Region demonstrates that the fishing industry played a significant role in shaping the ethnocultural characteristics of the Southern Aral area.

Following large-scale migrations in the sixteenth century, the Karakalpaks—like other steppe pastoralists—began to transition to a semi-sedentary way of life, settling in the eastern Aral region, particularly in the lower reaches of the Syr Darya River [Koy-Krylgan-kala, 1967: 327; Tolstov, 1951: 611]. By the nineteenth century, they had preserved their clan and tribal divisions and developed a mixed type of economy, combining transhumant pastoralism, agriculture, and fishing.

One of the most important historical factors influencing the formation of traditional Karakalpak culture was this mixed economic and domestic structure, which was shaped by the natural and geographical conditions of settlement as well as by the persistence of clan-based social relations. Through centuries of contact with neighboring peoples of the nomadic world and their interaction with the powerful Khorezmian state—one of the earliest centers of settled agricultural and urban civilization—the Karakalpaks developed close ethnic and cultural ties with the peoples of the Aral region, the Volga area, the Northern Caspian, the Ural region, and Western Siberia.

As a result of prolonged interaction with various groups—such as the Pechenegs and the Black Caps (Karakalpak ancestors), who maintained fishing, herding, and agricultural economies, as well as with the Oghuz, ancient Nogai, and other tribal communities—diverse forms of economic activity gradually took shape. These interactions also influenced ceramic production, folk crafts, and particularly ornamental art, which reflected an aesthetic worldview rooted in reverence for the forces of nature.

This artistic tradition absorbed and preserved the most distinctive ornamental motifs of the Karakalpak people's ancestors, serving as a bridge between their material culture and their spiritual conception of harmony between human life and the natural environment.

At the same time, the elements incorporated into this cultural system possess diverse and far more ancient origins, reaching back to the archaic period. In Karakalpak decorative and applied art, one can trace the influence of both ancient and medieval Khorezmian art. Thus, each historical era left its distinctive imprint on the evolution of ornamentation among the steppe peoples, including the Karakalpaks, influencing not only its form but also its semantic content.

When speaking of fish and fishing as forms of economic activity, their representations are clearly visible in numerous archaeological artifacts preserved in the collections of the State Museum of Art of the Republic of Karakalpakstan, named after I. V. Savitsky, and the State Museum of History and Culture. Among these artifacts, medieval metal mirrors featuring stylized depictions of fish are especially noteworthy; they were discovered over various years during archaeological excavations of the Dzhanypik-kala and Mizdahkan sites, as well as the fortresses of the Kavat-kala oasis, dating from the 11th to the 14th centuries.

The finely executed engravings and their stylistic features are particularly intriguing when compared with elements of Karakalpak folk ornamentation and the art of neighboring peoples. Such comparisons reveal a synthesis of archaeological and ethnographic elements, which together shaped the material and aesthetic culture of the peoples of the southern Aral region.

Among the bronze mirrors of Dzhanypik-kala, most specimens feature a raised rim shaped as an arched border, adorned with convex fish figures. The fish are typically depicted in pairs, arranged head to tail in a circular composition. The earliest discoveries of such mirrors within this territory were made by V. N. Yagodin in 1968 during excavations of the auxiliary structures near the Mausoleum of Mazlumkhan Sulu, and again in 1988 in the potters' quarter of Mizdahkan [Yagodin, 1970: 189–197]. Similar artifacts have been found widely across Golden Horde cities of the Volga region [Yagodin, 1968: 163], while even earlier analogies have been identified among materials from Far Eastern archaeological sites [Yagodin, 1968: fig. 6].

Among the exhibits are several fragments of light-clay bowls from the twelfth century, found at the Dzhanypik-kala site (inventory no. KP-13333) and Mizdahkan (10th–11th centuries). The interior surfaces of these vessels, covered with a light-green glaze, display black underglaze paintings depicting stylized images of two fish. A large group of artifacts consists of fragments of stamped narrow-necked pitchers, whose bodies are adorned with ribbed decorations in the form of small fish and dotted motifs symbolizing fish roe.

Evidence of the development of fishing practices is also provided by numerous finds of bone kochedyks—tools resembling thick, curved awls used in weaving. These implements were employed not only for making mats and leather goods but also for weaving fishing nets. On several kochedyks, one can observe engraved and impressed ornaments featuring fish, roe-like dots, and wavy lines. Such objects are especially common in cultural layers dating from the 10th to the 14th centuries at medieval sites of Right-Bank Khorezm [Dospanov, 1992: 96].

Researchers note that the image of the fish is among the most frequently encountered motifs in Karakalpak decorative and applied arts. The so-called "omyrtka" motif (fish spine) often adorns ritual garments such as *kyzyl kiymeshek* (red ceremonial dresses), sleeve cuffs (*zhengse*), and small storage bags for tea (*shaikhalta*) and dry goods (*shanash*). A similar motif—the fish backbone—is also found in Turkmen carpets [Bogoslovskaya, 2019].

Ethnographic records preserve a folk belief stating that *"if fish bones are placed on a felt mat (koshma) during a meal, sleep on that felt will be peaceful."* The same protective and calming effect could be achieved not only through the actual bones but also through their symbolic image or sign. Hence, the frequent depiction of the fish spine in pile carpets featuring the onurga-göl pattern — a chain of connected triangles, which serves as both a decorative element and a protective symbol. This motif, together with other related compositions, embodies ancient ideas of harmony, protection, and continuity within the visual language of nomadic textile art [Bogoslovskaya, 2019: 155–165].

Another Karakalpak geometric motif, known as *balyk köz* ("fish eye"), serves an auxiliary ornamental function, having derived its name through association with a specific type of fish. This motif, represented by small square patterns, is frequently encountered on embroidered collars of Karakalpak women's garments, as well as on carpet weavings and various smaller embroidered items.

The choice of this designation is deeply symbolic: the fish, which lays millions of eggs, has long been regarded as an embodiment of reproductive power and a symbol of abundance and fertility. In ancient mythology, the fish and its individual parts were believed to represent the lower world, a realm of transformation and renewal. Simultaneously, certain folk customs—for example, the prohibition against throwing fish bones into the fire—may reflect vestiges of ancient totemic beliefs in reincarnation, or the capacity of the totemic being to reincarnate alternately in human form and back into its original species [Rychkov, 2000: 17].

The fish motif in Karakalpak ornamental art, when viewed in light of its ancient analogues, was most likely associated with the traditional fishing culture of the peoples inhabiting the Amu Darya delta and the Aral Sea basin.

Similarly, the running wave motif (*meander*), especially prevalent in felt carpets of the Karakalpaks and Kyrgyz, has been known in Central Asian art since the Hellenistic period, having

been introduced following the campaigns of Alexander the Great. During the excavations of the Toprak-Kala palace (3rd century CE), a wall panel depicting waves and fish swimming among them was discovered in one of the rooms of the western tower [Tolstov, 1958: 393].

When discussing the broad range of symbolic applications, it is important to note that by the nineteenth century, certain tamga motifs (tribal emblems) continued to serve as hereditary marks of ownership. One such motif, found in embroidery ornamentation—particularly on the *ak kiymeshek aldı* (the chest part of a woman's white ceremonial headdress)—is the shanışqy (*trident*), a widely favored motif among Karakalpak embroiderers. The shanışqy spear, a traditional fishing tool, is known to historians as the tribal tamga of the Muyten Karakalpaks [Kamalov, 1968: 53].

According to S.P. Tolstov, trident-like symbols were already depicted on ancient Khorezmian ceramics [Kotin et al., 2006: 225]. The trident tamga is also attested on Khorezmian coins from the 3rd century CE, and at the Toprak-Kala archaeological site, a staff topped with a trident was represented as a symbol of authority [Fedorov-Davydov, 1966: fig. 100]. It can thus be reasonably assumed that tamgas and other ornamental patterns reflecting fishing implements originated among ethnic groups inhabiting the regions adjacent to the Aral Sea.

A. Allamuratov notes that the fishing spear motif (ostroga) "no longer possesses local or tribal limitations and is employed universally in Karakalpak ornamental art" [Allamuratov, 1969: 13].

The traditional forms of fish processing, preservation, and consumption among the peoples of the Aral region constitute an integral component of their culture and way of life. These practices were shaped under the influence of the region's specific ecological conditions, reflecting the deep interconnection between human communities and the natural environment.

They served not merely an economic or subsistence function, but also represented a social and ritual system, reinforcing communal cohesion and transmitting cultural knowledge and values from generation to generation through oral tradition.

In the modern era, the preservation of these unique cultural practices is of great importance, as they embody a vital element of the national heritage of the Karakalpak people and the entire Aral region.

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Rezyume: *Mazkur maqolada Qoraqalpog‘iston va Orol bo‘yi xalqlarida an’anaviy baliqchilikning tarixiy-etnografik va madaniy tahlili amalga oshirilgan. Baliq tutish usullari va uskunalarining evolyutsiyasi, shuningdek, mintaqaning tabiiy-iqlim sharoitiga mos ravishda baliqni qayta ishlash va saqlash xususiyatlari ko‘rib chiqilgan. Baliqchilikning xo‘jalik faoliyati, ma’naviy amaliyotlar va jamiyat hayotidagi muhim madaniy ahamiyati alohida ta’kidlangan. Folklor, marosimlar va muzey ekspozitsiyalari orqali an’analarni saqlash usullari yoritilgan hamda baliqchilikning milliy identifikatsiya va ekologik madaniyat shakllanishidagi o‘rni namoyon etilgan. Orol dengizining ekologik inqirozi baliqchilikning zamonaviy amaliyoti va ahamiyatiga ta’sir etuvchi omil sifatida tahlil qilingan. Maqola materiallari inson va tabiat o‘rtasidagi barqaror o‘zaro munosabatlarning tarixiy tajribasini anglash va Orol bo‘yi mintaqasining madaniy merosini asrashga xizmat qiladi.*

Резюме: *В статье проводится комплексный историко-этнографический и культурный анализ традиционного рыбоводства у народов Приаралья и Каракалпакстана. Рассматривается эволюция методов и орудий ловли, а также особенности переработки и хранения рыбы, обусловленные природно-климатическими условиями региона. Особое внимание уделяется культурному значению рыбоводства как важной части хозяйственной деятельности, духовных практик и социальной жизни каракалпаков и других народов. Отражены способы сохранения традиций через фольклор, обряды и музейные экспозиции, подчеркивающие роль рыболовства в формировании национальной идентичности и экологической культуры региона. Экологическая деградация Аральского моря рассматривается как фактор, влияющий на современные практики и значение рыбоводства. Материалы статьи способствуют осмыслению исторического опыта устойчивого взаимодействия человека с природой и сохранению культурного наследия Приаралья.*

Kalit so‘zlar: *Amudaryo, Orol bo‘yining madaniy motivlari, baliqchilik evolyutsiyasi, etnografik jihatlar.*

Ключевые слова: *Амударья, Культурные мотивы, Приаралье, Эволюция рыбоводства, этнографический аспект.*

THE ROLE OF INDUCTIVE AND DEDUCTIVE GRAMMAR TEACHING IN LANGUAGE ACQUISITION

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Summary: *Grammar instruction has always played an important role in second language acquisition, helping learners form accurate and meaningful expressions. Over the years, two methods—inductive and deductive—have guided grammar teaching and served as a foundation in methodology. The deductive approach begins with explicit rule presentation, while the inductive approach encourages learners to discover grammatical structures through examples. This paper debates the advantages and disadvantages of both methods, drawing insights from key scholars such as Brown (1987), Larsen-Freeman (2003), and Ellis (2006).*

Key words: *grammar teaching, inductive method, deductive method, language acquisition, communicative competence*

LITERATURE REVIEW

Teaching Method

Teaching methods play an important role in the process of language instruction, as they provide a framework for how educators make the learning process easier for the students. A teaching method can be determined as a systematic curriculum for organizing and presenting lessons based on a particular approach. It serves as a guide for teachers to decide which learning activities to use in order to achieve specific purposes.

In essence, a teaching method outlines the procedures and strategies that shape how learning takes place to cover the intended goals. Effective teaching requires careful planning and thoughtful selection of activities that align with learners' needs and lesson purposes.

Moreover, teachers must be skilled in applying and using efficiently different methods, adapting their techniques to suit the varying abilities, preferences, atmosphere and interests of their students. This involves developing strong language awareness and instructional competence to identify learners' strengths and weaknesses and to create meaningful opportunities for improvement. The choice of method also affects classroom dynamics, helping to establish a supportive and engaging environment that promotes active learning. Understanding students' learning styles and motivations is therefore essential to ensuring that teaching methods lead to effective and enjoyable language acquisition.

INTRODUCTION

Grammar is a fundamental component of language learning, serving as the system that organizes words and structures into meaningful communication. For decades, language educators and researchers have debated the most effective way to teach grammar in second language classrooms. Two central approaches—deductive and inductive—have shaped instructional practices around the world. The deductive method introduces grammatical rules explicitly before applying them in exercises, while the inductive method involves guiding students to discover rules through patterns and examples. Both have unique beneficial sides and weaknesses, and their effectiveness often depends on learner variables such as age, proficiency level, cognitive style, and motivation.

The goal of this paper is to explore both methods in detail, examining their respective advantages and disadvantages and identifying how they can be applied effectively in classroom settings.

DEDUCTIVE METHOD

The deductive method is a traditional and widely used approach in grammar instruction. In this method, the teacher explains grammatical rules first, followed by examples and practice exercises. This approach assumes that understanding the rule helps students apply it correctly in communication.

One of the key advantages of the deductive method is its clarity and efficiency. It provides a structured learning environment where students gain direct explanations, saving time and ensuring that they understand the rule before practice begins. According to Ellis (2006), deductive teaching promotes explicit knowledge—the conscious understanding of language forms—which can serve as a foundation for later implicit use. This is especially useful for adult learners or those studying for exams where grammatical accuracy is essential. The deductive approach also supports learners who prefer analytical thinking, as it appeals to their logical reasoning and need for structure.

Furthermore, the deductive method allows teachers to keep classroom control and consistency. In large classes, it can be easier to manage and ensures that all students understand the topic equally. For complex grammar topics such as conditionals, relative clauses, or verb tenses, the deductive method helps learners grasp the form and usage quickly before moving to application.

However, the deductive method also has significant disadvantages. One of the most common criticisms is that it can lead to passive learning. When teachers dominate the lesson by presenting rules and examples, students may become less engaged and fail to internalize the language through active use. As Brown (1987) notes, language learning should be interactive and meaningful, not mechanical. The deductive approach can also create dependence on the teacher, limiting learners' ability to notice and analyze patterns independently.

Another drawback is that deductive teaching may prioritize accuracy over fluency. Students may know the rules but struggle to apply them in real communication because they have not practiced enough in context. Overemphasis on error correction and memorization can also create anxiety or reduce motivation, particularly among younger or less confident learners. Therefore, while the deductive method is effective for presenting new material, it should be complemented with communicative activities that promote actual language use.

INDUCTIVE METHOD

The inductive method takes a more learner-centered and discovery-based way. Instead of providing rules upfront, teachers give examples—through texts, dialogues, or exercises—and guide learners to identify patterns and infer grammatical rules themselves. This method reflects the natural process of language acquisition, where learners notice and internalize structures through exposure and practice.

Among its advantages, the inductive approach fosters active participation and deeper understanding. Learners are more engaged because they play an active role in discovering how the language works. This aligns with constructivist theories of learning, which suggest that knowledge is built through experience and reflection. Larsen-Freeman (2003) emphasizes that grammar is not simply about correctness but about the ability to use forms meaningfully in context. Inductive learning supports this by integrating grammar instruction with communication, helping students connect form and function naturally.

Another major advantage of the inductive method is its ability to enhance retention. When students discover rules themselves, they are more likely to remember them because they have put invest in mental effort in analyzing and understanding the structure. This process leads to what Ellis (2006) calls "noticing," a key step in converting input into acquired knowledge. Inductive teaching also encourages learner autonomy, critical thinking, and problem-solving skills—abilities that extend beyond grammar learning.

However, the inductive method also has disadvantages. It can be time-consuming, especially in classes with limited instructional time or larger groups. Teachers need to prepare meaningful examples and guide learners effectively to ensure accurate generalizations. Without proper support, students may form incorrect rules or feel frustrated by the lack of clarity. According to Brown (1987), not all learners have the same cognitive ability or motivation to infer rules, and some may prefer explicit instruction. Additionally, beginners or students with limited exposure to the target language might struggle to identify patterns, leading to confusion and slower progress.

Despite these challenges, the inductive method provides a valuable framework for promoting communicative competence when combined with sufficient feedback and reinforcement. It

encourages learners to engage in authentic language use, helping them transfer grammatical knowledge to real-life situations.

IMPLICATIONS FOR LANGUAGE TEACHING

The ongoing debate about inductive and deductive methods suggests that no single approach fits all learners or contexts. Instead, teachers should aim for a balanced, flexible approach that integrates the strengths of both methods. Ellis (2006) proposes that effective grammar instruction should connect explicit knowledge (developed through deduction) with implicit knowledge (developed through induction). This means grammar teaching should not only explain rules but also create opportunities for practice, discovery, and meaningful use.

In practical terms, a blended approach might begin with deductive teaching to introduce new or complex grammar structures clearly. Once learners have a basic understanding, teachers can apply inductive techniques through communicative activities—such as role plays, problem-solving tasks, and text analysis—to reinforce understanding. This combination allows learners to benefit from both clarity and engagement. For example, a lesson on the present perfect tense could start with a rule explanation (deductive), followed by students analyzing examples from a short story to infer when and why the tense is used (inductive).

Larsen-Freeman (2003) suggests that grammar instruction should focus on "form, meaning, and use," ensuring that learners understand not only how grammar works but also how it functions in communication. Teachers should provide context-rich materials that connect grammar with real situations. Meanwhile, Brown (1987) emphasizes the importance of motivation and affective factors, arguing that learners acquire language more effectively when they are emotionally engaged. Inductive activities, such as games or discovery tasks, can create this engagement, while deductive explanation ensures that learners have a clear structure to guide them.

Additionally, teachers should consider learner differences when choosing an approach. For analytical or adult learners, deductive explanations may work best; for younger or more communicative learners, inductive methods might be more effective. The key lies in using diagnostic assessment, reflection, and flexibility to adapt lessons accordingly.

Finally, teacher training programs should equip educators with the skills to blend these methods effectively. Teachers must learn how to shift from explanation to exploration, how to provide scaffolding without over-controlling, and how to integrate grammar into meaningful communication. This balanced approach not only improves grammatical accuracy but also supports fluency, confidence, and learner autonomy.

ILLUSTRATIVE EXAMPLES FROM PRACTICE

Grammar can be taught through two main approaches: the deductive (rule-driven) method and the inductive (rule-discovery) method (Thornbury, 1999). In the deductive approach, the teacher explicitly presents a grammar rule before guiding students through examples and exercises. For instance, when teaching the present continuous tense, a teacher might demonstrate by walking across the classroom while saying "I am walking", then ask students to repeat and practice the same structure. This structured method ensures learners clearly understand the rule before applying it, which can be especially useful for beginners or for complex grammatical structures.

In contrast, the inductive approach allows learners to observe examples and infer the underlying rule themselves. For example, students may analyze sentences such as "Chris has lived in Cape Town for ten years" and "Wendy has lived in Edinburgh since 1995" to determine when to use for or since. Through guided discovery and feedback, learners test and refine their hypotheses, promoting deeper understanding and critical thinking. This method mirrors natural language acquisition, where learners infer patterns through exposure and experience, rather than explicit instruction. Thornbury says: "The principles of the guided discovery approach were originally intended for self-instruction as a part of the kind of programs which were used in language laboratories. They were soon adapted for classroom use, and coursebooks promoting an inductive approach to language learning are now more or less standard."

Modern language teaching often combines both approaches to maximize learning outcomes. A teacher may first introduce a rule to provide clarity (deductive) and then engage students in

exercises or problem-solving activities that require them to discover patterns and apply rules independently (inductive). Advances in technology, such as computerized corpora and authentic language resources, further enhance inductive learning by offering a wealth of real-world examples. By integrating these methods, contemporary instruction supports both explicit knowledge and experiential learning, leading to more robust and lasting grammatical competence (Thornbury, 1999).

CONCLUSION

Grammar teaching is a very important part of learning a language because it helps students express their thoughts correctly and clearly. Both the deductive and inductive approaches have important roles. The deductive method gives students clear rules and structure, making it easier to understand grammar forms quickly. The inductive method, on the other hand, makes learning more interesting by letting students find the rules themselves, which helps them remember better and stay engaged.

According to Brown (1987), Larsen-Freeman (2003), and Ellis (2006), the best way to teach grammar is to use both methods together. Language learning involves both understanding and experience, so teachers should mix clear explanations with activities that let students explore and use grammar in real communication. The main goal of grammar teaching is not just to memorize rules but to use them naturally while speaking or writing. When teachers balance inductive and deductive approaches, learners can build stronger understanding, feel more confident, and use the language more fluently.

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Rezyume: *Grammatika o‘qitish har doim ikkinchi tilni o‘zlashtirishda muhim rol o‘ynab, o‘rganuvchilarga aniq va mazmunli iboralarni shakllantirishga yordam bergan. Yillar davomida grammatikani o‘qitishda ikki metod - induktiv va deduktiv metodlar yetakchilik qilib keldi va metodikaga asos bo‘lib xizmat qildi. Deduktiv yondashuv qoidalarni aniq bayon qilishdan boshlanadi, induktiv yondashuv esa o‘quvchilarni grammatik tuzilmalarni misollar orqali kashf etishga undaydi. Ushbu maqolada ikkala usulning afzalliklari va kamchiliklari muhokama qilinib, Braun (1987), Larsen-Frimen (2003) va Ellis (2006) kabi yetakchi olimlarning fikrlari o‘rganilgan.*

Резюме: *Преподавание грамматики всегда играло важную роль в освоении второго языка, помогая учащимся формировать точные и осмысленные выражения. В эти годы два метода - индуктивный и дедуктивный - руководили преподаванием грамматики и служили основой в методике. Дедуктивный подход начинается с четкого представления правил, в то время как индуктивный подход побуждает учащихся к открытию грамматических структур посредством примеров. В данной работе обсуждаются преимущества и недостатки обоих методов на основе наблюдений ключевых ученых, таких как Браун (1987), Ларсен-Фриман (2003) и Эллис (2006).*

Kalit so‘zlar: *grammatika o‘qitish, induktiv metod, deduktiv metod, til o‘rganish, kommunikativ kompetensiya*

Ключевые слова: *обучение грамматике, индуктивный метод, дедуктивный метод, овладение языком, коммуникативная компетенция*

THEORETICAL APPROACHES TO THE STUDY OF COLOR IN LINGUISTICS

Khudaybergenova Z.O.

Summary*: This article deals with the cognitive-discursive approach to linguistics, focusing on how color designations reflect cultural, emotional, and linguistic meanings. It emphasizes that colors play a key role in expressing national worldviews and aesthetic values.*

Key words: *cognitive-discursive, linguistic phenomena, affix formation and word formation, aesthetic, symbolic, artistic, ontolinguistics, phraseological and paremiological units, cultural stereotypes, connotative components.*

It is no secret that the current trend in linguistics is the cognitive-discursive approach to language research. The features of this approach are attracting the attention of many linguists. In particular, the formal rigor of description in the process of communication draws attention to the analysis of linguistic phenomena from the point of view of their compatibility with functional explanations, as well as the role of linguistic phenomena in the implementation of communication. Researchers emphasize the importance of the color category in folk culture, as it is one of the main categories of culture, reflecting the national model of the world and the most important means of conveying aesthetic, symbolic, and artistic meanings.

We can find a number of opinions and discussions about the direct connection between language and the stage of linguistic and cultural development. In particular, according to Berlin and Kay, the longer the lexical-semantic system of any language develops, the more diverse the possibilities of language representation become. With the help of this language, a colorful picture of the world appears.

The history of English color symbols dates back to ancient Gothic, Latin, and Greek. In particular, color symbols in the Karakalpak language are related to color names in Turkic languages. The names of colors in the Karakalpak language are similar in their affix formations and word formation based on color names. However, in languages belonging to the Turkic family, different aspects of the linguistic status of colors can also be found.

B. Berlin and P. Kay identified the main color categories in the English language. According to the authors' theory, the following main categories of color terms in the English language were given: white, black, red, green, yellow, blue, brown, pink, purple, orange, and gray. Based on the data obtained by these scientists, in particular, it was concluded that the terms black and white exist in all languages, that is, they are universal.

There are various approaches to the psychological and linguistic study of color symbols. For example, N.A. Bagdasarova and A.P. Vasilevich studied the relationship between colors and emotions [Bagdasarova, Vasilevich, 2004]. It is noted that the mechanisms of the emergence of emotions, their manifestation in the form of a rise and fall of body temperature. In this work, the verbal expression of emotions such as anger, sadness, hatred, fear, joy and surprise is analyzed. This work notes that a number of emotions are associated with the consequences of a decrease in temperature, which form separate lexemes and phraseological units related to the semantics of "cold". An increase in temperature is not always expressed by color symbols. Thus, the verbal expression of emotions is associated with the events that occur in the human body under the influence of the above-mentioned emotions. The polar manifestations of the emotions of "temperature" are fear (a cold emotion) and anger (a hot emotion).

A.H. Merzlyakova approaches from a cognitive point of view. The author gives the following types of semantic changes of adjectives representing color signs in English, French and Russian: 1) composition of the field of color signs, 2) achromatic colors, 3) chromatic colors. [Merzlyakova 2003] According to him, it comes based on the physical properties of color and light. In addition, he bases the contrast of light and dark on the cognitive foundations of ontolinguistics and other materials of other languages. The author uses basic color terms to analyze the content of the main meaning (core theme) and potential themes.

We can see this in the work of I. Khojalepesova on the study of color in the Karakalpak language. She focuses on color-expressing lexical, phraseological, and paremiological units used to describe anthropocentric features in the material of various systemic and related languages. Also, the universal and ethnocultural characteristics of color symbols in the compared languages are mentioned. [Хожалепесова И. М. 2022]

E. V. Rakhilina analyzes various object names in terms of cognitive, semantics, and word associations. The author also pays attention to color terms in object naming [Rakhilina, 2000]. E. V. Rakhilina concludes that it is impossible to describe color semantics in a universal sense. In this he B. Berlin, P. Kay adheres to the point of view expressed by A. Vejbitskaya that every language has cultural stereotypes for color symbols.

E. V. Rakhilina is interested in color names and their naming, as well as changes in meaning in word formation. In the process of analyzing the attributive structures of color terms, the researcher finds that the meaning hidden in the semantics of lexemes denoting a color sign arises from the features of the attributive structure. At the same time, it is considered that the semantics of certain object names may contain an idea or characteristic of the color of the object they designate. Therefore, certain restrictions may arise in the use of attributive constructions related to color. The author emphasizes that the term color 1) is not used with any noun, 2) not every color term is used with a given noun, and 3) the semantic interpretation of constructions with terms of the same color can differ significantly.

E.V. Rakhilina identifies specific regularities in naming colors. She notes that in many cases the color is not given to the entire object (in a blue notebook only the outer surface is blue, in a red ring only the color of the stone), but only its variable part, so the physical color of real objects is actually unified. He also believes that the color expressed in color descriptions of a number of objects does not reflect the actual color of the object, but rather our thoughts about it.

In the scientific literature, several possible sources of the color symbol are indicated: 1) internal properties of each color, intuitively accepted as an objective fact; 2) the symbol of the planet that traditionally belongs to this color; 3) concepts obtained through elementary logic [Kerlot 1994: 550].

A distinctive feature of lexical polysemy is its closeness to word formation. This is known as “semantic derivation” [Shmelev 1964, Apresyan 1995]. The distinctive features that distinguish the polysemous model from the word-formation model are the absence of a morphemic index or format, the attribution of the resulting words to one part of speech, and the possibility of the model appearing in words belonging to different parts of speech.

T. P. Troshkina in her work considers the differentiation of lexical-semantic variation based on adjectives. In this work, the most effective and systematic models of lexical-semantic variation in the context of the participation of adjectives are developed. Such models include semantic changes according to the principle of “concrete attribute - abstract attribute”, “visual color attribute - intellectual attribute”. Certain principles are relied upon to correctly describe the polysemy model. As a result, it is emphasized that it can be implemented by determining the semantic base of the adjective (lexico-semantic group, lexico-grammatical category, or a combination of words capable of similar semantic changes) and its semantic formula. In identifying such models, it is important to use the transformation proposed by Chudinov, identifying a component that combines all primary meanings and components that combine all secondary meanings.

From a lexicographic perspective, cognitive approaches to language explain the differences in the categorical status of relevant information about the world around us and the stages of understanding it as a separate or new category, each piece of information being evaluated as a new category [Kharitonchik 2000]. Therefore, the comparison of lexical-semantic and speech changes of the adjectives “white, black” in the languages being compared allows to form the color fragment of the linguistic image of these adjectives and determine the role of its reflection in speech and context.

In particular, in Russian linguistics, a lot of work has been done on the analysis of denotative classes of nouns and the study of their adjectives. In particular, based on the lexico-semantic classification of words I. A. Sternin [1994] suggests groups of nouns in sheep: 1) clothing; 2) shoes;

3) the name of the person (common names, gender, age, family relations, names by profession); 4) names of persons according to external signs; 5) names of animals; 6) names of animal body parts; 7) names of plants; 8) names of plant parts; 9) names of areas covered with plants; 10) natural objects, etc.

The linguists' description of the schemes of joining the cited nouns to adjectives can also be applied to our research. Because the dictionary meaning of the word contains categorical-lexical, differential, semantic and connotative components. The features of the compared qualities, described from the point of view of categorical-lexical semantics, are determined by a number of differential semantics. In this case, the connotative components are expressed in various associative relations related to the meanings that the lexical unit denotes. This makes it possible to identify the semantics of the adjectives white, black, and ақ/қара in English and Karakalpak that are not reflected in dictionaries.

Thus, the semantics related to the concept of "white" are evaluated as colorlessness, purity, positive evaluation, chastity, etc. The concept of "black" is expressed as evil, sadness, night, darkness. In general, we can witness the lack of a single approach to defining and describing the linguistic status of color terms.

From the point of view of word formation, it is possible to classify simple and complex color signs. For example, light blue, dark red, and yellow. In general, there are differences in the word formation of color terms and color-related units in English and Karakalpak. However, as cases that are characteristic of both languages, simple words (ақ, қара, white, black) and adjectives formed by adding suffixes (ақшыл, blackish) are characteristic of the Karakalpak language. Color-related adjectives are ақ-қара, white and blue, and color-denoting adjectives with emotive and superlative forms are characteristic of the Karakalpak language: аппақ, қап-қара.

The emotive description of the color sign was also carried out by describing the skin sign. In particular, white color is associated as a negative feature in the reflection of emotions. For example: fear, excitement, pale from hunger etc. The emotive description of the color sign was also carried out by describing the skin sign. In particular, white color is associated as a negative feature in the reflection of emotions. For example: pale from fear, excitement, hunger, etc. The semantics of a negative assessment (marked at the edge of the adjective meaning) is based on the idea that a change in the color of a person's skin is a deviation from the norm. Thus, for the term white, the emotional semantics of a negative assessment of the color white arises from strong feelings or illness.

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***Rezyume**: Ushbu maqola rang belgilarining madaniy, hissiy va lingvistik ma'nolarni qanday aks ettirishiga e'tibor qaratib, tilshunoslikka kognitiv-diskursiv yondashuvni o'rganadi. Unda milliy dunyoqarash va estetik qadriyatlarni ifodalashda ranglar asosiy o'rin tutishi ta'kidlangan.*

***Резюме**: В статье рассматривается когнитивно-дискурсивный подход в лингвистике, особое внимание уделяется тому, как цветообозначения отражают культурные,*

эмоциональные и языковые значения. Подчеркивается, что цвета играют ключевую роль в выражении национальных мировоззрений и эстетических ценностей.

***Kalit so'zlar**: kognitiv-diskursiv, lingvistik hodisalar, affiks yasalishi va so`z yasalishi, estetik, ramziy, badiiy, ontolingvistika, frazeologik va paremiologik birliklar, madaniy stereotiplar, konnotativ komponentlar.*

***Ключевые слова**: когнитивно-дискурсивный, языковые явления, аффиксообразование и словообразование, эстетический, символический, художественный, онтолингвистика, фразеологические и паремиологические единицы, культурные стереотипы, коннотативные компоненты*

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EFFECTIVENESS OF THE DISCOURSE APPROACH IN THE FORMATION OF COMMUNICATION-ORIENTED SPEECH AND WRITING SKILLS IN STUDENTS

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Summary: *In this article, the pedagogical effectiveness of the discursive approach in the formation of communicative speaking and writing skills in students is analyzed on a scientific basis. The study reveals the basic principles of discourse theory, discursive units that ensure the semantic integrity of speech in the process of communication, and the mechanisms of their assimilation. Also, the role of discourse-based tasks, communication scenarios, and interactive methods in the development of competencies such as contextual correspondence, logical consistency, and clear expression of communicative intention in oral and written speech is scientifically and theoretically substantiated. The article proposes a pedagogical model that allows students to effectively organize speech activity in real communicative situations and empirically illuminates the influence of the discursive approach on educational outcomes. The research results serve as a methodological basis for the integrative development of speaking and writing skills in the process of language teaching.*

Key words: *discourse, discursive approach, oral speech, written speech, communicative competence, discursive units, communication scenarios, interactive methods, linguodidactics, speech activity, pedagogical effectiveness.*

The set of exercises for the formation of discursive competence is understood as a set and sequence of exercises of various types and types, based on speech analysis and taking into account the specifics of the formation of writing skills (procedural-effective approach) to ensure the formation of discursive competence in students. The complex includes groups of exercises for developing the skills of all components of rest training.

This methodology was developed on the basis of competency-activity and communicative-cognitive approaches. It is based on the following didactic and general methodological principles: communication; consciousness; taking into account the positive interaction of various types of speech activity; possibility of implementation, possibility of use and systematicity; the principle of taking into account the stage of skill development[1].

The training content includes the following components:

1. Skills of all components of discursive competence.

2. Cognitive components of discursive competence skills in writing, i.e., knowledge that they consider necessary to emphasize:

- knowledge of the stages of creating a work of written speech, paying special attention to the stage of text planning;
- simplified knowledge of what a communicative situation is, what its parameters should be taken into account when creating a text;
- basic concept of the text, its structure and features;
- Basic knowledge about the characteristics of written speech, its styles and genres.

3. Texts and types of texts, i.e., genres selected for the formation of discursive competence in productive and reproductive writing. As a result of the competition, the following types of texts were included in the training content:

• a personal letter with a story about you;
• letters of gratitude (personal and business);
• invitation (personal and business);
• apology letter (personal and business);
• application letter for employment;
• essay-description;

• story essay.

Undoubtedly, the list of these genres can be supplemented or changed, but when choosing text types, the following principles should be taken into account: 1) the possibility of using text types selected for study by students; 2) a combination of canonized and non-canonized genres, business and informal styles. 4. Linguistic and speech material that must be mastered first in order for the selected type of text to comply with the laws of genre, i.e., lexical and grammatical material of genre and stylistic color. In addition, the language material includes means of harmony and signs of harmony, which are difficult for students, but absolutely necessary for mastering the skills of text competence[2].

For the development of discursive competence, a learning model was developed, describing its methods (a set of exercises) and the organization of the educational process as a whole. This model is based on individual learning principles that reflect the specifics of forming DC in expressive written speech (reproductive and productive) and synthesize the rules of effective and procedural learning approaches. These principles complement the theoretical principles underlying the methodology and allow for a detailed description of teaching technology.

We consider the following to be proprietary technological principles:

- the principle of correspondence of the exercised skills to the psychological characteristics;
- the principle of harmonizing procedural and effective approaches to education;
- principle of modularity;
- the principle of adequacy and a gradual transition from reproductive exercises to productive ones.

The first of the specific, technological principles determines the list of exercises included in the complex for the formation of rest skills, and the rest determine the organization of the educational process.

The identified general and specific principles of training made it possible to develop a set of exercises for mastering the selected content of training and the technology of its development.

The learning model aimed at developing DC in written speech, in addition to a set of exercises, also includes a work system, that is, the organization of the educational process in accordance with the principles put forward above[3, 76].

In the process of teaching writing in English, the formation of DC is carried out in three stages.

The first, introductory stage includes the development of students' ability to create and perceive a speech work in an extralinguistic context. Accordingly, special attention is paid to the strategic and tactical parts of the DC. In addition, the skills of the text component of discursive competence are also being formed, at the introductory stage there is a need for proven special preliminary work in the analysis of the results of an intellectual experiment. The educational process at this stage is structured as a synthesis of only two approaches - procedural and textual. Exercises performed by students require the following actions:

- awareness of the subject's communicative intention;
- analysis of the communicative situation;
- changing the speech product depending on the communicative goal and situation;
- planning of the speech part;
- selection and organization of information;
- separation of text into paragraphs;
- organization of sentences within the framework of the paragraph;
- construction of various types of paragraphs;
- writing outlines and individual parts of the text;
- use of various means of harmony.

The second stage of the educational process is genre-oriented. The training is divided into modules, each of which is devoted to a different genre; an analysis of the extralinguistic features of the genre is carried out (the formation of the strategic and tactical components of the recreation center continues); genre norms are studied, exercises are offered to develop the ability to construct a speech work in accordance with genre norms (the genre component of the recreation center); text features

specific to this genre (the text component of the recreation center) are considered. Thus, in the second stage, all components of discursive competence are formed, but the main focus is on the genre and, to a lesser extent, on the components of the text. Each module includes the following types and stages of work:

- clarification of the purpose of writing this type of text, the author's communicative intention;
- study of the communicative situation, influencing the choice of genre, functional style, linguistic means, as well as reflected in the text of the address category;
- familiarization with the model text, studying its structure, genre and stylistic features, features of the use of lexical and grammatical means and other ways to achieve the communicative goal;
- various types of reproduction of typical texts, exercises for students to master the genre-style, rhetorical features of this type of text;
- creation (production) of independent texts of this type; At the same time, there is a gradual change in the conditions and situation of communication, as well as changes in the purpose and intention of the author of the text within the given genre[5].

At the second stage of training, students are offered two types of genres. Firstly, these are letters of different types, in which the degree of canonization of the genre is significantly higher, especially in business-style letters, so students should learn to set the parameters of the communicative situation, choose the genre, a specific communicative intention, and strictly adhere to its norms. Secondly, modules dedicated to writing essays of various functional and stylistic forms of speech are offered for learning, where the degree of canonization is much lower, but more attention is paid to creative, productive written speech. This type of text should be presented in the same sequence from informal letters to business letters, then to essays and various forms of their combination.

The third stage of training is devoted to the harmonization and creative application of acquired knowledge and skills. At this level, discursive competence is considered as a holistic ability (constructing a speech work in accordance with the writer's communicative intention in a certain communicative situation) without dividing it into its components - strategic, tactical, genre, and text; Accordingly, mainly productive-reproductive and actual communicative exercises of a productive nature are performed.

In conclusion, the research results show that the use of a discursive approach in the formation of communication-oriented speaking and writing skills in students significantly increases the effectiveness of the educational process. Relying on the basic principles of discourse theory made it possible to ensure the semantic integrity, contextual correspondence, logical consistency of oral and written speech, as well as the correct expression of communicative intention. Tasks, communication scenarios, and interactive methods based on discursive units helped students actively participate in real communicative situations, purposefully and meaningfully construct speech, and correctly interpret the sociocultural context[4].

The application of the pedagogical model developed during the study ensured the integrative development of speaking and writing skills in students, which led to the elevation of communicative competence to a new qualitative level. The discursive approach not only optimized the process of assimilating language material, but also formed such high-level competencies of students as independent thinking, the choice of optimal speech strategies, the use of linguistic means appropriate to the communicative situation. The obtained results show that the discourse-based teaching methodology is an integral part of modern language education and confirm that its widespread introduction into the practice of higher education is one of the most effective directions for the development of communicative-oriented speech competencies. The research lays the foundation for the development of new methodological solutions that combine integrative, contextual, and communicative approaches in the process of language learning.

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Rezyume: *Ushbu maqolada talabalarda muloqotga yo‘naltirilgan gapirish va yozish ko‘nikmalarini shakllantirishda diskursiv yondashuvning pedagogik samaradorligi ilmiy asoslarda tahlil qilinadi. Tadqiqotda diskurs nazariyasining asosiy tamoyillari, muloqot jarayonida nutqning mazmuniy yaxlitligini ta’minlovchi diskursiv birliklar hamda ularni o‘zlashtirish mexanizmlari ochib beriladi. Shuningdek, og‘zaki va yozma nutqda kontekstual moslik, mantiqiy izchillik, kommunikativ niyatni aniq ifoda etish kabi kompetensiyalarni rivojlantirishda diskursga asoslangan topshiriqlar, muloqot senariylari va interaktiv metodlarning roli ilmiy-nazariy jihatdan asoslanadi. Maqola talabalarning real kommunikativ vaziyatlarda nutq faoliyatini samarali tashkil etish imkonini beruvchi pedagogik modelni taklif qiladi va diskursiv yondashuvning ta’limiy natijalarga ta’sirini empirik jihatdan yoritadi. Tadqiqot natijalari til o‘qitish jarayonida gapirish va yozish ko‘nikmalarini integrativ rivojlantirish uchun metodik asos bo‘lib xizmat qiladi.*

Резюме: *В данной статье на научной основе анализируется педагогическая эффективность дискурсивного подхода в формировании коммуникативно-ориентированных навыков говорения и письма у студентов. В исследовании раскрываются основные принципы теории дискурса, дискурсивные единицы, обеспечивающие содержательную целостность речи в процессе общения, а также механизмы их усвоения. Также научно-теоретически обоснована роль дискурсивных заданий, сценариев общения и интерактивных методов в развитии таких компетенций, как контекстуальная совместимость, логическая последовательность, четкое выражение коммуникативного намерения в устной и письменной речи. В статье предлагается педагогическая модель, позволяющая эффективно организовать речевую деятельность студентов в реальных коммуникативных ситуациях, и эмпирически освещается влияние дискурсивного подхода на результаты обучения. Результаты исследования служат методической основой для интегративного развития навыков говорения и письма в процессе обучения языку.*

Kalit so‘zlar: *diskurs, diskursiv yondashuv, og‘zaki nutq, yozma nutq, kommunikativ kompetensiya, diskursiv birliklar, muloqot senariylari, interaktiv metodlar, lingvodidaktika, nutq faoliyati, pedagogik samaradorlik.*

Ключевые слова: *дискурс, дискурсивный подход, устная речь, письменная речь, коммуникативная компетенция, дискурсивные единицы, сценарии общения, интерактивные методы, лингводидактика, речевая деятельность, педагогическая эффективность.*

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SPIRITUAL CONDITIONS FOR THE FORMATION OF WORLDVIEW IN THE WORK OF THE KARAKALPAK THINKER AND POET AJINIYAZ

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Summary: *this article examines the spiritual prerequisites for the formation of the creativity and worldview of the Karakalpak poet-thinker Ajiniyaz, who made a major contribution to the development of the spiritual and moral values of the Karakalpak people.*

Key words*: folklore, oral creativity, spirituality, ethical views, morality, good and evil, value.*

In the formation of the worldview and development of the socio-ethical views of the prominent Karakalpak poet-thinker Ajiniyaz Kosybayuly, the spiritual, socio-moral ideas accumulated both by the Karakalpak people themselves, primarily in their folklore, and by other peoples, especially the peoples of Central Asia, played an important role.

In folklore, as one of the most important spiritual sources of creativity, Ajiniyaz's ideas, the life of the people and their worldview, social and moral ideals, traditions, and social positions find their holistic reflection.

Karakalpak folklore, which finds its embodiment in various legends, fairy tales, proverbs and sayings, historical, ritual songs, and heroic epics, as noted above, played an important spiritual and ideological role in the life of the people. The famous Kazakh scholar Chokan Valikhanov wrote that "thousands of stories, novellas, songs, and stories have been preserved in the memory of the Karakalpaks, which are "revered in the steppes by the first poets or songwriters" [1-223].

The oral creativity of the Karakalpaks is historically connected with the folklore heritage of other peoples of Central Asia, with whom the Karakalpaks are also connected by diverse economic, political, and cultural relations, including family and marriage. In one of the publications, it is reported that "the Karakalpaks living in the Khiva Khanate... give their daughters in marriage to Uzbeks and Kyrgyz, and themselves marry their daughters"[2-59]. According to some sources, the first wife of the famous Ernazar from the Koldaly clan was Uzbek. The renowned Qipchaq aga biy Yerejep was also married to an Uzbek woman. The Karakalpak people considered Uzbeks, Turkmens, and Kazakhs their own brothers. In the legends, he linked the origin of these peoples with his own: "There lived two brothers - Jailgan (ancestor of the Karakalpaks) and Seilkhan (ancestor of the Turkmens), they were twins"; "O'zbek o'z og'am - o'zbek mening og'am"[3].

It should be emphasized that folklore creativity has great historical value, as it reflects many socio-spiritual realities of different eras, peculiarities of the evolution of the worldview and psychology of the people. The best works of folklore represent one of the most important and necessary stages in the development of socio-ethical ideas and, at the same time, their traditional source.

As such, folklore primarily acts as a bearer of a certain people's aesthetic ideal, which possesses specific features determined by the very nature of the folklore heritage. In particular, the following feature and feature of all, including Karakalpak folklore, played an important role in Ajiniyaz's work, his philosophical, including socio-moral richness: "If we analyze the content of the aesthetic ideal..., then the following will be revealed: the presence of national-specific moments in it is connected, on the one hand, with the general philosophical significance of the form, and on the other hand, with the main element of the form of reflection, i.e., the ways of expression and transformation of the content"[4-16].

The peculiarities noted in this case of folklore, including the Karakalpak people, in some sense, its general philosophical, worldview richness, rich social and moral content, harmony of national and universal values played a great role in the formation and development of Ajiniyaz's work, its important significance in the history of socio-philosophical thought.

Ceremonial and labor songs constitute a necessary genre component of Karakalpak folklore. Their various forms express certain characteristics of the people's life and spiritual-value aspirations. Wedding songs (kəöjar, bet ashar), lullabies (besikzыgы), labor songs, love songs, mournful songs (plains, lamentations, farewells), children's songs, "medicinal" songs (bədik), religious songs, and many others vividly represent the specifics of this type of creativity. A number of Ajiniyaz's poems, in their form and content, closely resonate with such genres of folklore. In particular, the Karakalpak competition of wit (ju'ap) in the form of a poetic dialogue between young men and women is quite characteristic. Therefore, it is far from coincidence that in Ajiniyaz's work, poetic competitions occupy an important place, in the development of which he contributed, which is vividly illustrated by the example of his poetic duel with the aforementioned Kazakh poetess Menesh.

In oral folk art, moral ideals associated with the ideas of humanism, patriotism, etc., are affirmed through moral teachings, various artistic means.

In this regard, the proverb "Kisi elinde sultan bolgannan, өzeliңdeultanbolganjaqsyrak" ("Better to be a sultan in a foreign land than a sole in one's own") is instructive. A deep interpretation of it is given by Ajiniyaz in his poem "Jaksy" ("Better"):

One should not leave one's homeland in resentment.
Even if they don't value you here.
Better to live and suffer in a foreign land,
Better to be in the Homeland, even
If you are neglected [5-122,123]

In Karakalpak folklore, along with ideas of humanism and patriotism, folk ideas about the norms of social life, human moral qualities such as courage, bravery, resilience, readiness to serve common interests, truthfulness, frankness, loyalty, hospitality, simplicity, and modesty found their reflection. All of them are generalized in corresponding ethical categories and evaluative concepts such as good and evil (жақсылық ҳәм жаманлық), duty (ўазыйпа), conscience (ар-намыс), courage (мәртлик), nobility (нәмәрдлик), cowardice (қорқақлық), and others. All of these served as a spiritual foundation for the formation of Ajiniyaz's worldview and socio-ethical views, as evidenced by his use of conceptual means that largely coincide with folklore.

Another important ideological and theoretical source in the formation of Ajiniyaz's socio-ethical views is the rich philosophical and ethical thought of the peoples of Central Asia, which at that time found its reflection primarily in various artistic works, especially in poetry. In the era when Ajiniyaz lived and worked, the artistic literature of the East, including the majority of Turkic peoples, represented a unique complex synthesis of various components and performed many functions. Her influence on Ajiniyaz's work, his worldview, was not only direct but also indirect, that is, through the mutual representation of the literatures of different peoples.

It should be noted that "Ajiniyaz's deep knowledge of Arabic and Persian allowed him to become acquainted with the ancient Eastern culture and classical literature of the East."[6-193] During his studies at the madrasa, he studied the works of such great representatives of Eastern classical literature as Nizami, Dehlavi, Navoi, Fuzuli, Mashrab, Andalib, Mahtumkuli, and others.[7-11,12] At the same time, he had close direct contacts with the literary environment of Khiva of that time, in particular with Agahi, Munis, Kamil, and others.[8-7] It should also be noted that, largely thanks to the works of the aforementioned poets, he became acquainted with the rich heritage of Eastern culture as a whole.

Through classical Eastern literature, Karakalpak poets became acquainted with spiritual and moral values, drew enormous poetic experience from classical literature, and developed their aspiration for deep philosophical thinking. The philosophical richness of Eastern literature included, on the one hand, their own philosophical and worldview mastery of reality, and on the other hand, direct engagement with the philosophical heritage, its active use.

Therefore, considering classical literature as an ideological source for shaping Ajiniyaz's worldview, socio-ethical views, must stem from the close interconnection of these two aspects.

"It is not for nothing that it is impossible to reveal the poetics of Ajiniyaz's verses in the works of Navoi, Fuzuli, and other poets," wrote Academician M.K. [9-28] Nurmukhamedov. In this regard,

I would like to note a number of important points. Researcher B. Kalimbetov is right in writing that "In pre-revolutionary Karakalpakstan (i.e., until 1917-R.R.) Alisher Navoi was known by the pseudonyms Muralisher, Miralisher, and Foni. For example, in Berdaq: "Learned knowledge from Navoi," in A.Musayev: "Peace be upon Alisher like Zhirenshe." Ajiniyaz does not mention Navoi's name, although in his works, the names of Layli and Madjnun, Shirin are often mentioned, whose undying images were created by A.Navoi."[8-28] The opinion of the famous Karakalpak literary scholar K.Mambetov, according to which Ajiniyaz tried to master not only A.Navoi's teachings and mastery, but also the genres of his works and to include them in Karakalpak poetry, is justified:..."until Ajiniyaz, genres of literature such as ghazal and mukhammas are not found in Karakalpak literature."[10-84] In our opinion, the author is right, for Ajiniyaz was the first to introduce the genres of "ghazal" and "mukhammas" into Karakalpak poetry. It is necessary to note the opinion of the researcher K.Khudaybergenov, who, in particular, writes: "Singing of elevated love, Ajiniyaz further develops the thoughts of his distant predecessor and teacher Alisher Navoi, who said:

"The word (writer) in which there is no sign of the fire of love, consider it equal to a dead body in which there is no soul." In posing and solving the problems of love, Ajiniyaz also developed outstanding thinkers of the East - Nizami, Ferdowsi, Hafiz, Navoi, Mahtumkuli, and others"[11-85]. A similar conclusion is drawn by the Kazakh scholar J. Aliyev: "The Karakalpaks and Kazakhs knew many works of the Uzbek classic Alisher Navoi and the Turkmen Mahtumkuli. Further... Karakalpak poets of the 19th century. (Berdaq, Ajiniyaz, Kunkhoja, etc.) were familiar with the works of Uzbek, Kazakh, and Turkmen poets"[12-105].

In his works, Ajiniyaz continues and develops a number of valuable ideas of Alisher Navoi, often coming to similar positions and new conclusions according to the logic of creativity. In our opinion, a comparative analysis of some aspects of their work allows us to preliminarily conclude that in a number of cases, their thoughts coincide surprisingly, particularly regarding the criteria of human virtues even in their figurative-conceptual expression[13-57; 5-122].

Alisher Navoiy's work was of particular importance in the worldview evolution of Ajiniyaz, Berdaq, and other Karakalpak poets, as well as in connecting them with the socio-philosophical ideas of Farabi, Ibn Sina, Beruni, and others, as well as the ancient philosophers Plato and Aristotle.

As shown in a number of the above-mentioned works, the great Azerbaijani poet-philosopher Muhammad Fuzuli Suleiman oglu had a very tangible influence on the formation and development of the views of Karakalpak thinkers. "Fuzuli's works - his divans (collections of poems), poems, allegorical works, philosophical works - gained wide popularity not only in the poet's homeland but also in Central Asia - among the Tajiks and Uzbeks, in Tatarstan and Turkmenistan, Iran, Egypt, and many other countries" [14-19]. Fuzuli's works were read with great interest by Karakalpak poets. According to Berdaq, he "extracted a treasure trove of thoughts from Fuzuli"[15-40].

Fuzuli's work is imbued with ideas of humanism, service to man and society, condemnation of wars and their terrible consequences. Fuzuli's ideas played a significant role in shaping the works of Kunhoja, Ajiniyaz, Berdaq, and other Karakalpak poets.

A significant influence on the formation of Ajiniyaz's socio-ethical views was exerted by the work of the Tajik-Iranian thinker Abulqasim Firdowsi, particularly his epic work "Shahnameh." The characters of the epic, particularly Zal, Rustam, and others, appear in Ajiniyaz's work.

Babarahim Mashrab's moral and ethical ideas, which hold a prominent place in the history of Eastern socio-philosophical thought, significantly influenced the formation and development of Ajiniyaz's ethical views. A specific and comparative analysis of Mashrab and Ajiniyaz's works testifies to a certain worldview commonality, the correlation between their artistic-creative and social positions; this is especially evident in the peculiar combination of their life-affirming earthly aspirations with certain Sufi elements [16-67].

The creative legacy of the outstanding Turkmen poet and thinker Mahtumkuli Fragi played a significant role in shaping Ajiniyaz's creativity and worldview. "The works of the Turkmen poet Mahtumkuli were very popular not only among the Turkmen people," writes the famous Karakalpak literary scholar B. Kalimbetov, "but also among the peoples of the entire Khorezm oasis, including the Karakalpaks. He highly valued the works of Mahtumkuli and Ajiniyaz, revering them as his

teacher. Mahtumkuli's works, his ideological and aesthetic views, had a great influence on the work of Ajiniyaz" [8-38].

An interesting aspect of the problem of Mahtumkuli's influence on Ajiniyaz's work is revealed by the people's poet I. Yusupov, who noted that "with his translations of the immortal works of the Turkmen classic into the Karakalpak language, he enriched the artistic treasury of his people. Sometimes he used Ajiniyaz and the themes of Mahtumkuli's works, creating his original poems based on them"[17-11].

In Maxtumquli's poems, the names of philosophers known at that time in all countries of the East, his contemporaries and ancient ones, from Aristotle to Plato, are found. In our opinion, we can note certain ideological and artistic similarities in a number of works of Turkmen and Karakalpak classics, in particular, the poems "Bolarma," "Megzer" by Mahtumkuli and "Jaksy," "Bolarma," "Megzer," "Kerek" by Ajiniyaz.

In many cases, the commonality of Mahtumkuli's and Ajiniyaz's socio-moral positions is also explained by the commonality of the socio-historical events they experienced.

Ajiniyaz's work, his worldview, was influenced by the Uzbek literature of the late 18th - early 19th centuries, which was widely spread at that time and was well known to Ajiniyaz himself. In particular, these are the Khivan poets Agahi, Munis, Komil, and others, who were to a certain extent his contemporaries.

Summarizing the opinions of the aforementioned researchers, as well as the results of our own comparative analysis, we can conclude that a deep acquaintance with the works of prominent masters of the artistic word, their socio-moral views, undoubtedly played a significant role in Ajiniyaz's development as a poet and thinker, in the formation of his worldview, his humanistic positions in understanding socio-ethical phenomena.

Ajiniyaz's socio-ethical views, like his worldview in general, are largely connected not only indirectly but also directly with the philosophy of the peoples of Central Asia and a number of other regions of the East, and through it, with ancient Greek philosophy.

It should be noted that we have few data directly indicating such direct influence, however, as the subsequent concrete substantive analysis of his work shows, we can confidently speak about this.

In favor of such an exception, first of all, the fact that philosophical works themselves were undoubtedly studied in madrasas in one way or another speaks for themselves.

In his work "Nasiyhat," Ajiniyaz mentions the names of many thinker-poets of the East, as well as a number of ancient Greek philosophers, in particular, Aristotle and Plato. For example:

They say that in ancient times there was Aristotle,

Plato knew the heavenly foundations.

The soul was restored and healed by the healers Luqman.

Thousands of the wisest scholars have passed through this world [18-103].

Undoubtedly, ancient Eastern philosophy, particularly Indian and ancient philosophy, played a significant role as an important traditional component of the entire culture of Ajiniyaz's time.

It should be especially emphasized that the Islamic religion, its spiritual culture, played an important, and especially paramount, role. Through them, in essence, all other factors found their peculiar refraction, which prompted us to consider this factor in a generalized plan, i.e., after considering other sources.

Ajiniyaz, who was given the title of akhun, was a highly educated spiritual figure. The holy book of Muslims, the Quran, Hadiths, and other religious sources, which expressed high universal, spiritual, and moral values, and humanistic ideas, effectively contributed to the formation of moral and philosophical aspects of his worldview.

Of course, at the heart of Ajiniyaz's worldview lies a religious-philosophical worldview. He recognizes God as the sole creator of the universe.

In many of his poems, Ajiniyaz, while building his worldview on Islamic values, at the same time directly expresses his adherence to Islam and determination to strictly follow its tenets. In particular, this is reflected in his poems such as "Ҳәр ким хатәмболурпәнийдүнияда" ("Everyone will leave this transient world"), "Молла Еримә" ("Mulla Yerim"), "Әрманийдүния" ("The World

of Dreams") and others. A striking example is the lines from Ajiniyaz's poem, which expresses his disappointment in the transient world and concludes that he will praise God far from the world[5-195]. In a number of other poems, Ajiniyaz speaks about observing the five daily prayers, counting on God's mercy, fasting, and generally following the true "righteous path" [5-195].

Islam is a part of the spiritual and cultural history of the Karakalpaks, as well as other peoples of Central Asia. From this point of view, it is no secret that culture, including literature, and the worldview of their figures were closely connected with Islam. Regarding religion as a whole, Islam first and foremost, Ajiniyaz considers it as a component of the spiritual world of man, which must be used for the benefit of man.

In this regard, in the analysis of Ajiniyaz's worldview, socio-moral views, it is necessary to proceed from the recognition of the importance of this factor.

It should be especially emphasized that Islam "in the history of the peoples of the Near and Middle East also played a certain historical role in consolidating the peoples, creating a single language of science and culture, strengthening cultural and economic ties, etc."[19-13].

In general, it should be concluded that Ajiniyaz's work, his worldview, socio-ethical views were formed and developed under the influence of a complex set of sources and factors, which can be revealed in full and wholeness only from the standpoint of modern methodological approaches and principles, since totalitarian-class ideology led to the general and particular distortion of the components of this complex;

- In the formation of Ajiniyaz's worldview, his humanistic views, the folk art of the Karakalpak people was of great importance, which, for Ajiniyaz, as for Kunkhoja, Berdax, Otesh, and others, was essentially a priority in terms of the development of many worldview positions;

- Ajiniyaz's progressive views, creative mastery, and worldview were shaped and developed under the influence of the poetic heritage of great masters of the word who represented humanistic and democratic traditions in the East (Firdousi, Nizami, Jami, Navoi, Fuzuli, Mashrab, Mahtumkuli, etc.). Ajiniyaz made a great contribution to the spiritual treasury of the peoples of Central Asia, continuing the traditions of great predecessors, enriching them with new content;

- A number of other ideological and spiritual sources, the richest ideological and spiritual heritage of the classical past, including its most important manifestations such as the Islamic religion, its rich spiritual history, religious and philosophical directions within the framework of the Islamic religion; the philosophical achievements of the peoples of a number of Eastern countries, Eastern peripateticism, and mainly the spiritual life in all its diverse manifestations of that historical period with which Ajiniyaz's life and work are connected, were important factors in the formation and development of Ajiniyaz's worldview.

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Rezyume: *Ushbu maqolada qoraqalpoq xalqining ma'naviy-axloqiy qadriyatlarini rivojlantirishga katta hissa qo'shgan qoraqalpoq mutafakkiri shoir Ajiniyoz ijodi va dunyoqarashi shakllanishining ma'naviy shart-sharoitlari ko'rib chiqilgan.*

Резюме: *в данной статье рассматривается духовные предпосылки формирования творчества и мировоззрения каракалпакского поэта-мыслителя Ажинияза, который внёс крупный вклад в развитие духовно-нравственных ценностей каракалпакского народа.*

Kalit so'zlar: *folklor, og'zaki ijod, ma'naviyat, axloqiy qarashlar, axloq, ezgulik va yovuzlik, qadriyat.*

Ключевые слова: *фольклор, устное творчество, духовность, этические воззрения, нравственность, добро и зло, ценность.*

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MORALITY IS A MORAL PRINCIPLE THAT DEFINES THE DIGNITY OF SOCIETY AND THE INDIVIDUAL

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Summary: *The article describes the peculiarities of human nature, spiritual issues, the relevance of education to human content. The role of education in social life is widely discussed. The article provides a categorical analysis, guided by the views of scientists of our country and the world on the problems of education.*

Key words: *Education, upbringing, knowledge, science, spirituality, humanism, self-awareness, justice, universal value, freedom, human life, objective-subjective factors, education, etiquette, practical activity.*

Throughout its existence, humanity, as a distinct phenomenon, has raised a number of issues. What is the world?, can it be known?, who is a person?, how should a person live?, what constitutes the meaning of a person's life? what should be the relationship between people? what ideas and thoughts should a person take as a guide in their activities.

Until now, humanity has been developing various methods and theories to address these issues. These emerging theories and various methods play a significant role in societal development. Issues of morality have always been of great importance in the processes of societal development.

Looking back at history, these problems have intrigued both Eastern and Western scholars, and they have developed diverse perspectives, ideas, and theories on these issues.

In the scientific works of thinkers of the peoples of the East, morality occupied an important place in matters of education and upbringing. Since ancient times, they have paid special attention to human upbringing and created works aimed at developing the spiritual world of a person. We can see that Eastern thinkers, in their teachings, adhered not only to a theoretical approach to education but also to a religious-mythological one. In the works of Eastern thinkers, dedicated to the upbringing of the ideal, the cultural and spiritual development of people, the development of human qualities in the formation of high human feelings in them, is considered as a pressing issue. As an example, we can cite numerous epics, stories, and scholarly works.

If we pay attention to the early philosophical views developed in the Central Asian region, then the issues of spiritual development, morality, and upbringing of a person were specifically addressed. Specifically, the Avesta, the sacred source of Zoroastrianism, teaches that a person should live based on three noble goals. At the same time, the main goal of the ideas of good thought, good word, and good deed in the Avesta is aimed at the emergence of a well-mannered and perfect person. The Avesta served as an important source for studying the history of the formation of the moral and ethical teachings of the peoples of Central Asia.

A person achieves good manners through upbringing. Good manners are not inherited. A person's identity depends on themselves and other factors, such as the people around them, social institutions, community, family, and objective-subjective factors, among others. In any society where ethical practices are established, progressive developments are observed. If even one person in society is immoral, that is, a liar, cunning, swindler, or traitor, these traits of that person can spread throughout society, causing great harm to society and leading it to a regressive state. If the upbringing is wrong, then a person may be caught in the struggle between good and evil, and for various reasons, they may switch sides.

Therefore, the social role of knowledge of etiquette is high. A society that disregards the fundamental principles of ethics inevitably leads to its own demise. Furthermore, moral education shapes a person's discipline, cultivates human virtues, leads to happiness, and teaches them to live well in society.

Moral education demonstrates not the imposition of precision in a person's actions, but the thorough development of their integrity. The necessity of morality can be seen in its absolute connection with human existence.

Our ancestors taught that a well-mannered person should first think correctly about others, not go to extremes in human interactions and conversations, and not offend others in words or actions. All of these have established ethical principles that reflect human interactions based on moral standards. Through their understanding, they have been answering questions like "how to live, how not to be left behind." For example, in the teachings of Confucianism, founded by the prominent representative of Chinese philosophy, the renowned philosopher Confucius, regarding "high moral character," it is taught that a child should fully respect their father, their wife their husband, the citizen their leader, and the young and old [1-32c]. When we speak of morality, we first and foremost think of education and upbringing, interpersonal relationships, their love for one another, and people's human qualities.

According to the ancient Greek thinker Socrates, upbringing and knowledge are considered the core of a person. By complementing each other, knowledge and upbringing define the essence of a person and form the basis of their moral qualities. That is, in the words of Socrates, "A knowledgeable person is a good person." Indeed, the foundation of any etiquette and upbringing is undoubtedly knowledge. Ethical principles and norms are the main spiritual core of a person's development, and they cannot be imposed or artificially established. Manners don't form in a person on their own. Because a person achieves good manners through upbringing and knowledge. Science refers to complex and systematized theories that guide people towards goodness and provide knowledge about the basis of every phenomenon. Therefore, people should also be enriched with knowledge based on ethics in the educational process. In the life of society, education and upbringing serve as a whole for a person. In this case, one cannot be considered first or second. Because they are a whole system. Just as there is no disruption in the system, education cannot exist without upbringing, and upbringing cannot exist without education. Upbringing is always a goal-oriented process. Upbringing is not without purpose, because a person cannot live without a purpose. The goal is directed towards satisfying a person's material needs and spiritual needs.

One of the Eastern sages, Yusuf Khass Hajib, expressed his opinion that education and upbringing prepare a person not only for knowledge but also for freedom, liberty, and greatness. He said the following about this: "Where there is learning, there is greatness; where there is knowledge, there is greatness" [2-127c]. Indeed, these two sides are inextricably linked. Because a person knows all things and phenomena around them. Applying knowledge in practice makes them intelligent. As the wise man said, "Learn knowledge; knowledge is the sun in darkness, an advisor in hardship, a companion in solitude, a confidant in a foreign land, a leader in difficult times, and a weapon against the enemy."

Another renowned scholar, Abdulla Avloniy, said the following about education and upbringing: "Education for us is a matter of either life or death, either salvation or disaster, either happiness or misfortune" [3-61c]. In these thoughts of Abdulla Avloni, it is shown that these two substances are the most essential for a person. It determines the existence of all objects and phenomena around a person in some sense. Applying knowledge in practice makes a person intelligent, or in other words, leads to greatness. And reason teaches a person what to do in life, or it becomes a paradigm that determines a person's scientific and ethical life. These scholars consider the wisdom, ethics, upbringing, and ideology instilled in people as the primary measure of success.

Etiquette is the study of relationships between people and the responsibilities arising from these relationships. Therefore, these rules and requirements are formed naturally and voluntarily based on the customs and traditions of a nation or people. The requirements of ethical rules are implemented through public feedback and influence. Etiquette dictates how a person lives as a human being. Because it is a collection of strong social order and discipline. Politeness is also reflected in a person's attitude towards their family, their people, their homeland, and other peoples. A person is a social value. Therefore, society demands that people live for the benefit of society, protect their health, work, and maintain self-discipline.

A person performs certain duties and responsibilities in a social relationship. It is a duty imposed by the people, the Motherland, and the family on each of its members in society. True politeness is evident in individuals fulfilling this duty. Whoever benefits society, influences its progress, and does not tolerate the violation of public interests, is considered ethical. Because, along with a person's moral principles, caring for them is also crucial. If a person cares about the fate of their homeland as much as they do about their own, if they rejoice in the success of society as much as they rejoice in their own success, they demonstrate their ability to fulfill their duty.

In short, the main goal of moral education is to teach a person the harm of evil and to avoid it, to show them the right path, the path of good manners. Because the best person in society is a well-mannered person, and well-mannered people are society's invaluable asset and status. As a person lives in society, they must consider all factors. In this, the relationship between society and the individual serves as an integral element in elevating human spirituality.

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Резюме: *Мақолада инсон таълим тарбиясининг ўзига ҳос ҳусусиятлари, маънавият масалалар, таълим ва тарбиянинг яҳлитлиги тасвирланган. Таълимнинг ижтимоий ҳаётдаги ўрни кенг таҳлил қилинади. Мақолада юртимиз ва дунё олимларининг таълим муаммолари ҳақидаги қарашларини ҳисобга олган ҳолда категорик таҳлили келтирилган.*

Резюме: *В статье описаны особенности характера человеческого образования, духовные проблемы, актуальность образования для человеческого содержания. Роль образования в общественной жизни широко обсуждается. В статье приведен категориальный анализ, основанный на взглядах ученых нашей страны и мира на проблемы образования.*

Калит сўзлар: *таълим, тарбия, билим, илм, маънавият, ахлоқ, ўзини англаш, адолат, инсон қадр-қиммат, эркинлик, инсон ҳаёти, объектив-субъектив омиллар, тарбия, ахлоқ, амалийлик фаолият.*

Ключевые слова: *образование, воспитание, знания, наука, духовность, мораль, самосознание, справедливость, человеческое достоинство, свобода, жизнь человека, объективно-субъективные факторы, воспитание, мораль, практичность.*

REFLECTION OF THE CREATOR'S PHENOMENON IN STYLE

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Summary: *This article examines the reflection of the creator's phenomenon in the style of Karakalpak lyric poetry of the 1960s. It explores the socio-political and cultural background of the "Sixties Generation" (шестидесятники), their individual characteristics, and the influence of these on the stylistic evolution of literature. Special attention is paid to the works of Karakalpak poets Ulmambet Khodzhanazarov and Uzoqboy Pirzhanov, whose lyrical styles vividly embody their personal worldview, life experience, and creative individuality.*

Key words: *Creator's phenomenon, style, "Sixties Generation", Karakalpak poetry, individuality, worldview.*

I. INTRODUCTION. By the 60s of the 20th century, there was a radical turn not only in Karakalpak literature, but also in the literature of the entire former Soviet Union. This was due to the political and social events of that period, namely, the "emergence" of strict totalitarianism and schematism in all spheres, including fiction, as a result of Secretary General Nikita Khrushchev's prohibition of Stalin's personality cult at the 20th Congress of the CPSU in 1956. As a result of such historical processes, the intelligentsia of "The Sixties Generation" - "шестидесятники" (also called "children of the 20th Congress") [1], [2] was formed in Soviet fiction and culture. This generation of intellectuals advocated not blindly, but consciously following political and social ideologies, supporting humanism, internationalism, and a "world without borders" in their views. That is, he believed that a work should not be created in a ready-made mold built on noise in creativity, but rather each work should be created consciously as a product of a person's inner world and free thought.

II. LITERATURE REVIEW. Russian culturologist Kira Belyaeva, studying the phenomenon of "The Sixties Generation," identifies the following as their main individual characteristics:

- separate activity;
- clear life position;
- correctness;
- lightning-fast response to events occurring in the country and the world;
- support;
- optimism;
- faith in goodness;
- struggle with difficulties;
- durability;
- honesty;
- zeal;
- large creative range;
- versatility. [3. 65-70]

These features were also clearly manifested in fiction, which is a type of art. True, although not completely deviating from communist ideology, fiction has emerged that can illuminate the human soul, dignity, and worldview, moving from generality to individuality, far from dry noise as before. Especially in lyric poetry, the poetic range expanded significantly, and the active poets of their time stood out with lyrical works of a new direction.

In particular, in Russian literature, Robert Rozhdestvensky, Evgeny Yevtushenko, Andrey Voznesensky, Bella Akhmadulina, in Ukrainian literature Linoy Kostenko, Dmitry Pavlichko, Nikolay Vingranovsky, Igor Kalins, Ivan Drach, Vasily Simonenko, in Kazakh literature Abdizhamil Nurpeyisov, Mukagali Makatayev, Tulegen Aybergenov, Sherkhan Murtaza, Mukhtar Shokhonov, in Uzbek literature Abdulla Oripov, Erkin Vakhidov, Rauf Parfi, Asqad Mukhtar, Shukur Kolmirzayev, Utkir Khoshimov and many other creators were known as "The Sixties Generation." In

Russian literary and cultural studies, the "The Sixties Generation" have become a comprehensive object of study.

Kazakh literary scholar Alibek Baibol, evaluating the "The Sixties Generation" as a separate literary phenomenon in Kazakh literature, notes the lack of research works that have studied the dynamics of the development of their creative evolution as a whole, as an object that does not attract the attention of scholars, and the main achievement of the literature of the "60s" (in Kazakh literary studies, along with the term "The Sixties Generation" as a translation of this term, the term "60s" is also used - B.M.) is that they raised written literature to a certain level and strengthened it qualitatively. That is, a certain area, an environment, has been formed, in which the student seeks and reads, which can satisfy his aesthetic requirements. At the same time, literature has been enriched in terms of genre, style, technique, plot-content, intellectual, and philosophical aspects." [4]

Uzbek literary scholar Ulugbek Hamdam, studying Uzbek lyrics of the 60s, particularly emphasizes that it was a turning point in fiction. According to the scholar: "The lyrics of the 60s occupy a special place in the history of Uzbek poetry of the 20th century. This meant that he began to free himself from the former ideologization, formality and command, rhetoric, empty moralizing, voluntarism, noise, and unreasonable enthusiasm. The poet found his "I" among the many who were called the "Soviet people" and was able to look at it as if it were a single person.... As a result, instead of the usual "hurrah-hurrah" in poetry until the 60s, poetry with completely different content - a lyric full of sorrow - was born. This lyric again emerged as humanistic and truthful. This was the main feature of the lyrics of the generation of the 60s." [5. 10]

Such large-scale innovations began to be clearly visible in Karakalpak lyric poetry from the 1960s. Regarding the lyrics of this period, literary scholar A. Dosimbetova writes: "Indeed, if poetry previously depicted a person with limited emotions (one who loves labor and the Motherland, who hates fascism), now our poets have begun to strive to create a true human nature, to convey their emotional experiences and heartfelt pains. They began to violate the boundaries of the limited representation... In the early 1960s, manifestations of realistic depiction began to appear in the works of poets, and the tendency to reveal the spiritual world of each individual, to depict the relationship between the individual and society, nature and society, and to reflect moral norms intensified [6. 10-11] .

"In literature, the term "The Sixties Generation" (шестидесятник, шестидесятники) is used from time to time. This term is borrowed from Russian literature and does not mean a person's name, but refers to prominent writers and poets born in the mid-1920s and 1940s who reflected their progressive democratic ideas in literature. Recently, this term has also been used to refer to political and social figures who have served in the fields of science and art, as well as those who have made a huge contribution to the development of society. "The Sixties Generation" were born during the above-mentioned periods, freed from the pressures and fears of Stalinism in the late 1950s and 60s, warmed up in the "Khrushchev sun" (Хрущёвская оттепель) (meaning, breathing freely), and matured as figures of fiction, art, and socio-political figures (meaning of the term). The Sixties Generation emerged brilliantly young like youth, leaping out like young horses released from their hobbles" [7], emphasizes Doctor of Philological Sciences Qurbonboy Jarimbetov.

Indeed, in the 60s of the last century, a group of poets entered Karakalpak literature, including poetry, with lyrics that did not repeat the poets of the previous generation. Among them are D.Aitmuratov (1933), M.Seytniyazov (1934-2006), Sh.Seyitov (1937-1996), U.Pirzhanov (1937-2020), U.Khuzhanazarov (1938-2021), T.Matmuratov (1939-1984), T.Sarsenbayev (1940-2005), K.Rakhmanov (1942-2004) and other poets. These poets, as Sh.Seyitov, one of the "The Sixties Generation" poets, put it: "Until now, we will leave amonali on the old path in poetry!" [8. 95] - were the poets who entered with great aspiration. Although the thematic proximity is noticeable in the lyrics of the mentioned poets, each of them reflected it in their own way, based on their own worldview. Literary scholar Kamal Khudayberganov called these poets a "new wave of poetry." In his article of the same name, the literary scholar frequently uses the term "individual voice" in relation to poets. [9. 122-128]" We can also understand this as an "individual style. Because in fiction, including in lyrics, which is a separate literary genre, the strengthening of individuality, that is,

isolation, corresponds to the most developed time of lyrics. More precisely, in the poetry of a certain people, the increase in the creative layer due to the demands of the time naturally sets the task of poets and writers to be unique and original.

We didn't dwell on the "The Sixties Generation" for nothing. Firstly, historical and political processes directly serve as the basis for sharp turns and developments in fiction, and secondly, through this, the phenomenon, worldview, character, and in general, the formation as a person of the creator, who is the soul of fiction, is more clearly visible in his works and strengthens methodological research.

Russian literary scholar M. Khrapchenko put forward a study of the writer's style in connection with its phenomenon. The literary critic believes that the creator's personality and worldview play the most important role in the formation of style, that is, the content and form of the work depend on its worldview and character. According to M. Khrapchenko: "Style is the synthesis and reflection of subtle and interesting observations collected by a creator through a deep assimilation of life. Its comprehensive success and scale depend on the artist's way of thinking and reflecting the world. [10. 9]

In Uzbek literary studies, in the scientific research works of Sh.Tuychieva, Sh.Doniyorova, D.Kholdorov, M.Davronova, A.Davlatova, D.Tojiboeva [11], devoted to the problem of style, we can see that such issues as the phenomenon of the creator, his formation as a person, his biography are also leading.

Uzbek literary scholars G. Aripova and M. Tolibova emphasize: "Style is a phenomenon born from the unique, unrepeatable phenomenon of the creator. The first factor that creates the originality of the style is that the similarity of the features of the creative phenomenon is small, multifaceted, and stems from a rich life experience [12. 12]. Thus, at the same time, the phenomenon of the creator, that is, the nature and character of understanding and expressing the world, not only occupies the main place in the formation of his style, but is also a phenomenon that is clearly visible in his created works. Because, in the words of N. Shukurov: "...writers also differ in their character traits, interests, world of concepts, and psychology. On the one hand, the multifaceted nature of events and objects, and on the other hand, the unique character, understanding, knowledge, and psychology of each creative individual - these two factors combine to create a real opportunity for each creative individual to have their own unique style in literature [13. 5].

III. METHODOLOGY & EMPIRICAL ANALYSIS. Among the creators who entered the 60s as a "new wave of poetry," Ulmambet Khodzhanazarov and Uzakbay Pirzhanov were among the poets who stood out in poetry with their stylistic explorations. In Karakalpak literary studies, including literary criticism, the work of these poets was noted in fragments in the works of a number of scholars. In particular, M.Nurmukhammedov, S.Akhmetov, K.Khudaybergenov, K.Mambetov, T.Mambetniyazov, B.Kalimbetov, J.Sagidullaeva [14] in their scientific works and literary-critical articles expressed opinions about the ideological and thematic features of the lyrics of the two poets. Some journalistic articles were also published about them [15]. However, in national literary studies, the lyrics of U. Khojanazarov and U. Pirjanov have not been the main object of separate scientific research. Therefore, in modern Karakalpak literary studies, the comparative study of the poet's phenomenon and stylistic research, formal and artistic features, artistic sources, and issues of literary influence is one of the important tasks. "To determine the individual style of the master of the artistic word, one can use the method of comparative study of the works of two writers. As a result of such comparisons, both similar and dissimilar aspects of the skill of the two writers are revealed. [16. 86]" Indeed, a comparative study of the lyrics of U. Khodzhanazarov and U. Pirzhanov reveals their unique stylistic features.

IV. RESULTS. If in the lyrics of Ulmambet Khodzhanazarov, who is considered one of the "The Sixties Generation" of Karakalpak lyrics in our research object, there is a tendency towards realistic depiction, philosophical thinking, and conveying these thoughts with a flow of clear thoughts and beautiful rhymes, then in the lyrics of Uzakbay Pirzhanov there is a romantic reflection of feelings, a wide use of landscape details, and sharp and sharp reflection. These features can be considered to be directly related to the worldview, life path, and personal character of poets.

For example, U. Khodzhanazarov worked in responsible positions throughout his life. From 1960 to 2010, he worked as the editor-in-chief of the magazine "Amudarya" and the newspaper "Soviet Karakalpakstan," chairman of the Karakalpak State Television and Radio Committee, instructor in the Karakalpak Regional Party Committee, second secretary of the Bozatau District Party Committee, khokim of the Nukus District, head of the Center for Spirituality and Enlightenment of the Republic of Karakalpakstan, deputy of the Oliy Majlis of the Republic of Uzbekistan and the Jokargy Kenes of the Republic of Karakalpakstan. Competence, the ability to clearly and beautifully convey one's thoughts, and the ability to analyze every situation through the sieve of thought are characteristics of people in leadership positions. Based on these features, in the phenomenon of U. Khodzhanazarov, such features as a figurative analysis of each phenomenon, restraint, and a realistic view of emotions are noticeable. For example, according to the micro-plot given in the poet's poem "Someone's Place," before the soil of the deceased close person of the subjective hero cools down, a young man asks for his place. Although this story deeply affects the subjective hero, he conveys his thoughts about it not sharply, but gently, softly, and thoughtfully:

Oh God, be with this young man,
Careless cunning will not touch the earth.
I have one word hoping you'll listen,
Let them listen, let them not:

Live your five-day life, you cheerful one.
It's not us who come to this world, but a guest.
Never ask about the place of the dead,
They'll also ask for your place [17. 103].

In such cases, it can be noticed that the character of the poet is transferred to his subjective hero. The reason is that these are thoughts and feelings arising from a situation encountered in the poet's real life. The serious calmness, gentleness, and graceful conveyance of thoughts in U. Khojanazarov's personality are directly reflected in the character of the lyrical hero in his aforementioned poem.

Uzoqboy Pirjanov's personality is characterized by straightforwardness, principledness, and rebelliousness. Throughout his career, he worked as an editor for the magazine "Amudarya," the publishing house "Karakalpakstan," and the Karakalpakstan Television and Radio Company. The contradictions on his life's path made the poet known as a character who boldly defends his thoughts and views and unhesitatingly rejects and criticizes what he considers wrong. Therefore, in many of his poems, especially in his journalistic poems and epigrams, the spirit of sharpness and tension, creative debate, and rebellion is clearly felt. For example, in the poems "Epigrams," "To the Gramophone," "Citata," "Jingillar," "Fragments," thoughts are expressed so sharply that against the backdrop of the opposition of the lyrical object and the lyrical subject, it can be observed that the character of the lyrical subject is formed on the basis of the character of the poet. The lyrical subject has a character that correctly understands the high demands of fiction in the environment and protects its nature, strongly opposing what he considers wrong. He conveys his thoughts to the lyrical object with the help of sharp, bitter satire. There is no room for politeness or pity in him.

Another characteristic of Uzoqboy Pirjonov's creative phenomenon is that in his poems dedicated to love or nature, he conveys emotions in such subtle ways that at first glance it seems to nullify the tension in the poems we mentioned above. However, this can be understood as two sides of the poet's phenomenon. If the poet conveys feelings with a peculiar subtlety and romanticism in the image of the lyrical hero, who is nature and his beloved, then in his journalistic and satirical lyrics the mood of the lyrical hero changes dramatically in a completely different quality, inner experiences, reflections are reflected with bitter sarcasm, from a sharp critical point of view. The influence of the literary traditions of the classical poets Makhtumkuli and Ajiniyaz occupied one of the main places in the poet's lyrical work. Loyalty to these literary traditions and their skillful stylization further enhanced the artistry and elegance of the poet's lyrics.

At the same time, being a writer, a poet, and a translator with high poetic potential, the combination of these three qualities in the personality of Uzoqboy Pirjonov is also one of the rare phenomena in fiction. True, there may be many creators who wrote equally well in epic, lyric, and drama. However, maintaining the balance of poetic skill in them is also encountered in the work of a few creators in Karakalpak literature.

V. CONCLUSIONS. Thus, the features of the phenomenon of "The Sixties Generation," emphasized by Kira Belyaeva, are reflected to a certain extent in the lyrics of the talented Karakalpak poets U. Khodzhanazarov and U. Pirzhanov. Along with their formation as individuals in society, they expanded the scope of ideological-thematic, genre-stylistic, artistic methods, and compositional research with their phenomenal creativity in lyrics. We will discuss this in more detail in the following chapters and sections.

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Rezyume: *Ushbu maqolada ijodkor fenomenining 60-yillar qoraqalpoq lirikasi uslubida aks etishi tadqiq etilgan. Unda "oltmishinchilar"ning ijtimoiy-siyosiy va madaniy kelib chiqishi, ularning individual xususiyatlari va ularning adabiyotning uslubiy evolyutsiyasiga ta'siri o'rganiladi. Qoraqalpoq shoirlari Ulmambet Xo'janazarov va Uzoqboy Pirjanov ijodiga alohida e'tibor qaratilib, ularning lirik uslublarida shaxsiy dunyoqarashi, hayotiy tajribasi va ijodiy individualligi yorqin namoyon bo'ladi.*

Резюме: *В данной статье рассматривается отражение феномена творчества в стиле каракалпакской лирики 60-х годов. В ней рассматривается социально-политическое и*

культурное происхождение "шестидесятников," их индивидуальные особенности и их влияние на стилистическую эволюцию литературы. Особое внимание уделяется творчеству каракалпакских поэтов Улмамбета Ходжаназарова и Узокбоя Пиржанова, чьи лирические стили ярко воплощают их личное мировоззрение, жизненный опыт и творческую индивидуальность.

Kalit so‘zlar: *ijodkor fenomeni, uslub, "Oltmishinchi yillar avlodi", qoraqalpoq she’riyati, individuallik, dunyoqarash.*

Ключевые слова: *феномен автора, стиль, "Поколение шестидесятых," каракалпакская поэзия, индивидуальность, мировоззрение.*

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PHRASEOLOGISMS WITH A BLACK COMPONENT IN THE KARAKALPAK LANGUGE

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Summary: *This article discusses the issue of color in Karakalpak linguistics, the appearance of black in phraseologisms, and the organization of colors to represent different meanings. We have also mentioned the use of phraseologisms with a black component in works of art.*

Key words: *linguistics, color, coloristics, phraseologism, scientific knowledge, black, semantics, language, term.*

The topic of color has been one of the issues of interest to scientists since the emergence and development of man, therefore it has been studied in a number of directions.

Color is a subject of study not only for visual arts but also for linguistics. Scientific works dedicated to this issue have been created in world and Turkic linguistics, revealing the relationship to colors and their unique aspects.

Among colors, the most commonly used adjective "black" is polysemantic. In the study of the Karakalpak language, black is widely used and accepted culturologically, as its semantics are very broad.

A.X. Merzlyakova provides information about black as "the darkest color resulting from the absorption of all color waves" [1] and cites the lines "*Лицо у него черные, закопченное*".

In Russian, the color "qara" (чёрный) is used to describe a person's appearance and character. For example, *во время обеда черная кухарка кучер просили расчета* (L.N. Tolstoy). In this example, "*черная кухарка*" is translated into Karakalpak as "a woman doing manual labor in the kitchen," with the figurative meaning of "*black,*" referring to lower-ranking, heavy-duty workers who were uneducated at that time. It means “*Чёрнорабочий – a hard worker, чёрный люд – common people, чёрный крестьянин – a peasant”*.

In the Russian language, the phraseologism "ishi qara" is characterized by the lexeme "завистливый."

The lexeme "черный" (black) in modern Russian means:

1. *Черный* – самый темный из всех цветов, имеющих цвет сажи, угля, темный, более темный по сравнению с обычным цветом, принявший темную окраску: *чёрная сумка, чёрный карандаш, чёрный уголь.*
2. *Чёрнорабочий* – не требующий высокого мастерства, неквалифицированный, требующий тяжелый труд.
3. *Чёрный* – имеющий черный цвет кожи, негроидная раса.
4. *Чёрное кофе* – кофе без молоко, чёрные очки – солнцезащитные очки.
5. Очен плохой, крайне отрицательный.
6. Мрачный, безотрадный; траурный.
7. Грязный, испачканный.
8. Смуглый, черноволосый.
9. Чёрным по белому – совершенно четко, ясно.
10. *Чёрный люд* – принадлежащий к низшим не привилегированным сос ловиям.
11. Злостный, низкий, коварный; связанный злым духом.
12. Составная часть некоторых зоологических и ботанических наименований.[2]

In Russian, the word "черный" (black) describes mourning, death, that is, the passing of a loved one, and in some cases, when a person falls into despair and is deeply saddened, when they are offended by someone.

In ancient Turkic languages, "qara" meant "sign."

It is also used figuratively.

1. Unlucky, sorrowful.
2. Heavy.
3. Bad.
4. Fool.
5. Ordinary, simple, low-grade, coarse.
6. Dirty.
7. Means light blue.

Black also comes in the meanings of "*a crowd*" and "*group.*"

Interestingly, the primary colors used in all Turkic languages express the same meanings; the common colors are *white*, *black, blue*, *red*, and *yellow*.

In Turkology, there are numerous works dedicated to the semantics of the word "*qara*" [A.N. Kononov, S. Sydykov, T.Sh. Ryskulova and others]. Among them, the most important are the works of A.N. Kononov, in which several meanings of the word are given: 1) black, dark, dim, sparse; 2) livestock, herd, people, soldiers, slaves; 3) land, drought; 4) hill, height, high fortress; 5) large, large, many; 6) main, great; 7) strong; 8) pure; 9) dark side of the open sky. [Kononov 1978: 162]

The etymology of the word "black" was studied in "Ancient Turkic Dictionary" [DTS 1969:422] and "Etimological Dictionary of Turkic Languages" [Sevortyan 1952:286]. A comprehensive analysis of the semantics of the word "qara" was conducted in the work "Comparative-Historical Grammar of Turkic Languages," in which M.V. Kormushin identified more than thirty meanings. [Kormushin 1971:592]

Many meanings of *black* are used in the Kazakh language. When alone, this word can mean "paint," "color" "darkened something," "volume, size" "plan" "living" and figuratively, "comrade" "back" "bad" etc. The black color of the Kazakh people's felt making, alasha weaving, and rope-making is related to color. For example, alasha, woven from *black and white* wool, is black; the Kazakhs of Turkmenistan call a yurt a *black yurt*. The Kazakhs in the Tashkent region call the black wool pattern on the edge of the felt "*qara qas*" (*black eyebrows*).

Although black is rare, it is also used in reference to gemstones: *black pearl* is a type of gemstone.

The color black in modern Uzbek means:

1. All *black*-colored things: *the soot of the cauldron, coal, a black pencil, a black suit, black leather*.
2. Similar to this color, dark-colored: *darker, black bread, black cherry, black earth, black cloud*.
3. Heat-covered, soot-covered, darkened or unwashed, undecorated: *black house, bitter cold*.
4. Dark, dim: *a dark house, a dim room*.
5. In games like chess and checkers, the side playing with pieces opposite to white is referred to as *playing with black. The black side achieved victory*.
6. In a figurative sense, it indicates a sign of evil, possessing a bad characteristic: *dark intent, dark forces, dark thoughts*.
7. It is used in the meanings of not right, bad, bad thing, deed, evil: *The vodka itself is white, its deeds are black.*
8. It is used in place of the word "darkness": *People didn't rest until dark evening.*
9. In the sense of dirt, filth: *The collar of the dress has turned black.*
10. Sexual symbol, in the sense of a person: *Dark forces...*
11. It is widely used when describing negative aspects.
12. When used together with certain words, "*qara*" expresses the strongest degree of a characteristic related to the thing they signify: *"Qara suwıq" (Extremely cold). "Qara qan jılatıw" (To make someone cry tears of blood).*

In the Uzbek language, the phrase *"qara kiydi" (to wear black)* is used to express mourning or passing away. The expression *"qarasi ko'rindi"* is used to describe the distant appearance of

something. The phraseological expression *"qarag'a aliw"* is used in the context of targeting an object, aiming, or hitting a target.

In the Uzbek language, *black* is used to describe a person's appearance, such as the darkness of their body, clothing, and character. The Uzbek people understood black in meanings such as *"great"* and *"high."* Recently, the color black has been assigned the semes *"badness"* and *"unpleasantness." Black day, black event, black night,* etc.

In the Uzbek language, the primary meaning of the word "qara" is color. It is the opposite of the word "aq" (white). Scholar B. Bafoev, in his article, connects the word "qara" to the Orkhon-Yenisei inscriptions. According to his findings, the color "qara" was used more frequently in ancient monuments compared to other colors. There are more than ten instances of its use. For example, **Qara-** in the sense of black color, **Qara budun-** meaning common people, **qara bulung-** as a place name or toponym, **qara qum-** as a toponym, **qara ko'l-** in the sense of sea (a hydronym), **qara turgus-** as a name of a people, **qara ter-** meaning black sweat, implying hard labor. [3]

In the work "Devonu lug'atit turk" (Compendium of Turkic Dialects), it is written: "I wished the dark night would pass, I wished to ward off heavy sleep. [4] Furthermore, in this work, the word "qara" (black) denotes the color of black (black), "hár bir qara nárse" (every black thing) denotes black, "adolatli podshohlar" (Buǵra qora xoqon) denotes just kings, "qirg'iy" (hawk), "Sayyora" (Plane), "túye ayaǵınıń astı átirapları" (eagle), "gór, qábir" (black place), "qullarǵa berilgen atama" (slave name), "záhárli ot, maysa" (poisonous fire, grass) denotes black, " qaramay" (black face), "joy oti" (house name), "bir qıylı, bir túrdegi" (black-black).

The word "qara" (black) is used not only to denote color but also to intensify its meaning and is found in various terms related to geographical features, nations, tribes, celestial bodies, plants, birds, and especially people. Examples include: *Qarateren', Qaraqala, Qara oy, Qarataw, Qara bas, Qara darya, Qara uy, Qara jorga* (a melody), *Qaraqalpaq, qaramoyin* (a tribe), *qarabaraq, qara suyrik,* and others.

In the Karakalpak language, the word "qara" (black) has multiple meanings and uses. It can refer to a person, livestock (such as cows, horses, camels, and oxen), describe a person's physical appearance, indicate the color of clothing, characterize personality traits, denote units of measurement, represent a season, signify mourning, express a curse, and convey figurative meanings.

The explanatory dictionary of the Karakalpak language lists 48 meanings of black, each explained and illustrated with examples.

In the Karakalpak language, the word "qara" is directly related to the customs, traditions, beliefs, psychology, living conditions, and formation of the Karakalpak people. This color occupied a certain place in the consciousness of the people and represented unique concepts. The word "qara" (black) has been used in Karakalpak proverbs, rituals, and idioms, conveying various meanings. Especially among these, the word "qara" (black), used within phraseological units, is used productively, distinguishing itself from other linguistic units by its sharpness of meaning, figurative diversity, and emotional-expressive aspects. Therefore, it is widely used not only in folk oral literature but also in contemporary written literature.

Renowned scholars have expressed their opinions on the meanings of the word "black." For example, its meanings were studied by A. Bekbergenov. [6] Academic J. Bazarbayev notes that..."the origin of the name of the numerous Turkic-speaking peoples is linked to the word 'qora' (black), with the words "kúshli", "quwatlı", "ǵayratlı" (strong, powerful, energetic) (black cattle, black fog, black buvra, black depth, black power, black labor, black sweat, black neck, black ravine, black rain, black wind, etc.), and that the word 'qora' has historically been the names and nicknames of the strong and powerful."[7]

The direct nominative meaning of the lexeme "black" is "black" - the color of soot and coal.

The lexeme "black" means "sad, oppressive, tyrannical," and its origin is linked to the word "darkness." The adjective "qara" (black) has not only a semantic connotation of "grief, sorrow" but also a connotation of "evil, oppression." When studying the semantics of the word "qara," it became clear that it is more commonly found within phraseological units.

Black represents foolishness, blindness, grief, and death, contrasting with light. Night is also a symbol of sorrow. In the context of the word "black," phraseologisms with negative and unpleasant meanings have mainly emerged, because this color is considered a symbol of evil: *dark-hearted, dark-hearted, dark-hearted, dark-chested, with dark intentions, dark-hearted, dark-faced, dark winter, black rain,* etc.

In the course of the research, it was determined that the lexeme "black" is used in phraseological units in relation to ill-intentioned people.

In the Karakalpak language, the adjective "qara" (black) is used as a symbol of a person or people, primarily referring to a person, meaning "simple, humble." During the research, it was discovered that the color black, while signifying "simple, humble," also denoted a "ignorant, uneducated, illiterate" black people. For example, "Goodness comes from the *common people*" (S.Bahodirova). When his children grew up, he declared he couldn't work and submitted his resignation. Now, a *commoner* teacher, that's enough (K.Raxmanov). You've done a good job for the government, haven't you? "Or maybe they'll give it to a *commoner* like us," the old woman worried, sitting down and getting up. (G. Esemuratova) "Erjan is a high peak on the summit of a mighty mountain; even if a *commoner* reaches out, his hand won't reach him," Qazaqbay praised his son-in-law (M. Daribayev). Led by the rich, they brought their aid. After these, help began to come from *ordinary citizens* (A.Shamuratov. In the old school). In the Karakalpak language, the word "ápiwayı xalıq" (ordinary people) is denoted by the color "qora": "When Eltuzar Inoq declared himself Khan, everyone said, Your lineage has no Khanate; a *commoner* cannot be a Khan,'" said Aydos, speaking with great weight (T. Qayıpberganov).

In social terminology, in the class division of society, colors express their symbolic meanings: *black people, black soles.*

For example, the saying "The wind destroys mountains and stones, but words destroy humanity" is true, isn't it? After these "words of wisdom," she began to feel dissatisfied that she had married earlier than her peers and was now living with a *common* laborer, keeping house together (Alp Sultan). "Hey, who's there up there to get along with him? Aren't they all *ordinary* workers? It would have been one thing if they had spoken with you. You've been striving to become a scholar, at least," said his wife (Alp Sultan).. "*Black-footed*, barefoot!" said the ataman's "adjutant" (Alp Sultan). Why does He create one rich and another *poor*?! Where are we any less than them - are we mentally or physically capable? (M. Nizanov. Dushpan) "There are days when I, a poor orphan like myself, will see the tears of the *black-footed*!" I say to myself (J. Aymurzayev).

The phraseologism "*Qara shańaraq*" (*Black Family*). According to B. Yusupova: "When combined with the word 'shan'araq' (family), it expresses two different meanings. 1. 'Qara shan'araq' refers to the main, large house where one was born and spent their childhood, the place where their parents lived, their own home, in a phraseological sense. For example: However, a young man, weary from traveling and stunned by misfortune, thinking, "My own home is my comfortable bed," preferred to rest for a moment in his **ancestral home** (K.K.). Look, Bazarbay, my brother, although you have your own household, we share the same origin, the same family roots, so don't misunderstand the meaning of 'qara shan'araq' (Sh.S.).

Growing here,
We were a people of **common ancestry.**
Having endured hard work,
We were sweating profusely (I.Yu.). [8]

In the Kazakh language, the phraseological unit "*qara shańaraq*" means "large house; nurturing nest" [9] and "7) fig. ethn. qara shańaraq → the house of ancestors and their direct descendants, a respected and cherished home (literally: The black shańaraq (roof) of a black yurt - lit. The black roof of a yurt) " [10]. A.K. Bisenbayev indicates that "qara" can mean old or valuable: "And if it is necessary to emphasize the strength and anger of a hero, the color black is also used." Black is not always associated with the basis of evil and wickedness. In a broad sense, the term "qara" is also used with a positive meaning. For instance, "qara" often conveys the sense of ancient or precious, as in the example: "qara shañaraq" [ancestral home]. [11]

2. A free word is used as a phrase. In this case, the semantic difference between the word "oila" (family) in the phraseological unit, or the "qora" (black) adjective expressing its attribute, and its inflectional form is clearly noticeable. For example: Everyone lived in a confined life within their own household (Ó.X.). The families of many households fell into the middle (Ó.X.). After the thundering tears overwhelmed his heart, the pitch-black roof and roof poles seemed to have just emerged from the workshop... (T.Q.) The lights fell on the smoke-blackened roof of the house where Bektemir lay, then illuminated the frame covered with black felt (K.K.). In the first example, "xonadon" means "home," in the latter, it refers to a part of a dark house, and in the second and third examples, it indicates the color of the house. In the previous examples, it doesn't mean the color of the family, but rather the main, large house, the house where he was born and raised, the house of his parents. [8]

The adjective "black" indicates the absence of something (fat, milk) or signifies "tasteless, colorless, milk-free." This meaning comes from the word "qara," meaning "simple, ordinary." Black tea, black bread, and black water are used in the above sense. For example, the white samovar, steaming with black tea, began pouring water (S. Xojaniyazov). As if drinking black tea with sugar, he sank into the black water, his skin spreading and relaxing (M. Daribayev). Therefore, the poor man spent eighteen days in prison, eating black bread (M. Nizanov. Enemy His son has been lying in bed with water for three days (S.Bahadirova).

Scholars have expressed various opinions regarding the use of the adjective "black." A. Bekbergenov writes about the meanings of the word "qora": [7] The meaning of the word "black" sometimes changes even when it is used as a regular attribute. However, such phrases cannot be considered phraseological units because the general meaning of a phrase stems from the individual meaning of its constituent components. Such phrases can be called fixed phrases between free and phraseological phrases. The word "black" is metaphorical in this case and is used in the following cases:

b) It defines an object or phenomenon as nothing but itself. Black frost, black rain, black water, black force;

c) They clarify the words "kesh" and "quptan" giving them an additional intensifying meaning: For example: One day, workers who worked tirelessly from dawn till dusk gathered in the factory courtyard for a consultation. ("Karakalpak Folk Legends and Anecdotes"). [6]

In Karakalpak phraseologisms, the color black is associated with night, sunset, and night darkness: black night, dark evening, dark night, very dark night, black night, black curtain covering, wrapping in a black curtain, darkening eyebrows. The dark night, the thick rain, crushed my heart. The vast world seemed like a string (J. Aymurzayev). The dark night seemed to embrace me. It felt like the world had turned upside down (J. Aymurzayev).

The meanings of "to be angry, to not warm up, to be upset" are conveyed in the Karakalpak language through the phraseologism "to be a black lump of ice": Jamila touched a piece of fried meat to her lips and pulled it out. Even though his heart was a black lump of ice, he laughed with the light of his eyes.

- What did you say? - he said (K.Sultanov. Aqdarya).

"To be deeply saddened" is expressed by the phraseologism “qara matam bayraǵın jamılıw” (to cover with a black mourning flag): Leykin sum a’jeldiń suwıq xabarın júrgen jerime surǵılt bultın erte barǵanda kóz jasım kól bolıp etegime sorǵaladi. I suffered as if my father had died. My heart was as if wrapped in a black mourning banner (J. Aymurzayev).

In the worldview of the Karakalpak people, the color black is associated with the underworld and other otherworldly forces. Both the underworld and the surface of the earth are referred to as "black earth" in the Karakalpak language. For example: "Oh, cursed, merciless death! Who are you not taking beneath the black earth? Having endured so much hardship, now you've even swallowed into your embrace the mother who was living with great hope and strong faith, thinking she had finally made it. Did you begrudge her even that joy of the bright world?" (Z. Ishmanova. Woman's Heart) If only you could walk carelessly through the black earth in this bitter cold, play and work with your peers, but how many times has this young man not frozen in the frosty winter cold while

lying underground... just like a dead soul, not seeing the light of day... (S.Bahadirova) The wormwood and yellow reeds, unable to withstand the strong wind, swayed mournfully, bending back and forth towards the black earth (Alp Sultan). The father who followed his wife, seeing his only daughter hanging by her throat and his wife lying unconscious, sank like a camel to the black earth (Alp Sultan). When I think about this, I want to enter the black earth alive (Alp Sultan). The traditional symbolism of the color black is associated with wearing black clothing for the purpose of mourning among many other peoples, such as wearing a black scarf on the head, wearing black clothing, and wearing a black veil. Well, let me be caught, it's better to be caught because of such foolishness, my beloved wife sitting here in this black veil, her son passing away without being satisfied with his father's presence, what remains for her now (S.Bahadirova). Phraseologisms with the black component are often used in swear words: may your black blood be cursed, may your black blood be cursed, may your face be black, may you be buried in the black earth, may your black blood be lost, may your black blood be lost, etc. For example, "It must be difficult for the parents who raised such scoundrels" (G. Esemuratova)... His father, enraged, threw the cat at his son, saying, "Damn it all, wouldn't it be better to wish you luck than to wish me death?" (M. Dáribayev). "I'll give them God's death like candy now, damn them!" (M. Nızanov)

The phraseologism "black apocalypse" refers to the final stage, time, and era. The Karakalpak people (Muslim peoples) have the oldest understanding of the end of time, the final destiny and life of humankind and the entire universe. The disaster of humankind when oppression, evil, faithlessness, and malice prevail on earth, and goodness and justice reign supreme. With each passing day, people feel as if the dark end of time is approaching (S.Bahadirova). What will the storm do? Will it sweep your hair away, or will it fly you to the sky? "The dark end of the world will befall you," he said (K. Sultanov. Aqdárya). The concept of the end times is one of the oldest among people. The concept of the apocalypse in the Kyrgyz people means "the time of the flood." When the sins committed by humankind increase excessively, and when people cease to recognize God, the earth will be engulfed in floods and torrential rain, and human life will cease. The concept of the apocalypse was known among the Kyrgyz people before Islam. The fact that the prophet Noah and his ark saved several animals during the Great Flood among the Khakas people serves as evidence of this.[12] The addition of the "black" component to the concept of the apocalypse has come to mean intensification or exaggeration. Currently, the meaning of the phrase "black end times" seems to have shifted to a slightly milder form. This is because among our people, expressions like "don't bring about the black end times" and "don't cause the black end times" are frequently used. These are often employed in colloquial speech to mean "don't be hasty" or "don't rush things." As synonyms for the phraseological unit "black end times," expressions such as "bringing the black sky down to earth," "the black sky falling on one's head," "having the black sky fall on one's head," "causing the black sky to suddenly appear," "the black sky suddenly appearing," and "bringing the black sky two hands close" are also used to convey the meaning of "to worry, to be anxious, to grieve." Their meanings are synonymous; even when used interchangeably, the meaning remains unchanged. Whether hiring a new teacher for the school, distributing classes at the beginning of the new academic year, overseeing poorly functioning extracurricular activities, or assigning the lessons of female teachers who went on leave to care for their newborns to another teacher, we realized that our boss, who had grown accustomed to being "flattered" by everyone, was now in a dire situation (P. Khozhamuratova). After hearing these words, I became extremely anxious, feeling as if the dark sky had descended upon me, and I became completely distraught (Alp Sultan).

In modern Karakalpak, the phraseological unit "qara bası" (literally "black head") is frequently used to express the meanings "by oneself" or "alone." Regarding this, B. Yusupova states, "This phraseologism conveys the meanings of 'only by oneself' or 'solely by oneself'."[8] While we were saying, "Let's go there, let's go there," Sarsenbay's black head hadn't looked at us (T.Qayıpberganov).

What difficulty can a lone young man endure?

He looks at the people's faces and brows.

His black head is suitable for harassment.

When separated from relatives and loved ones (A. Ajiniyazov). Ayparsha was given into my care, while they themselves sat there with their black heads (M. Nızanov). The thought had long since settled in my mind that if I could join their ranks, listen to their advice, and take their counsel, I would be without regrets (J. Aymurzayev). This idiom also portrays the image of a person who thinks only of themselves, cares for no one but themselves, and lives only for themselves. For example: It seems there are heartless people who think only of themselves (S. Bakhadyrova). As they say, one loves wealth, another the world, and yet another something else. This Satlimurat, for instance, seems to be a person who lives only for his stomach and his own self-interest (J. Aymurzaev). In the Karakalpak language, the phraseological unit "qara qulqin" is used to refer to someone who only thinks about their own interests, only caring about themselves:

Share a little with others,
Don't be selfish, thinking only of yourself,
Others also have homes and children,
Don't say, "Elder brother, it's your turn to speak now" (A. Otepbergenov).

The idiom "to swallow one's black head." To harm oneself, to die, to suffer the consequences of one's own wrongdoing, to be the cause of one's own death. I don't know, Palym aga, those who bring about their own demise probably don't realize they're living among the people (A. Begimov).

The phraseologism "as if speaking to the black earth" conveys meanings of disregard, inattention, and indifference.

Phraseologisms such as "to sweat profusely," "to be drenched in sweat," "to be bathed in sweat," "to be soaked in sweat," and "to be immersed in sweat" are used to describe someone who works with all their might or is extremely tired. For example: The glasses they brought to their mouths retreated, and Sherniyoz, drenched in sweat, appeared in the doorway (K. Rakhmanov). "Thank goodness! I was sweating profusely trying to get those ignorant people to mention this scholar's name!" (M. Nızanov) Kutym, drunk and bathed in sweat, said "Ugh" and put the stick on the ground (T. Yusupov). After Qadir was soaked in sweat and exhausted, he threw himself onto the thick reeds (K. Sultanov. Aqdarya)...

In the Karakalpak language, the phrase "qaralay öshiw" expresses the meaning of "exhaustion." For example: He was completely exhausted and couldn't speak (Ó. Khozhaniyazov). This phraseologism is also used to mean "to be angry, to be furious." The commander, deep in thought, not knowing what measures to take, held his temple for a moment, then became furious and fumed (Ö. Khozhaniyazov). In the evening, when Jaqsımurat ağa returned from digging, he was visibly angry, his brow furrowed as if snow was falling from it (J. Aymurzaev).

In the Karakalpak language, the phraseologisms "qara tütini shığıw" (black smoke coming out) and "qara tütin bolıw" (becoming black smoke) express the meanings of "anger" and "rage": Qudaynazar's black smoke came out (he became enraged). From the corner of his eye, he glanced at Porxan maqsım, and understood a hint that meant "be patient" (M. Nizanov. Enemy). Even worse than Ötemurat, teacher Genjebay returned, black with smoke (furious). - No, I won't leave it like this. Now the main issue is to stand up for labor (M. Nizanov. Sleep of the afterlife). The editor-in-chief also became very angry, turning pitch black and smoldering (B. Xudaybergenov). - Hey... He sent me to the morning meeting he was supposed to attend himself... As I was coming with my black smoke billowing (extremely angry) after hearing the world's clamor, the secretary girl appeared before me (M. Nizanov).

The idiom "qara terge túsiw" (to break into a cold sweat) also conveys the meanings of "to sweat," "to feel constricted," and "to pant." For example, Perikhan, huddled under the blanket, drenched in sweat, bit her lower lip: "Oh, my poor self, why didn't I give in to him that time?" (T.Qayıpbergenov) He wiped his sweat-drenched forehead with his headscarf and gave another order to the women (S.Bahadyrova). The idioms "qara suw boliw," "qara suw," "qara ter bolıw," and "qara terge shomiliw" mean "to sweat profusely," "to be drenched in sweat," "to overheat," and "to burn up." The child was lying on the swing, drenched in sweat (Alp Sultan).

According to B. Yusupova, author of several works on phraseology: "This phraseology has two variants: 1. black sweat, to be black water - to be black sweat; 2. To sweat - to be drenched in sweat - to be drenched in sweat - to be drenched in sweat - to be drenched in sweat. [8]

The color "black" in idioms expresses life's difficult times, unhappiness, and hardships, and is used in the meanings of "sad, sorrowful, hopeless, unhappy": to have a black face, to have a black face, to have a black fortune, to have a black fortune, to have a black fortune, to have a black forehead, to have a black forehead, to be burned with black soot, to burn with black soot: There was no greater torment for a mother than this; she wandered the steppe until dusk, thinking, "Let me not see the appearance of these dark-faced people" (Alp Sultan). In the Karakalpak language, the phraseologisms "those who are on the blacklist" and "those who have been put in the black book" refer to people who have a bad reputation in society, at work, or among their colleagues, and who have become notorious for their negative aspects. This would indicate that his surname had been blacklisted (Alp Sultan. Widow). The following evening, the Days of Culture concluded at the Academic Theater, and talented artists who actively participated in the concerts were awarded titles. But among them, there were no surnames of those whose names were listed in the black book (Alp Sultan. Orphan).

The phraseological units “qara kúnler” and “qaralı kúnler” describe "difficult, difficult times in a person's life." In short, those dark days that would bring him misfortune, like a frightening vision on a moonless night, were gradually approaching (M. Nizanov).

"Qara kún" (black day), "qaralı kún" (black day), is used to mean "unlucky day." "No, my happiness was stolen, on that dark day when you couldn't follow me..." (Alp Sultan) The dark days have come when I will step on my boots with my own hands. One day, the path of my wandering dark head brought me to Qo'ng'irot (J. Aymurzayev). His thoughts soared again into his youth, into his dark days... (K.Raxmanov) Like an eternal, unfading fog descending, leaving no path to be found, as the dark days of clashing villages with each other dragged on, there wasn't a single person whose bones didn't ache (T.Qayıpbergenov). "Aydos biy!" he said, his voice growing stronger. "If you are with your people, even your dark days are a celebration," our ancestors said. Who do you want to celebrate with, bringing misfortune upon your people? (T. Qayıpbergenov) "Qaralı jıllar, qara zaman" means "a very difficult time." Before death, they say, a person wants to think about their life from the beginning, to remember it. Is that true? Why does he keep wanting to think about those years: happy and dark years? (K. Rahmanov) The idiom "Qara kún tuwdı" means to endure severe suffering, to experience difficult, sorrowful days.

Phraseological units like "black pain," "black sorrow," "black worry," and "black fate" are used when referring to a negative, difficult, or tragic event or thing. These idioms are synonymous. Now he was free from the grief of his beard and mustache. (K.Raxmanov) In the embrace of dark sorrow, wrestling with dark troublemakers, I finally dozed off (J.Aymurzayev). While I stood in the embrace of heavy grief, a sudden rain fell (J. Aymurzayev). "Although I don't sleep in the hearth of the black cauldron, I barely escaped the grief of my dark sorrow." (J. Aymurzayev). This is how my life, filled with sorrow and grief, began for me in the hearth of the roasting house (J. Aymurzayev).

- I'm not afraid of anything, let the mountains stand between us, they only show me a frightening task, and I will quickly lift you out of that fear, the lightning of dark fate gives you and me strength, don't say you're afraid, I will save you from everything, I will protect you, believe me, I don't need any angels to protect you (A. Begimov. The Fisherman's Daughter).

The disappearance of qualities like "honor" and "shame" in Karakalpak cultural traditions is conveyed through the idioms "face black," "face black," "face black," "face black," and "face black."

"What happened, sister?"

"What happened, you scoundrel?"

"They even announce death, tell me."

Qadir sobbed, his tears streaming down his face. May you be blessed! "Name this dark-faced one!" his wife's voice resounded (K. Sultanov. Aqdarya).

Death is better than this (J. Aymurzayev). "Hey, you rascal, come back to your house, what kind of behavior is this? Aren't you ashamed of your people? You're growing up and dying, you can marry a rich man. (Alp Sultan) If he hadn't done so, I would have been disgraced before the people

(Alp Sultan). Yes, my wretched fate is wretched, and I, with a black face, have sinned against God (G. Esemuratova). Every step you take is a sin, how can you stand up and look at people's faces? My children are disgusted by you, they can't forgive my mistake. No matter how much I burn my soul in fire, I face my children, and their father rightfully looks at me with suspicion. It's dark-skinned, it really is! (Alp Sultan) There was no greater torment for the mother than this; she wandered the steppe until dusk, thinking, "Let me not see the face of these dark-faced people" (Alp Sultan). It would have been like this if someone had betrayed their neighbor, or if they had acted with such malice that they couldn't look at someone (M. Nizanov).

“Qara shor”, “qara qurım”, “qara qurımday”, “qara qumırsqaday”, “qara shıbınday”, “qara nópir”: It is said when there are many people, many, in groups, when many people gather. Scholar B. Yusupova writes about this: "It is said when there are many people, when there is a large crowd, when many people gather." [8] A person, like black soot, is surrounding the front and back of the cart (N. Dáwqarayev). Because the guests were swarming like black soot, their trail unbroken, no one noticed Old Lady Boldygul anymore (A. Atajanov). The shouts and clamor of the dark crowd could be heard from afar (Sh.Seytov). A dark-skinned man covered the gallows (T. Qayıpberganov). As soon as he turned around, he saw the black soldiers, like a large, thick black smoke from the fire that had engulfed the earth, and sometimes he sighed, sometimes his breath lightened, and as if boundless joy lay before him, he hurried, sliding his whip from his horse's croup (T. Qayıpberganov). He sat silently, watching until the young man passed by and mingled with the people (A. Abdiev. The nest of jinns and demons). What will the neighbors say if we rush with so many troops? (H.Ótemuratova) Not long after, Khiva was surrounded by numerous guards like black ants (Ó.Xojaniyazov). Now Ill unload a cart of flour, and these people will swarm like black flies (M. Nızanov. Sleep of the afterlife).

T.Sh. Ryskulova defines the meanings of the word "qara" as follows: "VII. The adjective "qara" (black) when combined with nouns from various thematic groups (natural objects and phenomena, birds and animals, human body parts, food), expresses several meanings simultaneously: direct nominative and figurative. [13]

The color black is associated with darkness in the cultures of almost all peoples of the world and represents death, grief, and oppression. In the Karakalpak cultural context, black is understood in two ways. The color black, on the one hand, correlates negatively with underground and secular forces, while on the other hand, it assesses a person's bravery and strength: "No one will let anyone graze their sheep even with brute force" (M. Dáribayev. One in a thousand). "No, sister." Why should I sell my labor (M. Nızanov). If the oar is to be rowed, if the staff is to be used, it's his boat that leads everyone. His friends, delighted by his enthusiasm, spoke fondly of him, saying, "He has no regrets." The Owner of Black Power (K. Sultanov. Aqdárya). When I heard that I had mastered all the techniques of Samba in less than fifteen days, Qıyat Áwezxanovich himself said, "You will produce a talented HURAH! Resourcefulness, quick-wittedness, brute strength, bravery - all of this is extremely necessary for a police officer (Sh.Seytov. It should be attached to the work). All things are done by human labor, and all the labor not employed by humankind was used solely for the benefit of one or two people (A. Begimov. The Fisherman's Daughter). Dark power represents evil, all the bad events in life, and the hardships that befall a person: "We must always protect our children from fire, water, various misfortunes, dark forces, the deceit of women, and the violence of fraudulent people," Orazgul would say during each of her exercises with the parents. (N. Atabaeva)

Phraseologism for the sale of labor. It refers to someone who works as a hired hand: Why, when farmers are literate enough to read, do they sell their labor to the rich, work day and night, suffer, barely make ends meet, and live in humiliation as slaves? (A. Begimov)

The fact that the issue of color has become the object of research in many fields of science indicates the complexity of its nature. In Karakalpak linguistics, white, black, red, blue, and yellow are frequently used in phraseological units.

For a long time, many peoples "corrected black with night and darkness, which created terrifying associations in people's souls" (Panchenko 1968: 11). For this reason, black began to be contrasted with white.

Words denoting "black" have the greatest emotional and expressive impact on Karakalpak consciousness. The color designations "black" and "black" have great combinatorial ability and constitute almost the majority of phraseologisms with color-denoting components.

Another distinguishing feature of the category of phraseologisms under study is the predominance of negative meanings in the semantics of "black."

Black often represents negative aspects of reality. White is the color of the sun and light, symbolizing joy, happiness, and prosperity. Thus, black and white colors are semantically opposite, creating the greatest contrast in language, thereby creating a bright background for each other, where their symbolic and other evaluative meanings are clearly visible.

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Rezyume: *Ushbu maqolada qoraqalpoq tilshunosligida rang masalasi, frazeologizmlarda qora rangning paydo bo’lishi, ranglarning turli ma’nolarni ifodalash uchun tashkil etilishi haqida so’z boradi. Badiiy asarlarda qora komponentli frazeologizmlarning qo’llanilishini ham aytib o’tdik.*

Резюме: *В статье рассматривается проблема цвета в каракалпакском языкознании, появление чёрного цвета во фразеологизмах и организация цветов для передачи различных значений. Также упоминается использование фразеологизмов с чёрным компонентом в художественных произведениях.*

Kalit so‘zlar: *tilshunoslik, rangshunoslik, koloristika, frazeologizm, ilmiy bilish, qora, semantika, til, termin.*

Ключевые слова*: лингвистика, цвет, колористика, фразеологизм, научное знание, черный, семантика, язык, термин.*

TRADITIONS OF TEACHING YOUNG PEOPLE THE ORIGIN AND HISTORY OF FOLK WORDS

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Summary: *Musical education is not the education of a musician, but, above all, the education of a person. Karakalpak folk pedagogy has always strived to provide aesthetic education to young people through musical instruments. The songs of our people also depict the vast steppe of the Karakalpak people, where the main issue is the struggle against social inequality. It inspires the listener with its meaningfulness and energetic energy. Their musical imagery, with its unique characteristics and diversity, provides aesthetic pleasure.*

Key words: *music, art, artistic image, aesthetic culture, folk pedagogy, musical instruments, melody.*

In Karakalpak families, there is a peculiarity in the traditions of teaching children folk musical culture, playing musical instruments, and musical creativity. For example, children were taught to play musical instruments from an early age. Their teachers were their parents and teachers with musical literacy. The main musical instrument among the Karakalpaks was the dutor, which was present in almost all households. Because the soul of the Karakalpak people, and their companion was the dutar. The dutor is considered a heritage passed down from father to son. The bakhshi himself, sitting with his dutar and singing solo or playing a melody on the dutar, was considered the main tradition of Karakalpak musical art. Teaching how to play the dutar, playing heard melodies, and repeating what they heard were implemented through traditions. In particular, the method of repeating what has been heard (audio-imitatory method) contributes to the development of the child's musical hearing, the ability to quickly perceive and reproduce the heard melody, and its long-term memorization. For example, after the teacher demonstrates how to hold the instrument, how to tune it, how to hold the dutor’s «perde» with their hand, and how to move with their hand, the child plays a familiar piece of music or a piece of music taught by the teacher on their instrument. The teacher and the student try to play the music, or they repeat each other's movements as if they had seen them [1].

As a result of exercises taught in such a sequence, the child learns quickly and quickly memorizes what they see. Previously, depending on the child's age and height, parents made or bought a musical instrument themselves. The tradition of teaching the dutar is also provided for in accordance with the characteristics of the age period. Both adults and young people play short melodies on the dutor. There are many skilled dutor players among the Karakalpak girls. We wouldn't be wrong to say that Karakalpaks are true musicians. For example, the female bakhshi, Hurliman, began playing music from a young age and learned her first melodies from her father, Berdaq. Berdaq played the dutor very well. He trained his student, Hurliman, daily in his solo art, the secrets of playing music, and performance techniques, developing his musical abilities. All of the above testifies to the diverse and individual nature of the traditions of teaching musical instrument playing in folk pedagogy.

Due to the disappearance of specialized music educational institutions and musical notation, it is essential to learn independently from singers, musicians, and «jirovs» (folk singers), to learn a specific art form, and to develop and enhance one's skills by developing the ability to memorize what they see and hear. In our opinion, this method of sound imitation is the most convenient and necessary today. Because playing notes doesn't fully develop the learner's musical hearing ability; it only predominantly impacts their visual perception. This folk method, on the contrary, not only develops the learner's musical hearing ability but also enhances their ability to quickly adapt and play the heard melody.

Among Karakalpak musical works, the largest genre, in terms of compositional structure, is the «nama» (music), a branch of folk music. The content of the poems is based on the people's

experiences of suffering, their struggle against injustice, and their feelings of joy, demonstrating their deep reflection. The songs depict historical and social lyricism, the historical events experienced by the Karakalpak people, the nature of their native land, daily life's concerns, their attitudes towards work and art, as well as the impact of that art on people's aesthetic sensibilities.

Melodies are musical works created for folk instruments like the dombra, dutor, qobız, and sıbızǵı. The musical art of the Karakalpak people has its own traditional characteristics, which can sometimes be categorized based on performance characteristics, playing techniques, and types. These are known among musicians as «tókpe saz» and «shertpe saz.» … Listening to one of these melodies, you envision bravery and courage, youthful vigor, and shining diamond swords, while in another, peaceful life, harmless nature, sweet dreams, unattainable dreams, and feelings of joy and sorrow fill your heart.ehile «tókpe sazlar» depict heroic and courageous struggles, shertpe sazlar often reflect lyrical and philosophical thoughts. Elements of (tókpe) and (shertpe) melodies can also be found in the same melody. It holds a special place in the Karakalpak folk melodic traditions and musical art through cyclical melodies [2].

A group of melodies refers to a collection of melodies grouped around a single theme and named by the same name. The peculiarities of these melodies in their playing style indicate that this technique is not a random phenomenon. For example, while a melody known as «Sıy perde» is played with a single beat, the The «Lay-lay» melody is often performed by alternately plucking the two strings from the middle of the dutor. The melody «Mıng túmen» with its repeated syllabic pattern, is performed with a distinct, captivating touch, full of beautiful imagery. The Karakalpak people considered the kobyz sacred and considered it a powerful instrument. The kobyz technique has long been closely linked to the emergence of the shamanistic religion and its representatives – «porqans», and the kobyz instrument has become the «porqans», primary means of communicating with spirits during «zikr». To instill confidence in the power of the kobyz the «porqan» even included it in the «ot jaǵıw» (to make a fire) competition. Along with ancient shamanistic traditions, the kobyz, occupied a prominent place in the works of jıraws (folk singers).

A characteristic of the qobız melodies is the imitation of nature, the sounds of animals and birds, the howling of wolves, the whistling of swans, the galloping of horses, and the bleating of foals «Ullı Ziban», «Aytuwar», «Kelte Ziban», «Subay,» and so on. Music, practically parallel to all forms of artistic creation, vividly and easily depicts all objective phenomena of reality. For example, melodies like «Nar iydirgen» and «Qorqıt» which have become legendary, are played on the duwtar or kobyz and tell stories about heroes who worked for the people, about specific historical events related to people's lives, and about the power of art and the benefits of labor [4]. For example: The history of the «Aqsaq qulan» melody has the following legend among the Karakalpak people. No one dared to inform the enraged Genghis Khan of the tragic death of his beloved son Jochi. Death awaits those who deliver the tragic news. Here, the renowned jıraw Ket Buga's masterfully performed music conveys to the Khan the news of his son's death [5]. The Khan, who had promised to pour lead into the mouth of anyone who brought the bad news, obeyed his command and ordered the punishment of the qobız. The Karakalpak people have the following jıraw melodies and legends about them. «Ullı Ziban». One of the jıraw melodies that captivates listeners through the power of the jıraws verbal art when jıraws sing themes and tolǵaws is called «Ulli ziban» meaning mastery of language and speech. Tolǵaw. Short-syllable poems performed by jıraws were called terme, while multi-syllable poems were called tolǵaw. Tolqın. The type of song sung in groups, sometimes gathering in waves, is called the «Tolqın» melody because it resembles a wave of water.

«Gózińnen». The renowned Karakalpak bard Turimbet Jıraw loved to sing this melody. «That's why it's called «Gózińnen» they say. In epics, the jıraws depicted the sorrows and lamentations of a brave young man's beloved. That's why it's called the «Qızlar naması». Diydarım. The monotonous, similar form of the jırawlar words is called «Diydarım». «Asırım». The performed songs, the melodies of the jıraw, resembling the laborers who planted crops and dug earth, carrying the soil far with their belts, were called «Asırım.» That is, they expressed the desire to leave the soil far away and speed up the work.

This melody originated when a jıraw from among the soldiers sang of the soldiers' suffering. That's why this melody is called «Shól asqan». This melody sung by the jıraw helped Sátemirxan's soldiers safely cross the desert, providing them with strength and power. The «Íǵbal» melody, a type of song sung in epics when describing the circumstances of events or describing the experiences of heroes, is called «Íǵbal». The «Shalqıma» melody, when the jıraws recited epics, weaving a string of words, filled with joy, enthusiasm, and overflowing, was called «Shalqima», «Yar-yar», «Jan-jan». Because the endings of these melodies are «yar-yar» and «jan-jan» they have become «yar-yar» and «jan-jan». «Muńlı». When characters in epics endure humiliation and violence and fall into enemy hands, the melody sung when they fail to achieve their dreams is called «muńlı». «Dilim naması». This melody was composed by Dilim Jiraw. That's why it became «Dilim naması». «Dúysenbay naması». Dúysenbay jıraw's beloved melody. Noǵaylı. The «tolǵaw» (epic poem) sung by «jırawlar» is called «Ormambet.» After the fall of Altın Orda, the Nogai people abandoned their homeland and suffered hardship. «Qayırım». When a jıraw performs a «jır», it is called the «Qayirim» melody if it repeats the meaning of a word at the end of a long jır or at the end of a concluding line. «Ilǵal». In epic poems, this melody is called «Ilǵal» sung to express the joy of a prosperous and open country. «Keń qayır». This melody is sung when two people exchange words or while the «aytıs». «Shabıs». A melody imitating the horse's gallop when the warriors galloped. The running of a horse with a kobyz is described. «Nama bası». Before the jıraw takes the kobyz and begins a speech, the jıraw's melodies, played without words on the kobyz, are called «Nama bası» [5].

«Jolshı naması». The jıraws, having played the beginning of the melody, slowly began to speak. This melody of the jıraw serves as a prelude to the beginning of a song, or a prelude to a future song. This melody, known as «Jolshı» became the second of the jıraws melodies.

Terme. After the jıraw begins to speak with the melody of a «Jolshı», they sing short-syllable terme and advice, often incorporating folk proverbs. This melody is called Terme and is considered the third melody of the jıraws. After the jıraws have finished their words of wisdom and counsel, they begin to speak. «Sóz bası». After saying «Nama bası», the «jolshı», and the termes, the jıraws begin their «Sóz bası». In the jiraws' introductory song, the jıraw explains the concise content of the epic poems he knows to the gathered crowd, decides which epic to recite from among the gathered crowd, and then, at the request of the crowd, begins to recite the epic. This melody is called the fourth melody before the beginning of the epos. «Ne kórdiń qara at?» In the epic poem «Alpamıs,» the melody recited by the jıraws about Qarajan Batir's words spoken to his horse upon meeting Alpamıs is called «Ne kórdiń qara at». «Kóz aydın». In the epic poem «Alpamıs,» when Alpamıs's horse, Bayshubar, surpassed the prize, Gulparchin's melody emerged from her congratulatory speech to Alpomish [6]. «Shańqay naması». They say this is a melody sung by the jıraw Shanqay, a man from Bukhara. « Kóse qashqan» refers to the melody of the epic poem «Er Shora,» dedicated to Kóse's deception. In Karakalpak oral literature, there is the «Hawjar» song sung during the bride's wedding ceremony. The melody was dedicated to it. «Ayǵa shap». In the epic poem «Qoblan,» Qidirboy's wife, consumed by the tiger's heart, gives birth to Qoblan. Old Qidirboy goes to his wife to find a tiger's heart. Encountering a tiger, he kept saying, «Ayǵa shap sherim, ayǵa shap». Believing Qidirboy's praise, the tiger jumped to the moon, then fell hard to the ground and died. Old Qidirboy slaughtered the tiger, took its heart, returned home, and fed it to Boz kempir. That's why this song of the jıraws is called «Ayǵa shap».

«Sher báyit». When jiraws sing, sometimes a single poem consists of four stanzas, that is, four lines. This melody is called «Sher báyit.» This song, as a melody, has also been incorporated into epics. For example, in the epic poem «Alpamıs» it is called Alpamıs's «Qultay». Among the Karakalpak people, especially in the Borshi mountains of the Takhtakupir district, as well as among the Karakalpaks and Kazakhs living on the border of Kyzylkum and Kazakhstan, there are many legends about the origin of musical instruments. One of them is about the «Jetigen» instrument. In ancient times, an old man had seven sons. One year, all the old man's children died, and the blessing of the house was lost. Misfortune settled in the yurt's home, and seven sons died one after another. Having no means to offer a funeral feast for the deceased, the old man carved his «Jetigen» instrument from dried wood. When their eldest son died, they attached a string and installed a support, called

him «Qaraǵım,» and performed a mourning song. When their second son died, they also attached another string and performed the song «Qanat sınar». Thus, there are legends that seven strings are attached to the «Jetigen» and crated the new melodies like «Ot sóner», «Baxıt kóshti», «Kún tutıldı», «Jeti balamnan ayırılıp qusa boldım» [8].

Nevertheless, this legend cannot be understood in one way - in connection with the instrument's history; the most important issue here is the elder's mood, the irreplaceable grief in life, and the emergence of the aesthetic impact of melodies that express the soul's wound. We see, in particular, how the old man, through music, wishes himself endurance and patience, dispels his grief and sorrow, and consoles himself. Such legends and fairy tales have been widely used in the upbringing of children and youth as a tool of Karakalpak folk pedagogy. Sometimes, before playing the melody, the performer recites a short summary of the legend. This teaches children to deeply understand the meaning of the music they hear and helps them focus their minds. Imagination shapes the ability to convey one's feelings and emotions through music. Of course, a musician's skill, like the art of improvisational poets and storytellers, is evident not only in their ability to convey the core meaning of the legend but also in their artistic and musical mastery. Listening to the folk melody «Torǵay» when you hear the drawn sounds reflecting the sparrow's flight, you marvel at the beauty of the musical depiction. Playing the strings of the duwtar and depicting the sparrow's renewed flight, and so on, gives young people great inspiration, and enthusiasm. They learn from the eagerness of a small sparrow.

Indeed, if we can convey the sweetness of musical melodies to children from an early age, and if children can sense the multifaceted nature of human emotions through sounds, they will assimilate achievements that cannot be achieved through cultural means. Music education is not about educating a musician, but primarily about educating a person. Karakalpak folk pedagogy has always strived to provide aesthetic education to young people through musical instruments. It's worth noting that one of the legendary melodies of the Karakalpak people is «Qara jorǵa» a unique melody. The Karakalpak people, who respected horses, especially valued riding and lifting spirits. The jorǵa’s movements on the melody are conveyed with simple, simple rhythms, giving a person immense inspiration and strength. Another point worth mentioning is that music, regardless of nationality, feels a similarity to music in people of any nationality and is amazed that the Karakalpak people have not lost their identity. The role of folk pedagogy is particularly significant in developing the musical culture of the Karakalpak people and shaping young people's appreciation for art, including music. No matter which melody we consider, they are distinguished by their performance characteristics, unique diversity, and musical ornamentation. For example, the harmony between the artistic content and musical form of the «Muxalles» melody is particularly noteworthy.

The content of the melody reflects love for one's homeland, scenes from folk festivals, the characters of those close to it, the delicate psychology of women, and profound philosophical reflections. Songs like «Bozataw», «Mıń tumen», «Qızlar úyge kir» and «Aqsúńgúl» are primarily based on epic, historical, imaginary, and everyday themes and plots [9]. Folk pedagogy understands well that composing a musical melody that evokes human emotions from a simple two-stringed instrument depends on the performer's skill, experience, and performance characteristics.

In these songs, the vast steppe of the Karakalpak people is depicted, and the main theme is the struggle against social inequality. It inspires the listener with its meaningfulness and energetic energy. Musical images, with their unique characteristics and diversity, provide aesthetic pleasure. For example, the melodies «Aqsúńgúl» and «Aq qalqan» depict the image of a certain person. The melody «Qoshım palwan» was composed based on personal experiences. In general, folk melodies help children to correctly perceive and appreciate the beauty and elegance of life and art. Our renowned bakhshis, tirelessly teaching young people, have taught their craft to young people. They accompanied young musicians to major competitions and introduced them to renowned bakhshis. They have shaped us into young people with developed aesthetic sensibilities.

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Rezyume: *Musiqiy tarbiya - bu musiqachini tarbiyalash emas, eng avvalo insonni tarbiyalashdir. Qoraqalpoq xalq pedagogikasi musiqa vositalari bilan barcha vaqt yoshlarni estetik jihatdan tarbiyalashga harakat qilgan. Xalqimizning kuylari ham qoraqalpoq xalqining keng dalasi tasvirlanadi, undagi asosiy masala ijtimoiy tengsizliklarga qarshi kurash bayon etiladi. Tinglovchini mazmundorligi bilan, g‘ayratli quvvati-kuchi bilan jo‘shtiradi. Musiqiy obrazlari o‘ziga xos xususiyatlari va rang-barangligi bilan estetik zavq bag‘ishlaydi.*

Резюме*: Музыкальное воспитание - это не воспитание музыканта, а, прежде всего, воспитание человека. Каракалпакская народная педагогика всегда стремилась к эстетическому воспитанию молодежи посредством музыкальных инструментов. Мелодии нашего народа также изображают бескрайнюю степь каракалпакского народа, где основной вопрос - борьба с социальным неравенством. Он воодушевляет слушателя своей содержательностью и энергичностью. Музыкальные образы, благодаря своим уникальным особенностям и разнообразию, доставляют эстетическое удовольствие.*

Kalit so‘zlar: *musiqa, san’at, badiiy obraz, estetik madaniyat, xalq pedagogikasi, musiqiy vositalar, kuy.*

Ключевые слова*: музыка, искусство, художественный образ, эстетическая культура, народная педагогика, музыкальные инструменты, мелодия*

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THE HARMONY OF NATIONAL IDENTITY, HUMANISM, AND UNIVERSAL VALUES IN THE WORK OF AJINIYAZ

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Summary: *This article examines the problem of man in the aspect of humanistic ideas in the work of the Karakalpak poet and thinker Azhiniyaz Kosybay uly.*

Key words*: humanism, man, human reason, spiritual perfection, love, Eastern philosophy, good and evil.*

Humanistic ideas, being quite broad in their content, constitute one of the components of social and spiritual problems, the entire spiritual culture, including the socio-philosophical thought of the peoples of Central Asia.

"In general, the socio-utopian ideas," writes academician M.M.Khairullayev, "the doctrine of the spiritual essence of man of progressive thinkers testify to their high humanism, humanism. It was the highly humanistic nature of the works that determined the significance of these teachings in the history of social thought of the peoples of Central Asia, the Near and Middle East. Although this humanism was abstract, limited by the conditions of the given epoch, it undoubtedly occupies an important place in the history of humanism and played a certain role in the formation and development of humanistic ideas... " [1-180]. This provision is important from the point of view of analyzing the problem of man and organically related social-personal and moral aspects in the context of their humanistic essence.

The humanistic ideas of the Karakalpak poet-thinker Ajiniyaz Kosybayuly are multi-component in their problematic and ideological content. They are closely connected with the spiritual traditions of the peoples of Central Asia. A key position in Ajiniyaz's humanism is his understanding of human essence, its place in the world and society, its spiritual and moral potential, and its socio-personal manifestations. "Ajiniyaz's humanism has common roots and resonates with the humanistic ideals of his contemporary Berdah and his predecessor Mahtumkuli. "The beauty of this world is man," he says. This is the philosophical credo of a humanist poet"[2] - thus evaluates it the Karakalpak poet I.Yusupov, making legitimate historical parallels and comparisons. In our view, Ajiniyaz's humanism is not an abstract love for a person, not just kind feelings, sympathy for another's grief, but, first of all, the principle of a special approach to a person, the desire to see in him a bearer of the highest value, taking into account his personal potential.

One of the important features of Ajiniyaz's understanding of the human problem is that he attempted to approach it from the positions of those teachings whose role and place in the formation and development of his legacy were discussed above. At the heart of Ajiniyaz's reflections on man and all related problems lies the idea of man's rationality, considering reason as the main factor of personal and social perfection.

In Ajiniyaz's works, the humanistic approach to the problem of man suggests that a person's love for their neighbor and the Almighty (God) means the creator's return love for their creation. According to Ajiniyaz, since God represents the highest beauty, his creations, nature, and every being as their necessary component are also beautiful. Man represents the same inseparable particle and, at the same time, the goal of this nature, therefore, he should be exalted in every way, striving to be worthy of such a position. In our view, I. Yusupov's observation of Ajiniyaz's position "The beauty of this world is man" should be interpreted more broadly, taking into account the above. In general, man is the beauty of the world, as a creation of the Almighty, and therefore he is beautiful. Its beauty constitutes a whole complex of spiritual and physical qualities that contribute to its gradual improvement, harmonization with the surrounding world, primarily with the divine. The poet, however, understands that people are not all the same, they are characterized by diversity, their own

peculiarities, which also constitutes the true beauty of a person. In the poem "Bolmasa" [3-60], the poet, based on this principle, describes what characteristic features should be possessed by representatives of different groups of people. However, the main and general dignity of a person is spiritual perfection.

Important aspects of Ajiniyaz's humanism are manifested in his profound reflections on the essence of man, his spiritual world, his place in the universe, and the meaning of his life, which are considered by the poet as a whole through the prism of the concepts of "wisdom," "love," and "beauty," which constitute the spiritual and moral essence of man. Let us first note the general approach of Ajiniyaz to these concepts. He believes that there is no higher perfect creation in the world than man, for he has been given by God a "invaluable pearl" - the power of reason, in which lies the gift of knowing the secrets and heights of the world, with the help of which he must perform great deeds. Regarding the problem of love, in the East, especially in socio-philosophical thought, it appears quite multifaceted, having many manifestations and aspects. This was largely facilitated by Sufi teachings. In particular, in Ajiniyaz, it acts as a general humanistic factor in the interpretation of the problem of man, the development of the whole world, including society, the solution of important social problems, one of the most essential components and driving forces of increasing the moral potential of man and society. Thus, the problem of love acquires a great socio-philosophical and worldview significance. The theme of love, which had been raised and developed at that time, primarily from the standpoint of Islamic doctrine, for a long time, finds its generalizing and deepened embodiment in the works of Alisher Navoi. One of the main features of its interpretation is the inseparable combination and interconnection of its divine and earthly components, which found its expression in Ajiniyaz's works as well.

The second aspect, the uniqueness of the latter's views on this issue, lies in the fact that the earthly content often influences his general Sufi approach to the interpretation of love, beloved, which is manifested, for example, in his poem "Bir páriy" ("One fairy"):

There is no beauty like this in the world.
I likened her beauty to the beauty of the houri.
Her teeth are like pearls.
In our time, there is no such beloved [3-55]

In general, he skillfully combines the unity of earthly, divine, and cosmic approaches, which constitutes an important feature of the humanistic interpretation of the problem of love. If we integrate many of the poet's statements about love, it presents it in his understanding as a high spiritual moral force that contributes to the inner perfection and purification of a person. And beauty is the object of love, understood equally broadly and multifacetedly. Therefore, the pursuit of beauty implies constant spiritual and moral improvement, which constitutes the hidden essence of many of the poet's love-romantic poems.

Considering these problems in more detail, it should be noted that, according to Ajiniyaz, a person's mind should determine all their actions and deeds, from everyday-domestic to high social-state, spiritual activities. The poet asserts that people who approach life, their actions and deeds, without reason will inevitably acquire worse vices and will not be able to achieve any spiritual perfection, intellectual and moral virtues. Therefore, Ajiniyaz considers it expedient for people to be guided on the path of truth, humane deeds by mentors, teachers endowed with high intellect, the ability to comprehend the world from the standpoint of its rational interpretation. Moreover, every reasonable person is a mentor:

We have a legacy from the people of the past.
That wise people have the ability to think.
Their every word is a lesson. [3-187]

In this respect, he is reminiscent of the great humanist Alisher Navoi, who believed that there is no creature in the world that possessed a higher perfection than man endowed with intellect.

In the history of philosophy, there are known movements that opposed reason and faith, however, Ajiniyaz, following a number of Eastern philosophical traditions, does not follow the path of opposing them, but rather harmonizes them, believing that man uses reason as God's highest gift

to consciously follow faith, to be able to answer for his actions. Trying to comprehend the problem of man from this perspective, Ajiniyaz concludes that human life, even if not eternal in its individual-earthly manifestation, is still relative to the eternal world in its spiritual manifestations. In the poet's verses, the idea of the relative nature of human life, the afterlife, and the eternity of divine existence are expressed through various means. In it, there is often a comparison of man with other objects and phenomena claiming eternity (high mountains, oceans, deserts, etc.). However, in Ajiniyaz's view, all of this is also transient, including the person themselves, regardless of their origin, whether noble or not, rich or poor. In particular, he stated:

And Qarun was rich.
He was a hundred times richer than everyone else.
But he too was taken to the grave.
Like Zindon, there's no doubt about it. [4-40]

In his works, Ajiniyaz compares human life to a caravan, and the world to a caravanserai. A person, like a caravan, comes to a caravanserai and, after staying there for some time, leaves it. He expresses the duration of human life in the real world with the concept of "besh kunlik dunyo" ("five-day life"). In this regard, it should be noted that the frequently encountered concept of "paniy dunya"[3-74] ("transitional world") in his works, in our opinion, expresses precisely this relativity, that is, the transience of the world for the presence of a specific person in it. "I thoroughly showed that the world is transient" [5-51], the poet expressed in one of his poems. Here, Ajiniyaz in his views aligns with the general Sufi positions, which, however, are concretized in his Naqshbandi understanding of humanity, which is largely explained by his recognition of the active nature of human intellect.

Therefore, the poet does not absolutize, does not extend a certain peculiarity of the human personality to all people. He considers the life of each person in a specific manifestation. It should be noted here that the above-mentioned concept of "worldly possessions" expresses different degrees of transience of specific objects and phenomena of the world, individual person and humanity, the world as a whole. Ajiniyaz, recognizing the finite nature of each individual's life, believes that people in this real world come "to visit each other." Therefore, they should be guided by virtuous norms in their relationships, so that each of them adorns the life of the other with their presence, rewards him with joy. Therefore, in this "transitory world," everyone must do good deeds, for Allah punishes those who break this covenant in the "afterlife." He balances each person's good and evil on the scales of justice. Therefore, everyone should choose the "good" path from the very beginning. (i.e., a person must be honest, ("insaplı" - R.R.). The poet's opinion is expressed in the following lines:

If you want reward, follow the right path.
And can a person be a person who does not think about reward.[3-132]

In another poem, he reminds people of the swiftness of this world, urging them to treat all phenomena of the world rationally, which constitutes an important aspect of "Iman" [3-132], which will be discussed below.

As previously shown, for Ajiniyaz, this "right path" is connected with Sufi pursuits of truth" ("haq"). In this regard, in some cases, the poet describes paradise life in such detail that, in our opinion, it appears in him not only as a divine reward for a virtuous person, but also as a "search for truth," a certain state of the human soul. However, referring to ordinary people, in the poem "Ishinde," he describes a paradise where orchards grow, precious stones abound, and magnificent palaces are erected. There are beautiful virgins there. No one there feels cold and heat, no one experiences suffering. All of this is intended for those who have done good deeds in the past, ("qayır-saxawat"). Therefore, he calls people to be "virtuous":

If you are rich, then do good.
Help the orphans, build mosques.
Perform all acts of worship. [3-135]

Not limiting himself to this, the poet advises wealthy people to do good deeds not only by helping orphans, the destitute, but also by contributing to the acquisition of knowledge.

Ajiniyaz concludes his reflections on charitable works with these lines:

One who has no companions, does not do good to anyone,
He is likened to a barren tree. [3-72]

With these lines, the poet calls everyone to befriend worthy people and perform good deeds. A person should leave behind not wealth, but good friends who will remember his deeds," and children who received proper parental upbringing. Ajiniyaz puts forward a profound philosophical idea that just as a barren tree is cut down in a garden, a person cannot bear the sacred name of "human" if they cannot realize their status in society.

As a humanist, Ajiniyaz believed in human dignity, deeply sympathized with the oppressed and destitute, and sincerely wished for the triumph of goodness and justice. His humanistic ideas in their specific expression, while distinguished by their originality, at the same time had much in common with the views of other Karakalpak poets that every person should have respect and love for the dignity of another person. Ajiniyaz emphasizes more than other poets that man, being the most perfect creation, was born not for evil, but for good, destined to serve it, to develop in himself good and noble qualities. This aspect of the problem of man, its humanistic interpretation, necessarily leads Ajiniyaz to an attempt to comprehend the relationship between man and society. Every individual, while representing a certain personal value, at the same time cannot exist outside of society, outside of their surroundings. With this in mind, he writes: "A man detached from the people - a madman, deprived of his beloved - becomes a stranger to everything." [3-63]

Therefore, Ajiniyaz considers the ability to unite in the struggle for one's vital and spiritual interests against the vices manifested in the society of his time to be an inherent human quality. According to him, all people are born equal, free, and must enjoy all the benefits of life while not infringing upon the interests of others. Humane treatment of other people is the foundation of a person's social and spiritual-personal development, the source of all their virtues. Therefore, Ajiniyaz strongly condemns those people who base their well-being on base and against moral actions: lies, flattery, human ignorance, etc. In our view, this opinion of the poet can contribute to the affirmation of such an understanding of humanism, which implies not only respect for man, but also the enhancement of the spiritual and moral potential of the individual, the significance of man in the system of the world, nature, society. Good deeds, in Ajiniyaz's view, lead to good consequences for those who do them, and conversely, evil intentions and unworthy actions harm primarily those from whom they come. Continuing this thought in his poems "Jaxsi," "Meғzer," Ajiniyaz believes that a highly moral, spiritually rich person has the ability not only to respect but also to appreciate the virtues of other people, social groups. This is one of the main requirements of true humanism, and only in this case can one call oneself human.

According to the poet, a person's ability to adequately assess the merits of another should stem from a correct understanding of the essence of man, from a deep sense of respect, love for him, which is one of the most important conditions for the existence of society. Ajiniyaz's such understanding of the essence of man and society is largely due to the works of his predecessors Navoi and Mahtumkuli and serves as one of the main manifestations of his humanistic approach to this problem.

Uniquely and deeply summarizing his humanistic approaches to the problem of man, Ajiniyaz comprehends it not only from the point of view of the concept of "adam" ("human"), but also from the point of view of "insan," as its elevated and perfect state. Since there is no adequate concept in the Russian language, it seems that the original terms themselves should be used in translation:

By being called a human, whether he will be a "human." [3-52]

Thus, the following conclusions can be drawn:

1. The humanism of Ajiniyaz, the humanistic potential of his work, being a complex multi-component and integral phenomenon, as one of the leading constituent elements, includes the problem of man in its diverse personal and social manifestations.

2. The humanistic orientation of Ajiniyaz's solution to the problem of man, among other factors, is largely due to the influence of Sufi teachings, primarily the Naqshbandi order, the thinker's own aspiration to consider human life in its earthly and divine significance and unity.

3. If Ajiniyaz's humanistic interpretation of the problem of man in its personal aspect is connected with his analysis of the inherent nature of man in reason, the ability to love, spiritual and

moral perfection, then in the social aspect it manifests itself in the understanding of man and society, patriotism, love for one's people, in general, his highest state as "human."

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Rezyume: *Ushbu maqolada qoraqalpoq shoiri va mutafakkiri Ajiniyoz Qo‘sibay uli ijodida inson muammosi insonparvarlik g‘oyalari nuqtai nazaridan ko‘rib chiqiladi.*

Резюме: *в данной статье рассматривается проблема человека в аспекте гуманистических идеи в творчестве каракалпакского поэта – мыслителя Ажинияза Косыбай улы.*

Kalit so‘zlar: *insonparvarlik, inson, inson aqli, ma’naviy barkamollik, muhabbat, Sharq falsafasi, ezgulik va yomonlik.*

Ключевые слова: *гуманизм, человек, разум человека, духовное совершенство, любовь, восточная философия, добро и зло.*

UDC: 811.512.133

THE STUDY OF TURKISH WRITTEN MONUMENTS BY TURKISH SCIENTISTS

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Summary: *This scholarly review focuses on the history of research into Runic inscriptions in Turkey, highlighting prominent Turkish scholars and their substantial contributions to the field. Specifically, it provides a detailed analysis of the works of Necip Asım (Najib Osim), including "The Very Old Script of the Turks" and "Orkhon Monuments". Information is also presented on the four-volume edition "Old Turkic Inscriptions" by Husayn Namiq Orkun, the internationally recognized work "A Grammar of Orhon Turkic" by Tal'at Tekin, and the latest significant research by scholars such as Osman Fikri Sertkaya and Erhan Aydın, including his book "Witnesses of the Steppe: Old Turkic Inscriptions". The review also notes the development of mobile applications and electronic programs for studying Runic texts. This work illustrates the deep roots and continuous advancement of the study of ancient Turkic written monuments in Turkey.*

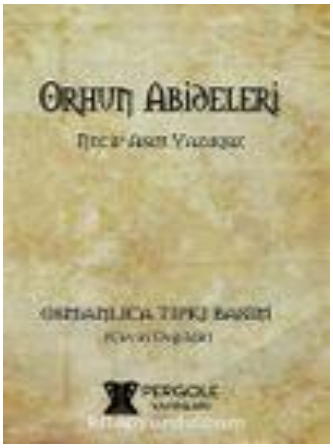
Key words: *Turkology, Runic inscriptions, Orkhon-Yenisei script, Turkey, Turkish scholars, Necip Asım, Husayn Namiq Orkun, Tal'at Tekin, Erhan Aydın, "Orkhon Monuments", Göktürk Khaganate.*

Monuments are being studied in almost all Turkic-speaking countries. Among them, a great deal of significant work has been done in Turkey on the study of monuments. In particular, mobile applications, electronic programs for studying runic inscriptions, as well as many scientific works are being published. Among Turkish scientists, Najib Osim, Husayn Namiq Orkun, Ahmet Jevat Emre, Ahmet Temir, Usmon Nedim Tuna, Omeljan Pritsak Orkhan, Muharrem Ergin, Usmon Fikri Sertkaya, Kazim Mirshan, Erhan Aydin have been engaged in scientific research for many years.

Najib Osim Yaziksiz. Necip Osim's work "The Very Old Writing of the Turks" was published as the first edition of this genre. Necip Asim was Mustafa Kemal's lecturer in Turkish, French and history at the Military Academy.



In 1921, he wrote the work "Orkhon Monuments". In this case; It contains the history of the Göktürks, the grammar of the Orkhon Turkic language, V. Barthold's article explaining the significance of ancient Turkic scripts, and the authentic text of the Orkhon inscriptions. Commenting on the history of the Göktürks and the grammar of the Orkhon Turkic language, he refers to the views of Wilhelm Thomsen and Vasily Radlof and compares these views, which increases the value of the work. This book includes a translation of the work from Ottoman Turkish into the Latin alphabet.



This esteemed scholar, who was the first to write Turkish history, translated the two Orkhon inscriptions for the first time and introduced the Göktürk alphabet with a treatise titled “The Oldest Turkish Writing”. However, in this work, the letters Z and N are confused, and the letters İ and P are wrong. Many names were corrupted during the writing and transmission of the text; but despite all this, the honor of introducing the Göktürk alphabet to us for the first time belongs to Necip Asim.

The first part of the Orhun monuments, which can also be called the Introduction. Its title is “The Orhun Captives and the Ancient Turks”. The reason for writing this introduction is to present the Turks as a community devoid of civilization and destined to destroy cities. However, it is said that this was to create historical monuments that prove that they were a civilized people from the first centuries of history. The next part of this part discusses the discovery of the monuments and the first publications about the monuments. Information about this will be provided.

Then he said: “Now let's talk a little about Mr. Thomsen's work. And let's give information from the “General Turkish History” that we are compiling, quoting from it, we will give the following sentence as an example: - Information about Turkish history is given by telling about the Turks who left. According to this, the fate of the Turkic peoples who were scattered everywhere as a result of the invasion of the invaders is discussed.

The second part of the work is called “Orkhon Monuments”. Information is provided about the location and preservation of the monuments.

The official characteristics of the stones with inscriptions on them are the subject of this section.

The first title of the next part of the work is Orkhan Turk's Alphabet and Grammar. Here, Necip Asim emphasizes that Yazykiz, the most prominent example of the Oghuz language in the Eastern Turks, called it Orkhon language because the main element of the language of the monuments belongs to the Oghuz language, and then provides information about the phonetics of Orkhon Turkish.

Other headings in the book and the things explained under these headings are as follows: Orkhon Alphabet: A section that introduces the letters that make up the Orkhon alphabet. Origin of Orkhon Letters: This section provides information about the origin of Orkhon letters. Nouns: Cases of nouns, plural forms of nouns, numerals (primary and ordinal numbers) are explained in this section. Pronouns: Personal pronouns, possessive suffixes, demonstrative pronouns, interrogative pronouns, and pronoun conjugations are the topics covered in this section.

The book “**Orhun Inscriptions**” was published for the second time in Turkey by **Hüseyin Namık Orkun**. The first volume of this work, published in four volumes, is devoted to the inscriptions of Kultegin and Bilga Khagan. Orkun took Thomsen's edition as an example, used his subsequent corrections and the dictionary of Mahmud Kashgari. Although Orkun tried to correct some of Thomsen's readings, this was not very successful, and Thomsen made new mistakes by trying to correct some words that he had read correctly.

Old Turkish Inscriptions. The work was prepared by the Turkish Language Society, which compiled inscriptions written in the Orkhon alphabet, and published by this institution. It was published in 4 volumes between 1936 and 1941.

Tal'at Tekin - Born in Ankara in 1927. Graduated from the Faculty of Literature, Department of Turkish Language and Literature, Istanbul University. His 419-page work "**A grammar of Orhon Turkic**" was published in Bloomington in 1968. In 1988, a 200-page book called "Orhon yazitlari" was published. In 1993, he created the works "Irq bitik" and in 1995, "Orhon yazitlari, Kultegin, Bilge kağan, Tönyuquq". He also defended his doctoral dissertations in Turkish language and Turkic studies under the supervision of Tal'at Tekin.

Talat Tekin, in addition to his direct students, is a mentor to all young people interested in Turkology. In June 1965, he received his doctorate from the University of California with his dissertation "Orxan Turkish Grammar". Under his supervision, doctoral programs were prepared in both Turkish and Turkic linguistics. In addition to his direct students, he became a mentor to all Turkology students with his articles and books, and with "Orxan Turkish Grammar" he became the most famous and widely read Turkish linguist outside of Turkey.

Under his leadership, both the Turkish language and Turkic linguistics were prepared. In addition to the students he directly trained, he became a mentor to all Turkology students with his articles and books, and with his "Orkhan Turkish Grammar" he became the most famous and widely read Turkish linguist outside Turkey. He wrote and presented his own unique views in almost all areas of Turkology, from the theory of Altai languages to the poems in Divanu Lugati't-Turk, from Yenisei Bitig to Irk Bitig, from Yunus Emre to Fuzuli.

Another well-known Turkologist, **Osman Fikri Sertkaya,** published a small but interesting article in 1983 about the phrase "oplayu tegmek" frequently used in the Kultegin and Kulichor inscriptions. He graduated from the Faculty of Literature, Istanbul University, with a degree in Turkish Language and Literature. One of Osman Fikri Sertkaya's articles on Turkic-Runic texts, "Issues of the History of Kokturk: Kultegin or Koltegin?", was published in the journal "Turkish Literature" in 1974. In 1976, he wrote his doctoral dissertation entitled "Sivaç-ul Kulub from the Uyghur Letters of the Islamic Period." Between 1966 and 2013, O.F. Sertakaya wrote more than 400 articles on the language, literature, history, art, folklore, and many other areas of the Kok-Turk, Uyghur, Karakhanli, Kipchak, Chigatai, early Ottoman, and modern Uyghur Turks.

Erhan Aydin. He was born in Malatya in 1973. The Turkic runic alphabet is a system that the Turks began to create from the 7th century. There is a corpus of inscriptions. Since the Danish scientist Wilhelm Thomsen deciphered the alphabet in 1893, many studies have been conducted and are being conducted on ancient Turkic inscriptions. Erhan Aydin has many works in this field. Several of them are currently stored in state libraries. One of his most famous works is "Bozkırın Tanıkları: Eski Türkçe Yazıtlar", published in Istanbul in 2021. This book by Aydin, published by Selenge Publishing House, is in line with the other works listed above in terms of subject matter. This book is presented to every reader interested in ancient Turkic inscriptions.

The main goal in preparing the book was to "provide the reader with information about the outline of these inscriptions and the period of inscriptions without burdening them with explanations, and therefore to create it in a convenient form so that readers from all walks of life can read it with pleasure." After the "Preface" and "Introduction" sections of the book, it is divided into four sections: "Kokturk and Uyghur. Khaganates", "Turkic runic alphabet, origin and naming", "Era of ancient Turkic inscriptions" and "Samples from inscriptions". At the end of the book there are "References" and "Index" sections.

The "Introduction" section (page 7) discusses the first inscription written in Turkic runic letters. It notes that researchers have not been able to draw any definite conclusions about texts written in runic letters. It then notes that texts written in Turkic runic letters are analyzed only from a grammatical point of view and that scientific fields such as history, geography, sociology, and philosophy have not been studied.

The "Introduction" section (page 9) provides an explanation of words in old Turkic inscriptions. It notes the characteristics of these words and their belonging to all Turks in general; in particular, to Turkic tribes such as Uyghurs, Turgesh, and Kyrgyz.

The first chapter of the book, entitled "Kokturk and Uyghur Khaganates" (pp. 11-26). It consists of the headings "First and Second Kokturk Khaganate" and "Uyghur Khaganate". The

heading “First and Second Kokturk Khaganate” uses the words Turk and Turuk. Aydin, Köl Tegin and Bilge provide information about how and in which inscriptions the khagans were used. He mentions the significant absence of Turkic spelling in the khagan inscriptions. There are also Turks in the Yenisei, an important region of the South Siberian region with many inscriptions. This word occurs in two places in the inscriptions of Uybat III (E 71) and Podkuninskaya (E 71).

Under the title “Uyghur Khaganate”, Aydın mentioned that the Uyghurs began the period of the Uyghur Khaganate, which was established in 745 as a result of the Uyghur-Basmil and Karluk alliance's uprising against the Blue Turks. After providing brief information about the Uyghur Khagans, he emphasized that Bogu Khagan was different from other Uyghur khans. This is because after Bogu Khagan adopted the Manichaean religion, the influence of the Sogdians increased among the Uyghurs.

Aydin also noted that the Uyghurs living in the steppes of Inner Asia were like the Blue Turks. They left inscriptions in Turkic runic letters, and the name Uyghur was identified ten times in these inscriptions.

The second part is “The Turkic Runic Alphabet, Its Origin and Nomenclature” (pp. 27-64). Under the title “Discovering, Decoding and Researching Ancient Turkic Inscriptions”, it consists of the following titles: “Old Turkic Inscriptions with the Turkic Runic Letter”, “Yenisei (Tuva and Khakassia) Inscriptions”, “Mountainous Altai Inscriptions”, “Kyrgyzstan (God Mountains) Inscriptions” and “Chinese People.“ Inscriptions of the Republic”. In this part, Aydin talks about the symbols in the Turkic Runic Alphabet and explains which symbols were used in which inscriptions.

The third chapter is called “Old Turkic inscriptions” (pp. 65-78). It consists of subheadings such as “General structure of the Turkish language in the period of inscriptions”, “Phonological features of the Turkish language in the period of inscriptions”, “Vowels”, “Consonants”, “Old Turkic inscriptions “Stylish features of the period”, “Lexical and lexical features of the period of ancient Turkic inscriptions”, “Dialectical characteristics”. The subheading “Phonological features of the Turkish language in the period of ancient Turkic inscriptions” indicates that the sound values of the signs in the Turkish runic alphabet were analyzed by Thomsen, and from his conclusion it became clear which sign corresponds to which sound.

The fourth chapter is entitled “Examples of Inscriptions” (pp. 79-120). It consists of subsections and headings such as “Examples of Inscriptions in Mongolia”, “Yenisei (Tuva and Khakassia), “Examples of Inscriptions of the Altai Mountains”, “Kyrgyzstan”, “Examples of Inscriptions of the People's Republic of China”. The “Sources” section (pp. 121) contains the research used in the book, and an “Index” (pp. 127) is provided at the end of the book to facilitate access to concepts.

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Rezyume: *Ushbu ilmiy-tadqiqot sharhi Turkiyadagi runiy bitiklar tadqiqi tarixiga bag‘ishlangan bo‘lib, bu sohada faoliyat olib borgan atoqli turk olimlari va ularning salmoqli ishlarini yoritadi. Xususan,* ***Najib Osim*** *va uning “Turklarning juda eski yozuvi” hamda “O‘rxun yodgorliklari” asarlari mazmuni batafsil tahlil qilingan. Shuningdek, Husayn Namiq O‘rkunning to‘rt jildli “Eski turk bitiklari” nashri va uning mazmuni, Tal’at Tekinning G‘arbda shuhrat*

qozongan "O'rxon turkiy tili grammatikasi" asari hamda Osman Fikri Sertkaya va Erhan Aydin kabi olimlarning so'nggi yillardagi muhim tadqiqotlari haqida ma'lumot berilgan. Sharhda bitiklarni o'rganish bo'yicha mobil ilovalar va elektron dasturlarning yaratilganligi ham qayd etilgan. Bu ish Turkiyada qadimgi turkiy yozma obidalarni o'rganishning chuqur ildizlari va uzluksiz rivojlanishini ko'rsatib beradi.

***Резюме**: Данный научно-исследовательский обзор посвящен истории изучения рунических надписей в Турции, освещая деятельность выдающихся турецких ученых и их значимые труды в этой области. В частности, подробно проанализировано содержание работ Неджипа Асима (Necip Asim) — "Очень древнее письмо тюрков" и "Орхонские памятники". Также представлена информация о четырехтомном издании "Древнетюркские надписи" Хусейна Намыка Оркуна (Husayn Namiq O'rkun) и его структуре, о всемирно известной работе Талаата Текина (Tal'at Tekin) "Грамматика орхонского тюркского языка", а также о последних важных исследованиях таких ученых, как Осман Фикри Серткая (Osman Fikri Sertkaya) и Эрхан Айдын (Erhan Aydin), включая его книгу "Свидетели Степи: Древнетюркские Надписи". В обзоре упоминается и о создании мобильных приложений и электронных программ для изучения рунических текстов. Эта работа демонстрирует глубокие корни и непрерывное развитие изучения древнетюркских письменных памятников в Турции.*

***Kalit so'zlar:** Turkiy tilshunoslik, runiy bitiklar, O'rxun-Yenisey yozuvlari, Turkiya, turk olimlari, Najib Osim, Husayn Namiq O'rkun, Tal'at Tekin, Erhan Aydin, "O'rxun yodgorliklari", Ko'kturk xoqonligi.*

***Ключевые слова**: Тюркология, рунические надписи, Орхоно-Енисейские письмена, Турция, турецкие ученые, Неджип Асим, Хусейн Намык Орхун, Талаат Текин, Эрхан Айдын, "Орхонские памятники", Тюркский каганат.*

UDC 316.77

TRADITIONAL HYPERTEXT IN JOURNALISM

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Summary: *This article discusses the issues of traditional and electronic hypertext, its classification, genetics, nature, specific features, typological description of its manifestations. Also, the period of formation of hypertext as a name, its historical manifestations, and traditional manifestations are noted. The impact of Internet journalism on the field is reviewed.*

Key words: *Internet journalism, traditional hypertext, electronic hypertext, multimedia, interactivity, hypertextuality.*

Introduction. There are three main features that distinguish Internet journalism from other media. They are multimedia, interactive and hypertext. In the Uzbek media sector, multimedia and interactive features have been studied in a special aspect across sectors, and hypertext has not been considered from a journalistic point of view. We can only find one or two articles on this topic. Therefore, studying its typology, further enriching practical examples and theories is becoming an urgent issue for the field. In particular, creating its typological description serves to further strengthen the concept related to the issue of hypertext.

Hypertext is the interconnection of materials in the context of time and space, or more precisely, "provides a non-linear presentation of a large textual work". Of course, in science, every new thing is a well-forgotten old thing. This is an axiom directly related to the fact that the projection of new technologies has been used for a long time. We have observed such a tendency in creating a typology of hypertext, that is, although hypertextuality is a new term that entered the field along with Internet journalism, its historical manifestations go back to ancient times. That is, it is both a new and an old phenomenon at the same time. On this basis, we consider it appropriate to distinguish and study two typical types of hypertext. This classification was developed based on its genetics, nature, specific features, typological description, and manifestations:

1. Traditional hypertext;
2. Electronic hypertext.

There are several reasons why we, from a journalistic point of view, divide hypertext into two types, as we noted above. They are:

firstly, this is a comprehensive, universally reflected analysis;

secondly, traditional and electronic hypertext forms are often found in mass media;

thirdly, two types of hypertext simultaneously affect the appearance, format, genre and content of the material. A journalist creating content for Internet journalism uses the unique capabilities of such a text more widely.

Literature review and methodology. A definition of change similar to our above classification, but with some specific features, is also found in the work of S.A. Stroykov. The scientist classifies hypertext from the point of view of fiction. He distinguishes it into three types: "electronic hypertext, artistic hypertext, kvazi-hypertext". He cited S.S. Panfilova's theory on artistic hypertext: "artistic hypertext is a nonlinear text system in which materials of a single content are reflected in different forms through different information channels. "In his opinion, this differentiation is associated with changes in visual, volume, and additional content. Electronic, on the other hand, emphasizes the type of hypertext that contains links. It considers quasi-hypertext as the practice of marking certain words in the text through links. In addition, A.S. Makhov in his dissertation "Typology of literary hypertexts based on German-language Internet sites" divides it into three types: "dispersed, artistic and electronic". In another source, it is divided into "networked and artistic-literary". Functionally and methodologically, it is divided into "publicistic, artistic-literary, scientific, oral-conversational". However, we believe that these divisions cannot fully reflect the

characteristic features of mass media. Therefore, dividing it into types and strengthening its study with practical examples is a factor that helps to reveal the topic more deeply.

Although the period of formation of hypertext as a name is associated with the emergence of the Internet, its historical manifestations go back to the history of text creation. Therefore, it would be a mistake to consider it a completely new phenomenon in journalism. When people first mastered the practice of using written information in text form, the traditional form of hypertext was used. But they did not know that this was a feature inherent in hypertext. At that time, the skill of naming certain events, incidents and phenomena was not formed. As a result, we can see that later its alternative variants were in circulation in the language: "adaptation sentence, link, intellectual directions (microhypertext), etc.." Because the main function of an adductation sentence or link is very similar to modern hypertextuality, providing a link to another work or address, which in turn serves to supplement the material.Imaginary hypertext (microhypertext) is the practice of the reader, while reading an article, stopping at a specific name, word, or place name in the context, mentally moving to another related context, and connecting to the original text through additional text. Similarly, based on the service of hypertext in ensuring the effectiveness of the article, we propose to call its historical appearance traditional hypertext.

Discussion. The oldest type of traditional hypertextual representation is the practice of the author using excerpts from another source, citing ideas or thoughts from the cited work, and using them in his own material. For example, Aristotle, in his book "Politics", cited Plato's thoughts on the theory of the "Ideal City" and referred to his work. In the section "Athenian Politics" of the work, the author wrote about the Athenian state system until the end of the 5th century and the restoration of democracy in 403 BC. In it, too, we can often find references to Egyptian sources. Also, in 59 BC, by order of Julius Caesar, the state prepared asturians (reporters) to deliver important political and territorial news of the day to citizens. They collected information about wars, deaths, various judgments, weddings and performances and delivered them to the people. In such reports, the asturians spread the information among the people by referring to someone or a representative body of the khan's palace. This ensured that the news would reach the people more reliably. In 1558, Michael Ensinger published a 24-page magazine in Cologne, Germany. We can also find many references in the news articles dedicated to the victory of the German army over the Spaniards. This includes references to information provided by the German government's armed forces. A Swiss newspaper called Post-och Inrikes Tidningar (PoIT) published in 1645 also promoted politics by publishing letters from correspondents who were carrying out diplomatic intelligence work, which was started by Princess Christina in consultation with Axel Oxenstäme. We can see in the letters that European intelligence officers were given direction, albeit not explicitly. This practice is still ongoing. More precisely, it is a rare phenomenon in science that historical manifestations of hypertext are used simultaneously with their modern counterparts.

Another historical form of hyperlinking is the use of references. This practice is more common in journal articles than in newspaper articles. The Journal of Scholars (Journal of Scholars) published in France in 1665 provided information about books published in various European countries in the fields of literature, philosophy, and medicine, and as a footnote, a brief description of the work was given in the last line of the text. This trend still continues today, that is, the practice of using references to articles published in scientific journals is widespread. For example, in the 3rd issue of 2019 of the journal "Khabarchi" of the Berdaq Karakalpak State University, a reference is provided to some names in the article "Textile Crafts of Khorezm in the Late Middle Ages". The reader has the opportunity to link to the context of the name in another source while familiarizing himself with the material. We can also see such references in the materials of the 3rd issue of 2015 of this journal.

No matter how strong the influence of Internet journalism on the industry is, its scope of application by users has not yet decreased. So, as mentioned above, in parallel with electronic hypertext, its traditional models are also used. For example: on April 11, 2018, the Karakalpakstan News Agency published an article entitled "The results of new ideas and reforms are finding practical expression." It contains a reference to the Resolution of President Shavkat Mirziyoyev of September 16, 2016 in a traditional form: "The Resolution "On the Program of Measures for the Further

Development of the Pharmaceutical Industry of the Republic in 2016-2023" set out relevant tasks for the development of the pharmaceutical industry, the development of technologies for the extraction of drugs imported from foreign countries from local raw materials and the creation of new drugs based on their deep processing". The context contains a Presidential Decree that is relevant to the content, and the decision served to further supplement the content of the material, which was given the direction. It also served to further strengthen the information provided by the journalist in the pharmaceutical industry. It has a fact-confirming character through an official document. On the page of the website www.karone.uz dated November 2, 2022, the message "Free lunches for students in Karakalpakstan were criticized for not being fully organized" was posted. In the context, the author uses not electronic hypertext, but its traditional form:

Context: "On November 1, at a videoconference dedicated to the field of public education, chaired by the Head of the Presidential Administration, Sardor Umurzakov, the problem of providing free lunches to schoolchildren in the Republic of Karakalpakstan was also criticized and discussed. This is reported by an UzA correspondent.

The journalist presented the content to the audience based on the UzA news. However, it is observed that the electronic hypertext was transformed into a traditional one. More precisely, the UzA material, which should have been provided via a link, was highlighted in writing and given a direction. As a result, the electronic hypertext form changed and became its traditional form. A similar tradition is also found in the practice of the website www.kruz.uz. On the page of the site dated November 11, 2023, in the message "New routes have been added to 21 more routes in the city of Nukus", the route schemes for the routes are given based on information received from the telegram channel of the Ministry of Transport of the Republic of Karakalpakstan. The journalist used the simultaneous appearance of an electronic and traditional hyperlink to the context. The practice of providing links in this form is common in Karakalpakstan's internet journalism. In particular, we can see the practice of using open methods by authors when providing links to internal sites. ..." reports hoja.uz,... Karinform.uz reports about this "routes" such as "routes" provide the reader with information about which is the main source on the topic. This method has its own advantages and disadvantages. If the author openly gives a direct link to the source, the reader is informed about where to find the "original" information. In addition, the name of another Internet publication is mentioned in another context or site address. Such a trend is considered an element of PR strategy in the Internet sphere. However, when using it, it can create some inconvenience for the reader, since it does not directly link to another context related to the text and take the audience to that address. Today, in Karakalpak internet journalism, cases of using electronic and traditional hypertext in the form mentioned above are common.

Results. We have come to the conclusion that the formation and development trends of hypertext in its traditional form should be studied in the following stages according to its historical models, functions, and services. They are the factors that have had a significant impact on the emergence of modern hypertext:

- the practice of providing written references to someone else's ideas in context;
- microhypertext;
- the practice of using links;
- openly highlighting the source.

The four stages mentioned above are the stages of the emergence, formation, and development of the hyperlink in electronic form, which are connected by the activity of providing references to someone else's work or ideas in context. But the appearance and use in context are different, one is recorded in written form, the second occurs in the reader's thinking process, the third is used in a written context, and the third openly indicates the author or source. The first tendency, that is, the practice of emphasizing someone else's opinion in the material, is often found in the oral and written context of palace heralds, which are considered the first manifestations of journalism. Those professionals went to markets where people gathered and conveyed the khan's orders and announcements to people orally. They were called heralds in history. Of course, the text used the method of transmitting messages to someone else through a link, such as "in accordance with the

khan's decree or on the basis of the order of the palace judge..." Later, the emergence of the printing press gave impetus to the creation of its written forms. This trend has not completely disappeared due to hyperlinking, and is still common in traditional media. In online journalism, some of its elements are still preserved.

During the research, we came across a new type of hypertext that is more typical of the traditional type. There is no mention of it in the scientific literature at all. Based on the characteristics and specific features of hypertext, we found it necessary to call its new type microhypertext. It is created in the process of the audience receiving the message in the text. More precisely, when the reader reads the context, he comes across a familiar surname, place name, or idea. Somebody stops here for a few seconds and further supplements the familiar event or idea related to that word or information with his micro-effects. Then he continues to get acquainted with the rest of the text.Such "stops" in the reading process can last from two to three times, and even up to ten to fifteen times, when familiarizing with linear texts. Thus, when the author is familiarizing himself with the hypertext, he creates a parallel text to the main hypertext using the microtext created in his mind. This parallel connection determines the synergy of the specific properties of hypertextuality. We propose to call the textuality of such connections that occur in the reader's mind and thinking a microhypertext. Because this phenomenon occurs very quickly in the reader's thinking. Also, other texts (created by him) that are connected to the main "original" text being read in his mind can be extremely short and fast. Therefore, we believe that it provides a basis for our assessment as a microhypertext.

www.karone.uz website. December 6, 2022. 7 facts that no one knows about the movie "Home Alone"

Context: 1. The spider on the face of actor Daniel Stern was real. The actor had to show his fear on his face without making a sound, and if he screamed, the spider could run away. This scene was successfully filmed in the first dubbing, and the sound was recorded later.

2. The Talkboy recorder in Kevin's hand was a concept model, and in reality it did not exist in real life.

3. The injuries received by Harry and Marvin are fatal in real life. This was officially recognized by doctors only in 2012.

4. Robert de Niro and Jon Lovitz were offered the role of Harry. But they refused the offer to star in the film.

5. Although the role of Kevin was written specifically for Macaulay Culkin, over a hundred children participated in the casting. The filmmakers held a casting to make sure that no one else would be suitable for the role of Kevin.

6. Macaulay Culkin's father, Kieran, also starred in the film. He played Kevin's brother, Fuller.

7. The "glass" shards that Marv walks barefoot on are made mainly of candy wrappers, and the actor even wore rubber socks on his feet.

Source: Karakalpakstan News Agency

In the above context, we can see two traditional hypertextual forms. The first is that the reader, while familiarizing himself with the "original" text, can stop when he comes to the word "broken glass", and in his mind he can pull out the candy wrappers thought up by the film director, and connect them with another context in his mind. The second is the practice of openly giving the source and directing to that address.

Links are a link technology located at the bottom of the text. It was first used in the Bible in 1568 by Richard Jugge in the form of a four-point square. It served the purpose of further supplementing the fact or information in the text and seeking to prove it with information from another context. If the reader wishes, he can search for that address or source through a special reference link, supplement the information, analyze it, or try to search for evidence in a comprehensive way. This trend has not lost its relevance. It is widely used in the practice of the media and serves as the literature used by the author. We can find the experience of using references in almost all issues of the journal "Xabarshi" of Karakalpak State University until 2016. For example: in its 3rd issue of 2015, the author gave a reference to the context of "in 1992-1994, there were such types of agriculture in Uzbekistan as collective farms, state farms, corporate companies, agro and

private firms." As a result, this text has established a connection with the context in another scientific journal. The feature of this, which is to take the reader to another source depending on the context, is reminiscent of the traditional manifestations of hypertextuality. That is, they are similar to each other in terms of the function they perform in the text. Only the appearance of the link, the nature of its placement are completely different from the link. So, the links that create hypertextuality are a historical phenomenon. It is only used in other alternative options, differing in appearance and usability. It does not have the full interactivity of today's electronic hyperlink. It is worth noting that several years later, thanks to the capabilities of internet journalism, it changed its appearance and model and acquired the ability to switch to other information or text. As noted above, there is a tendency in traditional media to openly indicate the author or source. We can even see this phenomenon in the practice of Internet journalism. For example, in the article "History of the Aral Sea Tragedy. - Why did the Aral Sea dry up?" published on August 28, 2023 on the website www.kruz.uz, the author highlights the material written by Nikita Makarenko in context, not through a hyperlink, and gives a brief summary of it. A similar practice is often used in Karakalpak internet journalism. In the Internet segment of Uzbekistan, there are many cases of using electronic hyperlinks. On this basis, we believe that our view of hypertext as a developing extension of traditional text is fully justified. Distinguishing the main differences between electronic hypertext and traditional hypertext creates a wide opportunity to create their theoretical models.

№	Traditional hypertext	Electronic hypertext
1	Characteristic of linear texts	Regarding non-linear texts
2	The reader may or may not be able to move to another text through them.	The audience establishes a connection with another source through the path specified by the author.
3	It takes time to move from the main text to another text through a link, written or verbal reference.	There is an opportunity to jump to another text via hyperlink within a certain number of seconds.
4	Interactivity, multimedia capabilities are limited.	There are many interactivity and multimedia possibilities.
5	Bounded intertextuality	Unlimited intertextual connectivity

Traditional hypertexts are a phenomenon inherent in linear texts and are often found in the practice of newspapers, magazines, television and radio channels. Through them, the reader can search for and find another source indicated in the context and supplement or not supplement the information. For this, the audience must search for and spend a lot of time on the indicated information. In addition, in traditional hypertext, interactivity is not observed much when the journalist leads the way to intertextual communication. Also, the author does not have the opportunity to combine audio and video materials with the main text. This creates limited intertextual communication.

In general, traditional hypertext is considered a historical manifestation of the electronic. Even in linear texts, the author often provides a link to another source or information. According to E.A. Chemodanova, "Hypertextuality is a new phenomenon, but a practice that has existed for centuries". Based on this idea of the author, "hypertext is a centuries-old phenomenon, that is, although they were used in paper form, they fully reflected the signs of hypertext". Today, such a view is very widespread in science. So, although "hypertext" is a new phenomenal phenomenon invented by the Internet, its historical roots go back many years. This means that hypertext elements are common to all texts written in a linear manner, and it is a widespread model throughout the world. It was only with the advent of the Internet that hypertexts changed their appearance and acquired new functions, principles, rules, and algorithms.

Conclusion. In conclusion, there are two types of hypertext typology in journalism, which are often used in the experience of journalists. Traditional and electronic hypertext logic play an important role only in reformulating the rules of information creation and exchange by gradually expanding the influence of users, while in materials it loses the strength of many paradigms. Based on the formation and development trends of hypertext in its traditional form, its historical models,

four different forms were identified: a) the practice of providing written references to someone else's opinion in context; b) microhypertext: c) the use of references; d) openly indicating the source. Such forms are characteristic of traditional hypertext and have a great influence on the emergence of electronic hypertext.

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***Rezyume**: Ushbu maqolada an’anaviy va elektron gipermatn, uning tasnifi, genetikasi, tabiati, o’ziga xos xususiyatlari, ko’rinishlarining tipologik tavsifi o’rganildi. Shuningdek, gipermatnning nom sifatida shakllanish davri, uning tarixiy ko’rinishlari, an’anaviy ko’rinishlari qayd etilgan. Internet jurnalistikasining sohaga ta’siri ko’rib chiqiladi.*

***Резюме:** В статье рассматриваются вопросы традиционного и электронного гипертекста, его классификации, генетики, природы, специфических черт, типологического описания его проявлений. Отмечается период становления гипертекста как наименования, его исторические проявления и традицищнные проявления. Рассматривается влияние интернет-журналистики на данную сферу.*

***Kalit so‘zlar:** Internet-jurnalistika, an’anaviy gipermatn, electron gipermatn, multimedia, interaktivlik, gipermatnlilik.*

***Ключевые слова:** Интернет-журналистика, традиционный гипертекст, электронный гипертекст, мультимедия, интерактивность, гипертекстуальность.*

CONTRASTING IN THE POETRY OF BEHZOD FAZLIDDIN

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Summary: *The article summarizes the method of creating contrast in image and expression, the factors of the manifestation of contrast signs in lyrics, the role of the poetic art of contrast in the illumination of imagination, the role of words with opposite meanings in the formation of the poet's creative intention in the work of Behzod Fazliddin. It examines the uniqueness of the paradox of interconcepts, the paradigm of using antonyms in poetic interpretation, and the harmony of the contradiction of words and essence in emotional perception. In fact, the degree of contrast serves to ensure the clarity of the artistic image, as well as the purpose of emphasizing, regulating and strengthening the ideological content.*

Key words: *contrast, contrastive signs, poetic art, emotional perception, lyrics, essence, word, idea, content, concept, paradox, artistic image, poetic interpretation, creativity, imagination, image, expression, paradigm, purpose, antonyms, philosophy, logic, psyche, analysis, generalization, speech, style.*

Contrast (ar. – to contrast, to oppose) is a type of poetic art that specializes in the relationship of opposite meanings. It is a means that enhances the expressiveness of the image and provides the brightness of the expressive movements, and the poet's poetic skill is demonstrated. In the course of creation, "the poet uses words with opposite meanings (antonyms) in the structure of the verse in order to express the contradictory experiences of the lyrical hero, to paint contrasting scenes, or for other similar purposes." The concepts represented by the words with opposite meanings that create the contrast may be completely opposite to each other (fire and water), the degree of contrast may not be so sharp (black and red), or they may only be contrasted conditionally, as between the participle and indivisible forms of the verb (came and did not come)"[7:306]. The stylistic unity that summarizes the contradiction of two conceptual objects defines the difference, describes the nature of each phenomenon while maintaining balance. Contrasting qualitative levels provide expressiveness of expression, colorfulness of image while illuminating the imagination. The author's aesthetic choice also shows his poetic skill, in the term that combines lexical, syntactic, stylistic and semantic levels, the task is brought to the stage of research. It uses words that are in competition with each other, constructions that serve to increase tension, and aim to renew poetic thinking:

Tez kelgan g’am ketgaymi sekin,
Armon – yaqin, orzular – uzoq,
Shodlik – qimmat, azoblar – tekin,
Gunoh tinmay qo’yadi tuzoq [4:7].

Behzod Fazliddin's work occupies a significant place in the annals of Uzbek poetry of the new era. The poet, who has already attracted the attention of readers with his poetry collections "Sacred Land" (1999), "Don't Leave Your Gardens Spring" (2000), "Let's Go to My Mother's Heart" (2003), "When Will You Bloom" (2008), "The Days I Didn't Expect, the Days I Expected" (2012), and "I Came Out of Your Dreams" (2017), creates a sense of imagination in his stylistic and formal research. Beautiful metaphors that set reality in motion, meaning that defines the philosophical-spiritual tone, a literary pleasure that mixes the heart's content and the expression of the heart, find a strange freshness in expression, and sublime ideas shimmer in the midst of feelings that drink water from wonder and enlightenment. In the poetic interpretation, which is a product of striving to perceive the creation of the heart, the scene, mood, situation, and scene are completely transformed.

The poem "Antonym World" (2006) is built on the basis of contrast, and in the descriptive interpretation, the volume of contrasts (slow-fast, near-far, joy-suffering, expensive-free) enhances the ratio, comparison, and comparison. "The low cannot reach the high, the night denies the day" - the confession of the lyrical hero deepens the suffering, the contrast of the phrase used (hungry, maybe, full) gives a sharp tone to the situation. There is another elegant meaning here: "my antonym

will be death" - confession testifies to the vitality of the soul, even the courage to ask a question (life is short, such a long road) serves to reveal the essence. "The clothes of my heart are wet" - the comparison, moved from imagination, awakens harmonious feelings in the soul, the questioning continues (why doesn't everyone love the Lonely?). The desire to see the human exterior and interior perfectly defines the ideal of every creative person, "I cry, the world laughs" - despair seems to overshadow the nature of the lyrical hero. The turmoil in the heart is actually a manifestation of suffering, the contradiction of two concepts living side by side summarizes the philosophical depth of the life problem. The power of words, the power of ideas, the uniqueness of metaphors adorn poetry.

"The artistic perfection, longevity, and charm of a work of art depend on many literary and aesthetic factors. A work of art that gives pleasure to the reader, that clearly depicts the human world, the scope of reality, and emotions, and at the same time, that figuratively interprets universal human problems in a unique style and in its own artistic language, is considered the best, regardless of the genre or creative method in which it is written. "The science of literary criticism has a certain experience in approaching works of art based on such requirements and analyzing them based on such theoretical criteria" [3:36]. A new poetic exploration of existence distinguishes the nature of each creator, because the transformation of form, the movement of meaning, the pursuit of originality of expression elevates a work of art to the level of art. On the other hand, feelings live in a circle of contradictions, the deeper the spiritual experience becomes, the more it is strengthened in a series of contradictions. The tendency to continuous research of the process directs the management of the creative nature to serious reforms, life experience acts as a means of organizing a specific goal and task in the aesthetic world of the poet:

Hali sen bormisan, yo’qmi – bilmayman
Bilganim – gunohim bo’yimdan baland.
Nega og’ulardan hazar qilmayman,
Bu qashshoq ko’zlarim nelar bilan band? [4:8].

In Behzod Fazliddin's work, the poetic art of contrast is manifested as one of the most effective and widely used means of expression, in most of his works the poet effectively uses the current stylistic unity to reflect the impressions formed under the influence of the feelings and reality that are going through his mind. "The cup of life was full, the heart was not full" - the contrast created by the verb form with and without participle characterizes a sincere confession, the connection of affirmation and negation (are you there, are you not there) opens the way to a vivid expression of imagination. The generalization of real feelings through the opposition of concepts, words, and meanings adorns the author's poetry, and as a phenomenon adjacent to metaphorical thinking, contrasting signs perform the function of ensuring creative and spiritual integrity. "Are you still there or not - I don't know, I know - my sin is higher than my height" - the paradox of philosophical generalization puts a barrier between "I" and "you", materializes the sadness that seeps from the heart's disappointments.

"The expressive possibilities of words are very wide, but the degree of their realization directly depends on the creative skill, or rather, on the sharpness of his aesthetic vision. That is, a poet or writer who has the ability to see the world with a painterly gaze seeks an opportunity to describe what he sees through words, and in turn, his creative searches expand the expressive possibilities of words" [6:257]. The synthesis of expression and image, materialized on the basis of the national language, acquires an individual essence in the creative nature, emphasizes the artistic speech characteristic. In this case, the choice of words combines the levels of both philosophical generalization and artistic image definition. Emotional coloring and expressive intensity prepare the author for the purposeful use of the lexicon:

Kimlarning ko‘ngliga qarab kun ko‘rdim,
Yalinib bormayman Baxtning yoniga
Kulib baxtsizlarga xalaqit berdim,
Yig‘lab baxtlilarning tegdim joniga [4:49].

Behzod Fazliddin's poem "Tushunmovchilik" (2006) consists of two stanzas, the text begins with the lines "It happened, I don't cry, it happened - I don't laugh." The contrast of words (I don't cry-I don't laugh) increases the sharpness of the philosophical observation, the volume of the contrast used side by side (laughing-crying, unhappy-happy) thickens the imagination. The emotional pressure on the subject of the image keeps the reader in suspense, the author does not create a new image, but makes a purposeful choice of words. Striving for independence of expression, the poet expands the creative possibilities of the concept, and with the help of paradox increases aesthetic expressiveness. "In a tazod, words with contradictory meanings are used to create contrasting images" [2:388], the stylistics of the use of concepts and expressions transforms the means into an end. The stylistic units that determine the specific features of the poetic language ensure the clarity and objectivity of the poetic image.

Tazod, which actively participates in creating the colorfulness, emotional perception, and conciseness inherent in the content, acts as a form in relation to the idea and as a content in relation to the language, and therefore, the meaning is enhanced in the means of images that decorate artistic speech.

"Each object in a poem leads us in the right direction, but it does not have the certainty of a signpost. While showing the way, the object does not cease to live its own inexhaustible and indescribable life. It is this metaphysical residue that allows the poet to tell the wisdom of the world in a language that he does not understand" [5:125]. Image and expression do not enrich the worldview, but seek to reform it. The subtle and profound imagination intersects at the crossroads of knowledge, the medium does not subject the image calendar to analysis, but is absorbed into thought. The experience of everyday life serves as material for figurative-expressive units, non-conscious perception directs philosophy to logic.

In general, the poetic art of tazod brings the image to the level of aesthetic expressiveness, the contrast signs, which are widespread in practice, firstly, generalize the contradiction of concept, detail, line, secondly, clarify the emotional attitude to the subject of the image, thirdly, control the composition of the image and the course of expression, fourthly, reveal the individual essence of artistic speech, fifthly, help to complete the poetic image. The aesthetic tool that provides the contrast of imagination, concept, word and expression allows you to exaggerate the image, enhances the expression as an ornament of the idea. In the work of Behzod Fazliddin, the poetic art of tazod characterizes the nuance of the verb form, directs the contrast of a word or phrase to its logical perfection in artistic observation.

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Rezyume: *Maqolada tasvir va ifodada ziddiyat hosil qilish usuli, lirikada kontrast belgilar namoyon bo'lish omillari, tasavvur yorqinlashuvida tazod she'riy san'ati vazifadoshligi, qarama-qarshi ma'noli so'zlar shoir ijodiy niyati shakllanishida tutgan o'rni Behzod Fazliddin ijod timsolida umumlashtiriladi. Unda tushunchalararo paradoks o'ziga xosligi, poetik talqinda antonimlarni qo'llash paradigmasi, hissiy idrokda so'z va mohiyat ixtilofi uyg'unligi xususida mushohada yuritiladi. Aslida zidlash darajasi badiiy obraz aniqligini ta'minlashga xizmat qilishi barobarida g'oyaviy mazmunni ta'kidlash, tartibga solish hamda kuchaytirish maqsadini ham ko'zda tutadi.*

Резюме. *В статье обобщается использование приёма создания противоречия в изображении и выражении, факторы проявления контрастных признаков в лирике,*

соотнесённость искусства тадзода с усилением образности, а также роль антонимов в формировании творческого замысла поэта на примере творчества Бехзода Фазлиддина. В ней рассуждается об особенностях межпонятийного парадокса, парадигме применения антонимов в поэтической интерпретации, а также о гармонии расхождения между словом и сущностью в эмоциональном восприятии. Степень противопоставления, по сути, служит уточнению художественного образа, одновременно преследуя цель подчеркнуть идейное содержание, упорядочить и усилить его.

Kalit so‘zlar: *tazod, kontrast belgilar, she’riy san’at, hissiy idrok, lirika, mohiyat, so’z, g’oya, mazmun, tushuncha, paradoks, badiiy obraz, poetik talqin, ijod, tasavvur, tasvir, ifoda, paradigma, maqsad, antonimlar, falsafa, mantiq, ruhiyat, tahlil, umumlashma, nutq, uslub.*

Ключевые слова: *тадзод, контрастные признаки, поэтическое искусство, эмоциональное восприятие, лирика, сущность, слово, идея, содержание, понятие, парадокс, художественный образ, поэтическая интерпретация, творчество, воображение, изображение, выражение, парадигма, цель, антонимы, философия, логика, психология, анализ, обобщение, речь, стиль.*

CHALLENGES IN TRANSLATING ENGLISH PROVERBS INTO OTHER LANGUAGES

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Summary: *Translating English proverbs into other languages is challenging because proverbs carry cultural, historical, and stylistic meanings that go beyond their literal wording. Many refer to traditions or concepts that do not exist in the target culture, making direct translation ineffective. Differences in grammar and structure can also change the proverb's rhythm or figurative meaning. Since proverbs often include metaphors and wordplay, translators must look for functional equivalents that preserve the message and emotional impact. Therefore, successful translation usually requires creative adaptation to keep both meaning and naturalness.*

Key words. *Translate, proverb, culture, examine, semantic, stylistic, equivalent, education, analyze, pronunciation, grammar, and vocabulary.*

Introduction. Proverbs and sayings are integral components of any language, reflecting the collective wisdom, culture, and worldview of its people. Translating them from one language into another presents complex challenges, as they are deeply rooted in cultural and linguistic traditions. The centuries-old experience of intercultural communication shows that a translator must not only understand the literal meaning of a text but also master the phraseological richness of both the source and target languages.

The English and Karakalpak languages differ significantly in grammar, syntax, and semantics. For instance, English prohibits the use of double negatives, while Karakalpak allows them. Word order and idiomatic structure also vary greatly. Therefore, translating English proverbs into Karakalpak requires more than word substitution—it involves the transmission of cultural meaning and emotional tone.

Methods. The study employs a comparative linguistic method focusing on English and Karakalpak proverbs. It involves:

-Literal translation analysis – examining how direct word-for-word translation affects meaning.

-Equivalence search – identifying identical or functionally similar proverbs in Karakalpak.

-Contextual interpretation – analyzing how meaning shifts depending on cultural background.

-Pedagogical application – studying how proverbs can be used in language learning to enhance pronunciation, grammar, and vocabulary acquisition.

To illustrate translation methods, examples of English proverbs were analyzed and compared to their Karakalpak equivalents or explanatory renderings.

Linguistic and Cultural Challenges. Direct translation of proverbs often results in loss or distortion of meaning. For instance, the English proverb *"The pot calls the kettle black"* literally translated into Karakalpak loses its figurative sense. However, the Karakalpak equivalent *"Whose cow would moo and yours would be silent"* conveys a similar moral implication about hypocrisy. When translated back into English (*"Anyone's cow may moo, but yours should keep quiet"*), it differs significantly from the original, demonstrating how meaning evolves across languages.

Translation Strategies. The study identified several effective strategies:

a. Identical Phraseological Equivalents – when both languages share similar expressions.

b. Analogous Proverbs – using a proverb with a different image but similar meaning.

c. Tracing (Word-for-Word Translation) – suitable for universal or biblical expressions.

d. Explanatory Translation – combining tracing with brief interpretation.

e. Lexical Substitution – using one-word or partial equivalents when no phraseological counterpart exists.

These strategies depend on whether a cultural or emotional equivalence can be maintained. Sometimes, translators even enrich the target language by introducing new idioms derived from other cultures.

English proverbs can serve as effective teaching tools:

-For pronunciation practice: *The belly has no ears, Great boast, small roast, Grasp all, lose all* (training vowels and consonants).

-For grammar exercises: *The chain is no stronger than its weakest link* (comparative forms); *First come, first served* (numerals and participles).

-For vocabulary and word formation: *Let the dead bury the dead*; *Butter to butter is no delight* (conversion and lexical patterns).

Proverbs are also thematically useful for lessons such as "Health" (*Good health is above wealth*) or "Labor" (*No pains, no gains*). Their rhythmic and figurative nature facilitates memorization and strengthens cultural understanding.

Discussion. The comparative analysis demonstrates that the translation of proverbs goes beyond linguistic transfer—it requires cultural adaptation. The translator must consider idiomatic resonance, emotional tone, and contextual relevance. Complete equivalence between English and Karakalpak proverbs is rare, so translators often rely on analogous or explanatory forms.

In education, proverbs serve as valuable linguistic tools that combine cultural knowledge with language skills. They help students grasp idiomatic English usage, enrich vocabulary, and understand native speakers' mindset. By analyzing and comparing proverbs from different languages, learners develop cross-cultural competence and critical thinking.

Conclusion. Translating English proverbs into other languages, particularly Karakalpak, presents numerous linguistic and cultural challenges. Literal translation often fails to convey the intended figurative meaning, requiring the translator to search for equivalent or similar expressions. Where no direct correspondence exists, explanatory or contextual translation becomes essential.

In language education, proverbs are not only linguistic artifacts but also pedagogical instruments that aid in mastering pronunciation, grammar, and vocabulary. Their use deepens students' understanding of cultural values and fosters appreciation of the expressive power of language. Ultimately, studying and translating proverbs enhances both linguistic proficiency and intercultural awareness.

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Rezyume: *Ingliz maqollarini boshqa tillarga tarjima qilish qiyin, chunki maqollarda ko'pincha maqsadli tilda mavjud bo'lmagan madaniy ma'nolar, obrazli ifodalar va tarixiy ishoralar bo'ladi. So'zma-so'z tarjima ko'pincha to'g'ri ma'noni yetkazmaydi, shuning uchun tarjimon madaniy jihatdan mos keladigan ekvivalentlarni topishi kerak. Asosiy qiyinchilik — asl maqolning ma'nosi va uslubiy ta'sirini saqlab qolgan holda uni maqsadli tilda tabiiy jaranglatishdir.*

Резюме: *Перевод английских пословиц на другие языки сложен, потому что пословицы содержат культурные смыслы, образные выражения и исторические отсылки, которые*

часто отсутствуют в языке перевода. Дословный перевод редко передаёт правильный смысл, поэтому переводчику необходимо подбирать культурно соответствующие эквиваленты. Основная трудность заключается в сохранении как значения, так и стилистического эффекта оригинальной пословицы, делая её естественной для языка перевода.

***Kalit so‘zlar**: Tarjima qilmoq, maqol, madaniyat,tekshirmoq / o‘rganib chiqmoq, semantik, uslubiy, ekvivalent, ta’lim, tahlil qilmoq, talaffuz, grammatika, lug‘at boyligi / leksika.*

***Ключевые слова**: Переводить,пословица,культура,изучать/ исследовать, семантический,стилистический,эквивалент,образование,анализировать,произношение, грамматика, словарный запас / лексика.*

BIONIC PATTERNS IN JEWELRY DESIGN

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Summary: *This article discusses the types of symmetry in jewelry. Special attention is paid to the branching processes in wildlife and how they affect the design of jewelry. The fundamental morphological characteristic of natural systems is branching. Different types of branching are analyzed, such as: "stick", "knot", "fork", "socket", "whorl" and "bundle". With the help of these types of branching, the shape and structure of jewelry changes. Examples from nature and jewelry are given.*

Key words: *bionics, natural systems, branching, jewelry, constructive systems.*

Bionic jewelry design is a field based on the study of natural shapes, structures, and processes to create aesthetically pleasing and functional products.

Bionics in design allows you to be inspired by nature, transforming its forms into artistic images and technological solutions.

What are bionic patterns?

Bionics (from the Greek. bio - life and techno - art) is the science of applying the principles of living nature in technical and artistic solutions. Bionic models are permanent forms, systems, and principles observed in nature that can be translated into design.

Examples of bionic shapes in jewelry design:

Natural object	*Bionic principle*	*Application in jewelry*
Shell (spiral)	The logarithmic spiral	Compositions with curls, shell shapes
The honeycomb	Hexagonal symmetry	Geometric patterns, modular elements
Flower petals	Symmetry, plasticity	Floral motifs, dynamic curves
Insect wings	Lightness, structure	Delicate designs, thin frames
Crystals	Geometry, repetition	Minimalism, faceted shapes
Tree bark, foliage	Texture, rhythm	Surface textures, matte or engraved elements
Skeleton of animals, fish	Frame, ribs	Open structures, durability with lightness

The main bionic principles that can be observed in jewelry design are:

1. Ergonomics and comfort. Natural shapes are comfortable for the body, and products modeled after them fit better.
2. Structural optimization. Durability and lightness at the same time.
3. Aesthetics of natural symmetry. The harmonious forms of nature are perceived as beautiful.
4. Functionality through the form. There are no unnecessary elements in nature, and this inspires a concise but expressive design.
5. Adaptation to the environment. Decorations, like organisms, can "adapt": transformers, multifunctional elements.

Why is bionics popular in jewelry design?

• People are intuitively drawn to natural forms.

Bionics provides an inexhaustible source of inspiration.

• It combines aesthetics and rationality

• Eco-trends and the pursuit of sustainable design increase interest in bionic principles.

Ideas for jewelry with bionics: a ring in the shape of an unfolded fern leaf, a pendant resembling the structure of a snowflake, earrings that repeat the shape of butterfly wings, a bracelet imitating the curve of a snake or spine, a brooch stylized as coral or a starfish.

Symmetry in jewelry is an important artistic and technical technique that ensures visual harmony, aesthetic perfection and emphasizes the jeweler's skill. It plays a key role in both classic and modern design.

Types of symmetry in jewelry:

1. Mirror (axial) symmetry. The most common type. One side of the decoration is a mirror image of the other. Examples include pendant earrings, necklaces, brooches, rings with a central stone and a uniform cut.

2. Radial symmetry. The elements are arranged around the center in a circle. Examples can be brooches in the form of flowers, cufflinks, medallions, rosettes.

3. Translational symmetry. A repeating pattern along an axis. An example is bracelets with a repeating pattern, necklaces with evenly spaced elements.

4. Rotary symmetry. The patterns are repeated when rotated at a certain angle. As an example, these are decorative inserts, floral motifs, and emblems.

Symmetry is very important in jewelry art. Symmetry is perceived by people as something beautiful and harmonious. It is pleasing to the eye and creates a sense of order.

Symmetry helps to focus attention on the central elements - stones or enamel. A balanced arrangement of details is important for comfort and visual perception.

Symmetry is associated with perfection, eternity, and spiritual balance (for example, in Oriental and religious symbolism). Although symmetry has long been the "gold standard", modern jewelers are actively working with asymmetry to add dynamics, novelty and expressiveness.

Branching in jewelry is a concept that can be interpreted in different ways depending on the context.

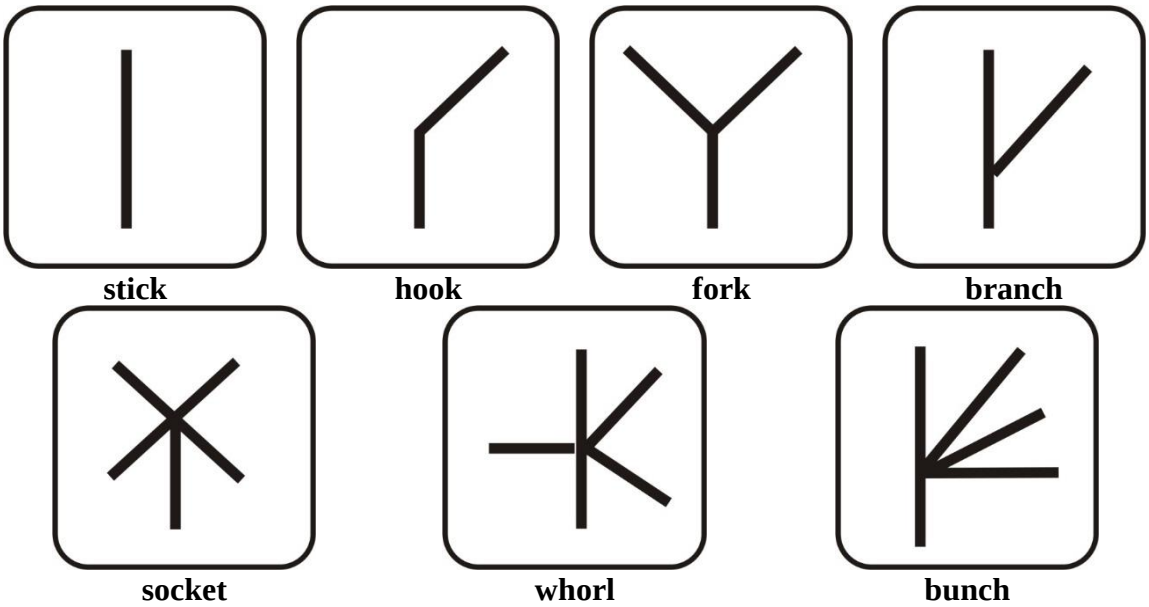


Fig. 1. Types of branching

Here are a few possible interpretations.:

1. Branching as a design element. Jewelry often uses elements that mimic branches, leaves, or other natural shapes. It symbolizes life, growth, evolution and connection with nature. For example, rings, earrings, or necklaces in the shape of branches can be decorated with precious stones or enamel, creating elegant and delicate patterns. This style is popular in nature-inspired collections in both classic and modern designs.

2. Branching in the technique of "mesh" or "weaving". In jewelry, the term "branching" can refer to weaving and netting techniques in which metal elements "branch" from each other, creating

intricate patterns. It can be hammered gold, patterned chains, or even filigree (a thin weave of metal threads).

3. Branching as part of multi-layered structures. Branches are sometimes used in jewelry to create multi-layered designs. For example, rings or bracelets with several parts forming complex compositions, for example, branches branching in different directions.

4. Branching in symbolism. Branching can be an important element of jewelry symbolism. Trees and branches often symbolize life, fertility, family ties and eternity. For example, the tree of life is a popular motif often used in jewelry and tattoos.

The term "stick" type branching in jewelry is not an established and widespread concept, at least in classical jewelry terminology. However, you can try to interpret this expression based on the context and possible associations.

Possible interpretations of the term "stick" type branching:

1. The shape of decorative elements. The shape of decorative elements. This can be, for example, a rod or branch-like element in decorations with natural ornaments (leaves, branches, corals). This can also be seen in compositions where the central element is the main rod (stick), from which smaller elements (branches, chains, pendants) branch off.

2. The type of construction. This may refer to a type of jewelry in which the central rod (stick) serves as a supporting element, and other elements are attached as branches. Example: earrings or brooches in which a long vertical element serves as the base. A necklace with a central vertical element and elongated side branches.

3. Chains and bracelets. Some types of weaves or link designs may resemble rod–shaped elements interconnected with branching, especially in designer jewelry with asymmetry and geometry.



Fig. 2. Examples of stick-type branching in nature and jewelry

A hook–type branching in jewelry is a type of locking or locking mechanism used to fix jewelry such as earrings, chains, bracelets, and necklaces. It performs not only a utilitarian function (holding jewelry on the body), but can also be a decorative design element.



Fig. 3. Examples of hook-type branching in nature and jewelry

The main characteristics of the "hook" type branching:

1. The form. It has a curved shape resembling a hook. One end of the element is inserted or hooked onto the mating part (loop, ring, eyelet, etc.).
2. Function. Provides a secure but easy-to-unfasten connection. It is often used in broach earrings, hook earrings, bracelets, necklaces, and sometimes as part of pendant elements.
3. Advantages. Simplicity of construction. The speed of fastening and unbuttoning. Reliable when wearing (with the correct shape and depth of the hook).
4. Disadvantages. It may not be the safest type of attachment (for example, with sudden movements, the hook earring may fall out if there is no additional fixation). It requires precision in manufacturing so that the hook does not deform and holds the jewelry securely.

Usage examples:

Decoration	Example of a "hook" branching
earings	Hoop earrings, French lock
Necklaces	Hook clasp
Bracelets	Hook-and-eye closure (more often in ethnic styles)
Suspensions	The suspension element is attached to the chain through a hook

In jewelry, the term fork branching refers to an element of jewelry design in which one rod (or part of the rim) is divided into two or more separate parts resembling fork prongs.

This can have both aesthetic and functional significance.

The main features of fork-type branching in jewelry:

1. Fixing the stones. One of the most common forms is a two–pronged or multi-pronged fastening, where the insert (stone) is held by "krapans" located from each other. Example: krapan fastening, where each "krapan" holds a part of the stone.

2. Decorative element. Branching is used in design as a stylized element of branches, roots, and ornaments. This is especially true for organic styles such as Art Nouveau or natural motifs.

. The functional part of the structure. It is used in bracelets, rings, or earrings to: separate and direct links, create flexibility or mobility of the structure, and balance weight.



Fig. 4. Examples of fork-type branching in nature and jewelry

Example: in a fork-type ring, the rim can split in the upper part and form two "horns" into which a stone is inserted.

In jewelry, a branch of the "knot" type is not usually found in jewelry, but if we consider it from the point of view of jewelry design and structure, we can assume the following:

Twig branching is perhaps a method of creating or designing jewelry, in which the main line or structure of the product branches into smaller branches, like the knots of a tree. Such branching can be used in design to create the effect of naturalness, natural shape, for example: in rings, bracelets or pendants, where the main line branches into several thin, elegant "twigs" or "knots"; in ornaments

resembling branches, vines, tree bark or plant motifs; in filigree or delicate work, where thin metal weaves are used.



Fig. 5. Examples of "knot" type branching in nature and jewelry

The use of a branch of the "knot" type in jewelry creates the effect of lightness and grace, gives the decoration a natural, natural look, and is used for artistic expression of plant and organic forms.

If we are talking about the technology or method of fastening, then the context should be clarified – perhaps this is part of the method of connecting "branched" elements to insert stones or other parts into the main element.

In jewelry, rosette branching is a method of connecting several chains, threads, or jewelry elements at one point using a special fastener called a socket.



Fig. 6. Examples of "rosette" type branching in nature and jewelry

A "rosette" is a metal element (often in the form of a small flower or star) that serves as a distribution point. Several chains or threads are attached to it, creating the effect of the decoration radiating from the center, like the petals of a flower.

The main characteristics of the "socket" type branching:

• Junction point: usually in the central part of the jewelry – a pendant, necklace, or bracelet.

• Number of branches: can be from two or more.

• Function: allows you to beautifully and securely connect multiple threads, creating complex compositions.

• Materials used: usually gold, silver or platinum.

Application in jewelry:

• In necklaces with several chains of different lengths.

• In bracelets with multiple strands.

• In suspensions where several elements need to be connected.

The "whorl" type of branching is a unique technique in jewelry design, in which many elements radiate from a central point or axis, resembling a crown or a star. The name comes from the botanical term for a multitude of leaves or flowers growing from a single point around the stem.



Fig. 7. Examples of "whorl" type branching in nature and jewelry

In jewelry, the "whorl" type of branching is manifested as follows: several twigs, petals, stones or decorative elements emanate from a single central point, forming a symmetrical composition similar to a star, flower or wreath. This technique is often used in rings, earrings, pendants, and bracelets to create a "diverging ray" or "wreath" effect.

Examples and features: in a ring with a central stone, there are "rays" of small stones around it, in earrings symmetrical twigs or pendants come out of the central attachment. It is often found in vintage and classic products, emphasizing the elegance and complexity of the work.

In jewelry, "bundle" branching often refers to a method in which several elements (such as wires, chains, or threads) are arranged and joined at a single point, creating a "bundle" effect - as if several twigs or strands are assembled into a compact and decorative knot or pattern.






8. Examples of "bundle" type branching in nature and jewelry

In the context of jewelry, bundle branching is a way of distributing or branching the elements of a piece. It means that several thin elements (wires, threads) come together, creating a dense knot or cluster resembling a bundle of grass, hair or twigs.

Application and features:

• The bundle type of branching is often used to create decorative accents, for example, in rings, pendants or bracelets.

• Can be used to connect multiple chains, creating the effect of layering and volume.

• It is used in weaving techniques and in filigree, when thin wires are assembled into a bundle and then fixed.

• Allows you to create complex and elegant shapes by playing with the number and location of branches.

This type creates a visual effect: the bundle looks like a compact, neat pattern that creates the impression of a dense collection of elements, and can serve as a transition from subtle and elegant details to more massive parts of the product.

From all this work, it can be concluded that structural elements play an important and significant role in jewelry design. Without them, it would be impossible for many plants and animals to exist. Similarly, without knowledge of such systems, people would not be able to reproduce this beauty in architecture, landscape design, jewelry, and any other activity.

A characteristic feature of the systems under consideration is the structurality of spatial grids, as if reflecting the universal principle of the structurality of the material world.

The subject of bionics is the study of the principles of building the functioning of living systems for creating jewelry.

Bionics is an innovative field of designing artificial objects that takes the best from nature: reliefs, contours, principles of shaping and interaction with the outside world.

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Rezyume: *Ushbu maqola zargarlik buyumlaridagi simmetriya turlarini ko'rib chiqadi, bunda tabiatdagi tarvaqaylab ketish jarayonlari va ularning zargarlik buyumlari dizayniga qanday ta'sir qilishiga alohida e'tibor beriladi. Tarmoqlanish tabiiy tizimlarning asosiy morfologik xususiyatidir. Shoxlanishning har xil turlari, jumladan, "tayoq", "tugun", "vilka", "rozet", "whorl" va "to'plam" tahlil qilinadi. Ushbu turdagi shoxchalar zargarlik buyumlarining shakli va tuzilishini o'zgartiradi. Tabiat va zargarlik buyumlaridan misollar keltirilgan.*

Резюме:. *В данной статье рассматриваются виды симметрии в ювелирных изделиях. Особое внимание уделено процессам ветвления в живой природе и как они влияют на дизайн ювелирных изделий. Фундаментальной морфологической характеристикой природных систем является ветвление. Проанализированы разные виды ветвления, такие как: «палка», «сучок», «вилка», «розетка», «мутовка» и «пучок». С помощью этих типов ветвления меняется форма и структура ювелирных изделий. Приводятся примеры из природы и ювелирных изделий.*

Kalit so‘zlar: *bionika, tabiiy tizimlar, tarmoqlanish, zargarlik, struktura tizimlari.*

Ключевые слова: *бионика, природные системы, ветвление, ювелирные изделия, конструктивные системы.*

CAUSES, CONDITIONS, AND PREVENTION OF HOOLIGANISM

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Summary: *This article examines the causes and conditions of hooliganism crimes, their social danger, and their negative impact on public morality. It also discusses preventive measures and provides suggestions for improving legal and social mechanisms to combat and prevent such offense.*

Key words: *hooliganism, causes of crime, conditions, prevention, social danger, legal responsibility, morality, public order, aggression, youth, criminality, offense, education, social control, legal culture.*

As noted in the scholarly literature, the principal foundations for preventing crime considered both as a phenomenon and as a system of specific types, categories, and groups of offences have long been developed by criminologists in our country, with the corresponding theoretical frameworks firmly established. The scientific basis for studying issues related to crime prevention and the prophylaxis of legal violations has been shaped by the extensive body of work produced by numerous researchers in the field.

The orientation of an individual's behaviour is shaped under the influence of the social environment that continuously surrounds them. Consequently, when distinguishing the principal object of crime prevention, we conceptualize it as the unity of the individual and the social milieu. In this context, the relationship between "the person and the environment" is considered central.

Within the system of hooliganism prevention, the primary responsibility rests with the internal affairs bodies. Their activities are primarily directed toward preventing gross violations of public order that manifest as overt disrespect for society, averting street assaults against citizens, and eliminating offences committed in everyday life and during leisure time [1, 71–73].

Through operational-search measures, the underlying causes and conditions facilitating hooliganism are likewise eliminated; most importantly, the individuals who planned and prepared such acts are identified. Essentially, this reflects the integration of preventive efforts with operational-search activities. All undertaken actions are ultimately directed toward preventing manifestations of hooliganism.

From a conceptual standpoint, the principal issue in the institutional framework of hooliganism prevention is the legal regulation of this sphere. Three fundamental aspects must be addressed: the rights and obligations of the subjects implementing preventive measures; the rights and obligations of the individuals to whom these measures are applied; and the rights and obligations of victims of criminal offences. Specialized preventive activities carried out by authorized agencies, aimed explicitly at precluding acts of hooliganism, constitute specialized preventive measures.

These measures encompass targeted actions specifically designed to prevent the commission of hooliganism. It should be noted that the special prevention of hooliganism presupposes, first and foremost, the identification of the subject of preventive influence in cases where the object of such targeted and specific impact is explicitly the phenomenon of hooliganism itself. However, in practice, its implementation requires not only internal institutional measures (for example, within a single agency such as the internal affairs bodies), but also external institutional intervention, involving the unified law-enforcement system — including the prosecution service, the courts, the Ministry of Internal Affairs, the Ministry of Justice, and other relevant bodies — whenever necessary to prevent acts of hooliganism.

In other words, the coordinated efforts of these agencies, services, and structural units are directed toward a goal-oriented preventive activity aimed at eliminating the conditions conducive to hooliganism and precluding its occurrence.

The distinctive feature of general social measures for the prevention of hooliganism lies in the fact that they are not directly aimed at counteracting negative phenomena—specifically, hooliganistic behavior—but rather serve as supportive mechanisms for such preventive activities. In essence,

general social preventive measures constitute the foundational basis for the entire system of special preventive interventions that are directly and explicitly oriented towards preventing the commission of criminal acts.

Hooliganism represents a specific form of social reality; accordingly, the means of combating it must lie within the domain of socio-legal interventions, the effectiveness of which is largely contingent upon the successful resolution of broader social issues. This principle applies equally to both general and individual preventive efforts against hooliganism.

Within the framework of general prevention, members of society are informed about normative rules of conduct, while particular emphasis is placed on the fact that criminal behavior is subject to legal punishment. With regard to acts of hooliganism, their manifestation within the general structure of crime can be described as follows: they represent a system of targeted interventions directed at individuals who maintain an anti-social lifestyle, whether in pursuit of their own interests or those of others. In other words, the prevention of hooliganism encompasses a set of measures aimed at identifying, examining, and eliminating (neutralizing) the causes and conditions conducive to these offences; detecting and analyzing individuals who lead an anti-social way of life and are inclined to engage in hooliganistic behaviour; maintaining a relevant registry of such persons; and applying necessary preventive influence to them.

The prevention of hooliganism constitutes a specific form of social prevention that involves implementing a system of purposeful measures designed to ensure public order and public safety, as well as to avert corresponding criminal encroachments. Prevention can be examined both as a theoretical framework and as a form of practical activity. Moral (ethical) and general legal preventive measures (in the broad sense—prevention of all forms of delinquency) may also be considered within this context. The most overarching concept, however, is that of **social prevention**. It should be emphasized that the varieties and directions of preventive activity are highly diverse.

Returning to the issue of hooliganism prevention, it is evident that within the framework of general prevention, various sectors and directions are distinguished, including the criminal-law sphere, criminal-procedural and penal-executive domains, as well as criminological directions. Moreover, within this context, there exists a broad scope for general social preventive activities such as moral (ethical) prevention, psychological, pedagogical, medical (including psychiatric) prevention, and so forth. The general preventive activities conducted by law-enforcement agencies may likewise be included within this framework. In all cases, the active use of mass media represents an integral component of these preventive measures. Within the indicated domains, it is also appropriate to consider general victimological prevention, aimed at individuals who may suffer from criminal offences. Taken together, all these measures constitute a large-scale activity implemented at the level of the state, encompassing both governmental and societal involvement. Such preventive actions extend to the entire population of the country; however, taking into account the specific nature of individual criminal acts, particular attention is directed toward specific manifestations of criminal behaviour.

General prevention of hooliganism is actually performed work aimed at influencing members of society with measures aimed at general prevention, that is, a measure of suspension. In other words, information is "sent" to the population on how to behave in order not to be punished in the criminal procedure for hooliganism.

Some authors believe that general prevention affects the psychology of law-abiding people more than the psychology of criminals.

Implementation of general preventive measures aimed at reducing the number of hooliganism still, on the one hand, prevents people from committing these crimes, and on the other hand, protects citizens from becoming victims of hooliganism.

According to our data on individuals held accountable for hooliganism, 28% of them are completely unaware of the concept of "general prevention," 47% believe this measure was prescribed for other individuals, and 25% say it was a deterrent, but the situation was even worse.

The results of questioning repeat offenders convicted of hooliganism are quite different, but they also know little about the effectiveness of special and general prevention. Here, the idea of

preventing hooliganism in general is reflected not only within the framework of criminal legislation, court verdicts, etc., but also in the detection of crimes, in other words, in all measures ensuring the certainty of punishment.

Individual prevention is always linked to the individual. Individual prevention is characterized by the specific features of working with each specific individual. At this level, only individual preventive measures related to personality and individual behavior are taken. General preventive measures are relatively broad and not very precise. Individual prevention is always specific and targeted at specific individuals. Furthermore, all practical conclusions and results related to criminal behavior are clarified. There is no contradiction between general and individual prevention here [2, 20].

Preventing and preventing hooliganism is the most important task. However, to prevent hooliganism, it is crucial to identify individuals engaged in criminal behavior. In practice, crime prevention occurs in two cases: when negative traits are already present, and when such instances have not yet taken their place and the possibility of their occurrence has emerged. However, it is possible to identify these negative traits, identify individuals with these traits, register these individuals, and then implement preventative measures against them. Here, the individual's "degree of social immorality," their social experience, criminal connections, and similar factors are taken into account.

Studying practice serves as a signal for early initiation of hooliganism prevention. An individual's antisocial act, the pursuit and development of criminal activity, and, in general, their unlawful behavior, which can lead to a criminal offense, could occur.

Observations show that individuals engaged in a criminal life are similarly influenced by hooliganism. Analysis of practice shows that the basis for initiating the prevention of offenses by such individuals can be both the negative influence of those engaged in criminal activity on them and their own influence on other law-abiding individuals. Here, the fact itself is necessary - there is an opportunity, now it is necessary to directly prevent hooliganism.

Early disease detection, i.e., prognostic information, is essential for determining the onset of harassment. Practice officers are well aware that preventing and stopping harassment at its initial stage and even when it has matured yields good results. However, this initial stage is often undetected.

It becomes known only during the design or preparation stage of the harassment. If criminal behavior is not detected in a timely manner, this does not mean that the prevention work is generally delayed. According to scientists, crime prevention is characterized by multifaceted functions: protective, regulatory, educational, etc. All of them are interconnected. Each of them plays its own role.

The protective and nurturing functions are particularly specific to individual crime prevention. A distinctive feature of the latter is its focus on individual work with individuals prone to committing crimes. The main thing for individual prevention is personalization. In addition, there is a separate operational-search preventive service of great practical importance, which has special measures in its "treasury." It is both independent and considered within the framework of individual prevention of criminal behavior. The object of preventive influence is the offender, both on a continuous basis and in each specific month.

Individual prevention of hooliganism is primarily aimed at conducting targeted work with each particular person, which makes it similar to operational-investigative activity. Among other aspects, it is applied when an individual develops an intention to commit an act of hooliganism; moreover, if such a person exhibits verbal aggression, this may additionally confirm the presence of corresponding hostile motives.

Individual preventive measures are directed, on the one hand, at the very person in whom an attempt to commit hooliganism has been detected, and, on the other hand, at those within this person’s immediate environment (when accomplices or individuals assisting in the commission of hooliganism are present). This type of prevention is also oriented towards persons who, due to victimogenic behaviour, may potentially become victims of such offences.

The principal components of the individual prevention of hooliganism include:

- a thorough study and assessment of the persons subjected to preventive measures;
- the identification of the main preventive actions and interventions through which the prescribed work will be implemented;
- the organisation (or design) of the preventive process itself and the subsequent supervision over the individual.

It should be emphasised that *"the most important challenge in the individual prevention of crime lies in determining the precise circle of persons for whom such preventive measures are genuinely necessary."* By its very nature, individual crime prevention constitutes a combination of persuasive (educational) and coercive (penal) measures.

The overarching goal of the preventive measures under consideration is to halt, avert, and preclude the commission of an offense; to identify the offender's criminal intent; and to organize preventive activity in such a way that the individual renounces the decision to engage in criminal conduct. The purpose of identifying individuals prone to committing offenses is to reveal the sources exerting negative influence upon them. The objectives of supervision over the individual, administrative oversight, and operational support converge in the course of addressing the tasks of control and preventive management.

In the system of hooliganism prevention, a specialized set of activities is distinguished, aimed at preventing offenses committed by individuals who lead an antisocial lifestyle. This activity is carried out by state bodies specifically authorized to maintain public order and combat delinquency. The relevant measures differ from others by their special purpose: preventing hooliganism constitutes their entire substantive focus. It can be stated that special individual prevention implies clearly identified targets of intervention and the use of specific means and methods tailored to these aims. The object of preventive influence—namely, hooliganistic behavior—is precisely determined. In this process, operative-search tools and methods are also employed. Ultimately, this presupposes highly specialized activities. With regard to hooliganism, special prevention primarily requires the classification of such acts for detection purposes—for instance, group-based offenses, recidivism, and similar categories. However, such special prevention is termed "special" because it demands specialized, professional knowledge on the part of those who implement it. For example, specific tools and methods intended to prevent hooliganism cannot be applied without a thorough understanding of the nature of such conduct. These special means and methods must always be used at a professional level.

The study of practical experience demonstrates the existence of an intrinsic connection between special individual prevention and operational-search prevention. These two areas of activity jointly constitute, particularly within internal affairs bodies, a comprehensive set of measures aimed at influencing the individual and his criminal behavior, functioning in a coordinated and purposeful manner. Although these areas are always distinguished separately, practical analysis shows that significantly greater effectiveness can be achieved in combating hooliganism when preventive tools and methods of a criminological nature are applied in conjunction with the necessary operational-search activities. Nevertheless, the most essential factor in this work is possessing complete and accurate information about hooliganism and its underlying conditions.

Individual prevention should begin before a person makes a decision about committing hooliganism, and, according to the decision, is often associated with the emergence of the goal and motive of criminal behavior. At the same time, "in general, in a number of cases, decision-making is not carried out quickly; therefore, there is a possibility of influencing it, reviewing the decision, and changing a person's behavior." Preventing harassment also serves one's own interests, and eliminating it is usually done when it comes to completely stopping certain things that are being discussed or started. Therefore, eliminating harassment is considered completely disregarding the occurrence of such a phenomenon and stopping it [3, 30].

As noted, hooliganism is based on impulsiveness, has a sensitive character, depends on the situation, and unexpectedness is their sign. But even in such cases, hooliganism does not always reflect a single, rapid movement. Therefore, since it represents a process that develops over time, the main thing here is individual work, special prevention, and operational service, and the specific task

is to intervene in this process in a timely manner, prevent the development of hooliganism, and stop it. If it is stopped at the necessary stage, then we will not allow harassment and will know that the secret victim will be protected from harassment. It is essential to define the unit of individual crime prevention, regardless of the form in which it is carried out. Whether this is special prevention or operational search prevention, it is directed at a specific person and their behavior. Taking this unity into account when carrying out crime prevention, practice has developed specific measures of influence. They equally belong to various forms of individual prevention, one of which is the protection of the individual from criminal encroachment.

Preliminary measures, as a rule, are applied to persons who have no prior convictions. Persons prone to committing crimes are identified, these individuals and their surrounding environment are examined, and if necessary, they are registered, and social monitoring is conducted regarding their place of residence, work, or study. Preventive measures against individuals prone to committing crimes are carried out with the help of justified and persuasive measures. Secondary measures are applied to individuals who have prior convictions but are considering committing a new crime. Here too, it is necessary to identify such individuals, hold them in special records, study them, and under specific circumstances, implement management control over them [4, 296].

It is necessary to clearly register the criminal intent of such "clandestine perpetrators." Coercive measures are typically applied to such individuals in practice. Applying primary and secondary measures is not a one-time action but a continuous process. Frequent and long-term measures can be repeatedIn this case, primary and secondary measures can be interchangeable and complementary, and they can be applied to a particular group of individuals regardless of their differences or the type of crime they may commit.

Early identification of individuals prone to harassment is becoming increasingly important today. Compared to such individuals, as practice shows, the prevention of hooliganism is more realistic.

These individuals have not yet developed serious criminal behavioral habits. Here, prevention will be seen as a preventive measure. Considering the unity of criminal and victim behavior, its complex characteristics, it is possible to think about various areas of preventive activity. With this comprehensiveness, the goals and objectives of prevention are determined.

Regarding hooliganism, the following purpose of preventative measures is usually observed here:

- Identifying and eliminating the causes and conditions of hooliganism, as well as the circumstances leading to their commission;

Identifying individuals who commit acts of misconduct.

- preventing previously convicted individuals who may be inclined to commit hooliganism from taking a criminal path;

- Prevention of real possible, as well as planned and planned hooliganism;

- Prevention and correction of real-world hooliganism in which criminal thought and preparatory actions are being carried out;

- Identifying previously convicted individuals who have not severed ties with the criminal world, preventing recidivist hooliganism.

As can be seen, relevant information, and most importantly, information of an operational-search nature, is needed regarding hooliganism. An organized system of information necessary for practice is essential, and therefore, it must have practical significance, meaning it must meet the requirements of anti-bullying practice.

In practice, in all cases, the implementation of individual prevention leads to a need for materials obtained through operational-search activities and special means, especially when the case relates to investigative crimes. Based on operational-investigative activities related to the implementation of individual measures for the prevention and correction of crimes, it is necessary to solve the task of information support, that is, obtaining relevant information for objective and effective preventive action. In the practical activities of internal affairs bodies and their special operational-search units, the collection, collection, evaluation, and processing of operational data on

reports of the most frequently committed crimes and criminals committing them are on the agenda. Operational information is a decisive tool in the fight against crime. Information interconnectedness is necessary. Operational information exchange is necessary between bodies, organizations, and their subdivisions carrying out the prevention of hooliganism. Operational information interaction is the key to the success of hooliganism prevention.

A properly organized system of mutual information exchange constitutes the multidimensional support structure of the preventive framework, ensuring its necessary flexibility and the capacity to be adapted to changing conditions while preserving and improving the quality of its substantive content. This system provides real opportunities for consolidating the efforts of various agencies, institutions, and their subdivisions, serving as a coordinating "bridge" for their joint activities. In this context, the unity between combating delinquency, ensuring the effectiveness of such efforts, and protecting individuals from crossing the threshold into criminal behavior acquires particular importance. For the prevention and resolution of operational-investigative tasks of a preventive nature, it is essential to maintain an information bank in which relevant data can be accumulated. This constitutes the foundation of the primary information support required for such activities.

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Rezyume: *Ushbu maqolada bezorilik jinoyatlarining sodir etilish sabablari va shart-sharoitlari, ularning ijtimoiy xavfi va jamiyat qadriyatlariga ta'siri ko'rib chiqiladi. Bezorilikning oldini olish masalalari yoritilgan, bunday jinoyatlarning oldini olishning huquqiy va ijtimoiy mexanizmlarini takomillashtirish bo'yicha chora-tadbirlar taklif etilgan.*

Резюме: *В данной статье рассматриваются причины и условия совершения хулиганских преступлений, их социальная опасность и влияние на общественные ценности. Освещаются вопросы профилактики хулиганства, предлагаются меры по совершенствованию правовых и социальных механизмов предупреждения подобных преступлений.*

Kalit so'zlar: *bezorilik, jinoyatlarning sabablari, shart-sharoitlari, profilaktikasi, ijtimoiy xavflilik, jinoiy javobgarlik, axloq, jamoat tartibi, agressiya, yoshlar, jinoyatchilik, huquqbuzarlik, tarbiya, ijtimoiy nazorat, huquqiy madaniyat.*

Ключевые слова: *хулиганство, причины преступлений, условия, профилактика, социальная опасность, уголовная ответственность, мораль, общественный порядок, агрессия, молодёжь, преступность, правонарушение, воспитание, социальный контроль, правовая культура.*

DEVELOPMENT OF GENDER LINGUISTICS IN TURKIC LANGUAGES

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Summary: *This study provides a concise comparative overview of the development of gender linguistics in Uzbek, Kazakh, and Karakalpak studies. Although gender research is relatively new within Turkic linguistics, it has expanded rapidly, with Uzbek scholars examining gender stereotypes, phraseology, and communicative behavior; Kazakh researchers exploring sociocultural evaluations of male and female speech, lexical oppositions, and comparative aspects; and Karakalpak studies emerging with analyses of kinship terminology and folklore-based gender representations. The findings highlight the growing scholarly interest in gender as a linguistic category and underscore its relevance for future research in Turkic languages.*

Key words: *gender linguistics, Uzbek linguistics, Kazakh linguistics, Karakalpak linguistics, gender stereotypes, sociocultural evaluation, phraseological units, conceptosphere, comparative linguistics, Turkic languages.*

In recent decades, gender has emerged as one of the most dynamic and interdisciplinary fields within modern linguistics, reflecting broader sociocultural and intellectual shifts across the humanities and social sciences. Although the distinction between biological sex and socially constructed gender roles was clearly articulated in Western scholarship beginning with the works of R. Stoller, G. Rubin, and R. Unger in the second half of the twentieth century, the integration of gender as a linguistic category has been uneven across global research traditions. In Turkic linguistics, gender does not constitute a grammatical category in the same way it does in Indo-European languages; however, the absence of grammatical gender does not eliminate gender distinctions from linguistic expression. Instead, gender manifests itself across the lexical, phraseological, pragmatic, and discursive layers of Turkic languages, offering rich material for scholarly investigation. This complexity has contributed to the gradual but steady formation of gender linguistics as a distinct research direction in Uzbek, Kazakh, and Karakalpak studies.

The increasing scholarly interest in gender-related phenomena reflects a broader recognition that language both shapes and mirrors sociocultural realities. The ways in which men and women speak, the lexical and phraseological units used to describe them, and the conceptual metaphors embedded in speech all represent culturally specific interpretations of masculinity and femininity. Thus, gender linguistics provides a methodological bridge between linguistics, anthropology, cognitive science, communication theory, and cultural studies. For Turkic languages, which possess a deep oral heritage, strong poetic traditions, and a complex system of kinship terminology, examining gender becomes particularly essential for understanding how social roles and cultural expectations are encoded and transmitted across generations.

In Uzbek linguistics, active engagement with gender issues began relatively recently but has expanded rapidly. Research has focused not only on identifying gender stereotypes within the lexicon and phraseology but also on exploring gendered aspects of communicative behavior, nonverbal expression, and conceptual categorization. Comparative studies have enriched the field further by analyzing gender representations across Uzbek and other languages. Similarly, Kazakh linguistics has developed a distinct gender-oriented discourse, shaped by early observations in traditional scholarship and expanded through contemporary studies on sociocultural evaluation, speech etiquette, morphological oppositions, and the conceptual structure of Kazakh linguistic consciousness. The interest of Kazakh scholars in linking gender with national worldview, folklore, and discourse practices underscores the growing theoretical depth of the field.

Karakalpak linguistics represents the newest and least explored terrain within the broader Turkic gender research landscape. Although earlier works did not explicitly employ the term “gender,” they nonetheless addressed gender-related phenomena through studies of kinship terminology, folklore motifs, and culturally marked lexical units. Only in recent years has gender

begun to emerge as an independent analytical category in Karakalpak scholarship, opening new avenues for comparative, semantic, and ethnolinguistic research.

Taken together, the growing body of research conducted in Uzbek, Kazakh, and Karakalpak linguistics demonstrates that gender is not merely a peripheral topic but a key conceptual and methodological framework for understanding the relationship between language, culture, and social identity.

Although gender studies represent a relatively new direction within linguistics, the field has advanced rapidly and has already established itself as an independent area of scholarly inquiry. Gender-related research now occupies a distinct position in linguistic science, leading to the emergence of gender linguistics, also referred to as linguistic genderology. The term gender was first introduced into academic scholarship by Robert Stoller in 1968, who used it as the title of his work Gender and Sex [21;383]. Later, G. Rubin and R. Unger further refined the terminological distinction between the concepts of sex and gender, contributing to the theoretical development of the field.

In Turkic linguistics, the gender concept has been widely examined, primarily from a linguistic point of view. Systematic research on gender in Uzbek linguistics began in 2011 with the dissertation of A.A. Morozova [12;177], which investigated the linguistic and cognitive nature of gender stereotypes. Subsequent studies by Uzbek scholars have focused on exploring gender representation not only in Uzbek but also across other languages. Among these, G.I. Ergasheva's PhD dissertation [7;165] offered a comparative analysis of gendered features in English and Uzbek phraseological units and proverbs, introducing a new perspective into the study of gender in linguistics. In addition, the scholarly works of I.M. To'xtasinov, E.A. Tuchkova, A.T. Knyazin, G.I. Ergasheva, and M.A. Abduvahobova demonstrate the dynamic development of gender-related research within Uzbek linguistics. Collectively, these studies highlight the multifaceted nature of gender research in Uzbekistan and provide comprehensive analytical insights.

Within Uzbek linguistics, gender studies extend beyond cross-linguistic comparison and also focus on Uzbek-language material itself. F.T. Musaeva [13;140] examined lexical items that encode gender distinctions, while Sh.Q. Gulyamova [4;163] explored how euphemisms convey gender identification and gender-based meanings. M. Saydkhonov's candidate dissertation investigated the role of nonverbal elements—such as gestures, facial expressions, and other paralinguistic features—in expressing gender differences. [19;160]

N.Z. Nasrullaeva identifies three dominant approaches to studying gender-related differences in speech behavior [15;14–16].

1. The pure gender approach, which aims to reveal the social nature of male and female linguistic behavior.

2. The sociopsycholinguistic approach, which focuses on statistical data and behavioral indicators in male and female communication, helping shape psycholinguistic theories on gender-specific speech patterns.

3. The cognitive approach, which seeks not only to identify linguistic differences but also to model the cognitive foundations underlying gender-based linguistic categories [15;15].

As gender linguistics intersects with multiple disciplines, its research directions are diverse. Emerging sciences such as quantum and computational linguistics also interact with gender studies, offering tools for collecting pre-statistical data related to language behavior in various social groups.

Empirical evidence shows that men and women possess different associative perceptions of the world, indicating that gendered linguistic behavior forms within gender-specific linguistic consciousness. Factors such as profession, social status, life experience, and gender influence the formation of associative links [17]. Linguistic consciousness plays a crucial role in shaping and interpreting reality, and it underpins human speech activity. Although cognition develops through language, it is also shaped by biosocial factors. Consequently, men and women may conceptualize and express culturally shared ideas differently. Scholars such as M.M. Rasulova and O.N. Kolosova note that linguistic categorization in women's linguistic consciousness differs from that of men [17;268]. As vocabulary constitutes the core material of categorization, the nominative system of

language is frequently analyzed in gender research. Feminist linguistics, in particular, critiques this system for its androcentric tendencies.

The noticeable increase in scholarly articles, dissertations, and conference papers on gender topics clearly reflects the growing academic interest in gender issues within Uzbek linguistics.

Although gender studies are considered a relatively new field, early indications of gender-related observations in Kazakh linguistics can already be found in the first half of the 20th century. In his research, A. Baitursynov examined linguistic features associated with gender in traditional Kazakh culture [3;464]. Professor Bakytzhan Hasanuly is recognized as one of the foundational figures in establishing the gender approach within Kazakh linguistics. In his article "The Concept of H.K. Jubanov in the Context of Gender Linguistics," presented at the V International Conference Jubanov Training, he argued that 21st-century Kazakh linguistics would increasingly focus on the division of humanity into men and women and the distinctive features of their speech and behavior. He emphasized that this division should not be interpreted solely in biological terms, but rather as an evaluation of gender roles within society—where women are traditionally assigned passive and subordinate roles and men are granted active and dominant ones. Such sociocultural patterns shape linguistic consciousness and are reflected in proverbs, sayings, and other elements of folklore. The scholar also noted the long-standing tendency to regard male speech as the normative standard and female speech as deviating from that norm. According to experts, this perspective constitutes a key factor in understanding how women are evaluated within a given cultural context.[9;140]

A.K. Akhmetov, in his examination of taboos and euphemisms in Turkic languages, investigated how these linguistic phenomena are manifested in women's speech in Kazakh [2]. Q. Jubanov also made substantial contributions through his comprehensive research on various linguistic issues. The gender dimension within Kazakh linguistics began to take shape in the late 20th and early 21st centuries, as reflected in scholarly works devoted to the Kazakh language and in specialized articles and conference papers addressing gender-related aspects. Among the notable contributors is B. Hasan o'g'li, who published studies on gender linguistics, women's language, girls' speech etiquette, and the gender-specific features found in the works of Yusuf Ko'pey o'g'li, while also supervising dissertations on gender-related topics [9;288]. Other prominent scholars include Z.K. Sabitova, who investigated the linguistic representation of gender oppositions [18;157]; N.M. Janpeisova, who explored the conceptualization of "mother" within the Kazakh conceptosphere from a contrastive linguistic (mother/matter) perspective [8;140]; Z.J. Tuyebekova, who conducted comparative gender research on morphological systems in Kazakh, Russian, and English [22;281]; A.D. Seysenova, who examined gender differentiation in Kazakh linguistics and the sociocultural contexts influencing male and female lexical choices [20]; and G. Mamaeva, who analyzed gender-based variation in word usage within Kazakh society [11;156]. Additionally, the works of Z.M. Nurjanova, V.D. Narojnaya, O.L. Soxackaya, and G.K. further contribute to the development of the field.

In Karakalpak linguistics, gender-related studies are only beginning to emerge as an independent research direction. Although earlier scholarly works did not employ the term gender explicitly, they nonetheless addressed gender-related issues through analyses of various lexical categories such as parent, spouse, son, daughter, and other kinship terms.

It would be incorrect to assume that the absence of research explicitly labeled as gender indicates a lack of scholarly attention to the topic. As noted earlier, gender-related phenomena have been examined from various perspectives under different thematic categories. For example, Professor Sh. Abdinazimov's article "Hayal so'zi haqqinda" discusses the etymology and usage of this term within Karakalpak linguistics. Similarly, Z. Davlatmuratova's research on kinship terminology provides extensive insights into the gendered characteristics and historical development of several kinship terms. In recent years, comparative bilingual studies on gender have become increasingly prominent. Noteworthy among them are investigations comparing the conceptualization of husband and wife in English and Karakalpak. A significant contribution in this area comes from Z. Rzamuratova, whose theses, articles, and dissertation examine gender features in folklore. Her research offers a detailed analysis of gender stereotypes in Karakalpak folk epics and identifies the

lexical and stylistic characteristics of gender-related expressions. Alongside these studies, a number of other articles and conference abstracts have also addressed gender topics [10].

Overall, gender remains a newly emerging area of inquiry in Karakalpak linguistics and requires further comprehensive investigation. Given the richness of the Karakalpak linguistic heritage, additional research is needed—particularly on the gender-specific features, stylistic functions, and semantic nuances of proverbs and sayings with distinctive poetic structures.

In conclusion, the article demonstrates the growing development and diversification of gender linguistics across Turkic languages. Research in Uzbek, Kazakh, and Karakalpak linguistics shows both shared tendencies and language-specific features in the study of gender, covering lexical, phraseological, cognitive, and sociocultural aspects. These works reveal that gender is not merely a linguistic phenomenon but also a reflection of cultural values, social structures, and historically formed perceptions of femininity and masculinity.

The analysis of earlier and contemporary studies confirms that gender issues have long been present in various forms, even before the term gender became widely used in linguistic research. Scholars have contributed to understanding gender-specific vocabulary, kinship terminology, folklore, and speech stereotypes, thereby enriching the theoretical and methodological foundations of the field.

Overall, the article underlines the necessity of expanding gender-oriented linguistic research, especially through comparative and interdisciplinary approaches. Further study of gender representation in Turkic languages—particularly in proverbs, folk literature, and everyday communication—will deepen our understanding of how language encodes social roles, cultural expectations, and identity.

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Rezyume: *Ushbu tadqiqotda o‘zbek, qozoq va qoraqalpoq tilshunosligida gender lingvistikasi rivojlanishining qisqacha qiyosiy sharhi keltirilgan. Genderga oid tadqiqotlar turkiy tilshunoslikda nisbatan yangi bo‘lsa-da, tez kengayib bormoqda, o‘zbek olimlari gender stereotiplar, frazeologizmlar va kommunikativ xulq-atvorni tadqiq etmoqdalar; Qozoq tadqiqotchilari erkaklar va ayollar nutqining ijtimoiy-madaniy baholanishi, leksik oppozitsiyalar va qiyosiy jihatlarini; qoraqalpoq tadqiqotlari qarindoshlik terminologiyasi va folklorga asoslangan gender tushunchalarini tahlil qilish bilan paydo bo‘ladi. Natijalar genderga lingvistik kategoriya sifatida ilmiy qiziqish ortib borayotganini va uning turkiy tillardagi kelajakdagi tadqiqotlar uchun dolzarbligini ta’kidlaydi.*

Резюме*: В данном исследовании представлен краткий сравнительный обзор развития гендерной лингвистики в узбекском, казахском и каракалпакском языкознании. Хотя гендерные исследования относительно новы в тюркской лингвистике, они быстро расширились, узбекские ученые исследуют гендерные стереотипы, фразеологизмы и коммуникативное поведение; Казахские исследователи исследуют социокультурные оценки мужской и женской речи, лексические оппозиции и сравнительные аспекты; каракалпакские исследования появляются с анализом терминологии родства и гендерных представлений, основанных на фольклоре. Результаты подчеркивают растущий научный интерес к гендеру как к лингвистической категории и его актуальность для будущих исследований в тюркских языках.*

Kalit so‘zlar: *gender lingvistikasi, o‘zbek tilshunosligi, qozoq tilshunosligi, qoraqalpoq tilshunosligi, gender stereotiplar, ijtimoiy-madaniy baho, frazeologizmlar, konseptosfera, qiyosiy tilshunoslik, turkiy tillar.*

Ключевые слова: *гендерная лингвистика, узбекская лингвистика, казахская лингвистика, каракалпакская лингвистика, гендерные стереотипы, социокультурная оценка, фразеологизмы, концептосфера, сравнительная лингвистика, тюркские языки.*

THE ROLE OF PHRASEOLOGICAL UNITS IN DISTINGUISHING GRAMMATICAL DESCRIPTIONS

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Summary: *This article discusses the importance of phraseological units in distinguishing grammatical descriptions and in achieving a deeper understanding of their meanings.*

Key words: *Grammar, description, distinction, phraseme, phraseological unit, system, form, paradigmatic and syntagmatic features.*

It is well known that language, as a dynamic social phenomenon, is constantly renewed in accordance with the conditions of society. Changes occurring in social life influence linguistic relations in the form of both internal and external factors. Taking this into account, our government has developed a system of measures aimed at improving language policy. Accordingly, the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan No. 311 of September 10, 1996, included the task of compiling a multi-volume explanatory dictionary of the Uzbek language into the State Program. The responsibility for organizing the publication of this dictionary was assigned to the Alisher Navoi Institute of Language and Literature (currently the Institute of the Uzbek Language, Literature, and Folklore) of the Academy of Sciences of Uzbekistan.

This project arose from specific scientific and practical needs. The existing two-volume Explanatory Dictionary of the Uzbek Language (1981), which includes about 60,000 words and word forms, did not cover the achievements of Uzbek lexicography in subsequent years. Furthermore, the dictionary entries were based on an outdated model and required modern explanatory supplementation. In addition, in every expanded and enriched new explanation, it was necessary to indicate the distinctions that occur during semantic shifts in word forms.

The publication of the five-volume Explanatory Dictionary of the Uzbek Language, edited by A. Madvaliev, which provides complete etymological information about words and their meanings, is considered a significant event in our cultural life. This work demonstrates a new approach—an effort to include as many words and word forms actively used in the literary language as possible, and a systematic representation of semantic explanation principles. The differentiation of grammatical features among spelling, pronunciation, word formation, and expression norms clarifies the essence of this issue.

In the development of every language, the main semasiological law is associated with the fact that linguistic units possess polysemous (multiple-meaning) characteristics. Accordingly, some linguists consider polysemy one of the objective indicators of language development and perfection. From the 1970s onward, numerous dissertations on phraseological polysemy appeared in linguistics. These studies demonstrated, with concrete evidence, that the polysemic nature ophrasemes reflects the semantic evolution of the phraseological system of a given language.

However, not all scholars share the same views regarding the process of developing polysemous phraseological units. For example, scholars such as N. N. Amosova, I. I. Chernysheva, and Yu. D. Apresyan believe that the semantic nuances (semes) within the semantic structure of polysemous phrasemes are interconnected and interrelated. In other words, in the semantic structure of polysemous phrasemes, there exists one primary (basic) meaning, and other shades of meaning are subordinated to it.

Another group of scholars (G. I. Kramorenko, V. P. Zhukov, V. N. Teliya) maintain that within the semantic structure of phrasemes, meanings exist not hierarchically but rather as coordinate, coexisting entities. According to V. P. Zhukov, the semes within polysemous phrasemes are of equal value and dual in character. Therefore, it is often difficult to determine which meaning is primary (dominant) and which is secondary (derived).

Linguist M. I. Sidorenko divided such distinctions in the sememes of polysemous phrasemes into two groups. The first group includes distinctions that do not directly affect the paradigmatic and

syntagmatic features of polysemous phrasemes; these he called sememe distinctions. Such distinctions are related to the degree of clarity or abstraction of meanings or the presence/absence of additional semantic shades.

For example, in Russian, the polysemous phraseme пускать корни // пустить корни ("to take root") has two meanings: (1) "to become firmly established somewhere" and (2) "to gain strength or power." Another example, перемывать косточки // промывать косточки, also has two interrelated meanings: "to gossip about someone" and "to criticize someone behind their back."

According to Sidorenko, a second type of difference between sememes—sememe-designator distinctions—is determined by grammatical structure, syntactic environment, valency, and stylistic function. For example, the Russian polysemous phrase рукой подать has two meanings: (1) "very close, within arm's reach," and (2) "very soon, in a moment."

In Russian linguistics, there are also other opinions about the semantic development of phrasemes. For instance, N. M. Shansky believed that in polysemous phrasemes, meanings always relate to each other as literal and figurative, primary and derived meanings. If there is no such relationship, they are not polysemous but phraseological homonyms. For example, валять дурака ("to act foolishly") is not a polysemous phraseme but a phraseological homonym.

A. I. Molotkov, however, approaches the issue differently: "Within polysemous phrasemes, just as in polysemous words, shades of meaning are interrelated as literal and figurative meanings. If it is impossible to determine such a relationship, then the phrase is excluded from the category of polysemous phrasemes."

In explanatory dictionaries, it is first necessary to define the boundaries of meaning. In phrases equated to lexical units, the semantic relationship becomes central. Comparing dictionary entries that provide main and derived meanings ensures a correct analytical approach. The main characteristic of phraseological units is determined by their polysemy.

In Uzbek, most polysemous phrases have two meanings. In Sh. Rakhmatullaev's Phraseological Dictionary of the Uzbek Language (PDUL), such expressions are referred to as polysemous phraseologisms that share a core meaning. Indeed, "phraseological polysemy" refers to the phenomenon where one idiom conveys more than one phraseological meaning; the task is to study the relationships between those meanings.

Conclusion

In explanatory dictionaries, the relationship between word forms and meanings is analyzed. Emphasizing the base lexical unit and defining its semantic boundaries form the foundation of research. Clarifying semantic development and the scope of usage is a key task of such dictionaries. Descriptive features combine to form constructions that create phrases and equate them with words. Lexical meaning, in turn, necessitates explanation. Therefore, the process of semantic interpretation becomes a natural requirement even for phraseological templates.

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Rezyume: *This situation is classified in sources as a separate layer and a group of assimilated layers.*

Резюме: *Данная ситуация классифицируется в источниках как отдельній слой и группа ассимилированніх слоев.*

Kalit so‘zlar: *lug‘atchilik, leksikografiya, ijtimoiy aloqalar, yangi so‘zlar, zamonaviy leksika, til va madaniyat, fan-texnika, nanotexnologiya, global masala, ensiklopedik lug‘at.*

Ключевие слова*: лексикография, общественніе связи, новіе слова, современная лексика, язік и культура, наука и техника, нанотехнологии, глобальній вопрос, энциклопедический словарь.*

LEXICO-GRAMMATICAL DESCRIPTION OF ADJECTIVE METAPHORS IN PROVERBS AND SAYINGS

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Summary: *The article discusses the analysis of metaphors in the form of adjectives in English and Karakalpak proverbs and the significance of metaphors in proverbs and sayings of both languages.*

Key words: *metaphors, semantic shift, adjectives, proverbs, expressiveness, figurative meaning.*

Conveying concepts in a person's mind through a sense of comparison is achieved through metaphor. The use of metaphor in proverbs has always been considered natural and legitimate, because metaphor is closely connected with all mythological manifestations - the need arises to explain incomprehensible things with the help of understandable knowledge. As people create proverbs, they are based on their everyday, simple view of the world, because they do not describe the world in broad terms.

In most proverbs, the metaphorical construction takes the position of a predicate and is characterized as a subject. It reveals the properties of a common subject for a predicate. The concept embodied by the predicate can be expressed in the adjacent semantic field indicated by the subject, for example, in the English proverb "Women are like wasps in their anger." However, in the following proverb, metaphors can also establish long-term connections without direct comparison: "A woman is a weather cock," "Woman and wine, game and deceit make the wealth small, and wants great." Such long connections of metaphors are often encountered: Miynettiń kózin tapqan, baxıttıń ózin tabadı; Erinshektiń eki dostı bar: biri uyqı, biri kúlki. The verbalization of a concept by individual experience and subjective consciousness through metaphorization can be spontaneous. Nevertheless, a distinctive feature of metaphor in proverbs is its connection to social experience. The meaning derived from metaphors should be ingrained in the consciousness of the people and become a characteristic of proverbs.

With the help of metaphor, an image is created that reveals the essence of the object and, to a certain extent, identifies and demonstrates the characteristics associated with the most essential elements perceived by the people: woman - a weather cock, woman - wasp, woman - wine.

To create a series of adjectival metaphors, adjectives in our language, combined with nominative words, express figurative meaning. Such metaphors are used in various stylistic functions to further enhance the artistic merit of proverbs and sayings. For example: Esiter qulaǵıń menen, Kórer kóziń de bolar. Shiyrin sóz shekerden shiyrin. Gúzi jarqın – topıraǵı altın. Qosıq - altın, sóz gúmis. Balalı úy - bazar, balasız úy - mazar. Jaqsı sınshı jol silteydi, jaman sınshı júregiǵe is súyreydi. Hárkimniń ósken jeri - Misir sháhári. Jaman kóldiń suwı ashshı, Jaman tonnıń biyti ashshı, Jaman adamnıń tili ashshı. Jaman adam - tana, Jaqsı adam - pana. Piter istiń basına, Jaqsı keler qasına. Arǵımaq attıń quyrıǵı, Birde jipek, birde qıl. Biyday nanıń bolmasa da, Biyday sóziń bolsın. Kitap sóz qulaq qurıshın qandırar, Aqmaq sózi júrek bawırıńdi jandırar. Fresh pork and fresh wine kill a man before his time; Cold hands, warm heart; A weak heart never won a fair lady; Two things prolong your life: a calm heart and a loving wife.

The words "bazar" and "mazar" in the proverb convey the concepts of joy and sorrow. In the "bazar" metaphor, the bustling, exciting, bustling life of the marketplace is shifted based on similarities to a child's actions, and “mazar” is understood as a place where peace, quietness, joy, and happiness are alien, depicting the opposite meaning of the word "bazar." The English proverb "Cold hands, warm heart" is a short and metaphorical phrase, expressing the idea that someone can be cold on the outside but warm inside, kind, and compassionate. In terms of lexical composition, this proverb consists of the main lexical units "Cold," "hands," and "warm": "Cold" is a metaphor with a figurative meaning (meaning a cold person); "hands" - an artistic component (a person's appearance or

behavior); "warm" is a metaphor with a figurative meaning (kind, warm-faced person). In a proverb, the grammatical feature is formed using a simple Subject-Verb-Object structure. The metaphorical use of "cold hands" and "warm heart" creates a powerful and memorable image, suggesting that this appearance can be deceitful and deceptive, and that a person should be evaluated not only by their external behavior but also from a close perspective.

In this case, the adjectives cited in proverbs and sayings are combined with nouns, giving them an adjectival metaphor corresponding to their meaning, which literally means "good critic, bad critic." In proverbs and sayings, we also encounter other forms of figurative imagery used to reveal the artistic merit of figurative metaphors. For example: Adam qolı - gúl, Mańlay teri - nur; Ǵariptiń esigi - qara bult.

In this adjectival metaphor, a metaphorical series corresponding to the inner meaning of proverbs and sayings is also constructed. The words "gúl" (flower) and "nur" (light), as well as "qara bult" (black cloud), which are natural phenomena, are distant from their literal meaning and are rendered figuratively. If words within proverbs and sayings were presented only in their literal, dry form, their effectiveness, like an adjectival metaphor, would be less noticeable.

Furthermore, in proverbs and sayings, figurative metaphors, depending on their meaning, are not only used appropriately but also interconnected and intertwined. One figurative metaphor is linked to another, and the latter is linked in succession: “Bilim menen ilim, Sóyler sózińde bolar, Esiter qulaǵıń menen, Kórer kózińde bolar”.

Usually, in proverbs and sayings, even in real life, a person's experiences during sleep and psychological state are presented figuratively, while the other side is expressed through direct meaning.

As we have seen in the examples, adjectival metaphors are depicted in this sequence, meaning that the second aspect of figurative adjectival metaphors is their literal meaning.

The conclusion and results drawn from the above is that metaphor plays a crucial role in these proverbs. Firstly, it is used to enhance the artistry and clarity of the depicted situations. This allows for a strong influence on consciousness to achieve didactic goals more effectively. Secondly, the metaphor helps the addressee clarify the purpose that is incomprehensible to them. To achieve this goal, the metaphor is based on a concept related to the semantic field, which is understandable and familiar to the addressee, which, in turn, enhances the educational value of proverbs.

Generally speaking, without the metaphors in proverbs and sayings, we would not be able to appreciate their artistry, expressiveness, and emotional-expressive meaning. Thus, figurative metaphors are skillfully employed for specific stylistic purposes and in creating artistic imagery.

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Rezyume: *Maqolada ingliz va qoraqalpoq maqollarida sifat shaklidagi metaforalarning tahlili va har ikki tildagi maqol va matallarda metaforalarning ahamiyati haqida so‘z boradi.*

Резюме: *В статье обсуждается анализ метафор в форме прилагательных в английских и каракалпакских пословицах и значение метафор в пословицах и поговорках обоих языков.*

Kalit so‘zlar: *metaforalar, ma’no ko‘chishi, sifatlar, maqollar, ekspressivlik, ko‘chma ma’no.*

Ключевые слова: *метафоры, семантический сдвиг, прилагательные, пословицы, выразительность, образное значение.*

THE ROLE OF PEDAGOGICAL COMPETENCIES IN TRAINING FUTURE COACHES AND SPECIALISTS IN FREESTYLE WRESTLING

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Summary: *This article discusses the role of pedagogical competencies in the training of future freestyle wrestling specialists-coaches.*

Key words: *freestyle wrestling, education, perception, personality, maturity, specialist, competence, listening, spirit, pedagogy.*

It is well known that our ancestors left behind written records on physical education and physical preparedness, and these historical sources show that such practices have come down to us as an important part of our cultural heritage. Over the centuries, physical education has been refined and elevated to the level of national pride, gaining recognition throughout the world. For this reason, Eastern scholars placed great importance on all types of sport—including wrestling—for their role in the moral and personal development of the individual. They conducted special studies in this field and produced timeless works that regarded human perfection as the highest ideal.

Since the day our country gained independence, renewing the spiritual and moral outlook of our people has been elevated to the level of state policy. This priority is reflected in Uzbekistan's national development strategies, which emphasize further advancement of physical education and sports, the improvement of educational institutions operating in this field, and the comprehensive modernization of their material and technical resources. A series of presidential decrees aimed at expanding the promotion of physical education and sports—especially in fostering physical skills among the younger generation—have opened wide opportunities across the country.

In light of the favorable conditions and opportunities created, it has become necessary to develop technologies directed toward building the professional competencies of future freestyle wrestling instructors within the traditional physical education and sports training process. [1]

The concept of competence is regarded as one of the most important factors in training modern freestyle wrestling coaches. The term itself derives from the Latin "competo"—meaning "to achieve", "to be capable", or "to be worthy"—and refers to knowledge and experience within a particular field.

Competency encompasses qualities such as expertise, professional suitability, qualification, experience, and responsibility. The key challenge in preparing specialists in freestyle wrestling lies in organizing training sessions based on innovative technologies while simultaneously improving athletes' physical preparedness and developing their skills and abilities to visualize and perform competitive activities. [3]

The only effective solution to this issue is the introduction of a new, competency-based approach in higher education. This approach requires future coaches to acquire theoretical knowledge and practical skills not separately, but as an integrated whole. In accordance with this requirement, the system for selecting teaching methods must also undergo change. The choice and practical application of teaching methods should focus on enhancing the competencies and functions demanded by the educational process. A competency-based approach represents a new pedagogical reality in terms of modernizing higher education. Within this approach, practical experience, competence, and competency are regarded as didactic units, and the traditional triad of education—*knowledge–skills–abilities*—is expanded into a six-element model (sextet): *knowledge–skills–abilities–practical experience–competence–competency.* This requires a re-examination of educational content through this broader framework.

First, it is necessary to clarify the essence of the concept of "**competence".** The term derives from Latin, meaning "to achieve" or "to be suited to," and refers to an individual's readiness to effectively use both internal and external resources in order to set and achieve goals. In other words, competence represents a person's ability to successfully resolve problems related to a specific field of activity. It should be emphasized that most definitions of competence are formulated in connection

with professional education and professional activity. However, when applied to education more broadly, this concept acquires an innovative character, which creates a particular need to further clarify its nature.

Professional competency refers to the mastery of the knowledge, skills, and abilities necessary for a specialist to perform professional activities, as well as the ability to apply them effectively in practice. L. M. Mitina defines pedagogical competence as the integrated combination of subject knowledge, teaching methodology and didactics, pedagogical communication skills, and the methods and tools of self-development, self-improvement, and self-realization. In her view, the structure of pedagogical competence consists of three components: activity-based, communicative, and personal.

Drawing on Mitina's structural model of pedagogical competence, we consider the following set of competencies to be both sufficient and essential for future specialists in freestyle wrestling, as their mastery determines the level of pedagogical development:

– Activity-based (or specialized) competence — knowledge, skills, abilities, and individualized methods of carrying out pedagogical activity;

– Personal (or professional) competence — knowledge, skills, and abilities related to professional self-improvement and self-realization;

– Communicative competence — knowledge, skills, and abilities that support the creative implementation of pedagogical activity. The concepts of professionalism and competency share several common features. It should be noted, however, that individuals who fully meet established requirements and standards are not always true professionals. The reason is that some may not know how to apply their knowledge in practice—therefore, their pedagogical activity remains ineffective. [2]

It is advisable to classify professional pedagogical competencies into separate categories:

– Special pedagogical competence,

– which involves having adequate knowledge to carry out pedagogical activity at the required level. It also includes a teacher's ability to evaluate their own professional standing and determine their further development as a specialist;

– Social pedagogical competence,

– which reflects a teacher's level of social authority, ability to build effective relationships with colleagues, and capacity to plan joint activities. Effective communication skills, pedagogical culture, and responsibility for outcomes are all part of this competence;

– Personal pedagogical competence,

– which refers to the ability to organize pedagogical work wisely, including time management and the pursuit of personal growth. Individuals with a high level of personal pedagogical competence tend to be less susceptible to physical fatigue and are better able to perform coordinated movements under time pressure.

In conclusion, it should be emphasized that pedagogical competencies hold a particularly significant place and role in the preparation of future specialists and coaches in freestyle wrestling.

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Rezyume: *Mazkur maqolada erkin kurash bo‘yicha bo‘lajak mutaxassis-murabbiylarni tayyorlashda pedagogik kompetensiyalarning o‘rni haqida so‘z boradi.*

Резюме: *В статье рассматривается роль педагогических компетенций в подготовке будущих специалистов-тренеров по вольной борьбе.*

Kalit so‘zlar: *erkin kurash, ta’lim, idrok, shaxs, kamolot, mutaxasis, kompotensiya, kompetentlik, tinglash, ruxiyat, pedagogika.*

Ключевые слова: *вольная борьба, образование, восприятие, личность, зрелость, специалист, компетентность, компетентность, слушание, дух, педагогика.*

PRAGMATIC AND DERIVATIONAL CHARACTERISTICS OF POLITICAL SPEECHES

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Summary: *This article discusses the structural-derivational and grammatical features of political lexicon.*

Keywords: *structural-derivational, grammatical, expression, term, simple, compound, pair, repetition.*

As is known, language and society are closely interconnected. Changes in society must find their expression in language. From this point of view, terminology is a rapidly changing and complexly structured field of linguistics. Every science is a system of terms. The Russian philosopher P.A. Florensky explained the role of terminology in science as follows: "The essence of science is the compilation, or more precisely, the arrangement of terminology." The life of terms is the very history of science.

Linguistics also has its own linguistic terms. Language education can be viewed as a process based on the study of the essence of linguistic terms.

Ensuring the standardization and modeling of terms, as well as their material appearance in the translation process, is of great importance. This is a key condition for the development of scientific terminology, terminography, terminological corpora, and the creation of terminological databases. As terminologist R. Doniyorov emphasized regarding the possibilities of studying terminological systems in groups, this process, firstly, creates an understanding of the general terminological richness of this system; secondly, it provides information about the system's word-formation capabilities; and thirdly, it identifies the word-formation model within each thematic group of the system. Political speech can be defined as a communicative action by speakers who attempt to convey a clear meaning to influence or persuade others. In other words, political discourse can be defined as a linguistic strategy - manipulation - serving ideological purposes. Political discourse can also include formal discussions or informal discussions on politics between listeners and family members. (Liebes and Ribak, 1991).

Political discourse, in essence, is an expression of the entire complex of relations between the individual and society, and therefore, this phenomenon is essentially functionally aimed at shaping a certain part of the worldview or worldview among the recipients. Using political discourse as a foundation, it is possible to understand how cultural values are modeled in different language communities, how social order is promoted, and which elements of the linguistic worldview remain outside the speakers' conscious speech strategies. Each language and society forms a conceptual representation of the world. Political text contains extralinguistic information (worldview) and symbolic information (worldview presented through a symbol or nomination).

Political vocabulary used in political speeches can be classified according to their formal structure as follows:

1. Simple terms
2. Compound terms
3. Paired terms

Simple terms Simple terms belong to the noun category and share a common root and form-semantic integrity. For example: republic, state, president, people, etc. Simple terms are divided into simple root terms and simple derived terms based on their derivational characteristics:

Simple root terms: homeland, friend, child, tragedy, etc.

- simple derived terms: birdamlik, porloq, bevaqt, bunyodkorlik, nufuzli.

Compound terms Such terms are considered compound words consisting of more than one root combination. In political discourse, we can encounter the following compound words: freedom-loving, hardworking, hospitable, and are mainly used when referring to place names. Kashkadarya, Surkhandarya, Syrdarya, Kyzyltepa.

Paired terms Paired terms are formed by combining two words. Paired terms consist of more than one lexical unit and can be combined: socio-economic, climate change, danger, food, etc.

Observations show that simple, paired, and compound terms are common in political discourse, but the use of compound terms is relatively rare.

Word formation using the affixation method, as in modern Uzbek literary language, is considered one of the active methods of word formation in political lexicon as well. Most of the word-forming suffixes existing within the general Uzbek language participate in the formation of these lexical words and terms. The most important of these suffixes are: -chi, -gir, -xona, -kash, -kor, -don, -lik, -chilik, -li, -simon, -soz, -furush, -shunos, paz, -xo'r, -bo'z, and others. We observe the formation of various words and terms related to political lexicon through these affixes.

Below is an excerpt from the congratulatory speech of the President of the Republic of Uzbekistan Shavkat Mirziyoyev at the solemn ceremony dedicated to the national holiday of Navruz.

"… Navröz teaches us all the science of humanity, kindness, and tolerance. In these blessed moments, we all understand well how precious peace and tranquility are, and its value and significance. These very days, in our tolerant land, feelings of interethnic friendship, mutual respect, generosity, and kindness are clearly manifested. As part of our noble work aimed at upholding human dignity, the wider community is going door-to-door, providing compassion and practical assistance to the sick, the elderly, the disabled, and families in need. We must continue to cherish these enduring traditions, which everyone admires, and raise our dear children in the spirit of such high human values.

II. Syntactic word formation is observed to be the most productive in political lexicon. Most compound words within the field's lexicon are neologisms.

Below is an excerpt from the President's speech at the high-level international conference "Regional Cooperation of Central Asian Countries within the Framework of the Joint Action Plan for the Implementation of the UN Global Counter-Terrorism Strategy."

"… We call upon the UN Counter-Terrorism Office to intensify efforts to implement the cybersecurity and new technologies programs in Central Asia adopted in 2020. Within the framework of this program, we believe it is necessary to create a Unified Electronic System for Cyberterrorism in Central Asia, aimed at developing the exchange of experience and data, research, and best practices in the field of cyberterrorism. Furthermore, the transboundary nature of security threats in cyberspace necessitates the creation of unified international legal mechanisms that enable the effective fight against various forms of extremism and terrorism in the information space. We express our hope for the UN's assistance in organizing and coordinating dialogue on this issue.

Thus, the derived words and terms within the political lexicon of the Uzbek language emerged based on the rules and principles of the general language word formation system. Language reflects political goals and interests, worldview, and emotions. In political discourse, lexical and stylistic devices are often used, which is explained by their significant argumentative potential and imagery, as these texts are intended for public discourse and are designed to immediately capture the listener's attention and influence their emotions. Furthermore, language develops in accordance with the socio-political development of each nation. That is, language operates in all spheres of society's life and serves to determine the strategy of socio-political development. Indeed, language is the product of a people's spirit and way of life. From this perspective, every nation cares about the development of its language and strives to strengthen the foundations of development. This process becomes even more profound when studying the political and philosophical foundations of language.

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Rezyume: *Mazkur maqolada siyosiy leksikaning struktor-derivatsion, grammatik xususiyatlari haqida fikr-mulohazalar bildirildi.*

Резюме: *В данной статье были высказаны мнения о структурно-деривационных и грамматических особенностях политической лексики.*

Kalit so‘zlar: *struktor- derivatsion, grammatik, ifoda, termin, sodda, qo'shma, juft, takror.*

Ключевые слова: *структурно-деривационный, грамматический, выразительный, термин, простой, сложный, парный, повторяющийся.*

ISUES OF CIVIL LAW REGULATION OF THE CONCLUSION OF A SALES CONTRACT

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Summary: *This article covers the procedure for concluding a sales contract and issues of its civil law regulation.*

Key words: *sales contract, offer, acceptance, contract term, goods, supplier.*

General procedure for concluding a sales contract. For the parties to reach an agreement and conclude a contract, at least one of them must make a proposal to conclude a contract, and the other - accept this proposal. Therefore, the process of concluding a sales contract is carried out in two stages. The first stage is called an offer, and the second is called an acceptance. Accordingly, the party proposing to conclude the sales contract is called the offeror, and the one accepting the offer is called the acceptor. A sales contract is considered concluded when the offeror receives acceptance from the acceptor.

At the same time, not every proposal to conclude a contract has the force of an offer. Proposal considered an offer, in accordance with Article 367 of the Civil Code;

a) be sufficiently clear and clearly express the person's intention to conclude the contract;

b) contain all essential terms of the contract;

c) must be directed at one or more specific persons.

The first requirement is justified by the fact that "a contract cannot be concluded without the intention of the person to conclude it, even if this person has already stated all the essential terms of the contract to the counterparty. [1]

The second requirement stems from Article 364 of the Civil Code, according to which a contract is considered concluded if an agreement has been reached between the parties on all essential terms of the contract. If even one of the essential conditions remains in the offer to conclude a contract, it cannot be concluded, even if the other party has agreed to such a proposal.

The third requirement is justified by the fact that at the time of concluding the contract, the proposal to conclude it must be removed. Otherwise, several contracts may be concluded in relation to the same object, and only one of them can be actually executed. In the absence of any of the above features, the offer may be considered only as an invitation to an offer (an offer to conclude an offer). For example, an offer received by mail from a trading firm to visit a store and purchase goods there is not an offer, since this offer does not contain essential terms of the sales contract. Advertising and other proposals addressed to an unknown circle of persons are considered an invitation to make an offer (invitation to an offer), unless otherwise expressly stated in the proposal. [2]

They must be able to distinguish a public offer from a call to offer. A public offer is understood as an offer containing all the essential terms of the contract, in which the willingness of the inviting person to conclude a contract with any person who has responded to it on the terms specified in the offer is expressed. (Part 2 of Article 369 of the Civil Code). In this case, the offer to conclude a contract is addressed to all interested parties. Therefore, the first respondent to the public offer accepts it, thereby removing the offer. For example, vending machines for cold drinks; goods displayed on store shelves, etc.

Acceptance is understood as the consent of the person to whom the offer is addressed to accept it, which refers not to any agreement, but only to complete and unconditional agreements. If a principal agreement to a proposal to conclude a sales contract is made with any additions or amendments to the terms contained in the offer, then such an agreement has no force of acceptance. Acceptance is the performance by the person who accepted the offer, within the period established for its acceptance, of actions to fulfill the terms of the contract specified therein (payment of the corresponding amount, shipment of goods, etc.), unless otherwise provided by law, other legal acts, or the offer itself is not specified.

To recognize the relevant actions of the addressee of the offer as acceptance, it is necessary to take into account that the fulfillment of the terms of the offer in full is not required. For these purposes, to recognize the aforementioned actions as acceptance, it is sufficient for the person who received the offer (as well as the draft contract) to commence performance under the conditions stipulated in the offer and within the time limit established for its acceptance. It should be noted that the concept of a public offer contained in Article 369 of the Civil Code does not fully correspond to the concept of a public offer of goods contained in Article 426 of the Paragraph on a retail trade agreement. [3]

An offer and acceptance, having the corresponding characteristics, entail certain legal consequences for the persons who made them. The legal force of the offer depends on whether it has been received by the addressee. Before the offer is received by the addressee, it does not bind the offeror in any way, and he can withdraw the offer and thereby cancel the offer to conclude the contract. If the notification of withdrawal of the offer is received before or simultaneously with the offer itself, the offer is considered not received. On the contrary, the offer legally binds the offeror to the offer from the moment it is accepted by its addressee. An offer accepted by the addressee cannot be withdrawn within the period established for its acceptance, unless otherwise stipulated in the offer itself or arising from the essence of the offer or its stated condition.

During this period, the offeror is not entitled to withdraw the offer themselves or conclude the contract specified in the offer with another person. Otherwise, it is obliged to compensate its counterparty for all losses incurred. Like an offer, an acceptance binds the acceptor from the moment it is received by the offeror. Until the acceptance is accepted by the offeror, the applicant has the right to withdraw the acceptance. In this case, if the person who sent the offer received a notification of withdrawal of the acceptance before or simultaneously with the acceptance, the acceptance is considered not received.

The legal effect of the offer also depends on whether it was made with or without specifying a time limit for the response. If the offer is made with a deadline for a response, and if the acceptance is received by the person who sent the offer within the time limits specified therein, then the contract is considered concluded. (Article 372 of the Civil Code). If an offer is made without specifying a deadline for a response, then its legal action depends on the form in which it was made. If an offer is made verbally, without specifying a deadline for acceptance, the contract is considered concluded if the other party immediately notifies it of acceptance. If there is no such acceptance, then the offeror has nothing to do with the offer made by him.

The contract is considered concluded if the offer is made in writing without specifying a deadline for acceptance and if the acceptance is received by the person who sent the offer before the expiration of the period established by law or other legal acts. If such a period is not established, then the contract is considered concluded if it is received within the time normally required for this. "Normal time required is sufficient for this type of correspondence to travel in two directions, to familiarize oneself with the content of the proposal, and to respond to it. [4]

If acceptance is delayed, then the fate of the contract depends on the offeror. He may ignore the postponement of the response and agree to conclude a contract or refuse to conclude a contract in connection with the postponement of the response to his proposal. The contract is considered concluded if the offeror who received the acceptance with a delay immediately notifies the other party about the acceptance of their acceptance with this delay. Article 374 of the Civil Code provides for a case when the response (acceptance) for agreement to conclude the contract is received late, but it is obvious that it was sent in a timely manner. In this case, only the offeror knows about the delay in acceptance.

If the response on consent to conclude a sales contract indicates consent to conclude a contract on other terms than those presented in the offer, then such a response is recognized as refusal of acceptance and is simultaneously a new offer. In this case, the parties switch places: the acceptor becomes the offeror with all the consequences arising from this. If the parties cannot resolve the dispute that arose during the conclusion of the contract themselves, then they have the opportunity to reach an agreement on the transfer of the dispute for consideration by the court. In this case, the terms

of the contract on which the parties have not reached an agreement are determined by a court decision. If the buyer does not respond to the offer to conclude a sales contract, then his silence, as a general rule, is considered as refusal to conclude the contract. Silence is considered as consent to the conclusion of a contract only in cases stipulated directly by law, customs of business turnover, or previous business relations of the parties.

When concluding a sales contract, the question of the time and place of its conclusion is of great importance. The legislation in force at the time of the conclusion of this agreement in the territory where it was concluded shall apply to contractual relations. The transaction is considered completed at the time the offeror receives the acceptant's consent. This time is recognized as the time of concluding the contract. For real contracts, the conclusion of which requires not only the consent of the parties, but also the transfer of property, a different rule is established. Such contracts are considered concluded from the moment of transfer of the corresponding property. A contract subject to state registration is considered concluded from the moment of its registration, unless otherwise provided by law.

If the place of its conclusion is not specified in the contract, then the contract is recognized as concluded at the place of residence of the citizen or at the location of the legal entity that sent the offer.

The question of the beginning and end of the contract is also of great importance. In accordance with Art. 365 of the Civil Procedure Code, the contract enters into force from the moment of its conclusion and is binding on the parties. At the same time, the parties have the right to determine that the terms of the contract concluded by them apply to their relations that arose before the conclusion of the contract. These may be established practical relations between the parties. For example, let's say the manufacturer sent the product to the consumer who needed it, and the consumer received it without any agreement between them. In this case, the parties can legally formalize their relationship by concluding a contract. It can spread its actions to the previously existing relations between them regarding product delivery. Among these definitions may be legal relations arising from other legal facts and not properly regulated.

As a general rule, the expiration of the contract terminates its validity if the parties duly fulfill all their obligations. If one of the obligations arising from the contract is not duly fulfilled, then the contract does not cease to be valid with the expiration of the term for which it was concluded. In such cases, the contract continues to be valid until the time specified in it for the termination of the parties' obligations. If such a time is not specified in the contract, then the rule of fulfilling the obligation within an indefinite period is applied.

At the same time, the law or contract may stipulate that the expiration of the contract may lead to the termination of the parties' obligations under the contract.

The expiration of the contract does not release the parties from liability for its violation. For example, the supplier is liable to the buyer for the shortage of the delivered goods even after the expiration of the supply contract.

Conclusion of a sales contract in a mandatory manner. This procedure is applied in cases where the conclusion of a contract is mandatory for one of the legal procedures, i.e., when concluding mandatory contracts. When concluding a contract in a mandatory manner, the rules of Article 377 of the Civil Code are applied. The party interested in concluding the contract, for whom the conclusion of the contract is not mandatory, sends the draft contract (offer) to the party for whom the conclusion of the contract is mandatory. The party for whom the conclusion of the contract is binding must consider the offer within 30 days from the date of its receipt and send the following to the other party:

- information on acceptance;
- information on the acceptance of the offer on other terms (minutes of disagreements on the draft contract);
- information on refusal of acceptance.

In the first case, the contract is considered concluded at the time the offeror receives information about acceptance. In the second case, the party that received information on the acceptance of the offer on other terms has the right, firstly, to notify the other party of the acceptance

of the contract in its version, and secondly, to transfer the dispute arising from the conclusion of the contract for consideration by the court within 30 days from the date of receipt of such information or during the expiration of the acceptance period. If the party disagreeing with the minutes of the dispute does not submit the resulting dispute for consideration by the court within the established timeframe, the contract is considered not concluded. In the third case, as well as in the event of failure to receive a response to the offer within the established timeframe, the offeror has the right to apply to the court with a claim to compel the conclusion of the contract. The draft contract may also be sent by the party that has undertaken the obligation to conclude the sales contract. In this case, the party for whom the conclusion of the contract is not mandatory has the right, within 30 days, to send the following to the other party:

- information on acceptance;
- information on refusal of acceptance;
- information on the acceptance of the offer on other terms (minutes of disagreements on the draft contract). [5]

In the first case, the contract is concluded on the terms specified in the offer. In the second case, as well as in the case of failure to receive a response to the offer within the established timeframe, the contract is not concluded, since its conclusion is not mandatory for the acceptor. In the third case, the party for whom the conclusion of the contract is binding must, within 30 days from the date of receipt of the protocol of disagreements, notify the other party of the acceptance of the contract in its version or the cancellation of the protocol of disagreements.

In the event of cancellation of the protocol of disagreements or failure to receive information on the results of the consideration within the established timeframe, the party that sent the protocol of disagreements has the right to submit the disagreement that arose during the conclusion of the contract for consideration by the court, which determines the conditions under which the disagreements of the parties arose. If the party that sent the minutes of the dispute has not transferred the resulting dispute for consideration by the court, then the contract is considered not concluded.

The above-mentioned provisions on deadlines apply if other deadlines are not established by law and other legal acts or are not agreed upon by the parties.[6]

If the party obligated to conclude a sales contract for him unreasonably refuses to conclude it, then he is obliged to compensate the other party for the losses caused by this. For example, if a commercial organization unreasonably refuses to conclude an open contract, then the citizen has the right to claim not only coercion to conclude a contract, but also compensation for the damage caused to him.

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Rezyume: *Ушбу мақолада олди-сотди шартномасини тузиш тартиби, унинг фуқаролик-ҳуқуқий тартибга солиниш масалалари ёритилган.*

Резюме: *This article covers the procedure for concluding a sales contract and issues of its civil law regulation.*

Kalit so‘zlar: *олди-сотди шартномаси,оферта,аксепт, шартнома муддати, товар, маҳсулот етказиб берувч .*

Ключевые слова: *договор купли-продажи, оферта, акцепт, срок договора, товар, поставщик.*

ANALYSIS OF METHODS FOR CIVIL LAW PROTECTION OF BIG DATA

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Summary: *This article examines the civil-law mechanisms available for protecting Big Data within the legal system of the Republic of Uzbekistan. It argues that while general methods of civil rights protection—such as recognition of rights, restoration of violated rights, compensation for damages, and judicial remedies—remain applicable, Big Data requires additional, specialized approaches. The study identifies four primary protection methods: contractual structures (including NDAs, DPAs, and SLAs), tort liability mechanisms, protection through personal non-property rights, and non-jurisdictional (alternative) methods such as consent management, encryption, anonymization, and access control. Through analysis of national legislation and comparative examination of international case law (including Lloyd v. Google LLC, Google Spain, and Carpenter v. United States), the article demonstrates how existing civil-law doctrines adapt to digital-era challenges. The author concludes that Big Data relations require both traditional and specialized legal mechanisms, and advocates for incorporating explicit provisions regarding information-related contracts and liability into Uzbekistan's emerging Information Code.*

Key words: *Big Data, civil law, methods for protection, contract, tort liability, personal non-property rights, non-jurisdictional methods*

INTRODUCTION

It is known that subjects of civil law have the opportunity to acquire and exercise various civil rights depending on their legal status. The procedure for exercising civil rights is defined in Article 9 of the Civil Code of the Republic of Uzbekistan, according to which citizens and legal entities exercise their rights at their own discretion and in pursuit of their interests. They also independently decide how to use and protect their rights. In this case, individuals make their own decisions regarding the exercise or non-exercise of their rights. Failure to exercise rights does not result in their termination, unless otherwise provided by law.

No person should infringe upon the rights and legitimate interests of others when exercising their own rights. The law requires a fair, conscientious, and reasonable approach from participants in civil legal relations. In this context, each person is presumed to have acted fairly and reasonably until proven otherwise.

When exercising their rights, citizens and legal entities are obliged to adhere to the moral principles and ethical norms of society, while entrepreneurs must observe business ethics and rules of conduct. In exercising their rights, they must not cause harm to others, abuse their rights, or act contrary to the law and legal norms. If individuals fail to comply with these requirements, the court has the right to refuse protection of their rights.

MAIN PART

One of the practical manifestations of civil rights is that if a person who bears an obligation does not fulfill it voluntarily, its compulsory fulfillment is ensured. Methods of protecting civil rights are defined in Article 11 of the Civil Code.

recognition of the right;

restoration of the situation that existed before the violation of the right and prevention of actions that violate the right or create a threat of its violation;

declaring a transaction invalid and applying the consequences of its invalidity;

invalidation of an act issued by a state body or a body of citizen self-government;

self-defense of rights;

compelling the performance of the duty in its original form (in kind);

compensation for damages;

collection of penalties;

compensation for moral harm;

termination or modification of legal relations;

non-application by the court of an unlawful act issued by a state body or a body of citizen self-government.

These methods are considered general methods for protecting civil rights. Undoubtedly, since Big Data consists of complex relationships, the aforementioned methods can be employed for the legal protection of the process. However, along with the methods listed above, it is advisable to utilize specialized methods of civil law in Big Data processes. In our opinion, these methods manifest themselves as follows:

1. *Protection through contractual structures (specific types of obligations);*
2. *Protection through mechanisms of tort liability;*
3. *Protection through personal non-property rights;*
4. *Non-jurisdictional methods (Alternative methods).*

Protection through contractual structures (specific types of obligations).

Today, Big Data technologies are widely used in various fields, including medicine, finance, industry, education, and public administration. With the help of these technologies, large volumes of digital data are analyzed, and decision-making processes are carried out effectively. However, when working with Big Data, ensuring data security, confidentiality, and integrity remains a pressing issue.

Systems storing large volumes of digital data are at risk of cyberattacks and potential information disclosure by internal personnel. In this context, ensuring data confidentiality is recognized as the primary concern. Additionally, maintaining the integrity and authenticity of data is crucial, as data corruption or manipulation can lead to incorrect decision-making. In such situations, a contractual approach to data protection is considered one of the most effective methods.

With the advancement of modern technologies, the concept of Big Data has reached an entirely new level. Big data analysis has opened up new opportunities for enterprises, research centers, and government agencies. Simultaneously, issues of data confidentiality and legal protection are becoming increasingly relevant. Particularly, ***Non-disclosure agreements (NDAs)*** have sparked serious debates among scientists and experts regarding their effectiveness in the Big Data environment.

The development of Big Data technologies is enabling companies and research centers to formulate business strategies using vast amounts of information. At the same time, the confidentiality of personal data is becoming an increasingly critical issue.

NDAs are often created to prevent the disclosure of confidential information to third parties. However, due to the constant updating and development of Big Data, debates continue regarding how to protect this information. For example, the effectiveness of data anonymization and encryption methods is still under question.

A. Tojiboev emphasizes that this agreement is widely used in startup activities and notes that the Non-disclosure agreement (NDA) is prevalent between startup owners and investors for protecting ideas, projects, technical, commercial, or organizational information.[51]

Taking into account the views of these scholars, in our opinion, the subject of the NDA contract should precisely be *the implementation of necessary measures to prevent the dissemination of any personal, commercial, or other types of information.* It is noted that all existing subjects of civil law can participate as parties to the contract. In general, this agreement defines the obligations of the parties not to disclose information. Companies reduce the risk of data leakage by signing this document before transferring their information to third parties.

Big Data and AI are closely interconnected. Training AI models requires large amounts of digital data. However, due to NDAs, access to some data may be restricted, which can affect the quality and accuracy of analyses. For example, in the medical field, real patient data is necessary for the effective performance of AI models, but this data must be kept confidential.

[51] A. Tojiboyev. Civil law regulation of startup activities. Dissertation. T., 2021, p. 72.

Big Data technologies enable organizations to collect, store, and analyze vast amounts of data. However, these processes raise important legal issues regarding the confidentiality and security of personal information. From this perspective, ***the Data Processing Agreement (DPA)*** plays a crucial role.

According to an analysis provided by WilmerHale, the DPA is essential for understanding and evaluating legal issues related to big data.[52]

An article published in the Stanford Law Review emphasized the importance of the DPA in managing and protecting personal data. [53] Additionally, a source from Washington University Open Scholarship discussed the role of the DPA in ensuring privacy in the era of big data.[54]

According to GDPR regulations, the DPA defines the rights and obligations of parties regarding the protection of personal data.

A DPA (Data Processing Agreement) is an agreement that defines the rights and obligations of parties in the process of personal data processing, concluded between the information owner (data controller) and the data processor. This agreement is necessary to ensure the legal and secure processing of personal data.

Big data technologies require the processing of large volumes of personal data, which makes the issues of confidentiality and security even more relevant. As parties to the DPA agreement, we can often see large corporations in the ICT sector acting as data processors. In general, today in our country, organizations operating in both public and private sectors are considered parties to this agreement. For example, in the mobile communications sector (Beeline, Mobiuz, Ucell), in the internet sector (Uztelecom), and my.gov.uz, the Single Portal of Interactive Public Services of the Republic of Uzbekistan (Digital Government Project Management Center), are considered data processors in accordance with the DPA agreement.

In our opinion, the DPA agreement is an important legal tool for ensuring the protection of personal data in the process of big data. The DPA clearly defines the rights and obligations of the parties and ensures the safe and lawful processing of personal data.

The development of the digital economy and Big Data technologies ***has increased the demand for Service Level Agreements (SLAs)*** . An SLA is a legal document that defines the terms of service provision based on Big Data, with its content specifying the quality of service, liability limits, and the rights and obligations of the parties.

Researchers emphasize that SLAs play a crucial role in Big Data relationships not only in terms of service quality but also in terms of data confidentiality and protection. These agreements serve as a legal foundation between service providers and users.

The subject of an SLA must clearly define the level of service provision, data confidentiality and security, responsibility and dispute resolution, as well as the boundaries of responsibility between the service provider and the client. In our view, this agreement can be manifested through collaboration with service and intellectual property agreements (such as license agreements, copyright agreements, etc.) in our national legislation. However, a natural question arises regarding which institutional rules or methods should be applied for liability in case of non-performance of obligations in this area.

If we define the SLA contract as a service agreement, special provisions may apply in addition to the general provisions on obligations. In particular, according to the rules for service provision, if the service provider (contractor) fails to fulfill the paid service contract fully or properly, they are obliged to fully compensate the customer for the damages caused. However, this compensation should not exceed twice the cost of the services specified in the contract. If this situation involves business

[52] https://www.wilmerhale.com/en/insights/publications/20230515-big-data-analytics-privacy-law-considerations

[53] Omer Tene & Jules Polonetsky. Privacy in the Age of Big Data A Time for Big Decisions. https://www.stanfordlawreview.org/online/privacy-paradox-privacy-and-big-data/

[54] Richards, Neil M. and King, Jonathan H., "Big Data and the Future for Privacy" (2016). Scholarship@WashULaw. 500. https://openscholarship.wustl.edu/law_scholarship/500

entities, enhanced civil liability is provided for. These provisions are reflected in Article 706 of the Civil Code.[55]

If it is deemed necessary to apply intellectual property protection rules to the SLA agreement, in accordance with Article 1040 of the Civil Code, the following measures can be taken: seizure of the objects through which the exclusive rights were violated, as well as the material objects created as a result of such violation; or mandatory publication of information about the violation, including details about the ownership of the violated right. The key aspect for this is the reflection of exclusive rights to the data or database that is the subject of the SLA agreement.

In general, according to the doctrine of contract law, parties may conclude a mixed contract that incorporates elements of various contracts. The rules governing the contracts that constitute its components apply to the relations between parties under such a contract. These provisions are reflected in Article 354 of the Civil Code.

In our opinion, it is appropriate to apply both service provision rules and intellectual property protection rules in SLA agreements.

Based on the principle of freedom of contract, parties are allowed to conclude contracts not provided for by legislation. This rule is enshrined in Article 354 of the Civil Code. Thus, contracts such as NDA, DPA, and SLA are also considered a separate type of obligation, and parties may conclude such contracts in the context of implementing information relations.

However, NDA, DPA, and SLA agreements (hereinafter referred to as agreements in the information sphere), their content, or closely related provisions cannot yet be found in either information legislation or civil legislation. In this case, it is advisable to include provisions related to such contracts, liability arising from them, and their protection in the draft Information Code of the Republic of Uzbekistan.

Moreover, in accordance with the doctrine of civil law, civil liability for breach of obligations consists of imposing on the debtor who failed to fulfill the obligation the duty to pay damages and penalties in favor of the creditor.[56]

Therefore, according to the general doctrine, it can be concluded that if parties fail to fulfill or properly comply with the obligations stipulated in information-related agreements, the other party is obligated to pay damages and penalties.

Protection through the mechanisms of tort law.

It is known that the existence of damage is one of the main factors in determining civil liability for a tort. In civil liability for breach of obligations, however, the presence of actual damage is not mandatory.[57] In Big Data relations, if civil rights are protected through tort, it is natural that the factor of damage comes to the forefront.

Big Data is analyzed by commercial and public sectors and used for various purposes. The need to protect Big Data is related to the confidentiality of personal data and the risk of illegal data use. According to Article 990 of the Civil Code, an act causing harm must be illegal and cause real harm to the victim. Within the framework of Big Data, such damage can manifest itself as follows:

- unauthorized disclosure of personal data;
- illegal use of data for commercial purposes;
- damage to the victim as a result of data corruption or loss.

According to Article 985 of the Civil Code, the person who caused the damage is liable for this damage and is obligated to compensate for it. Illegal collection, use, or disclosure of Big Data may infringe on personal privacy. In this case, the injured party may file a claim based on tort liability.

[55] National Database of Legislation, April 21, 2021, No. 03/21/683/0375, August 21, 2021, No. 03/21/709/0808; 10.02.2022, No 03/22/752/0113; March 30, 2022, No. 03/22/761/0250; 21.04.2022, No. 03/22/765/0332; May 18, 2022, No. 03/22/770/0424, June 7, 2022, No. 03/22/775/0477; 04.11.2022, No 03/22/800/0990; November 16, 2023, No. 03/23/878/0852; February 22, 2024, No. 03/24/911/0142; February 28, 2024, No. 03/24/914/0161; 11.09.2024, No 03/24/959/0698; 07.02.2025, No 03/25/1025/0116; 07.03.2025, No 03/25/1044/0224

[56] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 264 p.

[57] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 274 p.

Lloyd v Google LLC (2021) UKSC 50 [58] is a significant case heard by the UK Supreme Court, which addressed issues of personal data protection, the factor of harm, and class action lawsuits.

Richard Lloyd, acting as a consumer rights advocate, filed a lawsuit against Google. In the lawsuit, he alleged that during 2011-2012, Google used a mechanism called "Safari Workaround" to collect personal data from millions of users through the Apple Safari browser without their consent.[59]

Lloyd argued that this case violated the Data Protection Act 1998 (DPA 1998) and demanded general compensation from Google for English users. In the plaintiff's view, Google is obligated to pay compensation for the automatic harm caused to English users. However, in this case, the views on the degree of actual damage have already been called into question.[60]

Two main issues were discussed in this case: a) class action lawsuit - Lloyd filed a lawsuit on behalf of all English users, but under the British legal system, it is only accepted with the participation of victims who suffered actual damage; b) the fact of damage - although it was alleged during the case that Google had illegally collected users' personal data, it was not clearly proven that damage was caused to each user individually.[61]

The UK Supreme Court rejected Lloyd's claim based on the evidence in the aforementioned case, citing the lack of substantiated evidence that Google had caused harm to users.

In our opinion, *Lloyd v Google LLC* case notes that even if data is collected in the Big Data process without users' consent, the application of tort law rules should be based on the fact of actual damage.

The aforementioned court decision was a relief for companies in the Big Data sector, as if Lloyd had won, the number of similar mass lawsuits could have increased. However, it created a limitation for consumer rights advocates, as it has now become more difficult to pursue collective claims against personal data breaches.

Protection through personal non-property rights.

According to civil law doctrine, personal non-property rights cannot be valued, they are characterized by being free of charge, and their implementation does not entail equivalent property obligations of other persons. The objects of non-property benefits are intangible assets inseparable from the individual: name, honor, dignity, health, privacy, personal inviolability, and others.[62]

According to S. Gulyamov, at a time when digital technologies are becoming increasingly widespread, the vulnerabilities of personal data are opening the way for new forms of systemic corruption. Although robust data protection mechanisms are an important safeguard, they are still not sufficiently utilized in the fight against corruption.[63]

The life, health, honor, dignity, and personal inviolability of every individual are protected. Their business reputation, personal life, family secrets, rights to name and image, copyrights, and other personal non-property rights must not be violated. Moreover, intangible assets belonging to a person from birth or by law cannot be seized under any circumstances. These provisions are enshrined in Article 99 of the Civil Code.

According to the regulations on personal non-property rights, a citizen has the right to demand a refutation through the court if information damaging their honor, dignity, or business reputation has been disseminated, and the person who spread it cannot prove its truthfulness.[64] Typically, the procedure for issuing a retraction is determined by the court.

[58] See: https://inforrm.org/2021/12/22/top-10-privacy-and-data-protection-cases-of-2021-a-selection-suneet-sharma/

[59] Gruschka, Nils & Mavroeidis, Vasileios & Vishi, Kamer & Jensen, Meiko. (2018). Privacy Issues and Data Protection in Big Data: A Case Study Analysis under GDPR. 5027-5033. 10.1109/BigData.2018.8622621.

[60] Janeček, Václav, Mass Compensation Claims for Illegal Online Tracking (March 2, 2022). (2022) 138(April) The Law Quarterly Review 205-210, Available at SSRN: https://ssrn.com/abstract=4047736

[61] See https://inforrm.org/2021/12/22/top-10-privacy-and-data-protection-cases-of-2021-a-selection-suneet-sharma/

[62] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 112 p.

[63] S.Gulyamov, Sh.Raimberdiyev. Personal Data Protection as a Tool to Fight Cyber Corruption // International Journal of Law and Policy | Volume: 1 Issue: 7, 2023

[64] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 113 p.

A citizen whose honor, dignity, or business reputation has been tarnished by disseminated information has the right to demand compensation for losses and moral damages caused by its spread, in addition to the refutation of such information.

One of the specific methods of protecting personal non-property rights is compensation for moral damages.[65]

Furthermore, Article 31 of the Constitution of the Republic of Uzbekistan stipulates that everyone has the right to protection of their personal data, as well as the right to demand correction of inaccurate information and deletion of information about themselves that has been collected illegally or has lost its legal basis.[66]

In addition to the methods outlined in civil legislation, the Basic Law of our country also establishes the right to demand the deletion of illegal and unlawful information. This *"right to be forgotten" (the "Right to Be Forgotten")* essentially *Google Spain SL v. Agencia Española de Protección de Datos (2014) - CJEU*[67] entered the realm of social relations and civil law as a result of a court case.

In the Law of the Republic of Uzbekistan "On Personal Data," information relating to a specific individual or enabling their identification, recorded electronically, on paper, and (or) on other tangible media, is interpreted as personal data.[68]

In accordance with the provisions of this Law, the state, while guaranteeing the protection of personal data, implements the following methods of protecting personal data for the owner and (or) operator, as well as third parties:

ensuring the realization of the subject's right to protection from interference in their private life;

maintaining the integrity and security of personal data;

Ensuring the confidentiality of personal data;

Preventing illegal processing of personal data.[69]

In our opinion, the above measures are considered protective (preventive) and may not be of particular significance.

In the case *of Carpenter v. United States (USA, 2018),* it is also possible to observe harm caused to the victim as a result of a mobile operator disclosing personal data without the permission of the data owner and without a court warrant.[70]

In 2003, several armed robberies were committed in Detroit, USA. Law enforcement agencies demanded location history data (CSLI - Cell-Site Location Information) from mobile operators to prove that one of the suspects, Timothy Carpenter, and his accomplices were at the crime scenes.

The U.S. prosecutor's office obtained a court order to acquire this information, but a traditional warrant was not required. This order was issued based on the Stored Communications Act (SCA) adopted in 1986, which allowed obtaining information without requiring a warrant.

Using Carpenter's mobile phone signals, investigators confirmed his presence at the crime scenes, which was used as evidence in court. Carpenter was found guilty by the court and sentenced to a long-term imprisonment.

Carpenter filed an appeal, arguing that law enforcement agencies obtaining location history data stored by mobile operators without a warrant violates the Fourth Amendment to the US Constitution.[71] The amendment stipulates that a person's right to privacy, home, documents, and possessions should be protected from unreasonable searches and seizures.[72]

Carpenter and his lawyers asserted that mobile phone location history data is personal and requires a court order to obtain such information. The government, however, argued that this

[65] Internet resources: https://lex.uz/docs/-6445145
[66] National Database of Legislative Information, 01.05.2023, No. 03/23/837/0241
[67] See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:62012CJ0131
[68] National Database of Legislation, April 21, 2021, No. 03/21/683/0375; November 29, 2023, No. 03/23/880/0905
[69] Ibid
[70] Margot E. Kaminski, Response, Carpenter v. United States: *Big Data Is Different*, GEO. WASH. L. REV. ON THE DOCKET (July 2, 2018), https://www.gwlr.org/carpenter-v-united-states-big-data-is-different.
[71] Gerald G. Ashdown, The Fourth Amendment and the "Legitimate Expectation of Privacy", 34 Vand. L. Rev. 1289, 1315 (1981)
[72] Danielle K. Citron, Mainstreaming Privacy Torts, 98 Cal. L. Rev. 1805, 1852 (2010)

information falls under *the Third-Party Doctrine*, meaning that users have no right to privacy because they have voluntarily provided such information to certain organizations (mobile operators).

In 2018, the U.S. Supreme Court ruled that mobile phone location history data is considered personal information, that law enforcement agencies must obtain a warrant to access such information, and that the Third-Party Doctrine does not apply in this case, as users do not intentionally share their location history data with operators. According to the U.S. Supreme Court, this information is automatically recorded.

According to M. Kaminski, this court case created an important precedent in *the field of digital privacy rights* by establishing that courts should protect citizens' data automatically collected through technology. Moreover, the U.S. Supreme Court set limitations on *the third-party doctrine*, indicating that even if a person has transferred data to a private company, such data may still be under constitutional protection.[73]

In our interpretation, *the Third-Party Doctrine* principles are also reflected in national legislation. For instance, according to the Law of the Republic of Uzbekistan "On Personal Data," the owner and (or) operator, as well as other persons who have been granted access to personal data, are obligated not to disclose or disseminate personal data to third parties without the subject's consent.[74]

Overall, this court case is a significant event that expands digital privacy rights, potentially limiting law enforcement agencies' access to Big Data, and in such situations, civil liability measures may be applied through tort obligations.

At the same time, registering personal data in the state register is considered necessary as a preliminary mechanism for protecting the Big Data process through personal non-property rights. In the EU, the controller and the processor are responsible for this process.[75] According to the provisions of the Regulation "On the State Register of Personal Databases," approved by Resolution No. 71 of the Cabinet of Ministers dated February 8, 2020, the owner and operator of personal databases are authorized in this matter.[76] Based on this, it is advisable to identify, as the next mechanism, a group of information that is not considered personal data by authorized persons. In this case, publicly available data that have not used automation tools and are processed based on labor legislation should not be reflected in the personal data registry.

Non-jurisdictional (alternative) methods.

In our opinion, regulatory and legal frameworks may not be sufficient to ensure security in Big Data, particularly regarding the protection of personal information. Therefore, in Big Data relationships, it is necessary to widely utilize additional non-jurisdictional methods such *as opt-in and opt-out (giving consent and withdrawing it), encryption, pseudonymization and anonymization, access control, data masking, and audit and log systems.*

Such measures are required to comply with international standards for personal data protection, particularly legislation like the European Union's GDPR, the U.S. HIPAA (Health Insurance Portability and Accountability Act), and the CCPA (California Consumer Privacy Act).

According to the GDPR, users must participate in the processing of their personal data based on full and informed consent. This makes the *opt-in* mechanism critically important. Additionally, users have the right to withdraw their consent (opt-out) at any time. This mechanism is one of the fundamental principles of personal freedom and information security.

Big Data systems, *encryption technologies* can render data unreadable by third parties during storage and transmission processes. Specifically, encrypting data in transit and at rest is an integral part of modern cybersecurity. Encryption algorithms widely employ technologies such as AES (Advanced Encryption Standard) and RSA (Rivest-Shamir-Adleman).

[73] Margot E. Kaminski, Response, Carpenter v. United States: *Big Data Is Different*, GEO. WASH. L. REV. ON THE DOCKET (July 2, 2018), https://www.gwlr.org/carpenter-v-united-states-big-data-is-different.
[74] National Database of Legislation, April 21, 2021, No. 03/21/683/0375; November 29, 2023, No. 03/23/880/0905
[75] See: https://gdpr-info.eu/art-28-gdpr/
[76] See: https://lex.uz/docs/-4729730

Pseudonymization modifies personal data, reducing the possibility of directly linking it to the user. This method plays a crucial role in protecting privacy while maintaining data value, especially in analytical and statistical processing. Anonymization, on the other hand, aims to completely eliminate the possibility of identifying an individual from a dataset. However, this method should be implemented cautiously to minimize the risk of re-identification.

RBAC (Role-Based Access Control) model grants users access rights only at levels corresponding to their roles. This approach serves to mitigate internal risks. Additionally, all actions related to data access and usage must be recorded in log files. Audit and monitoring systems can be used to observe these processes and detect actions that violate security policies.

Data Masking is a technology for creating modified but syntactically authentic-looking data used for testing or development environments instead of real data. This allows developers to work without real user data and reduces the risk of personal data leakage.

Additionally, *the "Zero Trust"*model-based infrastructure relies on verifying every action of the user and device. This model abandons the concept of a "trusted network" and constantly checks any attempt to access the system. This helps create a high level of protection in Big Data systems at both corporate and government levels.

CONCLUSION

In Big Data relations, it is essential to employ not only the general methods of civil rights protection but also specialized legal mechanisms tailored to the unique nature of digital information processes. These methods collectively ensure a balanced and comprehensive framework for safeguarding the interests of data subjects, data controllers, and all participants in information relations. In particular, protection may be achieved through Sui Generis intellectual property rights, which help secure the legal status of databases and prevent unauthorized use; through contractual structures that define specific obligations between parties and regulate data processing, confidentiality, and service quality; through tort liability mechanisms that address harm caused by unlawful data collection, disclosure, or misuse; and through the protection of personal non-property rights, which uphold the inviolability of personal data, privacy, dignity, and digital autonomy. Together, these complementary approaches form a robust legal foundation capable of addressing the challenges posed by Big Data in modern civil law.

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15. California Consumer Privacy Act (CCPA), California Civil Code §1798.100 et seq.

Rezyume: *Ushbu maqolada O'zbekiston Respublikasi huquqiy tizimida katta ma'lumotlarni himoya qilishning mavjud fuqarolik-huquqiy mexanizmlari ko'rib chiqiladi. Uning ta'kidlashicha, fuqarolik huquqlarini himoya qilishning umumiy usullari - huquqlarni tan olish, buzilgan huquqlarni*

tiklash, zararni qoplash va sud orqali himoya qilish usullari qo‘llanilishi mumkin bo‘lsa-da, Big Data qo‘shimcha, maxsus yondashuvlarni talab qiladi. Tadqiqotda himoyaning to‘rtta asosiy usuli aniqlangan: shartnomaviy tuzilmalar (shu jumladan NDA, DPA va SLA), huquqbuzarlik uchun javobgarlik mexanizmlari, shaxsiy nomulkiy huquqlar orqali himoya va rozilikni boshqarish, shifrlash, anonimlashtirish va kirishni nazorat qilish kabi yurisdiksiyadan tashqari (muqobil) usullar. Milliy qonunchilikni tahlil qilish va xalqaro sud amaliyotini qiyosiy o‘rganish orqali (jumladan, Lloyd v. Google LLC, Google Spain va Carpenter v. Amerika Qo‘shma Shtatlari), maqola mavjud fuqarolik-huquqiy doktrinalar raqamli davr muammolariga qanday moslashishini ko‘rsatadi. Muallif katta ma’lumotlar bilan bog‘liq munosabatlar ham an’anaviy, ham maxsus huquqiy mexanizmlarni talab qiladi, degan xulosaga keladi va O‘zbekistonning yangi Axborot kodeksiga axborot bilan bog‘liq shartnomalar va javobgarlik to‘g‘risidagi aniq qoidalarni kiritish tarafdori bo‘ladi.

Резюме: *В данной статье рассматриваются доступные гражданско-правовые механизмы защиты больших данных в правовой системе Республики Узбекистан. Он утверждает, что в то время как общие методы защиты гражданских прав, такие как признание прав, восстановление нарушенных прав, возмещение ущерба и судебные иски, остаются применимыми, большие данные требуют дополнительных, специализированных подходов. В исследовании выделены четыре основных метода защиты: договорные структуры (включая NDA, DPA и SLA), механизмы ответственности за правонарушения, защита посредством личных неимущественных прав и неюрисдикционные (альтернативные) методы, такие как управление согласием, шифрование, анонимизация и контроль доступа. Путем анализа национального законодательства и сравнительного изучения международного прецедентного права (включая Lloyd v. Google LLC, Google Spain и Carpenter v. Соединенные Штаты), в статье показано, как существующие гражданско-правовые доктрины адаптируются к вызовам цифровой эпохи. Автор приходит к выводу, что отношения с большими данными требуют как традиционных, так и специализированных правовых механизмов, и выступает за включение четких положений о договорах, связанных с информацией, и об ответственности в формирующийся Информационный кодекс Узбекистана.*

Kalit so‘zlar: *Katta ma’lumotlar, fuqarolik huquqi, himoya usullari, shartnoma, huquqbuzarlik uchun javobgarlik, shaxsiy nomulkiy huquqlar, yurisdiksiyadan tashqari usullar.*

Ключевые слова: *Большие данные, гражданское право, методы защиты, контракт, деликтная ответственность, личные неимущественные права, неюрисдикционные методы.*

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METHODS OF IMPLEMENTING THE INTEGRATION OF PHYSICS AND TECHNICAL SCIENCES

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Summary: *This article analyzes effective methods for implementing the integration of physics and technical disciplines. The possibilities of deepening students' knowledge, linking theoretical knowledge with practice, and developing engineering thinking through the organization of an integrated educational process are highlighted. The article presents the theoretical foundations of strengthening interdisciplinary connections, stages of integration, and methodological approaches. Also, recommendations are given for orienting students to real production processes in physics lessons through technical examples, models, and laboratory work.*

Key words: *Physics, technical sciences, integration, methodology, interdisciplinary connection, innovative education, engineering thinking, theory and practice, educational effectiveness, pedagogical approach.*

In the current era of rapid development of science and technology, the education system is faced with the task of training highly qualified, innovative thinkers and practical skills. In particular, deepening the interrelationship between physics and technical sciences and their integrated teaching is one of the important factors in increasing the effectiveness of education. Theoretical laws studied in physics form the scientific basis of technical sciences, and technical sciences serve to apply this theoretical knowledge in practice. Therefore, by teaching these sciences in close connection with each other, it is possible to develop scientific and technical thinking in students, harmonize theory and practice, and thoroughly prepare them for future professional activities.

In our country, special attention is paid to the introduction of innovative approaches and strengthening interdisciplinary integration in the educational process. In particular, the Law “On Education”, the Strategy for the Development of the Republic of Uzbekistan until 2030, as well as the decrees and resolutions of our President “On the Development of Science and Innovations” determine the main directions in this regard. These documents set out specific tasks for improving the quality of education, combining theoretical knowledge with production and technology, and training qualified specialists in accordance with international standards[1,2].

Scientific research on the integration of physics and technical sciences into the educational process is widely covered not only in domestic but also in foreign sources. Scientific research conducted in this area is mainly aimed at strengthening interdisciplinary connections, increasing educational efficiency, and developing scientific and technical thinking in students. Literature analysis allows us to divide them into three main groups: sources that study theoretical foundations, works that describe methodological approaches, and studies that analyze practical experience.

The scientific literature included in the first group covers the theoretical foundations of interdisciplinary integration. For example, the works of scientists such as V.A.Slastenin, L.S.Vygotsky, J. Piaget show the psychological foundations of cognitive development in the educational process, the organization of interdisciplinary connections in the process of assimilation of knowledge by pupils and students. Also, the theory of contextual education developed by A.A.Verbitsky and BLFarberman defines the methodological foundations of integrated teaching. These theories serve as an important basis for harmonizing theory and practice in the joint teaching of physical and technical sciences[3].

The second group of sources analyzes methodological approaches. In particular, the works of Uzbek scientists RAMavlonova, ASSattorov, and SMSharipov extensively cover the didactic principles of integrated teaching of technical disciplines and methods of using innovative pedagogical technologies. These works are especially aimed at developing technological thinking in students [4,5].

The third group of literature covers practical experiences. For example, at the international level, the research of J. Dewey, D. Bruner and M. Fullan shows methods of combining project work, laboratory exercises and production practice in the educational process through an integrated approach [6,7,8,9].

The analysis shows that although the theoretical and methodological foundations for the integration of physics and engineering sciences are sufficiently developed in the existing scientific literature, research on the application of new pedagogical opportunities, such as modern digital technologies, distance learning, and engineering simulations, has not been sufficiently conducted. Therefore, additional scientific research and the development of practical methodological recommendations in this area are urgent.

The integration of physics and engineering sciences into the educational process is one of the important directions for adapting the education system to the requirements of the times in today's era of globalization and digital transformation[10,11,12,13].

An integrated approach serves not only to thoroughly master theoretical knowledge, but also to prepare students for a modern production environment by inextricably linking it with practice. An analysis of the literature shows that by effectively implementing the integration process, it is possible to increase the effectiveness of education, develop students' engineering thinking, and encourage the creation of innovative ideas.

The main goal of implementing integration is to harmoniously develop theoretical knowledge and practical skills in students. For this, the effective methods presented in Figure 1 can be widely used.

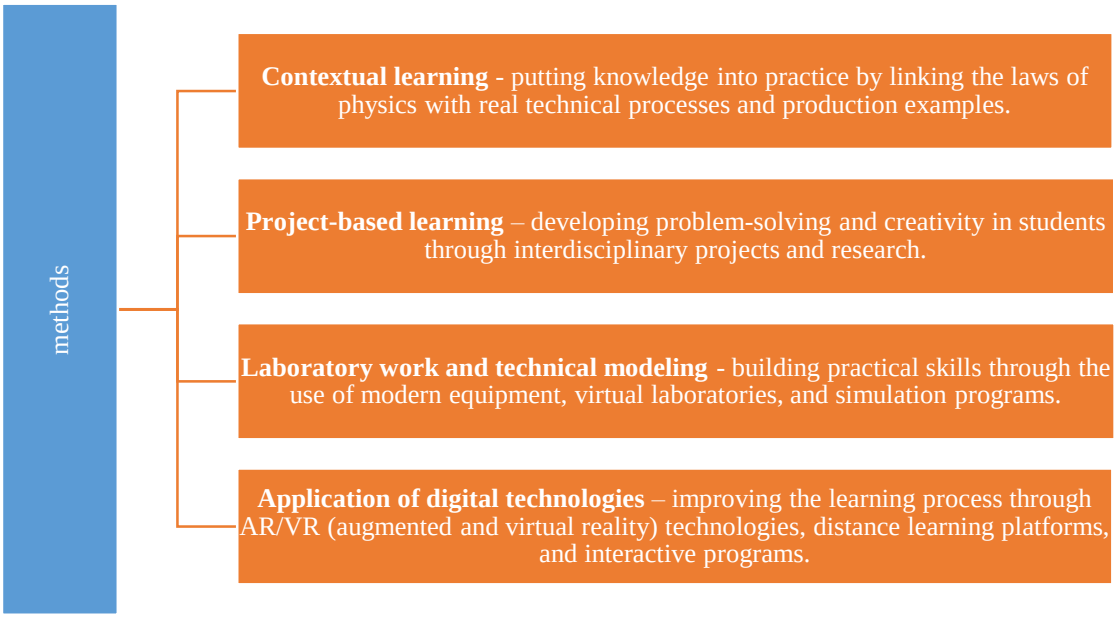


Figure 1. Main methods for implementing integration .

However, there are a number of problems in fully implementing the integration approach. In particular, some teachers lack the necessary qualifications in integration methods, lack of technical resources, inconsistency of subject curricula, and gaps in linking theoretical knowledge with practice. In addition, the lack of independent research and innovative thinking skills among students also negatively affect the effectiveness of integration.

As a result of the research, the theoretical, methodological, and practical foundations of integrated teaching of physics and technical sciences were deeply analyzed, and the following important scientific and practical results were achieved:

The regulatory and legal framework was systematically analyzed.

The Law of the Republic of Uzbekistan "On Education", Presidential Decrees on the Development of Science and Innovation, and the Development Strategy until 2030 were identified as the main legal foundations for the integration of physical and technical sciences. These documents determine the need to combine theory and practice in the educational process, widely introduce digital

technologies, train qualified and competitive specialists, and form an innovative education model in line with international standards. It was also revealed that the incomplete implementation of legal frameworks in practice is causing certain difficulties in the integration process.

Effective pedagogical and technological methods of integration have been developed.

Through the contextual teaching method, it was observed that the laws of physics are connected with real technical processes, students' knowledge deepens, and engineering thinking develops.

Interdisciplinary project-based teaching technology has shown high effectiveness in combining theory and practice, solving problem situations in students, and developing a creative approach.

The importance of using virtual laboratories and simulation programs to develop practical skills through laboratory work and technical modeling was substantiated.

Opportunities have been identified to increase the interactivity of the educational process through the use of digital technologies – AR/VR (augmented and virtual reality) and online platforms.

Problems and obstacles in the integration process were studied.

It was found that teachers lack sufficient training in integrated teaching methods and there is a lack of methodological guides.

It was noted that one of the important problems in educational institutions is the lack of laboratory equipment, digital platforms, and technical infrastructure that meet modern requirements.

The incompatibility of curricula in physics and technical sciences hinders the effective organization of integration.

The low level of motivation and preparation of students to apply theoretical knowledge in practice also negatively affects the quality of integration.

Recommendations for improvement were developed.

It was proposed to create unified curricula and methodological guides for the integrated teaching of physics and technical sciences .

The need to train teachers in an integrated methodological approach through regular in-service and retraining courses was justified.

Specific measures have been identified to provide educational institutions with modern laboratory equipment, digital platforms, simulation programs, and AR/VR technologies.

It was recommended to expand practical projects and industrial internships in collaboration with enterprises in order to bring students closer to the production environment.

The positive impact of integration on educational effectiveness has been proven.

It was observed that the integrative approach serves to deepen students' theoretical knowledge, connect them with practice, and develop their ability to make independent decisions in problem situations.

It was found that the level of engineering thinking, creativity, and innovative thinking in students significantly increased.

It was scientifically proven that the combination of physical and technical sciences through the widespread use of the STEM approach serves to train competitive specialists who meet the requirements of the market economy.

As a general conclusion, this study shows that the systematic and comprehensive implementation of the integration of physics and technical sciences is of strategic importance for improving the quality of education, the widespread introduction of innovative technologies into the educational process, and the development of the country's scientific and technical potential. An integrated approach not only increases the level of knowledge of students, but also thoroughly prepares them for future professional activities and creates the basis for their formation as competitive specialists in the international labor market.

The integration of physics and engineering sciences is an important direction in improving the modern education system. The results of the study showed that the integrative approach is effective in combining theory and practice, developing engineering thinking, creative thinking and practical skills in students.

The widespread introduction of project-based learning, virtual laboratories, digital technologies and contextual methods into the integration process will increase the quality of education and prepare competitive specialists who meet market requirements. Therefore, the integration of physical and technical sciences is one of the strategic factors for increasing the country's scientific and technical potential and achieving innovative development.

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Rezyume: *Ushbu maqolada fizika va texnik fanlar integratsiyasini amalga oshirishning samarali usullari tahlil qilinadi. Integratsiyalashgan ta'lim jarayonini tashkil etish orqali talabalar bilimini chuqurlashtirish, nazariy bilimlarni amaliyot bilan bog'lash hamda muhandislik tafakkurini rivojlantirish imkoniyatlari yoritilgan. Maqolada fanlararo aloqadorlikni kuchaytirishning nazariy asoslari, integratsiyani amalga oshirishning bosqichlari va metodik yondashuvlari keltiriladi. Shuningdek, fizika darslarida texnik misollar, modellar va laboratoriya ishlari orqali o'quvchilarni real ishlab chiqarish jarayonlariga yo'naltirish bo'yicha tavsiyalar berilgan.*

Резюме: *В этой статье будут проанализированы эффективные способы интеграции физических и технических наук. Освещены возможности углубления знаний учащихся, увязки теоретических знаний с практикой и развития инженерного мышления посредством организации интегрированного образовательного процесса. В статье представлены теоретические основы усиления междисциплинарного взаимодействия, этапы и методические подходы к реализации интеграции. Также на уроках физики даются рекомендации по ориентации учащихся на реальные производственные процессы с помощью технических примеров, моделей и лабораторных работ.*

Kalit so'zlar: *Fizika, texnik fanlar, integratsiya, metodika, fanlararo bog'liqlik, innovatsion ta'lim, muhandislik tafakkuri, nazariya va amaliyot, ta'lim samaradorligi, pedagogik yondashuv.*

Ключевые слова: *физика, технические науки, интеграция, методология, междисциплинарность, инновационное образование, инженерное мышление, теория и практика, образовательная эффективность, педагогический подход.*

POETRY OF TURKIC WOMEN POETS: TRADITION, THEMES, AND ARTISTIC CONTINUITY (ON THE EXAMPLE OF KAZAKH AND UZBEK POETRY)

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Summary: *This article revisits the poetic legacy of early to mid-20th century Kazakh women poets − Sholpan Imanbayeva, Mariyam Khakimzhanova, Ziyash Qalauova, and Amina Shalabayeva − through the lens of contemporary literary criticism, highlighting their role in establishing the female subject within the literary space. The study also conducts a typological comparison with contemporary and kindred Uzbek women poets, Zulfiya (Zulfiya Isroilova) and Halima Khudoyberdieva. The analysis covers themes such as motherhood, homeland, heroism, ethics and aesthetics, the lyrical "I," and the condition of women in the context of war and modernization. Based on brief textual excerpts and motif-semantic parallels, the article identifies both continuities and distinctions in the artistic expression of Kazakh and Uzbek women's poetry.*

Key words: *women's poetry, lyrical "I", national modernization, war lyrics, civic pathos, Kazakh literature, Uzbek literature, comparative poetics.*

The literature of Turkic peoples is a spiritual heritage that has continued unbroken from ancient times to the present day. One important strand of this heritage is the poetry of women. In the works of female poets, themes such as love, maternal tenderness, fate, heroism, and love for the homeland are deeply expressed. These women poets were not only artists but also spiritual figures who preserved and passed on national worldviews and traditions to future generations.

In Kazakh oral literature, the image of the woman is embodied through epic heroines such as Kyz Zhibek and Aiman-Sholpan. In the 19th century, improvisational poetesses like Sara Tastanbekkyzy, Akbala, and Yrysszhan became widely recognized among the people. In the oral epics of all Turkic-speaking peoples, the image of the woman often symbolizes heroism and fidelity. In Kyrgyz oral literature, for example, the epic *Kyz Saykal* presents a powerful image of a heroic woman.

In Uzbek literature of the Middle Ages, figures such as Zebuniso and Makhzuna emerged, while in Tatar and Bashkir literature of the 19th–20th centuries, poetesses such as Sayyida Sharifa and Göländäm played a significant role. In the 20th century, Zulfiya gained fame not only in Uzbekistan but across the entire Turkic world for her delicate lyricism. In Kyrgyz literature, Kulipzhan Adysheva and Gulanda Asylbekova, and in Tatar-Bashkir literature, Maryam Burashova and Sagidä Ramiyeva explored themes of women's fate and social roles, thereby contributing to the development of women's poetry.

In Turkish literature, women's voices began to emerge distinctly from the 20th century onwards. Poets such as Gülten Akın and Lale Mükerrem Mükeçoğlu stood out with their sensitive, modern poetic expressions. Across Turkic literature, women poets have become a mirror of national spirituality. Through their work, they combine tradition and modernity, portraying not only the tenderness of the female essence but also resilience and spiritual depth. This tradition continues today, and the voice of women holds a significant place in Turkic literatures.

One of the most educated and refined lyric poets of the East was Zebuniso (1638–1702). She stood out in the cultural circles of her time for her independent thinking and wrote poetry that opposed injustice, wars, and the suffering of the people. While she is primarily known for her delicate love poems and Sufi-influenced verses, her work also contains strong patriotic themes, advocating for the protection of her homeland’s peace and well-being. Despite being a woman, Zebuniso gave voice to the difficult fate of society.

Among Uzbek women poets, Makhzuna (17th century) is notable for expressing the people’s sorrows and criticizing social injustice, often calling for national unity. Her poetry reflects the belief

that "the honor of the nation is the honor of its men." For Makhzuna, the value of the homeland and the fate of the people were central themes.

Likewise, the name of Sayyida Sharifa (19th century), a female poet who wrote in support of the Tatar people's liberation and national pride, deserves special mention. Her poems express a desire to free her people from colonial domination and awaken their national spirit. For Sharifa, freedom and independence were ultimate ideals, vividly depicted in her verse.

Göländäm (19th–20th centuries) highlighted the hardships of the Bashkir people, especially the difficult lives of mothers and women, while promoting the idea of defending the homeland. Her patriotic lyrics are closely tied to love for the land and the spiritual resilience of the people. Despite being women, all these poets engaged with traditionally male poetic themes such as heroism and national defense. Common motifs in their poetry include love for the homeland, national unity, and the pursuit of freedom and justice.

The poetry of Uzbek and Tatar-Bashkir women poets served to awaken national consciousness and instill a sense of patriotism in future generations.

Although these women were daughters of a common Turkic origin, they are now recognized as poets of their respective nations. If we examine their individual characteristics: Uzbek women poets (Zebuniso, Makhzuna) often used Sufi and lyrical elements to subtly express patriotic ideas, whereas Tatar-Bashkir poets (Sayyida Sharifa, Göländäm) leaned more directly toward political and social advocacy. Zebuniso's work, shaped within courtly culture, is rich in philosophical layers, while the poetry of Tatar-Bashkir women is closer to folk traditions and liberation movements. Uzbek women poets tend to portray women's fate within a socio-spiritual framework, whereas Tatar-Bashkir poets stand out for their fiery calls to national liberation.

The Poetry of Uzbek and Tatar-Bashkir Women Poets and the Study of Women's Literature in Turkic Traditions.

The poetry of medieval Uzbek poetesses Zebuniso and Makhzuna, as well as that of later-era Tatar-Bashkir poets Sayyida Sharifa and Göländäm, reflects the shared patriotic spirit, national identity, and deep love for homeland and people among Turkic nations. Despite being women, these poets spoke on behalf of their people and made significant contributions to preserving national consciousness and spiritual values.

One of the leading scholars in the study of women's poetry in Uzbek literature is Sayokhat Arziqulova. Her research comparatively analyzes formal structures, poetic typology, and lyrical imagery in the poetry of contemporary Uzbek and Turkish women poets. In her academic articles, she pays particular attention to the works of Uzbek poets such as Halima Akhmedova, Zulfiya Muminova, and Gulnoza Muminova.

Another prominent figure in recognizing the significance and weight of women's voices in modern poetry is scholar Nodira Saidovna Nabiyeva. Her research focuses on the works of Halima Khudoyberdieva, interpreting her poetry through the lens of women's hopes and dreams, and uncovering the poet's role in expressing the lived experiences of Uzbek women through verse.

In Kazakh literature, a key contributor to the study of women's creative work is S. Aybergenova. Her academic works under the theme *"Continuity of Tradition in the Work of Kazakh Women Poets"* examine the stylistic and thematic continuities and distinctiveness of women's poetic traditions in Kazakhstan. A. Kenzhebaeva defended her candidate dissertation titled *"The Representation of the Female Image in Women's Prose,"* which focuses on the portrayal of women in Kazakh prose.

The poetic works of women such as Amina Shalabayeva, Halima Ötegalieva, Damesh Bersugirova, and Tursynkhan Abdirakhmanova have also received scholarly attention, with their creative paths and poetic perspectives explored in literary studies. Of particular note is that Tursynkhan Abdirakhmanova not only wrote poetry but also conducted literary criticism, as evidenced in works like "The Poet's Secret" and "The Poetics of Qasym Amanzholov."

Kazakh poet and scholar Fariza Ongarsynova also made a significant contribution to the discourse around women's poetry. She challenged the notion of labeling poetry as *"women's poetry,"*

pointing out that the very phrase suggests a “second-tier” classification. In her view, and in truth, the most important qualities in poetry are artistic value and content, civic voice, and aesthetic power [1].

The emergence of women in poetry across the Turkic world during the 20th century was not merely a gender-based phenomenon, but a cultural epiphenomenon of national modernization. This process unfolded in parallel with the rise of women’s poetic creativity in both Kazakh and Uzbek cultural-literary spheres (e.g., Zulfiya, later Halima Khudoyberdieva, and others).

In Kazakh literature, Sholpan Imanbayeva laid the foundation for women’s lyrical tradition. As one of the first published Kazakh female poets, despite her short life, she became the first woman to publish a full collection of poetry under her own name. The "Sholpan phenomenon" marks a historical precedent of a woman speaking in her own voice. Her poetry engaged with themes such as women’s fate, social justice, and enlightenment, blending tender lyricism with a civic tone—a fusion that influenced later generations.

The motif of the "girl under pressure" continues in the poems of Ziyash Qalauova and Mariyam Khakimzhanova, with the latter especially known for combining maternal themes with civic pathos. Mariyam Khakimzhanova, named *People’s Writer of Kazakhstan* in 1986, elevated women’s poetry to the level of civic poetry. Her lyricism and narrative poems integrated themes of motherhood, homeland, and heroism, portraying the active social role of the female subject. Through her poem *"Manshuk"*, she helped canonize the image of the female hero.

Khakimzhanova was also a prolific translator. In micro-comparative terms, Zulfiya Israilova, a prominent Uzbek poet, likewise amplified civic and ethical pathos in the postwar years. Zulfiya consistently used the "Mother–Homeland" metaphor, with her poetic voice shaped by the emotional toll of wartime loss. In Mariyam’s poetry, the triad of *Manshuk–Mother–Homeland* expresses a unified female spirit. While in Zulfiya’s work, "mother" and "heart" form a recurrent emotional nexus, Mariyam expands "mother" through the semantic field of heroism.

In the second half of the 20th century, war and peace-time labor lyricism gained prominence. In this regard, the work of Ziyash Qalauova is particularly noteworthy. From her 1941 collection *"Sholpan"* onward, she became a voice for the generation that chronicled both the battlefield and labor front. Her poems such as *"Caucasus Peak"* and *"Kazakh Youth"* are rich in heroic motifs. The figure of *Manshuk* in her work becomes an archetype of the female hero.

Zulfiya's war poetry is marked by a mourning and restrained tone, while Ziyash emphasizes resolute and mobilizing heroism. These two registers—Zulfiya's loss and resilience, and Ziyash’s frontline mobilization—reflect different poetic responses within the same historical context. This offers a clear case of motif-level parallelism between Uzbek and Kazakh women poets.

One of the most talented Kazakh women poets, Amina Shalabayeva, infused her lyricism with tenderness and domestic-ethical sensibility. Beginning with translation work, she transitioned to pure lyric poetry. Her collections such as *"My Swallow"* (1962), *"Daughter of the Sun"*, *"Mountain Spring"*, and *"The Singing Bell"*, capture delicate registers of nature, time, ethics of everyday life, and maternal affection. This poetic line parallels the intimate-existential lyricism of Uzbek poets like Halima Khudoyberdieva and Khosiyat Rustam. In Khudoyberdieva’s work, the image of the "proud and resilient woman" is front and center.

A symbolic figure in Uzbek poetry, Zulfiya deeply explored themes of war and postwar socio-moral challenges, and held a high status in public life. Like Mariyam Khakimzhanova in Kazakh literature, Zulfiya unified the female voice with civic poetry. Halima Khudoyberdieva became known as the “voice of Uzbek women.” She transformed themes of female freedom, civic stance, and national-spiritual revival into the ethical core of her poetry. Her leitmotifs—such as *“sacred woman”* and *“white apples”*—move from the personal to the collective. She remains one of the most distinctive poetic voices of 20th-century Uzbek literature.

Khudoyberdieva’s lyrical universe revolves around love, inner feeling, life and death, shaped by linguistic minimalism and philosophical intonation. As a representative of the mid-generation, her later work in the 21st century continued to display innovation and social sensitivity. However, it must be noted that Khudoyberdieva’s poetry has not yet been fully explored within the broader context of contemporary Uzbek women’s poetry.

I am not in the sky, but on the ground.
I have seen the strongest fall –
Strength too comes from the earth."

In these lines, Khabibi presents herself as an ordinary human being, a child of the earth. By stating that she is not an angel, she acknowledges the burdens of human fate and accepts the trials of earthly life. This reflects the transient nature of human existence and the resilience one must show in the face of destiny. The line "I have seen the strongest fall − strength too comes from the earth" philosophically expresses the idea that no one is eternal, and that even the mighty eventually return to the ground.

The uniqueness of Khanbibi Esenkarakyzy's poetry lies in its civic voice born from real-life experience. Her poems clearly express the resilience of Kazakh women and their strength to withstand fate.

In Halima Khudoyberdieva's lyric poetry, too, the identity of women, their rights as individuals, and their place in society are central themes. In verses like:

"I am a woman,
My voice is the voice of the people,
My tears are the tears of the earth,"

she portrays the woman not just as a symbol of delicacy, but also as a voice of national spirit and freedom. Her poetry is often written in an ethical-patriotic register, blending the fate of women with the destiny of the nation.

Similarities:

Both poets depict the woman as a "simple human being" who possesses inner spiritual strength. Khabibi, starting from personal experience, portrays the broader essence of the Kazakh woman, while Halima elevates the image of the woman to a national level, portraying her as the conscience of society. In both poets' works, the impermanence of life and the resilience of the human spirit are conveyed philosophically.

Differences:

Khabibi's tone is lyrical-philosophical and close to domestic experiences, depicting the person as one who has gone through life's trials. Halima Khudoyberdieva's tone is social and civic, raising the individual female experience to the voice of the nation. In Khabibi's poetry, the strength of the Kazakh woman is portrayed with historical-ethnic coloring, while in Halima's poetry, the image of the Uzbek woman becomes the core of national modern ethics.

In the poetry of both Khabibi Esenkarakyzy and Halima Khudoyberdieva, the woman is a symbol of both tender femininity and inner strength, national dignity, and resilience against fate. Khabibi reveals the fate of the Kazakh woman from a lyrical-philosophical perspective, while Halima raises the voice of the Uzbek woman to the level of societal discourse and forms a national-modern tone.

The Mother–Homeland Paradigm in Kazakh-Uzbek Women's Poetry:

In Mariyam Khakimzhanova's poetry, motherly lyricism is interwoven with civic duty (e.g. through the image of Manshuk). Zulfiya Israilova uses the motif of the mother-heart to reflect on the moral healing of post-war society. A common feature in the poetry of Kazakh poet Mariyam and Uzbek poet Zulfiya is that the **moral foundation is embodied in the image of the mother.**

Their individual poetic styles differ:

- **Mariyam Khakimzhanova** writes in a **heroic-epic register**,
- **Zulfiya Israilova** writes in an **elegiac-reflective register**.

Across the works of Uzbek and Kazakh female poets, the **freedom of the female self** stands as a central theme.

- In **Sholpan Imanbayeva**, there is the historical legitimization of the female subject (first books, free speech);
- In **Khudoyberdieva**, female freedom becomes the ethical core of **national modernity**.

In the Kazakh context, women's poetry reflects **origins and precedents**, while in the Uzbek context, it reflects an **institutionalized societal voice**.

It is well known that war lyrics were widely written in the 20th century, and women's poetry was no exception. In **Ziyash Kalauova's** poetry, we see a strong pathos of a wartime participant (e.g., *"On the Caucasus Peaks"*) and an emphasis on the mission of the younger generation. In contrast**, Zulfiya's** poetry highlights the intimate and moral weight of wartime loss. In both poets' works, the endurance of the female spirit is present, though conveyed in different tones.

Elements of **intimate and existential lyricism** are more pronounced in **A. Shalabayeva's** poetry. Her works like *"The Milky Way"* and *"A Mother's Light"* serve as vivid examples of delicate metaphors involving nature and time.

The theme of **love** in both nations' female poets is pure, sincere, and heartfelt. Zulfiya placed the traditions of the Uzbek people, national culture, and mother tongue at the heart of her poetry. Both Kazakh and Uzbek female poets wrote about the **fate of their nations**, the **importance of language**, and **national spirit,** showing deep concern for their people's future. These poets from closely related Turkic nations made **national spirit** the central axis of their poetry.

The poetry of Kazakh and Uzbek women in the 20th century reflects a **complex spiritual phenomenon,** evolving from personal experience to public mission, in line with the historical and cultural context of the time. The **"Mother–Homeland" paradigm** became the ethical core of the poetry; Themes of **love, freedom, and spiritual resilience** defined the artistic essence of the female identity; **National spirit and language** were fundamental values in women's lyrical poetry; Female poets elevated poetry to a **social-civic level** by expressing resilience and courage, and by singing of **nation.**

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Rezyume: *Maqolada XX asrning birinchi yarmi va o'rtalarida qozoq ayol shoirlarining she'riy merosi zamonaviy adabiyotshunoslik nuqtai nazaridan qayta ko'rib chiqiladi. Ularning adabiy makonda ayol subyektini qaror toptirishdagi o'rni aniqlanadi. Shuningdek, ruhan yaqin va zamondosh o'zbek shoiralari ijodi bilan ham tipologik qiyoslanadi. Tahlilda onalik, Vatan, qahramonlik, etik-estetik kategoriyalar, lirik "men," urush va modernizatsiya sharoitida ayol mohiyati kabi mavzular yoritilgan. Qisqa matnli iqtiboslar va motiv-semantik parallellar asosida qozoq va o'zbek ayollar she'riyati o'rtasidagi badiiy o'xshashliklar va farqlar ko'rsatilgan.*

Резюме: *В статье с позиции современных литературоведческих подходов переосмысляется поэтическое наследие казахских женщин-поэтов первой половины и середины XX века − Шолпан Иманбаевой, Мариям Хакимжановой, Зияш Калауовой и Амины Шалабаевой. Определяется их роль в утверждении женского субъекта в литературном пространстве. Также проводится типологическое сравнение с творчеством родственных по духу и современниц − узбекских поэтесс Зульфии (Зульфия Исроилова) и Халимы Худойбердиевой. В анализе затрагиваются такие темы, как материнство, Родина, героизм, этико-эстетические категории, лирическое «я», а также женская сущность в условиях войны и модернизации. На основе кратких текстуальных цитат и мотивно-семантических параллелей показаны художественные переклички и различия между казахской и узбекской женской поэзией.*

Kalit so'zlar: *ayollar she'riyati, lirik "men," milliy modernizatsiya, harbiy lirika, fuqarolik pafosi, qozoq adabiyoti, o'zbek adabiyoti, qiyosiy poetika.*

Ключевые слова*: женская поэзия, лирическое «я», национальная модернизация, военная лирика, гражданский пафос, казахская литература, узбекская литература, сравнительная поэтика.*

METHODOLOGY OF USING CASE TECHNOLOGIES IN NON-NATIVE RUSSIAN LANGUAGE LESSONS IN KARAKALPAKSTAN SCHOOLS

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Summary: *The article examines the methodology for implementing case technology in Russian language lessons as a foreign language for developing the B1 level in schools in Karakalpakstan, describes the requirements for cases, advantages, and difficulties of using this method in Karakalpak classes. The significance of the situational method, its role in implementing the communicative-activity strategy, and the tasks of enriching the spiritual culture of students are revealed using specific examples.*

Key words: *case study; active teaching methods; casestudy method; communicative competence; case technologies; types of case technologies; collage.*

The development of methods for teaching Russian in Uzbekistan as a scientific discipline is linked to the fact that the Russian language, in the new conditions as in previous times, despite the predominant position of the English language, has retained the status of a compulsory subject at all levels of education and has not lost its social function - the function of the language of interethnic communication, the leading position as a phenomenon of stability and interethnic harmony.

It should be noted that, under current conditions, Russian language teaching methods in Uzbekistan are undergoing changes due to the synergetic approach that has led to "scientific revolutions" and the emergence of new approaches, such as linguorhetorical, cognitive, linguacultural, and intercultural communication. These approaches necessitate the activation of integrative processes in Russian language teaching through the use of innovative pedagogical and information technologies. In this regard, the targeted implementation of case studies and the case study method of situation analysis is of paramount importance. These methods are integral parts of the integrative approach, the methodological significance of which is determined by the developmental principle of teaching, the individual-activity approach, and, in many respects, its multi-level nature, characterized by the fact that, within the same case, various approaches can be applied to develop intercultural communicative competence. [4] Hence the increased interest of scientists, teachers, and methodologists in case technologies, as evidenced by the works of V.K. Dyachenko, O.G. Smolyaninova, G.A. Agafonova, M.A. Bushuev, M.V. Kunmova, A.L. Gurkina and others, which reveal the role of case technology, reveal various ways of applying case technology, such as the method of analyzing specific situations; situational tasks and exercises; the incident method; the method of situational role-playing games; the method of analyzing business correspondence; the method of projects, discussions, and many others.

In this article, the author, relying on the works of the above-mentioned scientists, makes an attempt to reveal the methodology for implementing case technology in the practice of teaching the Russian language in modern conditions, its importance in improving the quality of students' knowledge, activating their communicative activities, and developing creative thinking.

A study of the experience of teachers of Russian as a second language in the city of Nukus, Republic of Karakalpakstan, using case technology by O.V. Utemuratova, M.M. Berdibaeva, and G.A. Fofonova showed that the case used must be presented in such a way that the information within is clearly structured and visually easy for students to perceive.

Here are some example cases for students studying Russian as a second language at Schools No. 46, No. 27, and the Ibrahim Yusupov School in Nukus.

Examples of case topics and possible assignments in Russian:

1. Grade– 8, general educational profile

Lesson duration - 3 study hours

Case form– practical

Case type – research (Case study method)

Thesis: "Computer games teach nothing, and it's best for young people to avoid them. What is your opinion on this matter? Explain your reasoning."

Assignment for subgroups:

The class is divided into 3 groups – 2 problem groups, 1 focus group.

Group 1 adheres strictly to one point of view on the problem, while Group 2 has a completely opposite one. Groups (after working individually on a case and preparing their own presentation on the topic as homework) explain their point of view and put forward arguments in its favor.

Groups 1 and 2 substantiate their points of view with the necessary evidence. The focus group monitors the presentations and selects the most objective and well-reasoned opinion.

2. Case Topics: "In the Canteen", "Menu," "Best Menu Competition."

Thesis: "The students of 6th grade go to the canteen for lunch every day. Everything is so interesting here! The dishes are new and unusual! What should we have for lunch? How do we say what we want in Russian?"

Key Tasks:

1. What do they usually eat for breakfast, lunch, and dinner in the canteen?

2. What do you like to eat for breakfast, lunch, and dinner?

3. Answer the following questions: What is the best way to ask about the menu? Which request options are the most successful? Why?

4. You are the manager (director) of the canteen. Come up with a name for your canteen and create a menu.

5. Hold a "Best Menu" competition with your friends.

This case presents a problematic situation: How do you find out what's for lunch today and how do you order what you want, and do so as appropriately as possible? Each student can propose their own solutions to this problem. The most productive solution is developed through discussion. Students also have the opportunity to approach the task creatively and, when creating their own menu, use not only the material provided by the teacher but also find something on their own. This research will allow them to convincingly defend the quality of their menu in the competition, the outcome of which will directly depend on their ability to defend their position and engage in the discussion. It is quite possible that there will be multiple winners. Thus, all three stages of the case are sequentially implemented: 1) familiarization with the communication problem, 2) gathering the necessary information to develop the skill of acquiring and evaluating it, and 3) discussing the possibility of alternative solutions.

For case-based learning to be effective, it must be regular. Therefore, it is necessary to develop cases covering most of the Russian language topics studied and systematize the situations in which case-based learning can be used. These can be roughly divided into three broad groups: everyday, educational, and professional situations.

Everyday tasks involve solving communication problems that arise daily in students' everyday lives (how to ask for directions, buy movie tickets or medication at the pharmacy, call a taxi, meet someone you like, offer help, etc.). Academic tasks address communication challenges in the realm of education (how to borrow a book from the library, how to write an autobiography). The key to productive case study work is not only regularity but also the cyclical nature of their implementation. For example, at the elementary level, this could be a story about oneself in a newspaper format with photos and text. At the B1 level, the story is accompanied by a presentation or album and can be presented not just as a story about oneself, but also as a story about what one will be like, for example, in 10 years.

When composing a case, the teacher must, of course, rely on the requirements of the State Standard for Russian as a Second Language [1]. This means that the level of difficulty of the task and the lexical and grammatical content of the case must correspond to the level of language acquisition. However, this does not mean that the student is forced to use only the vocabulary or grammar provided in the case. Each student is free to draw on a variety of available lexical and grammatical resources when completing the task. In this case, the case serves as a framework that facilitates the search for a solution to the problem, but does not limit it.

Furthermore, case technology can be used at various stages of language acquisition: at the elementary, basic, and certification stages. The teacher's task is to formulate the tasks and the case problem methodically and correctly (taking into account the requirements of the standard, the student's age, and their capabilities). O.P. Fesenko provides examples of the practical application of case studies in Russian as a Foreign Language lessons [5]. So, at the most basic level, it could be a newspaper or a table; at the most basic level, the material product that needs to be created within the case could be a more complex form, such as a collage:

Case Study "My School" (collage)

Ruslan is nervous. He transferred to a new school just yesterday. The unfamiliar city and the new school gave him a cold reception. He has no friends yet, and he doesn't know the school he'll be attending at all. Where's the cafeteria? Where's the library? Where will he study? Who will his friends be? Key tasks: 1. Draw a plan of the school.	• Canteen • Library • Sport hall • Assembly hall • Museum • Class rooms Go to (what?) (what?) is located (where?)

Write where it is.

Explain to Ruslan how to get to the canteen, library, and where the classroom building, gym, and assembly hall are located.

2. Take photos or draw interesting moments from school life.

3. Create a collage including drawings and photos from school life and captions. Explain why you chose them.

Proficiency at Level I of the Russian language allows one to organize work not only on compiling tables, preparing newspapers or presentations, but also to compose a report in accordance with style requirements.

Examples of case topics (level B1):

1. Computer games teach nothing, and young people are better off avoiding them. What's your opinion on this?

2. Final project work: "Make a list of cultural attractions in Nukus that, in your opinion, could be considered new wonders of the world. Justify your choice."

3. A discussion lesson on the topics of the textbook sections: Family. Food. Hobbies. Sightseeing. Ecology and the Environment. Computer Technology. Education. Choosing a Career. Travel. And many others.

Example situations for B1 level classes:

Situation 1. You're in St. Petersburg and need to call home. The phone isn't connecting. You call the telephone exchange and ask to be connected.

Situation 2. You call your friend, but he's not home. You ask his parents to leave a message.

3. Discussion lesson on the topics of the textbook sections: Family. Food. Hobbies. Attractions. Ecology and the environment. Computer technology. Education. Choosing a career. Travel and many others.

Situation 4. Your friend is planning a visit to the UK. He calls you and asks for your advice. You should suggest the best mode of transport, describe the weather, and advise him on what to wear.

We offer case studies in the classic sense, where the case presents a real-life problem that students must solve based on their existing knowledge, practical experience, and intuition. Since any situation has multiple possible solutions, a discussion of all possible solutions takes place. In our work, we adopted the case study stages described by L.V. Lezhnina. This plan is best suited for conducting discussions among students with a consistent group/class composition. Dividing into small groups in a familiar environment will feel natural to students and will not create problems in

discussing the assigned topic, allowing for a smooth transition from small-group discussion to a larger discussion [4].

In our opinion, a careful analysis of the structure and content of case studies reveals that they require a certain amount of effort from both the teacher and the students. The teacher must prepare the case material, format it appropriately, formulate the tasks, and devise a workflow. Students will need a considerable amount of time to complete it. Most often, case studies can be completed outside of class, during hours allocated for independent study. To ensure maximum productivity using this technology, several issues identified in the work of S.V. Shermazanova [6, p. 154] must be considered when working on cases:

1. The significant amount of time required to complete a case. Sometimes, solving a case requires devoting hours of homework to it. This means the assignment must be formulated in such a way that students have no difficulty understanding its content. Of course, explanations of the case in class are essential.

2. A desire to use modern teaching methods and the teacher's level of professionalism. Given that case studies require significant time and intellectual investment from teachers (both in preparation and organization), as well as careful consideration of the method's place within the system of other teaching methods, not every specialist readily or readily embraces this method.

3. Students' communicative experience and the characteristics of the class. It is necessary to prepare psychologically for a case (especially a team or group case) so that during the solution or presentation and defense of the results, the desire to ridicule the other person is avoided. The teacher's task is to create a positive communicative attitude and a focus on success. Learning can be active, engaging, and communicative with an effective combination of traditional teaching and case study elements. When designing the learning process, attention should be paid to the selection of appropriate cases, their relevance to modern realities, the ability to apply knowledge acquired in class, and the students' psychological readiness to work with cases. While generally positively assessing the implementation of case study techniques, I would like to note that, unfortunately, fiction, which could serve as a fertile source of situational analysis, which forms the fundamental basis of case study techniques, is still not used in Russian language lessons.

In conclusion, I would like to note that case technologies, distinguished by the diversity of situations, should be regarded as a mandatory learning situation in Russian language classes, expanding cognitive resources, contributing to a radical transformation of the creative independence of students, stimulating creative thinking, self-disclosure of the individual in communicative activities.

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Rezyume: *maqolada Qoraqalpog'iston maktablarida B1 darajasini rivojlantirish uchun rus tilidagi darslarda Case texnologiyasini chet tili sifatida amalga oshirish metodologiyasi ko'rib chiqiladi, holatlarga qo'yiladigan talablar, ushbu usuldan qoraqalpoq sinflarida foydalanishning afzalliklari va qiyinchiliklari tavsiflanadi. Muayyan misollar vaziyat usulining ahamiyatini, uning kommunikativ-faoliyat strategiyasini amalga oshirishdagi rolini, talabalarning ma'naviy*

madaniyatini boyitish vazifalarini ochib beradi.

Резюме: *В статье рассматривается методика реализации кейс-технологии на занятиях по русскому языку как иностранному для развития уровня В1 в школах Каракалпакстана, характеризуются требования, предъявляемые к кейсам, преимущества и трудности использования данного метода в каракалпакских классах. На конкретных примерах раскрывается значимость метода ситуации, его роль в реализации коммуникативно-деятельностной стратегии, задачи обогащения духовной культуры обучаемых.*

Kalit so'zlar: *ish; faol o'qitish usullari; casestudy usuli; kommunikativ kompetentsiya; ish texnologiyalari; ish texnologiyalari turlari; kollaj.*

Ключевые слова: *кейс; активные методы обучения; метод casestudy; коммуникативная компетенция; кейс-технологии; виды кейсовых технологий; коллаж.*

COMPARATIVE TYPOLOGY OFTHE CASES OF GENITIVE AND IYELIK (POSSESIVE)

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Summary: *The development of comparative typological grammar is closely related to the development of teaching about the grammatical system of historical languages and the history of learning grammatical categories. Languages have been studied by comparing them with each other before, but these comparisons focused only on the principle of their historical kinship, and most often related languages were studied by comparing them with each other.*

Key words: *Genitive case, iyelik (possessive), affix, personal pronoun, initial and main functions, genitive in Indo-European languages.*

In ancient Greeks, the term seplik (case) is understood as a form that has changed from the original meaning of the word. This language phenomenon was related not only to noun, but also to verbs. The Greeks considered the initial form of noun to be nominative, and verbs to be the present tense.

Genitive and possessive cases are considered affixal cases in both languages. This does not include feminine nouns. In German and Karakalpak languages, these case affixes have several morphological variants: in German - *(e) s,* - *(e) n;* in Karakalpak: *-nıń//-niń, -dıń//-diń, -tıń//-tiń*.

In the Karakalpak language, there is another morphological variant of the possessive case affix, which is also an orthographic and orthoepic form of *-nıń//-niń, -ıń//-iń*, which is added to the personal pronouns in first and second person of singular and plural forms: *me-niń, se-niń, o-nıń, biz-iń, siz-iń*.

One of the distinctive features of the Karakalpak language is that when the possessive case affix is added to the third person of the personal pronoun, the pronoun undergoes a phonetic change. This phenomenon is also observed in demonstrative pronouns like *"this" and "that."*

In German and most Germanic languages, the genitive is formed mainly with the suffix *-s*. This is the primary morphological indicator of masculine and neuter nouns in the singular [2].

Furthermore, it is considered the affixes of pronouns specific to articles, masculine gender, neuter gender proper nouns (person's name, surname), and genitive.

According to linguist V.M. Voznitsiya, this suffix, in forming the plural form of nouns, in addition to performing grammatical functions such as forming compound words by combining two nouns, its use is associated with expressing the "genitive relation," which expresses the meanings of possession and belonging [3].

In Germanic languages and German, the genitive has long been the focus of the linguists' attention. Linguists who have entered into this field have conducted research on three issues of genitivity:

1. Formation of the primary and basic functions of the genitive;
2. Its polysemy;
3. Shortening and narrowing of usage.

The main focus is on the first issue in Greek, Latin, and German. The results of scientific research show that the genitive has several meanings and is diverse. He indicated that the most important of these are the divisor, meaning the part of the whole, possessive meaning, locative meaning, and the common case [2].

The linguist supports his point with examples.

There is another theory about genitivity, which dates back to the Byzantine period. According to this theory, the genitive in Indo-European languages replaced the "avlative" (prepositional) case, that is, began to be used in its place. This case also existed during that period, expressing meanings such as division, separation, and distancing (einer von den Studenten). This concept became the basis

for the theory of the expression of the place meaning through cases. According to this theory, all cases express the concept of locative meaning.

Although the -s function is used in the expression of the genitive, cases of its use without a suffix are sometimes encountered. Here, we are talking about monoflexia. V.G. Admoni attributes the origin of monoflexia not to the expansion and development of the noun phrase, the detachment of the article from its "own" name, and the strengthening of the genitive position, but rather to the general tendency of many nouns losing this flexion as a result of the reduction of cases[1].

In addition to the synthetic method, the genitive has an analytical form. It is a prepositional phrase expressed by the preposition von. This method is considered the old (oppositional) form of the first, that is, the formation using an affix.

The semantic closeness of the genitive with the preposition von, and the combination of the preposition with nouns, became the main reason for the use of the preposition von instead of the genitive case in the formation of the lexical meaning of the preposition von.

V.M. Voznitsya's scientific work shows that, as in linguistic literature, the genitive is giving way to a prepositional phrase.

The main information about the possessive case in the Karakalpak language is provided in A. Kidirbaev's work [6], R. Japakova's doctoral dissertation, and in the author's scientific articles published in the 1970s, as well as in the grammar of the Karakalpak language and academic grammar of other Turkic languages. They have thoroughly examined cases.

In the Karakalpak language, the possessive case is connected to the stem of the affix, such as *adamnıń balası, úydiń tóbesi, shıranıń nurı, oqıwshınıń kitabı, fermanıń malı, kárxananıń baslıǵı* (a person's child, the roof of the house, the light of the lamp, the reader's book, the farm's livestock, the head of the enterprise).

In this case, the base word with the possessive case affix (*-nıń//-niń, -dıń//-diń, -tıń//-tiń*) is called an attribute, and the word with the possessive case affix (*-sı//-si, -ı//-i*) is called an attributive. Although the terms "owner" and "possessor" express their meanings differently, these words have not yet been established as grammatical terms.

The possessive case is connected in two different grammatical relationships.

1. The possessor-possessed relationship forms the first of two independent bases - the subject, where the possessive case forms a syntactic function. The roots in this relationship belong to an independent group or are used as such words: *inimniń balası, terektiń japıraǵı, sabaqtıń baslanıwı* (my brother's child, a tree's leaf, the beginning of a lesson). This is the main condition for the possessive case.

2. A word in the possessive case enters into a grammatical relationship with conjunction (case form + conjunction). In such a relationship, the first component is expressed by numerals or personal pronouns like *men, sen, biz, siz* ("I," "you," "we," and "you,") while the second component involves the conjunctions *ushın, menen, penen, benen* ("for," "with," "with," and "with"). The possessive suffix is not attached to this component. In the construction, grammaticalization occurs as a whole and becomes an integral unit. In this respect, this combination differs from others: *soniń menen, soniń ushın, seniń menen, oniń menen, siziń ushın* (therefore, therefore, with you, with him, for you).

In the Karakalpak language, nouns in possessive case are used in both affixal and non-affixal forms.

Some linguists consider using without affixes to be forms of the nominative case based on their form. In their opinion, this property corresponds to possessive and accusative cases: *qala parki, shay ishiw, kitap oqıw* (city park, drinking tea, reading a book).

However, in many published scientific works on the grammar of Turkic languages, the above opinion is stated as incorrect, and forms without affixes are also indicated as possessive case forms. Indeed, there isn't much difference in meaning between phrases like *mákemeniń baslıǵı – mákeme baslıǵı (*"head of the institution"), *mektep baǵı – mekteptiń baǵı* ("school garden"). As a result, the idea that both forms are possessive case forms is considered acceptable. If the first one has a case suffix, it should be considered that the second one has a hidden form.

Some sources suggest that the genitive case in German can be either definite or indefinite [5].

In spoken language, it is mainly used implicitly, only when it's necessary to mention it is given with an affix:*Olar kúni boyı kanal boyında dem alıp otırdı. Doslar aldında bunday sózdi aytıw qolaysız boladı. (They restedalong the canal all day long. It was uncomfortable to say that in front of friends) .*

If it is necessary to highlight the possessor expressed by "o'z (my)," this word appears in the explicit form of the possessive case: He would go to his bed and come back. Unless specifically mentioned, the word "my" is used in the possessive case without an affix:*Óz mektebimde bolıp qayttım, óz kózim menen kórdim, óz qolım menen uslap kórdim*. (*I visited my school, saw it with my own eyes, touched it with my own hands).*

The possessive case is used without an affix in geographical names and in compounds like enterprise, organization, department, street, etc.: *Beruniy city, Aral Sea, Ajiniyoz street, carpet factory, car factory, etc.*

A case suffix cannot be attached to the components of such compounds, that is, to the possessor. If we add a case suffix to them, the meaning of the phrase changes: *Ájiniyaz kóshesi – Ájiniyazdıń kóshesi*. (*Ajiniyoz Street - Ajiniyoz's Street).* In the first, the street is named Ajiniyoz, and in the second, it refers to the street where Ajiniyoz lives.

A machine factory is a machine-building factory, but it's not called a machine's factory.

When expressing grammatical uncertainty or generality, it is used in the form of a candidate of sciences. If the possessor and possessed denote a part or a fraction of a whole, a possessive noun is used:

Úydiń qapısı sırtqa qarap ashıladı eken. Bunday sulıw jer dúnyanıń heshbir jerinde bolmasa kerek. Tamnıń tóbesi saban menen bastırılǵan. Usı júristen biz kanaldıń quyar jerine kelip jettik.(The door of the house opens outwards. Such a beautiful place probably doesn't exist anywhere in the world. The roof is covered with straw. From this path, we reached the mouth of the canal).

If a noun in the possessive case contains a plural suffix, it is added explicitly in the same word: *Tawlardıń biyikligine kóz jetpeydi. Diyqanlardıń jumısı elege shekem dawam etip atır. Kitaplardıń barlıǵın kórip shıqtıńız ba?* (*The height of the mountains is beyond sight. The farmers' work is still ongoing. Have you looked through all the books? (T. Qayipberganov, 2021, p. 75).*

So, the explicit and implicit (with and without affix)use of the cases genitive in the German language and possessive in Karakalpak language is common in both languages,mostly is related to the factors. While this demonstrates similarities between languages, in German, the omission of the genitive case affix in words borrowed from foreign languages is one of its distinctive features.

Below, we will discuss the meanings expressed by genitive and possessive cases in both languages, their similarities or differences, and their syntactic functions.

If "Genitive meanings" are clearly defined and grouped in grammars, this does not mean different grammatical meanings of the genitive, but rather a grouping formed on the basis of two nouns in the possessor and possessed relationship, taking into account the logical connection between them, sometimes their lexical meanings, and their formation methods.

In grammars the following meanings of the genitive can be seen.

I. The genitive case in possessive meanings (genitivuspossessivus). This meaning of genitive:

1. It means the belonging, relativity in narrow circle, brief meaning: *Das Buch des Schülers. Das Kleid der Mutter, das Haus des Vaters.*

Such meaning in the Karakalpak language is expressed through a noun in possessive cases and the possessive affixed noun associated with it:*oqıwshınıń kitabı, ananıń (anamnıń) kóylegi, atamnıń úyi*. (*reader's book, mother's (my mother's) dress, my grandfather's house)*.

Among them the main feature is that, if in German it comes in the type of „possessed+possessor", in Karakalpak, on the contrary, „possessor+possessed":

Germanlanguage	Karakalpak language
$S_N + S_{Gen}$	$S_{iy} + S_{t.af}$

2. It means the owning, relativity, belonging in wide meaning. It means the the belonging, relativity of some object, person to community, other person, time, age, country and others: *der Bürger Uzbekistans, die Menschen unsererEpoche, der Direktor der Fabrik, Professor der Fakultät, Rektor der Universität, die Mitglieder der Brigade* u.a.

In the Karakalpak language, the equivalent of this type of genitive is the possessive case form indicating the belonging of the subject. The possessive case can be used both explicitly and implicitly: *Ózbekstan puqarası, zamanamızdıń adamları, fabrikanıń direktorı, fakultettiń professorı, universitet rektorı, brigade aǵzaları* hám basqalar. (citizen of Uzbekistan, contemporaries, factory director, faculty professor, university rector, team members, and others).

3. When possessive, belonging, and possessive meanings express kinship relations, nouns in German are constructed as possessor + possessed. This is unique to the Karakalpak and all Turkic languages. This refers to the similarities related to the comparatively studied languages:

Oles Vater Paule arbeitete in den Wäldern des Barons. (E.Strittmatter Ole Bienkopp). *Olenin ákesi Paule baronnıń toǵaylarında isleytuǵın edi (Ole's father, Paule, worked in the Baron's forests). Peters Bruder – Peterdiń aǵası (Peter's brother); Der Onkel des Vaters – ákemniń dayısı (The father's uncle)* .

4. It expresses such meanings as showning the creator, owner (performer) of one thing or phenomeno : *Pedros Brief lag neben dem seinen* (W.Bredel,1954:- 26). *Pedroniń xatı ózinikiniń janında (qasında) jatır edi. (Pedro's letter lied near his).*

This type of genitive is expressed in similar form in Karakalpak language. In the abovementioned scientific work of V.M.Voznitsya, he emphasized that the genitive's possessiveness, belonging and relativity meanings are not identical to themselves, but rather present in this form, not close to them, and distant from possessiveness [3].

Die Art des Wartens, die Pflicht des Schreibens, das Steigen der Sonne, die Ausgabe des Materials, die Verhütung eines neuen Überfalls, die Verletzung der Menschenrechte, die Einstellung der Produktion.

In the Karakalpak language, such syntactic units, i.e., the possessed+possessor form, appear in the possessor+possessed form: *kútiwdiń túri, quyashtıń kóteriliwi, insan huqıqınıń buzılıwı* hám basqalar. (the form of waiting, the rising of the sun, the violation of human rights, and others).

5. It signifies the source of the origin, appearance of an object or human being.*Der Sohn eines Arbeiters – xızmetkerdiń ulı (balası) (servant's child), Die Tochter des Künstlers – artisttiń qızı (artist's daughter); Schillers Balladen – Shillerdiń balladaları (Schiller's ballades)*.

This meaning is also expressed in the Karakalpak language through possessor and possessed phrases.

If a characteristic is expressed in relation to the characteristic of an attribute using the phrase "possessed+possessor" in German, it appears as "possessor+possessed" in Karakalpak:*Die Tapferkeit des Soldaten – áskerdiń mártligi, batırlıǵı (militar's bravery); die höhe des Berges – tawdıń biyikligi (height of mountain).*

6. The genitive phrase (genitivus partitivus), denoting a fraction of the whole, is present in both languages being compared and is also called the dividing genitive:*die Hälfte des Apfels – almanıń jartısı (half of apple); der Anfang der Rede – sóz bası, sózdiń bası, baslaması (beginning of speech); das Zentrum der Stadt – qalanıń orayı (the center of city); die Fenster der Wohnung waren breit und schön – Kvartiranıń aynaları keń hám sulıw edi (The windows of the flat are wide and wonderful).*

This genitive-possessive case is also used in German and Karakalpak languages to exaggerate the degree of intensification of a sign: *Der beste der Freunde – doslardıń eń jaqsısı, aǵlası* (the best of friends)*; die schönste der Frauen – hayallardıń sulıwı (*the most beautiful of women).

As can be seen from the examples, this meaning of the genitive is not conveyed through the phrase possessed + possessor, but rather by a non-noun adjective in place of the possessor, which is also used its superlative degree. This situation applies to both languages.

A type of separator genitive separates and designates a person or a group of objects. *Einer der Studenten – studentlerdiń biri (one of students); keiner der Gäste – qonaqlardıń hesh biri, heshqaysısı (none of guests); eines der Mädchen – qızlardıń biri (one of girls)*.

In the Karakalpak language and other Turkic languages, the prepositional case can be used instead of the possessive case. For example: *studentlerden biri, qızlardan ekewi, balalardan besewi (*one student, two girls, five boys, and so on).

The separator genitive combination is syntactically indistinguishable and is considered a polysyllabic, compound sentence part. For example: In the compound sentence "*Ein Teil der Arbeit*" the subject is not only the first component - ein Teil, but the entire compound "Ein Teil der Arbeit."

This situation can also be fully applied to the Karakalpak language: *jumıstıń bólegi* (part of the work).

II. Genitive case with a characteristic adjective (genitivusqulitushum). A genitive combination indicates a characteristic or quality of an object or person. *Ein Mann diplomatischer Schule* (W.Bredel, 1954:- 45). *– Iykemli adam (*Flexible person)*; das Wort des Mitgefühls – tilekleslik sózi (*word of solidarity);

The translation of phrases into Karakalpak indicates that the meaning is preserved in the phrases, but a difference in form is noticeable. The German genitive in the Karakalpak language can be expressed through a word in the nominative case, an adjective, or an adverb.

III. In the subjective genitive (genitivus subjectivus), the noun refers to a noun formed from a verbal noun: *das Weinen des Kindes – balanıńjılawı (cry of child); das Gebell der Hunde – iyttińúriwi (bark of dog);*

IV. In the object genitive (genitivus obectivus), a noun formed from a verb, while possessed related to the possessor, also serves as an object:*Entdeckungen neuer Sterne – taza juldızlardıń tabılıwı (ashılıwı)(discovering the new stars); die Erfindung des Motors – motordıń oylap tabılıwı (inventing motor); die Teilung der Arbeit – jumıstıń bóliniwi (dividing work);*

Just as a subject phrase can be transformed into a predicative phrase, i.e., a sentence, such phrases transform into three-part simple sentences. Because in these combinations, the person (face) performing the action is unknown. Therefore, the infinitive pronoun with *man* is included in the sentence as the subject. Alternatively, they can be transformed into sentences of both active and passive degrees. Then there's no need for *man*. A noun in the genitive case is used as the subject of a sentence:*Die Entdeckung Amerikas – man entdeckte Amerika – Amerika wurde entdeckt. Die Teilung der Arbeit – man teilte die Arbeit – die Arbeit wurde geteilt.etc.*

When we pay attention tot he Karakalpak variant of these conditions, it can be seen as in followings: *Amerikanı ashtı; Amerika ashıldı; fabrikanı qurdı; fabrika qurıldı*. (discovered America. America is discovered. Built the factory. the Factory is built).

Thus, the object genitive phrase has the same meaning in German as its equivalent in Karakalpak, and the phrases become easy sentences. The difference between them is that in German, if the indefinite pronoun is included as a subject in a sentence, in Karakalpak, because of the absence of such situation, it expresses through passive voice (general) sentence. This distinction is explained by the unique characteristics of each language.

In German, the use of the quantitative genitive is considerably more limited than that of the divisor genitive. Because the meanings of volume and measurement are expressed through other parallel constructions: through a prepositional combination, i.e., von+D: eine Schar blühender Kinder - eine Schar von blühenden Kindern. Through the common case: ein Stück Brot - *bir bólek nan* (a piece of bread); Ein Faß Wein - *bir bochka vino* (a barrel of wine); etc.

If a noun is preceded by an adjective, personal pronoun, or demonstrative pronoun, a quantitative genitive is used, not a prepositional phrase or a generally agreed construction. This is a characteristic feature of the German language, its method.

However, there are also cases where a prepositional phrase is used even if one of the aforementioned words appears before the noun:*eine Anzahl von meinen Bekannten; ein Staßel von solchen Büchern; eine Anzahl von unseren Studenten* u.a.

The frequent use of the prepositional phrase in this way, compared to synonyms, indicates its stylistic convenience.

As can be seen from the examples being translated into Karakalpak, this meaning is conveyed through word combinations using possessive, prepositional, or nominative cases.

Another distinctive feature of the German language is that it is used in conjunction with genitive verbs, as connected and subordinated. Verbal genitives were widely used in ancient and medieval times. According to V.M. Voznitsya's research, the number of verbs requiring the genitive reached 300.Later, their use decreased. By the 16th century, their number had decreased to 70. Gradually, many verbs changed their governing cases or became obsolete at all.

When considering the verbs governing the genitive, three types can be distinguished.

1. The reflexive verbs: *sich annehmen, sich bedienen, sich besinnen, sich bemächtigen, sich brüsten, sich enthalten, sich entwohnen, sich ertreuen, sich erinnern, sich schämen.*

2. Verbs with an inseparable prefix: *bedürfen, gedenken, entlehren, ermangeln, erwöhnen.*

3. Also, verbs that included into 3rd group: *harren, spotten, würdigen.*

Not all of them are used equally; some are common, while others are rarely used. They are used in almost archaic phrases (Kazakbayev K., 1968: - 12).

Er erinnerte sich genau dieser Stelle (L.Feuchtwanger ,2008:- 73) – *Ol bul jerdi anıq esinde saqlaptı. (He remembered this place exactly).*

In modern German, the genitive case with the verb often comes as:

a) object: *Ein Teil der Abgeordneten hat sich der Stimme enthalten.* (Deutsch für Ausländer);

b) predicative : *Sie war kümmerlichen Wuchses* (L.Feuchtwanger,2008:- 66)

There isn’t such cases in Karakalpak and Turkic languages; therefore, the meaning of the genitive case, as indicated above, is determined through the nominative, dative, and accusative cases.

Based on the aforementioned, the genitive case in German is used more widely than the similar possessive case in Karakalpak, and it should be understood as a developed linguistic phenomenon (both in meaning and usage). As a result, nouns in the genitive case in German are also expressed in the Karakalpak language through possessive and other cases.

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Rezyume: *Qiyosiy tipologik grammatikaning rivojlanishi tarixiy tillarning grammatik tizimi va grammatik kategoriyalarni o'rganish tarixi haqidagi ta'limotning rivojlanishi bilan chambarchas bog'liq. Ilgari tillar bir-biri bilan taqqoslash orqali o'rganilgan, ammo bu taqqoslashlar faqat ularning tarixiy qarindoshlik tamoyiliga qaratilgan va ko'pincha qarindosh tillar ularni bir-biri bilan taqqoslash orqali o'rganilgan.*

Резюме: *Развитие сравнительно-типологической грамматики тесно связано с развитием учения о грамматическом строе исторических языков и историей изучения грамматических категорий. Языки изучались путём их сопоставления друг с другом, но эти сопоставления основывались исключительно на принципе их исторического родства, и чаще всего родственные языки изучались путём их сопоставления друг с другом.*

Kalit so'zlar: *Genetiv kelishik, iyelik (egalik), affiks, shaxs olmoshi, dastlabki va asosiy funktsiyalar, hind-yevropa tillarida genetiv.*

Ключевые слова*: Родительный падеж, ийелик (притяжательный падеж), аффикс, личное местоимение, начальная и основная функции, родительный падеж в индоевропейских языках.*

ETHNODIALECTISMS RELATED TO MATERIAL CULTURE IN THE LANGUAGE OF KAZAKHS OF KARAKALPAKSTAN

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Summary: *This article examines ethnodialectisms related to material culture in the language of Kazakhs residing in the Republic of Karakalpakstan, with a specific focus on lexical units used in everyday domestic life. The study analyzes the usage patterns of these ethnodialectisms and highlights their distinctive features shaped under the influence of local Karakalpak and Uzbek languages.*

Key words: *vocabulary of material culture, alaqshyn, anshyk, sebet, atkönshek, daskér, etc.*

INTRODUCTION.

As a speaker of the language, an individual acquires the skills and techniques necessary for living within both social and natural environments while passing through the stages of development shaped by their own history and culture. All of these elements form the foundation of ethnic culture. Drawing on established linguistic data, scholars emphasize that the material and spiritual culture of any ethnic group–its intellectual worldview and cognitive experience– is reflected in its language. Among such linguistic data are linguocultural units, which embody the ethnocultural heritage of the people and preserve national imagery, symbolic meaning, and a culturally embedded worldview. A linguocultural unit represents a culturally significant concept encoded in language, referred to in scholarly terminology as a *linguocultureme***. These units form the core of ethnocultural vocabulary.**

When a language is examined through the lens of its own history and the historical experience of its speakers, it becomes impossible to ignore the multifaceted nature of culture. Culture represents the totality of human activity– its outcomes, the accumulated knowledge and practical skills shaped through labor and experience, and the objectified reflection of a community's spiritual world and artistic consciousness within language. It is through linguistic meaning that culture manifests itself as a mirror of a people's character and worldview.

Human needs and daily necessities stimulate purposeful activity, and it is through such continuous engagement that the Kazakh ethnos has historically linked its existence to labor, modes of livelihood, and practical action. This connection is materialized in the creation of essential objects– tools and equipment, household utensils, clothing, food and meals, and other items of material culture. For the Kazakh ethnos, whose written sources are relatively limited, these material artifacts function as «texts» that can be read, interpreted, and used as sources of cultural information.

The material evidence of culture emerged and expanded in connection with human subsistence activities, the construction of dwellings, and the mastery and refinement of building techniques. For this reason, the dwelling is regarded as a cultural phenomenon. A wide range of domestic cultural data is organized around the concept of the dwelling.

Among the objects used in everyday household life, one of the most essential items for the traditional nomadic lifestyle was the chest (*sandyq***) in its various forms. The lexemes** *abdyra/äbdire***,** *arsha***,** *ärzhe***, and** *bögre/bögire* **represent different types of storage chests;** *taysandyq* **and** *keusandyq* **denote large chests, while** *jagylan/jaktan* **refers to a leather suitcase. The** *tekşe sandyq* **is considered a subtype distinguished by the geometric form of the chest.**

The lexical items related to household objects encompass the names of various items used in daily life. N. Jünisov classifies the vocabulary of Kazakhs living in the northern districts of Karakalpakstan into fourteen lexico-semantic groups and designates the subset referring to household objects under the category «Vocabulary related to household management and domestic items» [1:81].

Alaqshyn – In the interior of a traditional yurt, the *alaqshyn* refers to a pit or shallow cavity dug into the ground to accommodate the hearth. For example, in the dialects of the Qongyrat,

Qaraozek, and Takhtaköpür regions, the expression *«Be careful, there is an alaqshyn dug inside the house»* is commonly used.

In the standard Karakalpak literary language, however, the term is defined differently: *«A specially crafted platform placed around the exterior area of the hearth for purposes of cleanliness (used for holding a teapot, cups, ladles, etc.). It is made from wooden boards and sometimes formed from clay or wood along the edge or rim of the hearth» [2:289]*.

Anshyq – In the dialects of the Qongyrat region (Aday village), *anshyq* denotes the hinge of a door or mirror. For example: *«The door hinge (qapynyń anshyǵy) has broken.»*

In the *Dialectological Dictionary of the Kazakh Language*, *anshyq* is recorded with the meaning «hinge» [3:62]. However, among the Karakalpaks and Kazakhs of the Kenimekh region, the item is referred to by an entirely different name—*ashyq-mashyq* [4:12].

The word *ashqysh*, on the other hand, denotes a «lock» in the sense of a locking mechanism: *«Put a lock (ashqysh) on the door; someone might take something.»*

In the standard Karakalpak literary language, *ashqysh* is not used to mean «lock»; instead, in dialectal usage, it carries the meaning «key,» that is, «an object used to open a lock.»

A similar observation is provided by G.Qaliev, who notes that in the Mangystau dialect of Kazakh, the word *ashar* is used to refer to a «key» [5:215].

Thus, while in the speech of Kazakhs of Karakalpakstan the word *ashqysh* **denotes a «lock,» in several regions of Kazakhstan the etymologically related form** *ashqysh* **is used with the meaning «key.» Although these lexemes refer to two different physical objects, they are classified as semantic dialectisms, as their meanings remain conceptually close.**

Ätkönshek – a type of cradle or low bed used for laying a child. For example: *«Rock the child's ätkönshek.»* N. Jünisov defines this household item as *«a cradle, a wind-cradle for laying a child»* [1:81]. However, in the spoken language of the Qongyrat Karakalpaks and Kazakhs, the term *ätkönshek* does not refer to a cradle for infants, but rather to a ground-level rocking bed designed for children aged four to five. One side of this structure is elevated, while the other is weighted for balance. In local usage, this variety is also termed *ayqan-ǧoyqan älkönshek // ätkönshek*. Prof. Sh. Abdınazimov notes that in Kipchak-Oghuz written monuments of the 17th–18th centuries, the word *könshek* denoted «trousers made of leather or rawhide.» He hypothesizes that the component *könshek* in the word *ätkönshek* may be etymologically linked to *kön* meaning «animal hide» or «rawhide strap» [6:108].

Däskér – a pot-holder or handle cover used to prevent burns when removing a cauldron from the fire. For example: *«Let me take the cauldron off–where are your däskérs?»*

In the standard Karakalpak literary language, however, the form *däskér* is not used; instead, the word *däske* denotes a «thing, object, item, or utensil.» In the local varieties of Karakalpak spoken in this region, both *däskér* and its synonymous form *tutqysh* («pot-holder») are used interchangeably. This demonstrates that dialectal words contribute to the enrichment of the literary language, as such units provide broader expressive possibilities for naming even small objects or nuanced concepts. The term *däskér* originates from Persian, where *dast* means «hand.»

Dünggir – a container used for storing or pouring various liquids:*«Fill the household dünggir and bring it for the lamp.»*In the Karakalpak literary language, however, *düng* refers to a large clay vessel used for storing grains or similar bulk items. Among Karakalpaks of the Qanlykól district, this vessel is known by an entirely different name–*qolsha*. Depending on its size (e.g., 2 liters, 5 liters), a *qolsha* is used for curdling fermented milk or for holding various liquids [7:63].

Elegézer – a sieve or strainer: *«Pour the milk through the elegézer so no impurities remain»*. In both the Karakalpak and Kazakh literary languages, the utensil used for sifting flour is known as *elewísh/elek*. However, the utensil used for straining milk, removing broth foam, or performing similar functions is referred to specifically as *elegézer*.

Jumyr – a container used for beverages and for pouring products such as butter, cream, and other liquid or semi-liquid dairy items.*«I have drunk many meals from the herders' jumyr,»* as the saying goes.

The term *jumyr* is used not only in Karakalpakstan but also across several regions of Kazakhstan. In the dialects of Kyzylorda, Aral, Qarmaqshy, Syrdariya, Shieli, Aktobe, Qarabalyq, Oral, Zhympyty, Gurev and Mangystau, as well as among Kazakhs of Karakalpakstan, the word refers to *«a container made from a sheep's stomach used by herders for storing and serving beverages»* [3:298].

Zağama – a container used for cleaning grains by separating them from chaff, dust, and other impurities. The *zağama* is typically made from lightweight plywood. Alongside this term, the item *kepshik* is also widely used among Kazakhs of the region. *Kepshik*, however, is usually made not with a wooden base but with a bottom crafted from animal hide.

In this region, where the population has traditionally been engaged in pastoral and agricultural activities, the lexicon contains a large number of professional terms associated with subsistence and household economy. These items appear primarily in the names of domestic utensils and kitchenware.

A variety of words are used to denote the concept of a *basket* or *bag* (*sebet*).

Boğjama refers to a cloth bag or pouch used for carrying clothing:*«Put the clothes into the boğjama.»* (Qongyrat)

The **qorzhyn** is a container used for carrying food supplies or various items when traveling. Its straps are typically woven from sheep's or camel's wool:*«Hang the strap of the qorzhyn.»* (Qongyrat, «Jastyk»)

The **jağlan** is another type of container, usually made of animal hide or felt:*«Put my shirt and blouse into the jağlan.»*

Alongside the term *dastarqan*, the synonym **jaima** is also used to denote a table cloth or spread.

The forms **arsha** and **ärzhe** derive from the Old Turkic root *arshy*, with dialectal variations (*arsha/ärzhe*) attested in several regions. For example:*«Bedding and linens were piled on the arsha; the wall hanging was placed above it.»* (Karaq.) The lexeme *ärzhe* occurs in the Urzhar and Aqsuwat districts of Semey: *«Bring your ärzhe and put it in the car.»* (Aqs.) In the Abai district, the form *ärzhi* is used:*»Abai's manuscripts were kept in one ärzhi.»* In these contexts, *ärzhe/ärzhi* carries the meaning of «suitcase» or «storage trunk.» The Old Turkic term **arshy**, recorded in M. Kashgari's dictionary as «bag, pouch» [8:154], retains the semantic components «to place, to store» in its dialectal reflexes. In the composite forms **taysandyq** and **keusandyq**, the morphemes *tai* and *keu* add the semantic nuance «large.» A.Qaiydar identifies seven meanings of the root *tai*, including «load,» «large» (as in *tai kazan*, large cauldron; *tai sandyq*, large chest), and «flat, shallow» [9:254]. This latter semantic feature underlies the formation of the term **taişunaq**, meaning «small flat sack or pouch»: *«They store grain in the taişunaq, and its opening is sewn shut.»* The root *tai*, expressing «flat, shallow,» also implies that the container is easy to carry, reinforcing its functional suitability.

Tekshe sandyq – a small hand-held chest. It is traditionally used for storing tea. The name derives from its external geometric shape. In everyday life, the *tekshe sandyq* appears in two functional varieties: a portable type convenient for travel and a stationary type intended for storage.

Shanash – a container made of leather. *The shanash is full of flour. Dishes are kept in the shanash.* The form *shanash* is historically attested in earlier Turkic sources in the variant *sanash*, demonstrating the original alternation between *s* and *sh* in Turkic languages. M. Kashgari records *sanash* as «a leather pouch or bag» (Kashgari I, 415). The form *sanach* meaning «leather bag, pouch» is also noted by Borovkov (p. 184). The meaning «leather flask» appears in Kyrgyz (chanach, Yudakhin, p. 814) and Turkmen (sanach). In Uyghur, the term is used in the sense of «skin container,» as documented by S. Malov (UNS, p. 149).

In the everyday life of the people, items related to fire-making can be included among essential daily tools, and their names show regional variation, forming a corresponding system of dialectisms. *Shymshuyr, zhamke, zhiptik, shattauyq, mästemir, ätishkir* denote tools used for handling embers or transferring hot coals. All of these objects are made of iron, which demonstrates both the Turkic peoples' knowledge of ironworking and their understanding of the power of fire.

The tool used for rolling dough and baking bread is called *astaqta* **among Turkmen and Karakalpak Kazakhs:***»Kenzhem, bring the house's astaqta, please.»*

In the Almaty region it is called *nan taqtay*, in Talas *nan sürgish* («Your nan sürgish is at Düysen's house,» Talas), while the rolling pin is known as *nan aghash* in the Zhankeldin district of Kostanay. **The two tools needed for rolling out dough in the Shelek area are encoded by the compound expression** *oqtau-taqtay***.** In all of these names, the etymology is clearly visible: the first component (*as, nan*) means «food,» «raw bread,» or «dough,» while the second component (*taqta, taqtay*) indicates the material «board.» This shows the degree to which the Kazakh ethnos mastered agricultural culture and developed techniques for using grain products.

Shyra – in the language of local Kazakhs, this is a widely used dialectal word (*«Place a flat shyra in the corridor.»*). The roots *sham* and *shyraq* are used independently in the common literary language. *Sham* refers to an artificial source of light used to illuminate the home, workplace, or dark streets–an oil lamp, wick lamp, or blind lamp – old traditional names. *Shyraq* means a lamp or lantern that lights a room. The words *sham* and *shyraq* function as synonyms in the meaning «to give light.» At the same time, *shyraq* also has expressive and ethnographic meanings common to the whole people (e.g., *«lighting a ritual shyraq»*– a lamp lit in memory of the deceased).

One of the object names whose literary variant has not yet been clearly defined within the system of dialects is the group of words meaning «pliers.»

This lexical group includes: *attis – atawyz – zhylyqauyz – balghauyz – qanauyz – qoyauyz – kempirauyz – sapsalqy – tisteuik*. The form *atawyz* is actively used in the speech of Kazakhs in Karakalpakstan. These doublets emerged as a result of analogy based on resemblance; the objects of comparison are *mouth* and *teeth*, indicating an external similarity of form, and, most importantly, the concept of *biting*. We can assume that the *biting* semantic component underlies the formation of these compound names.

In the language of Kazakhs of Karakalpakstan, the word shymshuyr, meaning «fire tongs,» has many doublets.In Aral and in the Zhankeldin district of Kostanay – zhamke;in the Syrdariya district and in the Talas district of Zhambyl – shattauyq;in Turkmenistan – zhiptik; in the Chapayev and Zhymsyty districts of the Oral region– mästemir/ masatemir;in Mangystau– ätishkür;in the Almaty region– qyshqash. Atash in Persian means «fire, ember,» while gir means «to take.» Atashger therefore denotes «fire tongs» (Ongdasynov, QPTS, 16).The variants äteshkir/ätishkür/ äteshker/ächkir are also found in Uzbek, Turkmen, and Karakalpak, formed from the meanings «fire» and «to clamp»: atash+ gir→ ätäshgir→ ätешкir→ ätishkir (QTDC, 1.102).The scholar also considers the component shymshuyr to be a borrowing from Mongolic languages. In Kalmyk it appears as chimkyur («tongs»): shym + shy → shymshy + uyr→ shymshuyr.

CONCLUSION.

Some dialectal units in the language of Kazakhs of Karakalpakstan do not occur in the Kazakh literary language or in other Kazakh dialects, and even when they are found in the Karakalpak language, their meaning in actual speech is completely different.

The linguocultural lexicon of the Kazakhs of Karakalpakstan is an integral part of the traditional Kazakh culture as a whole, and their system of values is likewise shared. Local ethnographisms are ethnocultural units that reflect regional manifestations of traditional Kazakh culture. Therefore, the ethnocultural features found in the local lexicon represent the regional coloration and regional character of traditional Kazakh culture. **Contemporary linguistic science increasingly focuses not on studying ethnocultural units in isolation, but on examining them as interconnected sources of ethnocultural information.**

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Rezyume*: Maqolada Qoraqalpog‘iston Respublikasida yashaydigan qozoqlarning tilida moddiy madaniyatga oid uy-ro‘zg‘orida qo‘llaniladigan etnodialektizmlarning tahlili keltirilgan. Mahalliy qoraqalpoq va o‘zbek tillarining ta’siri ostida shakllangan etnodialektizmlarning qo‘llanish xususiyatlari yoritib berilgan.*

Резюме: *В статье проведён анализ этнодиалектизмов, связанных с материальной культурой и используемых в быту казахов, проживающих в Республике Каракалпакстан. Описаны особенности употребления этнодиалектизмов, сформировавшихся под влиянием местных каракалпакского и узбекского языков.*

Kalit so‘zlar: *moddiy madaniyat leksikasi, alaqshın, anshıq, sebet, atkonshek, dasker va boshqalar.*

Ключевые слова: *лексика материальной культуры, алақшын, аншык, себет, атконшек, даскер и др.*

METHODS OF ANALYZING NOVELS

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Summary: *Methods of artistic representation are modified by the writer, they are combined and synthesized with each other when necessary, and have a scientific-theoretical and practical significance. The writer makes good use of dialogues, short and inverted forms of internal monologues, internal monologues of heroes and author's and personalized internal forms of monologues, types of merging of characters and author's monologues, synthesis of movements and characters. All this was fully disclosed during the analysis.*

Keywords: *the process of the lesson, teaching methods, science fiction, novel, mental hallucinations, movement, portrait, plot, objective plot, subjective plot, novel, dialogue, monologue, creativity.*

That pay attention to such methodological problems as forms of teaching Karakalpak literature and curricula for teaching Karakalpak literature at academic lyceums. All teachers are required the legal organization of the educational process, to have a creative attitude to each lesson. In order to draw up a curriculum, literary programs, educational standards in accordance with the requirements of the law, the main direction of the study was to achieve the improvement of the results and quality of education. Basic concepts are studied according to the methodology of teaching Karakalpak literature, the relationship of programs with subjects, the principles of teaching, the organization and planning of classes, interactive methods, the analysis of works of art, the study of the writers' work, the conduct of extracurricular activities.It is important to study in a comparative way the point of view of scientists on current problems of teaching literature, to outline the development of the direction of methodological and theoretical opinions. The methodological studies indicate the opinions of K.Yuldoshev [1], B.Tukhliev [2], A.Pakhratdinov[3], K.Yusupov[4] and others on the problems of teaching literature at schools.

Considering age and psychological features of students on the materials included in the program on Karakalpak literature, it is necessary to familiarize students with the best examples of Karakalpak literature, literature of related people and world literature, to instill a sense of love for the motherland in the hearts of young people, a national feeling, and also an awakening of a sense of respect for national values and the ability to express one’s opinion by studying the poetic characteristics of fiction. It is also necessary to consider that the materials included in the literature program are selected literary works, and therefore it is necessary to take into account the peculiarity of the language, psychological and pedagogical requirements of students.

Analysis of works of art and requirements for them, discussion of the text, types of analysis and methods will be studied in the course of classes under the program intended for academic lyceums. By analyzing the works of art, the students are explained the educational, moral, aesthetic, spiritual tasks of upbringing, that each people is strong in its high culture and spirituality. These program materials will be studied with the help of new types of classes: seminar, game, competition, test, conference and discussion. Teachers will need pedagogical and methodological abilities while teaching Karakalpak literature. Each lesson in literature should be held in connection with philosophy, linguistics, literary criticism, history, aesthetics, pedagogy and psychology.

Explores the problems of using innovative technologies in teaching Karakalpak literature, introducing innovation into the educational system of the Republic of Uzbekistan, tasks based on the development of methods that give quick and good results in practice, new methods and ways of education that are consistent with world achievements.

The study of the biography of each writer is considered as a presentation and introduction of his works. Studying the biography of writers, students take an example from the deeds they have done for the good of the homeland and people, from their humanism and courage. Therefore, it is necessary to take into account the educational aspects when studying the biography of writers. When explaining

the biography of the writer, respectively, each lesson provides information about important moments in the life of the writer, about the truths of that time, about his attitude to the environment where he was born and raised.

The methods of artistic depiction in the whole world prose as author's descriptions or author's information, dialogues and monologues from interior, monologues, depictions of nature and natural phenomena (landscape), portraiture of the characters, movements**,** letters written by the characters of the work, diaries and dreams, or mental hallucinations are skillfully used by classical writers in their work. Famous Karakalpak writers T. Kaipbergenov, Sh. Seitov, K. Mambetov, K. Kamalov, K. Karimov and others have successfully used similar techniques in their prose works [7]. The heroic deeds of Karakalpak children Bahadyr and Tamara, who made discoveries in world cosmonautics in the plot of S. Ismailov's novel "Galaxy of the Heart", despite the experiences of their son Sabyr, in addition to this, the memories and visions of several characters, stories, legends and dreams, letters were a barrier to plot and composition. The ancient "objective plot" of the work Bahadyr and Tamara, along with Sabir's experiences Bahadyr's father Mahmud, Mahmud's father Karim, an old man Atamurat, whom Sabyr met in Takhtakopir, through the representatives of other planets, the stories of Tahira, Kuo Man, Theo Lan, and others, the letters they wrote and their dreams, the events they experienced are transmitted in parallel through their recollections.

These qualities are clearly reflected in the work of the writer's high imagination through the possibilities of poetic mastery.

The novel has two main plot orientations: objective plot: Bahadyr, Tamara, Sabyr's experiences and subjective plots are in a convincing way for readers.

S. Ismailov's novel "Galaxy of the Heart" has a number of artistic methods, which differ from the artistic power and aesthetic qualities of the plot and compositional development.

These author's descriptions or author's information, dialogues and monologues, landscapes and scenery descriptions, portrait of heroes, movements, letters written by characters of the work, diary entries and dreams, or mental hallucinatory processes are considered to illustrate.

It is also interesting and scientifically-theoretically and practically significant that these methods of artistic expression were modified by the writer and synthesized together where necessary. In particular, the master of prose short and extended forms of dialogue and internal monologues, internal monologues of heroes and forms of author's and personalized internal monologues, types of merging of characters and author's monologues, author's narrative data, landscape fusion, movements and synthesis of portraits are well used. [8]

Here, we will try to reveal all this in more detail in the course of our analysis below.

In our opinion, it is better to dwell on the author's information and narratives in the novel. While cold and ineffective external narratives of psychology and thought are allowed, on the basis of various environments, especially in space and on other planetary conditions, their history, sometimes with sharp philosophical, social and ethical ideas and current problems, with his (author's) stories has achieved great success in depicting the inner psychological thoughts of a person.

"The view of planets sometimes roll over like a small whale, and disappear into space. They also think that they have a livelihood. What a life on a dark planet! Only the intergalactic spacecraft is piercing the world like a dagger. Darkness is terrible. The feeling that we are walking in the desert where there is no humanity. How happy you would be if you wandered in the wilderness and saw a light at night. You hurry to get to it… What awaits you there, even if you do not think about it. Even you do not worry about whether he is a friend or a foe. You strive, hurry until you reach, hope. Now young couples are in such a situation, they wander in a dark space every day".1

Here are the author's descriptions of the events of Bahadur and Tamara in the long world of darkness, who were in search of the constellation Cepheus and on that trip had a child named Sabyr in a spaceship. Their idea at that time was to temporarily take care of their child Sabyr, even if it was an unfamiliar planet, and to allow him to grow and develop anatomically and physiologically. The author manages to convey to readers in an effective and clear way through a number of extended internal monologues of Bahadyr and Tamara, other descriptions, author's information.

"Planetary shipwrecks are half-moved to the sand". It is necessary to describe the fact that in the past these sands were under the ocean, marked in the mountains. The writer used it correctly. More precisely, this is a case of sending to another planet and the loss of human tracks, where Bahadyr, Tahhira and other names lived. Here, Tamara stayed in a large ship, where Bahadyr found Tahira's half-dead body on a small planet, and all the remaining relics, and took them back to the big ship.

"Here is a wonderful planet! On one side of it there is a desert, and on the other side there are gardens. Cities that are equal to the sky on one side, and on the other side you can see the barns…It's amazing that people do the opposite of what you say!

The spaceship descended and landed on the side of an ordinary village. "People were burying a canal."

In this way, the writer describes the planet "Impostors" of Shiylan and Miylan with author's references (information), and then complements it with dialogues, further impressing and animating the plot and composition. As we can see, they are on the one hand, in a satirical-humorous test, secondly, it is very similar to the situation we are all witnessing on the planet. The author's successes are also visible to in such places. See:

"They flew over the drying sea. Birds are spreading their wings on both sides trying to bury them. "

Isn't this our Aral Sea?! The writer incorporated it into a fantastic plot composition woven in his imagination, and conveyed it to the readers as if it were another planet.

"If there is a lot of grass in the rivers, there is a lot of waste in space. From a distance, something resembling a barrel is draped over it, and right next to it is a bucket, a funnel, and a stream of uncontrollable objects. What is not in this space; If you look for pieces of broken wood, burnt iron, the wreckage of a shipwreck, the clothes of astronauts who have been traveling since ancient times ... "(92).

In our opinion, it is possible that the author's imaginative depictions through the author's narratives are realistic, interesting and thought-provoking. Science does not exaggerate this either. The power of the writer's creative imagination is also evident. "Humanity is free from the unique individuality of nature. We should be grateful for our nature, not for ourselves…[9]

What is the cessation of life in nature? What is eternity? What is death? ... Even if we dig up a poplar and throw it upside down, can we find out that its roots still have life-sustaining nutrients, that is, its roots are green again, and if we take care of them, they will grow again.

"Is it death? No! Death is also the source of life. You seem to believe that there will not be a death in the living nature. Belief is good… But I wish it would happen! There is a temporary death in our nature from ancient times. This is called lethargic sleep, although it is not very accurate in our science…" (148-149).

Such authorial information, expressed in the words of the author, is followed by philosophical or scientific fiction in different places, in the novel, with the idea that after death a person's body turns into a number of other chemical elements. All of them are thought-provoking, perhaps, call for the acquisition of science, as well as humanism and patriotism.

It is also worth noting that the relevant author's reference here turns into a short plot after the comments, that is, his ability to present the events related to the temporary death of old man Atamurat. This story in the works is complemented by the author's infinity and the author's monologue, which enrich and explain each other. There are many such philosophical ideas in the inseparable synthesis of the plot with other methods of depiction of the novel.

One of the most widely used methods in any literary prose is dialogue. Through it, the effectiveness of the work increases, the plot-compositional development is revived, and sometimes with the help of it, the plot is shortened by the writer. We can clearly feel these qualities and their skillful use in the novel "Galaxy of the Heart". Such skills are evident in the following examples and our analysis.

Scientists and talented writers rightly warn that dialogues should not consist only of greetings and simple greetings of the heroes. From this point of view, S. Ismailov successfully developed dialogues. For example:

"The guests were in a good mood.

– Fruit juice "Moscow" is very cool! Every time you drink, your mood rises.

“My late grandfather said that such bottles were once filled with vodka, which drives people crazy,” Sidorov said, taking a glass of fruit juice and looking at it for a long time.

Was there vodka when you were young?

– Yes, we had drinks like this when we were girls.

God forbid others to experience grief of this. Then the production of vodka decreased ... In the end, even though the stores were full, customers stopped buying them ...

Now that I think about it, some of the people of that time bought it because of a lot of grief! "(33).

In the dialogues, the writer narrates the space of time in a fantastic way and gives it a realistic, objective character. At the same time, it seems that in the plot paintings related to the realities of the epochs, one by one, they pass before our eyes.

In this way, they ideally raise the most important issue of our time. Make it clear without going into too much detail. Many of the dialogues in the novel contain deep and wide-ranging important philosophical thoughts.

See:

"The rays from the star are scattered in all directions and are received in a certain place, that is, they are absorbed. Her children are breastfeeding."

– And childless mothers can breastfeed, Tamara!

– That's right. But this star has nursing children. This is a breastfeeding mother with many children. If the rays of this star were not received, in time they would return to themselves. The energy of such stars falls on them and sometimes kills itself. Black stars are extinct stars that do not know where to spend their energy, burn themselves in their own heat, fry in their own oil and eventually go out. An enormous grief was the infertility in this world [10].

A mother with children will never die, her face will always be bright and radiant.

This is a troubled world, Bahadur. "

– If we say that infertility is a tragedy that only destroys a person, it is a common disease in the world!

- It is probably wrong to divide the world into the world. It's a world together! ” (64)

So, as we have seen, the two great astronauts, Bahadyr and Tamara, are summed up in two things: first, the objective scientific truth about the relationship between stars and galaxies, and second, the great philosophical truth that comes from them. Such philosophical, ethical, and psychological content is based on the contradictions between the afterlife world, the dead world and the living world, the contradictions of conscience and non-conscience, kindness, compassion, and dishonesty. This is the significance of the conversations between Bahadur and Sabir about "fascists" and fascism. The talented writer was able to use them in the direction of the plot.

In this fantasy novel, as in many realist fiction novels, some dialogues are directly aimed at revealing the inner psychological world of the protagonists.

The methods of artistic depiction in the whole world prose as author's descriptions or author's information, dialogues and monologues from interior, monologues, depictions of nature and natural phenomena (landscape), portraiture of the characters, movements**,** letters written by the characters of the work, diaries and dreams, or mental hallucinations are skillfully used by classical writers in their work. Famous Karakalpak writers T. Kaipbergenov, Sh. Seitov, K. Mambetov, K. Kamalov, K. Karimov and others have successfully used similar techniques in their prose works [11].

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When studying the biography of the writer, methodological issues such as a brief definition from the biography of the writer, as well as stories and essays about the biography, are taken into account. At the same time, it occupies a special place to study the life and work of the writer, the disclosure of the ideological and artistic quality of works and historical and literary tasks.

The effectiveness and quality of conducting a lesson related to the biography of a writer, first of all, depends on the teacher’s preparedness, as well as on collecting material and drawing up a good lesson plan. Therefore, the teacher must use the writings of writers on the life and work of writers. Research prospects are thought in creating a series of special educational tools that form linguistic and communicative competence and educational tasks.

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Rezyume: *Badiiy tasvir usullari yozuvchi tomonidan o‘zgartirilib, zarur o‘rinlarda bir-biri bilan uyg‘unlashib, sintezlashib, ilmiy-nazariy va amaliy ahamiyat kasb etadi. Yozuvchi dialoglardan, ichki monologlarning ixcham va kengaytirilgan shakllaridan, qahramonlarning ichki monologlari va monologlarning mualliflik va shaxsiylashtirilgan ichki shakllaridan, personajlar va muallif monologlarining qo‘shilish turlaridan, harakat va portretlar sintezidan yaxshi foydalanadi. Bularning barchasi tahlil jarayonida to‘liq ochib berildi.*

Резюме: *Методы художественного изображения видоизменяются писателем, они при необходимости комбинируются и синтезируются друг с другом и имеют научно-теоретическое и практическое значение. Писатель хорошо использует диалоги, краткие и развернутые формы внутренних монологов, внутренние монологи героев и авторские и персонализированные внутренние формы монологов, типы слияния персонажей и авторских монологов, синтез движении и портретов. Все это было полностью раскрыто в ходе анализа.*

Ключевые слова: *процесс урока, методика обучения, фантастика, роман, психические галлюцинации, движение, портрет, сюжет, объективный сюжет, субъективный сюжет, роман, диалог, монолог, творчество.*

TECHNOLOGY FOR DEVELOPING STUDENTS' SINGING SKILLS THROUGH METACOGNITIVE STRATEGIES AND MODERN TECHNICAL TOOLS

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Summary: *This article scientifically explores the possibilities of using metacognitive strategies and modern technical tools to develop students' singing skills. The study demonstrates how a student consciously manages the performance process, identifies errors in vocal timbre, intonation, and phrasing, analyzes them, and plans subsequent exercises using metacognitive strategies – planning, monitoring, and reflection. Additionally, the methodology for effectively enhancing singing exercises through video recordings, metronomes, interactive educational programs, and virtual platforms is presented. The results indicate that integrating metacognitive approaches with technical tools enables students to consciously improve their singing skills, efficiently organize independent practice, and deeply develop their creative expression.*

Key words: *Metacognitive strategies, Singing skills, Musical thinking, Reflection, Monitoring, Technical vocal skills, Rhythm and phrasing, Independent practice, Modern technical tools, Pedagogical competence*

Introduction

Singing skills are a crucial component of modern music education, encompassing technical vocal ability, artistic expression, phrasing, intonation, and creative potential. For the professional training of future music teachers, it is essential to develop singing skills in a systematic and conscious manner. In this context, metacognitive strategies—planning, monitoring, and reflection—serve as effective tools for controlling and improving the singing process. Modern technical tools, including video recordings, interactive software, metronomes, and virtual platforms, further enhance the efficiency of vocal training [1]. For instance, when a student learns a new song, video recordings allow them to analyze their performance, identify errors in timbre and phrasing, adjust rhythm, and refine expression. Integrating metacognitive strategies with technical tools enables students to consciously control and independently develop their singing skills.

Theoretical basis of metacognitive strategies in singing. The theoretical foundation of metacognitive strategies in singing is one of the most important aspects of contemporary music education. These strategies help students understand their own thinking processes and develop conscious control over their performance. The three main components of metacognition—planning, monitoring, and reflection—play a central role.

Planning allows students to structure their practice and work systematically on performance. For example, when learning a new song, a student may first practice rhythmic phrases at a slow tempo, then focus on technical elements such as timbre, intonation, and tone quality, and finally integrate the phrases into a complete performance. This ensures that practice is goal-oriented rather than random. Planning also helps students progressively develop skills, anticipate errors, and organize practice efficiently.

Monitoring involves real-time observation and evaluation of performance. Students can record their singing, use a metronome to check rhythm and tempo, and identify inconsistencies in phrasing or intonation [2]. If errors are detected, the student can focus on those sections, slow down the tempo, and correct the intonation independently, without relying on external feedback.

Reflection occurs after practice, enabling students to analyze their results and plan future sessions. For example, if the emotional interpretation of a phrase is insufficient, the student may first sing it mentally, then practice it slowly, consciously shaping the tone and emotional nuance. In this way, singing develops both technically and artistically, and the student learns to consciously manage the performance process.

Theoretically, metacognitive strategies allow singing to develop systematically rather than intuitively. They help students analyze errors, control performance, and consciously shape creative

expression. For instance, when performing songs that require rapid phrasing, students may practice each segment individually, analyzing timbre, intonation, and rhythm, before integrating all parts into a complete rendition [3]. This approach ensures that singing develops not only technically but also artistically and aesthetically.

Studying these theoretical foundations equips future music teachers with the skills to consciously manage singing, identify errors independently, and systematically improve performance. Consequently, they not only enhance their own abilities but are also prepared to conduct effective, structured, and methodologically sound lessons for their students.

Methodology for developing technical and artistic vocal skills using metacognitive strategies and technical tools. In contemporary music education, integrating metacognitive strategies with technical tools provides an effective method for systematically and consciously developing students' singing skills. This approach enhances technical vocal skills as well as artistic elements such as phrasing, timbre, and intonation. Metacognitive strategies—planning, monitoring, and reflection—allow students to control their performance, identify errors, and organize independent practice effectively.

Technical tools such as video recording, metronomes, and interactive software are particularly effective in developing technical skills. For example, when learning a new song, a student can record their performance to identify errors in rhythm, timbre, or coordination of breath and articulation. A metronome ensures correct tempo and rhythmic precision, and any discrepancies can be isolated and practiced separately. Interactive music programs visually analyze phrasing, intonation, and pitch, assisting students in correcting pitch and tone [4].

Artistic skill development also benefits from metacognitive strategies. If timbre is inconsistent or phrasing lacks expressive quality, students may first sing the phrases internally, then practice slowly, analyzing each phrase for tone, emotion, and dramatic expression. Technical exercises, such as breath control or articulation drills, are integrated into the phrasing and artistic interpretation, ensuring a holistic development of vocal skills. For instance, singing high notes with accurate timbre and smooth transitions is refined through coordinated technical exercises.

By combining metacognitive strategies with technical tools, students learn to identify and correct errors, consciously control their performance, enrich creative interpretation, and integrate these skills into complete renditions. Future music teachers, therefore, gain the ability to organize independent practice efficiently, deepen their technical and artistic vocal skills, and develop professional pedagogical competence.

Enhancing the effectiveness of independent practice and reflection is crucial for future music teachers to develop singing and instrumental performance skills consciously. Independent practice allows students to control performance, identify and correct technical and artistic errors, and shape creative expression. Metacognitive strategies significantly increase the efficiency of practice sessions [5].

Before practice, planning and goal-setting help students conduct structured exercises. For example, when learning a new song, the student may first practice rhythmic phrases slowly, strengthen technical elements (finger positioning, articulation), and finally integrate the phrases into a complete performance. Vocal practice focuses on controlling timbre, identifying intonation errors, and enriching artistic expression, ensuring goal-oriented and systematic learning.

Monitoring allows students to detect technical and artistic errors during practice. Using video recordings, metronomes, or audio apps, students can identify rhythmic inconsistencies, insufficient timbre, or intonation errors. For example, if rapid phrasing leads to rhythmic elongation, students practice these sections separately at a slower tempo to correct errors, developing independent error-identification and correction skills.

Reflection occurs after practice, enabling students to analyze strengths and weaknesses, determine the causes of errors, and update future practice plans. For example, if timbre or emotional expression is inadequate, students may first sing internally, then perform the entire song at a slow tempo, integrating corrections. This process enhances technical, rhythmic, and artistic mastery, as well as creative interpretation.

Independent practice and reflection also allow students to identify and develop their strengths. For instance, rapid phrasing songs can be divided into segments for analysis and practice, ensuring rhythm, timbre, and phrasing are refined before performing the complete song. Consequently, future music teachers deepen their ability to organize independent practice and consciously manage performance.

Overall, using metacognitive strategies to enhance independent practice and reflection strengthens students' pedagogical and musical competence, develops creative expression, and significantly improves the quality of performance.

Conclusion

Developing singing skills through metacognitive strategies and modern technical tools transforms students into active and conscious participants in their own performance. Through planning, monitoring, and reflection, students can identify technical, rhythmic, phrasing, and timbre errors, analyze them, and plan subsequent practice accordingly. For example, rhythmic inconsistencies may be corrected using video recordings or a metronome, while insufficient timbre or intonation can be addressed by practicing phrases internally at a slow tempo before integrating them into a full performance. This approach enhances the effectiveness of independent practice, develops creative interpretation, and deepens students' pedagogical and musical competence. As a modern methodological tool, it significantly improves the quality of singing instruction and the educational process.

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Rezyume: *Ushbu maqolada o'quvchilarning kuylash mahoratini rivojlantirishda metakognitiv strategiyalar va zamonaviy texnik vositalardan foydalanish imkoniyatlari ilmiy asosda yoritilgan. Tadqiqotda o'quvchining ijro jarayonini ongli boshqarishi, ovoz tembrini, intonatsiya va frazalash xatolarini aniqlashi, ularni tahlil qilishi va keyingi mashqlarni rejalashtirishda metakognitiv strategiyalar – rejalashtirish, monitoring va refleksiya – qanday qo'llanilishi ochib berilgan. Shuningdek, videoyozuvlar, metronomlar, interaktiv ta'lim dasturlari va virtual platformalar yordamida kuylash mashqlarini samarali rivojlantirish metodikasi taqdim etilgan. Tadqiqot natijalari shuni ko'rsatadiki, metakognitiv yondashuv va texnik vositalarni uyg'unlashtirish orqali o'quvchilar kuylash mahoratini ongli rivojlantiradi, mustaqil mashg'ulotlarni samarali tashkil etadi va ijodiy ifodani chuqur shakllantiradi.*

Резюме: *В данной статье научно освещены возможности использования метакогнитивных стратегий и современных технических средств для развития певческих навыков у учащихся. В исследовании раскрывается, как учащийся осознанно управляет процессом исполнения, выявляет ошибки в тембре голоса, интонации и фразировке, анализирует их и планирует последующие занятия с использованием метакогнитивных стратегий – планирования, мониторинга и рефлексии. Также представлена методика эффективного развития вокальных упражнений с помощью видеозаписей, метрономов, интерактивных образовательных программ и виртуальных платформ. Результаты исследования показывают, что сочетание метакогнитивного подхода и технических средств позволяет учащимся осознанно развивать певческие навыки, эффективно организовывать самостоятельные занятия и глубоко формировать творческое выражение.*

Kalit so‘zlar: *Metakognitiv strategiyalar, Kuylash mahorati, Musiqiy tafakkur, Refleksiya, Monitoring, Texnik ovoz ko‘nikmalari, Ritm va frazalash, Mustaqil mashg‘ulot, Zamonaviy texnik vositalar, Pedagogik kompetensiya*

Ключевые слова: *Метакогнитивные стратегии, Певческое мастерство, Музыкальное мышление, Рефлексия, Мониторинг, Технические вокальные навыки, Ритм и фразировка, Самостоятельные занятия, Современные технические средства, Педагогическая компетентность*

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EFFECTIVE WAYS OF DEVELOPING ECOLOGICAL CULTURE IN PEDAGOGICAL EDUCATION THROUGH ECO-PEDAGOGICAL APPROACH

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Summary: *The article examines the specific features of ecological pedagogy - a new methodological direction in pedagogical science that emerged at the intersection of ecology, ecological psychology, and pedagogy. On this basis, the eco-pedagogical possibilities of the course "Fundamentals of Ecological Culture and Sustainable Development" are revealed in the formation of the ecological culture of future teachers.*

Key words: *environment, ecology, future teacher, ecological psychology, ecological pedagogy, ecological education, ecological culture, sustainable development, pedagogical conditions, ecopedagogical opportunity.*

The development of ecological enlightenment was influenced by research in the field of ecological pedagogy, which emerged on the eve of the 21st century. Data from ecological pedagogy allow us to identify the features of the development of ecological thinking, ecological consciousness, ecological culture, and the quality of ecological responsibility (responsible attitude to the environment), which is their product, various types of personality attitudes towards the environment and the mechanisms of their formation. As a result, it becomes possible to establish a clear correspondence between the pedagogical process of environmental education and the psychological process of forming established personal characteristics. All this led to the emergence of a new methodological direction in pedagogical science - ecological pedagogy [1].

Ecological pedagogy is a methodological direction in pedagogy, within the framework of which the content, principles, methods, and organizational forms of environmental education (education, upbringing) and the formation of ecological culture are developed. Ecological pedagogy emerged at the intersection of three scientific disciplines: ecology, ecological psychology, and pedagogy.

Ecology identifies general problems arising from the state of ecological crisis (including the drying up of the Aral Sea and the crisis of the Aral Sea region ecosystems), on the basis of which ecological pedagogy develops the following specific content of the formation of ecological culture through environmental education: ecological knowledge, methods of ecological activity, experience of ecological creative activity, and a system of emotional-value attitudes towards the environment.

Ecological psychology provides concepts about the laws and mechanisms of development of ecological thinking and ecological consciousness of the individual, on the basis of which ecological pedagogy develops appropriate specific principles and methods of pedagogical management of this process.

Pedagogy defines general pedagogical principles and methods, as well as organizational forms, while ecological pedagogy purposefully uses them in solving the problems of forming ecological education and ecological culture.

Therefore, the processes of forming ecological education and ecological culture can be effectively implemented within the framework of ecological pedagogy within its three fundamental foundations: ecology, ecological psychology, and pedagogy, which are united into one whole, i.e., integrated [3].

One of the most important didactic conditions for the formation of ecological thinking, consciousness, and culture in the personality of a future teacher is the identification of the ecological potential of all compulsory and elective subjects in the curriculum of pedagogical education. When choosing the content of educational material, it is necessary to adhere to the rule that the formation

of ecological culture and the possibility of its application in subsequent ecological-pedagogical activities are revealed through the substantive aspect of ecological education.

As a result of the analysis of state educational standards, curricula, and working programs of areas and specialties of pedagogical education, the following was revealed: the ecological aspects of the subjects are practically not included in the content of almost all academic disciplines; their discussion from the point of view of forming ecological culture in future teachers has practically not been conducted.

Despite the potential for hidden but emergent possibilities of most academic disciplines (courses on the methodology and technologies of teaching such specialized disciplines as "Ecology and Environmental Protection," "Life Safety," "Anatomy, Physiology and Hygiene of Age," "Fundamentals of Medical Knowledge," "General Psychology," "General Pedagogy," "Philosophy," "Cultural Studies," "Chemistry," "Physics," etc.), the need arose to introduce a basic integration link. Because the complexity and specificity of the problem under study, as experience shows, requires its deeper and more comprehensive study. For this reason, we have developed and implemented a program of a competitive course for students entitled "Fundamentals of Ecological Culture and Sustainable Development." This course is designed for 120 hours, of which 30 hours are allocated for lectures, 30 hours for seminars, and 60 hours for independent study.

This course, having essentially integrative content, as an important link in the environmental policy implemented by the President of the Republic of Uzbekistan and the government, in 2025, which was declared the "Year of Environmental Protection and Green Economy" in our country, will be of particular importance in preserving nature, ensuring environmental sustainability, and most importantly, improving the level of eco-pedagogical training of future teachers.

The main goal of the course "Fundamentals of Ecological Culture and Sustainable Development" is to develop students' ecological literacy and form their eco-pedagogical culture by introducing them to the system of scientific and theoretical knowledge, practical skills, and abilities (competencies) related to ecology, nature management, environmental protection, ecological education (education, upbringing), ecological culture, and the foundations of sustainable development.

The priority tasks of the course "Fundamentals of Ecological Culture and Sustainable Development" are:

- familiarization of students with such scientific-ecological and moral-ecological concepts as "ecology," "use of nature," "environmental protection," "ecological crisis," "ecological disaster," "ecological education," "ecological upbringing," "ecological thinking," "ecological consciousness," "ecological worldview," "ecological value," "ecological behavior," "ecological morality," "ecological culture," "sustainable development" and consideration of the relationship between them;
- substantiation of the system of scientific and theoretical knowledge, practical skills, and abilities (competencies) related to ecology, nature management, environmental protection, environmental education, environmental culture, and the foundations of sustainable development as a set of the most important factors (components) serving to ensure the sustainable development of the Republic of Uzbekistan;
- formation of students' understanding of the relationship between nature and society, man and the environment, as well as environmental protection measures;
- Teaching students to perceive the essence of natural, socio-economic objects, phenomena, and processes related to human life in the environment from an eco-pedagogical perspective;
- disclosure of the eco-pedagogical aspects of solving environmental, economic, and social problems of the transition to sustainable development at the local (local), regional, and global (universal) levels;
- formation of a responsible attitude towards the environment, professional ecological thinking and culture in future teachers.

The course content covers the following topics:

1. The goal, objectives, history of development, and methods of "Ecological Culture and Fundamentals of Sustainable Development."

2. Organism and environment.
3. Populations and biocenoses.
4. Ecological systems.
5. Biosphere.
6. Rational use of natural resources and nature.
7. Environmental quality and pollution.
8. Atmospheric air and its protection.
9. Water resources and their protection.
10. Soil resources and their protection.
11. Flora and fauna, their protection.
12. Relationship between nature and society: evolution and current state.
13. Fundamentals of environmental education (education, upbringing).
14. Fundamentals of Ecological Pedagogy and Ecological Culture.
15. Fundamentals of sustainable development and "green" economy.

The logic of the course is systematized in accordance with the general methodological requirements of the structure of the educational material. The sequence of topics is determined by movements from the abstract to the concrete, from the general to the specific, and vice versa. The conceptual-terminological system of the course is also formed on the basis of similar methodological requirements.

For example, before analyzing the specific aspects of ecological education, its goals, objectives, and place in the structure of pedagogical knowledge, general considerations are presented regarding the formation of the educational significance of the natural world in the student's personality. When revealing the course topics, attention is paid to the role of environmental pedagogy and environmental education in the training of pedagogical personnel, and the importance of implementing the principle of humanism in environmental education in higher education is noted.

The specific aspects of the course "Fundamentals of Ecological Culture and Sustainable Development" are related to revealing the essence, structure, and specific features of the teacher's activity. The essence of this activity is the scientific and moral environmental training of schoolchildren. Thus, the main task of the teacher-pedagogue is to understand the skillful use of the goals, tasks, principles, forms, and methods of environmental education based on humanism.

Attempting to create a unique educational environment in training sessions contributes to the formation of ecological culture, as well as personal self-expression, through the creative activity of the future teacher [6]. If his educational activity is imbued with a creative mood, the student tries to manifest himself as a creative person through his creative activity. Therefore, along with the selection and systematization of educational material, in our opinion, the creation of an educational environment aimed at personal self-expression in future eco-pedagogical activity is of particular importance.

The implementation of this condition in the educational process includes practical games, discussions, the performance of creative tasks, and the organization of students' independent activities outside the classroom, which are considered as elements of an ecological educational environment. Consequently, the necessity of teaching the student to manifest himself as a creative personality is considered an urgent task.

One of the practical classes offered to students studying in the field of pedagogical education is a didactic game held in the form of a press conference on the topic "Models of Formation of Environmental Education and Environmental Culture." The purpose of this lesson is to encourage students to acquire the knowledge necessary for the proper organization of future eco-pedagogical activity. In accordance with the stated goal, the solution of the following didactic tasks is envisaged [2]:

1) revealing the essence of each presented model of environmental education and the formation of ecological culture as a means of preparing students for eco-pedagogical activity;

2) formation of a personal and cognitive attitude towards environmental education and the formation of ecological culture in future teachers;

3) explaining the social significance of eco-pedagogical activity in the formation of ecological culture among schoolchildren.

When presenting the material, attention should be paid to the following issues:

- ecological education (education and upbringing) of future teachers as one of the complex and urgent socio-educational problems;
- the role of higher educational institutions in solving this problem;
- goals, nature, and pedagogical conditions of relations in the "teacher-student" system;
- organizational forms and methods in traditional and humanistic models of environmental education and the formation of ecological culture.

During the lesson, all students are divided into two subgroups: "experts" (speakers) and "participants." The task of the "experts" is to clarify the important aspects of the topic. "Participants" take the position of listeners who ask questions to "experts" at the conference. At the end of the session, each "participant" will be given the opportunity to express their personal opinion on the issues discussed at the conference.

The professor-teacher participates in the conference as a "participant." His duties are to ask questions as a "participant" of the conference, to express his personal point of view, as well as to periodically lead the discussion process and regulate the atmosphere of the conference. At the same time, he attentively listens to the point of view of each student, does not reject any of them, and does not try to bring them to the information known in pedagogical literature.

The reason for this is that the disclosure of the essence of this course allows the student to rely on their personal experience, as well as to express their personal point of view as a future teacher.

Objectives of the lesson: to show the differences between the proposed models of modern environmental education and the formation of environmental culture; to form a clear point of view on the topic; to take into account the specifics of environmental training of schoolchildren; to discuss the possibility of applying the models in the study of a specific subject.

During the discussions, students show the main features of the models of environmental education and the formation of environmental culture and their effectiveness in the formation of environmental competence of schoolchildren. The positive feedback of the students showed that there is a great need to use such a lesson.

In our opinion, this is facilitated by problematic questions, purposefully selected facts, the ability to express and defend a personal point of view on the issue under consideration, as well as the opportunity to take the initiative in certain situations.

Independent activities of students outside the classroom expand their knowledge of the subject, as well as develop information retrieval, organizational, and other skills [4]. When planning such student activities, it is necessary to take into account the following features: the performance of work by students without the direct participation of the teacher; the need to take into account the specifics of the course.

The purpose of students' independent work outside the classroom is:

1) systematization and consolidation of students' knowledge and practical skills;
2) deepening and expanding students' theoretical knowledge;
3) development of students' ability to effectively use information sources of various content;
4) development of students' cognitive abilities and activity;
5) formation in students of independent thinking, as well as the ability for self-development, self-improvement, and self-expression;
6) development of research skills in students.

Students can be actively involved in the process of developing and defending projects of various content in accordance with the above-mentioned goals of extracurricular independent activity. The project method is attractive due to the following features: 1) interdisciplinary nature; 2) development of personal ideas about the principles of cooperation and scientific organization of work; 3) the possibility of applying the acquired knowledge in future pedagogical activity; 4) self-improvement of students [5].

In the process of project defense, a small group can present their "know-how" in the field of environmental education and the formation of environmental culture. For example, the main idea of the project "Nukus - City of the Future," according to the students, is the need to "understand a sense of responsibility for one's city, one's country, and the future of our planet."

Within the framework of the created educational environment, student scientific and practical conferences dedicated to the study of the global nature of the environmental problem can be held in May of each academic year. It is advisable to conduct presentations in the branches on the following topics: "Ecological Pedagogy - a New Methodological Direction in Pedagogical Science," "Ecological Education of Students and Youth as a Condition for Solving the Environmental Problems of the Aral Sea Region"; "Humanistic Goals in the Content of Environmental Education"; "Conceptual Principles of the System of Continuous Environmental Education," "The Problem of Creative Self-Realization of Students in Environmental Education," "Creativity and Environmental Education," "Ecologization of the Pedagogical Process," "Formation of the Quality of Environmental Culture of Future Teachers," "Ecological Component of Pedagogical Professional Culture," etc.

In conclusion, it should be noted that the eco-pedagogical possibilities of the course "Fundamentals of Ecological Culture and Sustainable Development" in the formation of the ecological culture of future teachers are very large, however, the small experience accumulated in this area cannot serve as a basis for drawing important conclusions. Therefore, it is advisable to regularly introduce this course in pedagogical higher educational institutions and increase its effectiveness, as well as expand the scope of scientific research in the field of environmental pedagogy.

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Rezyume: *Maqolada ekologiya, ekologik psixologiya va pedagogika o'zaro tutashgan joyda vujudga kelgan pedagogika fanidagi yangi metodologik yo'nalish – ekologik pedagogikaning o'ziga xos xususiyatlari ko'rib chiqiladi. SHu asosda bo'lg'usi pedagoglarning ekologik madaniyatini shakllantirishda "Ekologik madaniyat va barqaror taraqqiyot asoslari" kursining ekopedagogik imkoniyatlari ochib beriladi.*

Резюме: *В статье рассматриваются особенности экологической педагогики - нового методологического направления в педагогической науке, возникшего на стыке экологии, экологической психологии и педагогики. На этой основе раскрываются эколого-педагогические возможности курса «Основы экологической культуры и устойчивого развития» в формировании экологической культуры будущих педагогов.*

Kalit so'zlar: *atrof-muhit, ekologiya, bo'lg'usi pedagog, ekologik psixologiya, ekologik pedagogika, ekologik ma'rifat, ekologik madaniyat, barqaror taraqqiyot, pedagogik shart-sharoitlar, ekopedagogik imkoniyat.*

Ключевые слова: *окружающая среда, экология, будущий педагог, экологическая психология, экологическая педагогика, экологическое образование, экологическая культура, устойчивое развитие, педагогические условия, эко-педагогическая возможность.*

SPEECH AS AN EDUCATIONAL INSTRUMENT: STRATEGIES FOR EFFECTIVE ENGLISH LANGUAGE LEARNING

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Summary: *Being proficient in English is now an essential talent in a world that is becoming more and more interconnected. English has been demonstrated to improve access to educational and career prospects because of its function as a medium of international communication. In this article, we examine the role of speech as an educational tool and provide practical methods for improving English language acquisition through spoken interaction.*

Key words: *online platforms, enhancement, construction of coherent narratives, pedagogical approach, an efficacious method of cultivating oral language skills, enhancing confidence, optimizing fluency.*

The significance of language in the context of languages of instruction cannot be overstated. This medium is not merely a means of communication; rather, it constitutes an integral part of the process of language championing. It has been proven that engaging in oral interaction to understand pronunciation, fluency and skills facilitates student learning. Using language enables us to receive immediate feedback and adapt our actions accordingly. This is a significant aspect of language acquisition. Furthermore, oral interaction has been demonstrated to enhance students' confidence and promote the articulation of their thoughts and ideas with greater ease (Smith).

This paper sets out strategies for effective English language teaching through speech.

1. The regular practice of speaking skills is an essential component of any comprehensive language learning programme, as it facilitates the enhancement of an individual's ability to communicate with clarity and efficacy in a variety of contexts.

It is widely acknowledged that the use of spoken English is an efficacious method of enhancing one's proficiency in the language. It is recommended that language learners seek opportunities to practice with native speakers or other learners. It is evident that this objective can be accomplished through a multitude of methods, including yet not limited to language exchange programmes, conversation clubs, and online platforms such as Tandem and HelloTalk. It is a commonly held belief that regular practice is an effective method to help learners become proficient in everyday language use. Regular practice has also been demonstrated to enhance learners' capacity for independent thinking.

2. Role-playing games are highly recommended for use.

Role-playing games can be defined as dynamic strategies that allow students to simulate real-life situations (Smith). It has been demonstrated that scenarios such as ordering in restaurants, participating in interviews and relaxed small talk at social gatherings have the capacity to improve vocabulary and phrases, whilst providing a measure of communication that is contextually appropriate. Such pedagogical approaches have been shown to engender increased confidence in students, whilst also cultivating their understanding of cultural subtlety and the appropriate use of language in a variety of contexts.

3. The employment of storytelling techniques is recommended in order to achieve the desired result.

Using storytelling as a teaching tool has been shown to be an effective way of developing oral language skills and encouraging creativity. Learners are able to hone their retelling skills, whether it be personal experiences, fictional stories or cultural stories, in English. This pedagogical approach encourages the use of descriptive vocabulary and the development of vocabulary, as well as the construction of coherent narratives. This pedagogical approach encourages the use of descriptive vocabulary and the development of vocabulary, as well as the construction of coherent narratives. Furthermore, storytelling can be regarded as a collaborative endeavour in which students share their narratives with their peers, thereby fostering a culture of feedback and discussion.

4. It has been demonstrated that the use of technological resources enhances the efficacy of speaking practice.

Advancements in technology have led to the development of numerous tools designed to enhance spoken English proficiency. Using applications such as Speech ling gives students the chance to improve their pronunciation and receive feedback from native speakers. Speech recognition software assists students in evaluating the precision of their pronunciation. Furthermore, the video conferencing platform facilitates real-time interaction with virtual partners and educators, thereby enhancing accessibility. Engagement with multimedia resources is strongly encouraged.

It has been demonstrated that a comprehensive understanding of a diverse array of multimedia resources exerts a significant influence on the enhancement of examination and conversational skills. Using audio-visual media in English, such as films, podcasts and YouTube channels, helps students engage with a variety of accents, dialects and styles of speech. Following a viewing of the relevant materials, students are invited to participate in discussions about their observations or contributions. This process facilitates the integration of understanding and the promotion of verbal expression.

6. The process of recording and reviewing speech constitutes an essential component of linguistic analysis.

Recording one's own verbalisations can be a valuable tool for self-reflection and assessment. Learners are permitted to select a topic of interest, deliver a brief presentation, and subsequently listen to the recording in order to assess their pronunciation, intonation, and fluency. The objective of this exercise is twofold: firstly, to facilitate the identification of areas that may require enhancement, and secondly, to enable the monitoring of progress over time. Moreover, the distribution of audio recordings to pedagogues or colleagues can facilitate the provision of constructive feedback.

7. The subsequent text has been meticulously crafted to provide the reader with a comprehensive overview of the subject matter. The establishment of a speaking routine constitutes a pivotal element in the preparation process for any public address.

The establishment of a consistent speaking routine has been demonstrated to have a significant impact on the enhancement of language acquisition. The establishment of designated periods on a weekly basis for the purpose of speaking practice, whether in the form of conversations with friends, online interactions, or individualised exercises, has been demonstrated to facilitate the consolidation of learning habits. The cultivation of consistency is of paramount importance in the pursuit of enhancing confidence and optimizing fluency.

8. It is recommended that participation in public speaking be encouraged.

Participation in public speaking events, including debates, presentations and storytelling competitions, has been demonstrated to have a significant positive impact on the confidence and communication skills of learners. These activities have been meticulously devised to promote clarity of thought and engagement with an audience. Furthermore, they provide invaluable experience in the effective organisation of ideas and their subsequent delivery.

Conclusion:

Speech is a fundamental educational instrument in the journey of learning English as a second language. Integrating pedagogical approaches that prioritise conversational training, role-playing exercises, storytelling techniques, technological utilisation, multimedia engagement, self-assessment strategies, routine establishment and active public speaking participation can effectively enhance learners' spoken English proficiency. As their proficiency in verbal communication improves, they will develop a greater sense of confidence and be presented with new opportunities for personal and professional growth within the English-speaking world. The integration of speech as a pivotal element within the domain of language acquisition has the potential to facilitate effective communication and cultivate a more profound cultural comprehension.

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Rezyume: *Ingliz tilini bilish hozirgi kunda o'zaro bog'liq bo'lib borayotgan dunyoda zaruriy ko'nikma hisoblanadi. Ingliz tili o'zining xalqaro muloqot vositasi funksiyasi tufayli ta'lim va martaba istiqbollariga kirishni yaxshilashi isbotlangan. Ushbu maqolada biz nutqning ta'lim vositasi sifatidagi rolini ko'rib chiqamiz va og'zaki muloqot orqali ingliz tilini o'zlashtirishni takomillashtirishning amaliy usullarini taklif etamiz.*

Резюме: *в современном мире, который становится все более взаимосвязанным, владение английским языком является необходимым навыком. Доказано, что английский язык улучшает доступ к образованию и карьерным перспективам благодаря своей роли средства международного общения. В этой статье мы рассмотрим роль речи как образовательного инструмента и предложим практические методы улучшения владения английским языком посредством устного общения.*

Kalit so'zlar*: onlayn platformalar, takomillashtirish, bog'lanishli hikoyalar tuzish, pedagogik yondashuv, og'zaki nutq ko'nikmalarini rivojlantirishning samarali usuli, ishonchni oshirish, nutq ravonligini optimallashtirish.*

Ключевые слова: *онлайн-платформы, совершенствование, построение связных нарративов, педагогический подход, эффективный метод развития навыков устной речи, повышение уверенности, оптимизация беглости речи.*

THE AESTHETIC INTERPRETATION OF THE MODERN CHARACTER

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Summary: *This article talks about the principles of the emergence and development of comics in Uzbek literature. The essence of the idea and content of comic works is analyzed.*

Key words: *humor, criticism, satire, humor, drama, pathos, theme, idea, criterion, motive of laughter and crying.*

When thinking about the emergence of comics in Uzbek literature, it is necessary to assume that this social phenomenon is inextricably linked with contemporary press and comic literature. That is, the manifestations of comic journalism were manifested in the works of comedy and humor in Uzbek literature before the press was born. Uzbek comic literature has a rich history. Humor, satire, as a special ideological-artistic principle of reality reflection, has had a great place in the literature of all civilized nations, including the oral and written literature of the Uzbek people. Satire, which is a humorous criticism of social ills, was widespread in Uzbek folk art. Working people created anecdotes, comic tales and songs as a special form of protest against injustice and oppression in social life. Kal, Nasriddin Effendi ridiculed social vices and defects with the help of comic characters and exposed them.

Folk, comic, satire and laughter are very ancient and at the same time have continuity, and have provided inexhaustible creative food for written comic literature and journalism. Satire and humor have had an important place in Uzbek written literature since the early times. It is known that there are many humorous songs in "Devonu Lugatit Turk", which is an example of the first literary monuments. The great Uzbek poet and thinker Alisher Navoi also made a significant contribution to the development of Uzbek comic literature. In the history of Uzbek literature, Turdi, Makhmur, Gulkhani, Muqimi, Zavqi and other poets also created immortal works in the field of humor and satire, and aroused the public's anger over the oppression, injustice and other social evils of their time.

It should be emphasized that poets and writers of the past performed the function of Uzbek comic journalism in the period when the Uzbek comic literature did not yet exist. Because in the works of Uzbek comic literature, and in particular, in the literature of Uzbek enlightenment, there are ideological and artistic elements of comic journalism, some features, which, in turn, indicate the mutuality of comic literature and comic journalism. proves our point once again. On the other hand, a number of comic-journalistic works of the representatives of satire in Uzbek enlightenment literature were published in the first Uzbek press publications and played an important role in the direct emergence of Uzbek comic journalism.

The gradual improvement and artistry of hajviyot in Uzbek poetry is not a spontaneous literary phenomenon. After all, the facts reflected in the pages of history made it possible to show its true image today. Based on this criterion, we will be able to give a proper assessment of the gradual improvement and artistry of the comic.

If we look at history, at the intersection of the literature of the Enlightenment and modern times, this genre has colored its form, style and style of expression. Ghulam Karimov, a muqimi scholar, who spoke about this, writes: "Hajviyot (satire and humor) occupies an important place in the muqimi's creative heritage. Mukimi's humor is organically connected with the main motives of his work, helps to fully imagine the image of the poet, to give his characteristics as an enlightened poet. It seems that if we take into account that the first roots of this genre go back to folk epics (folklore), the essence of the matter becomes clearer. The genetic development of the nation and the age-old values of the people's struggle for survival are directed to systematize the architecture of the lyrics. It becomes clear that this self-existing genre has gained vitality in literature, and it has been developed in a syncretic way in the heart of various works. Literary critic K. Yolchiyev puts forward the following points while evaluating the period: "By the end of the 19th century and the beginning of the 20th century, serious changes began to occur in the structure of poetry. The main reason for

this is the great social and political changes between the two centuries. Because at that time global events were taking place around the world for their time. In this, the technocratic and powerful countries were dominating, and there was a struggle to divide the world. As a result, it was a time when serious changes in life, unusual customs and innovations were being introduced for our people.

These problems, as a reflection of social life, also left their mark in literature. First of all, there is a lot of subjectivity in the organization of reality in traditional poetry and bringing it into the artistic text, they are very silent and symbolic in solving problems in real life, and the power of miniatureism in describing them, difficulties in understanding the art of words in this form for the reader. Such problems brought changes to the structure of the poem. As a result, it should be noted that at the beginning of the 20th century, the sharp progress of the moderns paved the way for the diversification of literary types and genres recognized by Aristotle in the improvement of artistic form. Sometimes in the field of prose (Qadiri), poetry (Cholpon, Hamza), dramaturgy (Avloni, Behbudi, Fitrat), the national strategy of the Republic of Turkestan, the ideologicalization of literature, unprecedented struggles, conflicts, conflicts for national identity and freedom. it is true that he has shown his position even more. The reason is that the real intellectuals did not accept the reforms that led to chaos in the life of their predecessors. A strong critical spirit deepened in the history of the art form. Human destiny, aspirations for intellectual capital, and efforts towards the future of the nation have become more stable. It has become the supreme belief and duty of modern enlightened intellectuals to completely contradict and oppose existing beliefs.

It is no secret that the sadness of Great Turkestan is at the center of the works created by Cholponu Qadiri and Fitratu Behbudi. The literary mood that prevailed at the beginning of the 20th century, which considered the improvement of the people's lifestyle and education as one of the painful issues of life and death, had a different tone in the work of our moderns. The unity of laughter and suffering radically renewed the process of synthesis in literary works. Let's pay attention to the numbers. After 1850, the decadent artistic chronicles of the khans took their own course, as the weight of social pain increased, people's faith in the future began to "suffocate" under the yoke of the existing system. This, in turn, is determined by the fact that the dreams of nationalists such as Qadiri, Cholpon, and Fitrat were severely suppressed in literary works. Why is that? Why? Such questions are endlessly tormented in the hearts of old people. Today, none of us will forget that the grief of Great Turkestan continues to manifest its existence both in the form of serious literature and in satirical form. Although they also know what the crowd needs. It is no secret that the impiety of the religious leaders, the blasphemy of the faith, and the spread of error have worried the true intellectuals. Academician Naim Karimov writes about this: "The main reason why the people of Turkestan lived in a difficult economic situation at the beginning of the last century was the decay of the system in the country, the fact that the country experienced a social, economic and cultural crisis for several centuries. But at the same time, there were some "national" customs during this period, which could not help but make this difficult situation even more difficult. If one of these habits is wedding, the second is drug addiction, the third is womanizing, and the fourth is ignorance. All these defects were the result of the ignorance that destroyed the people. The enlighteners of Jadid unitedly fought against these four evils - the consequences of ignorance and ignorance." Indeed, the timely press statements made by modern intellectuals, be it serious, humorous, or satirical, regardless of their direction, are aimed at cultivating national pride and consciousness, ignorance. It was to wake up the people faster. In one way or another, these were conveyed to the people through satire and were written in order to influence them. These attempts also play an important role in medicine. Behbudi's "Padarkush", Qadiri's "Unhappy Groom", Avlani's "Is Advocacy Easy?" It is noteworthy that the suffering at the heart of laughter in his works is focused on the 4 elements that N. Karimov emphasized to counteract these vices. Therefore, it would not be an exaggeration to say that the grief of Great Turkestan is the first concern of the intellectuals of the nation and the ground of hope and confidence in the future.

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4. Hamdamov U.Yangi o‘zbek sheriyati.-T.: Adib,2012

Rezyume: *Ushbu maqolada o’zbek adabiyotida hajviyaning vujudga kelishi va rivojlanish tamoyillari haqida so’z boradi. Hajviy asarlardagi g’oya va mazmun mohiyati tahlil qilinadi.*

Резюме: *В данной статье говорится о принципах возникновения и развития комикса в узбекской литературе. Анализируется сущность идеи и содержания комических произведений.*

Kalit so‘zlar: *yumor, tanqid, satira, hajvnavislik, jadid , pafos, mavzu, g‘oya, mezon, kulgi va yig‘i motivi.*

Ключевые слова: *юмор, критика, сатира, юмор, драматургия, пафос, тема, идея, критерий, мотив смеха и плача.*

PRINCIPLES OF POETIC IMAGE TRANSFORMATION IN CHOLPON'S WORKS

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Summary: *In this article, the principles of renewal of poetic images in new Uzbek poetry are highlighted through the works of representatives of enlightenment and modern literature. It is analyzed that traditional images such as flower, nightingale, snow, and cloud in classical literature acquired social meaning in the work of representatives of enlightenment and modern literature.*

Key words: *classic literature, enlightenment, modern literature, image, tradition, sociality, form, content, flower, nightingale, cloud, snow, new Uzbek literature.*

It is known that the renewal of the poetic image in the new Uzbek poetry is a process that has gone through a complicated path. At the first stage, enlightened writers tried to bring the language of poetry closer to the living language by using the poetic images of classical Eastern poetry with a new meaning. In the second stage, representatives of modern literature introduced new images into poetry in harmony with the changes taking place in social life, and completely new content was assigned to classical images. First of all, let us pay attention to the changes that occurred in the literature of the Enlightenment period. K. Khorazmiy, who stands at the head of enlightenment literature, is a creator who was able to give an enlightening tone to the traditional images of classical literature in his socially spirited works. His following poem:

Borurda dahri fonidin barobardur gadovu shoh,
Qani Iskandaru Doro, qani Bahromu Jam, ahbob.

Many of the poet's poems depict historical figures, great poets, and historical events. He looked for solutions to the problems of his time from the spiritual heritage, used the qualities and life experiences of great people as examples. Kamil Khorezmi strives for simplicity in his poems written during this period, does not look for complex and abstract expressions, does not decorate the poems with various ornaments. But he writes lines with such enthusiasm and warmth that the enthusiasm in them evokes a high poetic mood in the reader. Such poems play an important role in reflecting the problems of human inner feelings and social and political life with their brevity and brevity, the uniqueness of pressure and excitement. Under their influence, they expanded the creative scope of Muqimi, Furqat, and Zavqi's poetry. In addition to the national heritage, they turned to the universal cultural heritage. In their works, they used the values of world civilization, mythological and historical images, and through them they sought solutions and lessons for the most important socio-political problems of the time. "The purification of social consciousness affected the national spirit and feelings, and led to the renewal of the nation's artistic thinking"[1,174].

If the classical Uzbek literature aims to awaken the hearts of the people, the new Uzbek literature aims to awaken the minds of the entire people, to awaken the hearts of people who are drowned in the mire of laziness and heedlessness. The only way to raise awareness was to spread enlightenment. Since its creation, the new Uzbek literature has been aimed at enlightening the entire public. Even romantic ghazals promote enlightenment. "That's why in Muqimi's lyrics, we often find expressions such as "unhappiness", "tole zabunlik", "oppression", "jabru sitam", many of the poet's poems complain about "Charkhi Kajraftor" and "nightingales take the place of nightingales". " received, "our people" are despised, and speaks about the "ignorant" being in honor"[2,21].

Mukimi has satires about Viktor, Toyi Ikan bachcha, Kor Ashurboy Khoji, whose actions and characters give priority to showing a certain group or a certain social event in live pictures. Through them, the corruption of the society and the real personalities of the officials are exposed. "These individuals were also created by Muqimi as a complete type and reveal the essence of a certain social phenomenon with their actions and characters" [2,25]. In the period of Uzbek literature before Muqimi, there were no works that reflected the life of society through the image of a person. There are many examples of this in the works of artists after Muqimi.

One of the pioneers of new Uzbek literature is the naturalness, expressiveness and imagery typical of folk poetry in the poetry of Fitrat. The poet assigns a social meaning to the image of a flower in his work, unlike classical literature. We know that in classical literature, the image of a flower is used as a symbol of the future, and in the work of Fitrat, it discovers a poetic meaning as a sign of hope for the future, bright and beautiful days. Artists who were forced to hide their thoughts in the layers of images and symbols brought a new spirit to the new Uzbek poetry without realizing it. It is true that the literature of the classical period is also a literature built on the language of images, silent similes, and hidden meanings, but the images of Fitrat and Cholpon are sharply different from the literature of the classical period. They try to express their thoughts through phenomena in nature. In the works of Fitrat and Cholpon, a simple "piece of straw" also has its place, and the symbol of "cloud" in black and white colors has completely opposite meanings.

Expressing the white dreams of the people through the image of "Snow", the poet tries to describe the wishes blown in the wind in a unique way. Cholpon assigns a special meaning to the image of snow in his poem "Tortishuv Tongi":

Qayg‘uringiz:
Kishanlarni yasavchi “ustalar”,
Boshqalarni “tubanlar” deb atovchi xo‘jalar:
Sizning uchun yoz boshining qoridek
Eruv kunlar keladur,
Sizning uchun olbostining zoridek
yig‘lar kunlar keladir
Chiqadigan quyoshni siz behuda
Etak bilan to‘smoq uchun tirishmang,
Ahmoq bo‘lib, Azroilning oldida
Jon talashing to o‘lguncha berishmang!

Both creators were able to make appropriate use of natural phenomena. The skill of both creators in putting the events of real life through the prism of the heart and placing them in new images is worthy of praise. The image of blood is of particular importance in Cholpon's work. In his poems, "You were the one who cried more blood than anyone", "His blood that you drank a lot", "Does a dark cloud group cry bloody tears?", "The winner G "like the blood-filled eye of the west", "On the wave of the great sea, in its bosom, there is a bloody, terrible trace of a hundred years;" The sad state of the country, the unprecedented oppression of the people, the cry of fathers, the cries of mothers, the wails of children, and the painful tears of widows are reflected through such verses. In Cholpon's work, the image of "cloud" also carries a unique poetic meaning. "From the eyes of the cloud, tears fall to the ground." "Is my mind black?" Or a cloud in the sky of the country?", "My black cloud group, the veil that covered the blue, the East, has closed the new one" "A gathering of clouds like a black giant, Covered the face of the sun again", "On the blue face black, rows of clouds like Coal; through verses like.

"No matter how urgent the need for change is, it should be noted that the creative research of modern poets was first of all based on the traditions of classical poetry. This is natural, because all modern poets grew up in the national cultural soil. Just as the research in the field of weight began with the selection and use of measures most suitable for the living language of aruz, expanding the possibilities of aruz, research in the field of expression also began with adding new content to poetic images in classical poetry" [3,78]. Just as the ideas and themes of Cholpon's poetry have undergone changes and updates in accordance with the times, changes and updates have also occurred in the world of symbols, metaphors, and symbols. In his poems, he used the traditional poetic images of our classic poetry to interpret the social, spiritual and moral issues of the time and life, while preserving their previous ideological and artistic content. If we pay attention to the following poem of his, we can witness that he assigned a social meaning to the traditional images of nightingale and flower. Cholpon is a symbolist poet who was able to use the symbols of wind, blood, cloud, shadow, road, star, morning, night, sun, for new life truths and goals. "But Cholpon's symbolism stands on real ground, because its symbols and images are taken from life and nature. That's why the poet was able

to express his worries and sorrows that "by describing the bird's dream, apathy is increasing in society, that human dignity is being trampled through "Purple", and that the status of individuality in society is being nullified by "Straw". That is, as a true artist, he thought figuratively with the help of analogies, and because of this, he turned poetry towards art with his work"[4,232].

It should be noted that innovation in image is a somewhat more complex phenomenon than in form. is counted, but the true rise and renewal of poetry depends more on this poetic phenomenon. "The purification of social consciousness affected the national spirit and feelings, and led to the renewal of the nation's artistic thinking"[1,174].

In conclusion, it can be said that if the classical Uzbek literature aims to arouse the hearts of the people, the new Uzbek literature aims to arouse the opinion of the masses. The only way to raise awareness was to spread enlightenment. Since its creation, the new Uzbek literature has been aimed at enlightening the entire public. Even romantic ghazals promote enlightenment.

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4. Hamdamov U.Yangi o‘zbek sheriyati.-T.: Adib,2012

Rezyume: *Ushbu maqolada yangi o‘zbek she’riyatidagi poetik obrazlarning yangilanish tamoyillari ma’rifatparvarlik va jadid adabiyotlari namoyondalari ijodi orqali yoritib berilgan. Mumtoz adabiyotdagi an’anaviy gul, bulbul,qor, bulut kabi obrazlar ma’rifatparvarlik va jadid adabiyoti namoyondalari ijodida ijtimoiy mazmun kasb etganligi tahlilga tortilgan.*

Резюме: *В данной статье через творчество представителей просветительства и современной литературы освещаются принципы обновления поэтических образов в новой узбекской поэзии. Анализируется, что такие традиционные для классической литературы образы, как цветок, соловей, снег, облако, приобрели социальное значение в творчестве представителей просветительства и современной литературы.*

Kalit so‘zlar: *mumtoz adabiyot, ma’rifatparvarlik, jadid adabiyoti, obraz, an’ana, ijtimoiylik, shakl, mazmun, gul, bulbul, bulut, qor, yangi o‘zbek adabiyoti .*

Ключевые слова: *Классическая литература, просвещение, современная литература, образ, традиция, социальность, форма, содержание, цветок, соловей, облако, снег, новая узбекская литература.*

PHILOSOPHICAL APHORISTIC MEANING COHERENCE IN THE POETRY OF MATNAZAR ABDULHAKIM

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Summary: *The article analyzes examples of philosophical and aphoristic poems from the lyrical heritage of Matnazar Abdulhakim,one of the creators who made a worthy contribution to Uzbek literature. Attention is paid to the poet's deep philosophical-social views, issues of form, theme, unique poetic perspective, and individual style. Reflections are presented on the interpretation of the philosophical-aphoristic meaning in a number of Matnazar Abdulhakim's poems such as "Ta'birsiz tush" ("Expressionless Dream"), "Meva" ("Fruit"), "Qarsaklar" ("Applause"), "Tog' manzarasi" ("Mountain View"), and "Mehmon" ("Guest").*

Key words: *poet, quatrain, octave, stanza, line, wisdom, artistry, mastery, poetics, figurative means, image.*

Matnazar Abdulhakim (1948-2010), one of the creators who made a worthy contribution to Uzbek literature during the dawn and era of Independence, was widely known as a sage poet. Poetry constitutes a significant part of the rich literary heritage he left behind. The People's Poet of Uzbekistan, Abdulla Oripov, admitted, "He became an enthusiastic reader who would seek out and read his writings," stating in one meeting: "At one meeting, Matnazar Abdulhakim also read his poems. We asked him to read more poems. Because his poems were wisdom, as demanded in our holy book, the Quran"[1;3]. This high praise from the heroic poet is pertinent to Matnazar Abdulhakim's poems in both aruz and syllabic meters. Here, the dialectical balance between the weighty poetic meaning (content) and the formal-structural appearance (form) in the poet's verses is considered.

Indeed, although Matnazar Abdulhakim's deep philosophical-social views and instructive, wise thoughts are reflected in various poetic forms on different scales and levels, his unique poetic gaze and the richness of his artistic thought are evident. The poet strictly adheres to his own style and expressive diversity according to the demands of content when using poetic forms. Here, poetic forms in syllabic meter are considered. Importantly, the poet effectively managed to use all types of stanzas composed of lines ranging from 2 to 12 syllables in this meter. Among them, we see examples of simple (from two-line to six-line) and complex (from seven-line to twelve-line) stanzas. Among these, 4, 8, and 12-line stanzas constitute the majority. This is explained by the author's artistic intention, the characteristics of each stanza, and the various meanings and essences aimed for through them. For a stanza is the rhythmic part of a poem that embodies a specific idea and feeling, theme, rhyme, as well as logical and syntactic unity. In the poet's work, the basis of stanzas is often formed by the four-line stanza (quatrain).

Subsequent multi-line stanzas are formed on the basis of this stanza, i.e., the quatrain loses its independent generic characteristic and becomes a component of eight and twelve-line stanzas. Among these, the poet used octaves more frequently. Their emergence is clearly seen in two cases: 1) in the form of the fusion of eight lines into a single whole; 2) in the form of integral octaves where two quatrains are formally separate but aimed at expressing a single meaning. Each of these has its own specific aspects. For instance, the first type of octaves mainly consist of 9-11 syllable lines with two or three feet, where philosophical-social, intellectual thoughts are predominant. These are given wide space in the poem "Ko'chki" ("The Move"); 2) The second type of octaves have titles placed, which refer to the meaning within the stanza. The marks placed by the poet between the two quatrains are highly conditional and do not hinder the general meaning specific to the octave and other formal elements like syllable count, foot, and diversity of rhymes.

"Ta'birsiz tush" ("Expressionless Dream"), "Meva" ("Fruit"), "Qarsaklar" ("Applause"), "Tog' manzarasi" ("Mountain View"), "Mehmon" ("Guest"), and others are among these.

It is especially important to note that a common characteristic of the octaves is the dominance of philosophical-spiritual contemplation, high artistry, and the harmony of mental (intellectual-spiritual) imagination. Indeed, "philosophically symbolic imagery is a unique independent manifestation of artistic thought... due to its wise, sage, instructive meaningfulness, it adorns the history of human culture"[2;21]. Consequently, the poetry of the independence period, including Matnazar Abdulhakim's octaves, is significant for being aimed precisely at this purpose.

The poet's poem "Ko'chki" ("The Move") can be called an artistic reflection of the philosophy of human nature and the value of life. It contains 81 octaves, and all themes are aimed at illuminating various facets of this universal idea based on artistic-intellectual criteria. We read in the following octave:

Someone did me a kindness.
I didn't know who it was, my God.
Which Hatam, which generous soul.
What a rich man. What a devoted one.
These past two days, my God, here
My heart is troubled, my spirit is clouded,
Whoever shows me kindness now
Makes me forget all else.[3;84]

Based on the sequence of lines, this octave glorifies the humility and sincerity of a person who selflessly does good to others. The expression of this idea necessitated a single form for both quatrains. Because the thought intended in the first couplet of lines was not complete, creating the need for its continuation. Therefore, the main poetic meaning found its expression in the integrity of the octave. The elements of artistry in the stanza gave rise to the impact of thought and expression. For instance, the concept of kindness as a divine blessing is explained through the repetition of the word "my God," the art of allusion in the name "Hatam," emphasis through the repetition of the word "what," a metaphorical shift in the word "clouded," and semantic closeness in the words "rich man" and "devoted one." In the final two lines, where the essence of the thought is embodied, the influence of the wisdom from the Hadiths, "forget your kindness to others, do not forget the kindness of others," becomes clear.

The views in the octave stanzas center around the attitude towards the belief "Man is a mystery." The poet imagines man not as some abstract concept, but as a divine being of real existence, a creation with complex nature, a possessor of good and bad deeds, and manages to appreciate and promote his nobility through the perspective of profound thought and criteria of artistry. The following octave serves as an example:

From you is hope, from you is dream,
From you is desire, from you is plea.
In one hand, for your friends, a flower,
In the other hand — for the enemy, a sword.
Our songs, our melodies,
If you know, are about those.
Your sword is very patient. Your flower
Is eager to reach our hands (97).

The lines are built on the basis of gradation in the main poetic-philosophical meaning. The flow of thought in them is perfected in the synthesis of the two quatrains. The contrasting facets in human character are clarified through the method of comparison. In these facets, positivity is reflected in the symbols of "flower," and negativity in "sword." Furthermore, the poet also skillfully utilized the following means of poetic art, artistic depiction, and poetics:

1. Repetition: The repetition of words derived from the stem "sen" (you) in four places, and the phrase "bir qo'lingda" (in one hand) in two places does not feel redundant because the main thought is focused on the central object (man);

2. Synonymy (Tanosub): The sequential appearance of words with mutually close meanings: "umid" (hope), "orzu" (dream), "murod" (desire), "ilinj" (plea);

3. Antithesis (Tazod): "do'stlaringga" (to your friends), "dushmanga" (to the enemy), "qiliching" (your sword), "guling" (your flower);

4. Personification: The sword being patient, the flower being eager to reach the hand.

Structurally, the octave belongs to the category of nine-syllable lines, with each line consisting of two feet (scheme 4,5). The even-numbered lines have rhymes without radif (repeated word after rhyme).

The poet's mastery was also evident in the complex use of poetic syntax and artistic depiction possibilities in some octaves. This is embodied in the following five lines of one octave:

[True]{.underline}, the sound of thigh-nightingales,
[True]{.underline}, the taste of some melons.
[True]{.underline}, the sweetness of candy apples,
[True]{.underline}, the moisture of sherbet dews
[True]{.underline}, the soul is also sweet... after birth. (80)

Here, the repetition of the word "true" at the beginning of the lines is systematic and is a form of poetic syntax – anaphora. It serves to focus the reader's attention on the leading thought and increase the intensity of the intonation, is logically connected with the expressions based on the art of simile in the subsequent four lines, and ensures coherence of meaning and melody.

The poet's unique way of thinking, deep poetic gaze, and striving for original reflection are also relevant to octaves in the form of two separate quatrains. In them, thematic breadth, eventfulness, and a tendency towards symbolic expression are stronger. However, in the overall meaning, the fusion of individual aphoristic views with imagery is superior. The octave titled "O'rgatilgan qush" ("The Trained Bird") is an example of this characteristic. Its first quatrain is dedicated to the narrator's address to the bird, and the second quatrain to the description of the bird's character. Against the general background, compositional and spiritual integrity is evident.

They gave you freedom. Gave you the sky,
Here. Gather the stars like grain.
In return — only do not speak lies,
In return — only speak the truth!
No! The wretched one did not stop chirping for a moment,
It sang sweetly for its own whim.
However much you drive away the trained bird,
It still flies back to its cage (156).

In the content of the octave, one can observe the stage-by-stage development of the artistic thought. Namely, in the first quatrain there is a thesis, in the second quatrain an antithesis and a synthesis (conclusion). In the thesis, motifs are reflected in the bird's release from the cage, giving it "freedom" (right), "sky" (space) and "stars" (gift), and in return, the conditionality of "speaking the truth." The antithesis is seen in the bird's continued "chirping" as before, and the synthesis in its "flying back to its cage even if driven away a thousand times." True, the mere singing of the trained bird in one tone is not an original idea, but the subtext in the interpretation of its inability to leave the cage is quite profound and weighty. Secondly, there is harmony with the people's wise saying, "However much you feed a wolf, it still looks to the forest." Thirdly, in the interpretation of the trained bird image, one can also sense an allusion to the stifling atmosphere of the period of stagnation and the political consequence of placing human thought into an unconscious mold, as in Abdulla Oripov's poem "Tilla baliqcha" ("The Little Golden Fish"). For the bird is a poetic metaphor, a symbol of certain narrow-minded individuals who did not know encouragement, selfhood, or independent thinking. For, "figurative meaning is the basis of the artistic image. If this meaning takes the lead, the word becomes a symbol"[4;54]. Indeed, the bird is an image that has shifted from its literal meaning as a fowl to a symbolic meaning. Its stubbornness helps to strengthen the feeling of valuing virtues such as kindness, truthfulness, and repaying goodness with goodness in people.

Furthermore, unlike other octaves, the odd-numbered lines 1,3,5,7 of the poem are also rhymed. However, proportionality in the number of syllables was not fully maintained until the end:

although eleven syllables were taken as the general base, the 4th line ended up with 12 syllables, and the 8th line with 9 syllables, disrupting the melodic consistency. In general, it is not difficult to understand the instructive, warning lesson condemning the base servility at the heart of the motif of the bird preferring terrible bondage to genuine freedom, a narrow cage to the vast sky. Our brief conclusion is that the octaves, based on theme, image, artistry, and expressive diversity, possess important social-aesthetic significance as excellent examples of philosophical-symbolic figurative thought.

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Rezyume: *Maqolada o‘zbek adabiyotiga munosib hissa qo‘shgan ijodkorlardan biri, shoir, tarjimon, publitsist Matnazar Abdulhakimning lirik merosidagi falsa-ya aforistik she’rlardan namunalar tahlilga tortiladi. Shoirning teran falsafiy-ijtimoiy qarashlari, shakl, mavzu, o‘ziga xos poetik nigohi, individual uslubi masalalariga e’tibor qaratildi. Matnazar Abdulhakimning “Ta’birsiz tush”, “Meva”, “Qarsaklar”, “Tog‘ manzarasi”, “Mehmon” kabi qator she’rlaridagi falsafiy-aforistik ma’no talqinlari yuzasidan mulohaza yuritildi.*

Резюме: *В статье анализируются примеры философско-афористических стихотворений из лирического наследия одного из творцов, внесшего достойный вклад в узбекскую литературу, поэта, переводчика и публициста Матназара Абдулхакима. Уделено внимание вопросам глубоких философских и социальных взглядов поэта, форме, теме, неповторимому поэтическому видению и индивидуальному стилю. Рассмотрены философско-афористические интерпретации смысла в ряде стихотворений Матназара Абдулхакима, таких как «Таъбирсиз туш», «Мева», «Карсаклар», «Тогъ манзараси» и «Мехмон».*

Kalit so‘zlar: *shoir, to‘rtlik, sakkizlik, band, misra, hikmat, badiiyat, mahorat, poetika, tasviriy vositalar, obraz.*

Ключевые слова: *поэт, четверостишие, октава, группа, стих, мудрость, артистизм, мастерство, поэтика, изобразительные средства, образ.*

THE ACTIVITIES OF RELIGIOUS INSTITUTIONS IN KARAKALPAKSTAN IN THE MID-20TH CENTURY

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Summary: *The article discusses the religious institutions that operated in Karakalpakstan during and after the Second World War.*

Key words: *Central Asia, religious, mosque, Muslims, official*

The USSR's failures in the early years of the war, the defeats on military fronts, and countless losses forced it to pursue a cautious domestic policy in military conditions. In wartime, the leaders of the Soviet state, as a means of strengthening patriotic feelings among various nationalities and ethnic groups, considered that religious beliefs could also be an important factor. Starting in July 1941, the publication of the magazine "Bezbojnik" and all similar magazines published under various names in various republics was discontinued. It should be noted that during the peacetime period of 1941-1945, which was not of a defensive nature, a number of print media outlets were also forced to temporarily cease their activities [1, 99]. Prior to this, in the first half of 1940, 170 anti-religious articles were published in republican newspapers [2, 218-219]. By October 1941, all anti-religious publications were closed. By this time, the persecution of religious people had practically ceased [3, 101].

It should also be noted that after the start of hostilities, after a 20-year hiatus, churches, mosques, and places of worship began to open in various regions of the former Soviet Union, even without legal documentation.

Both before and during the war, the legal status of religious organizations in the country was determined by the resolution of the All-Union Central Executive Committee and the Council of People's Commissars of the RSFSR "On Religious Associations" of April 8, 1929, which comprehensively restricted the liturgical and social activities of religious communities. Among the representatives of party and state bodies, there were also those who advocated for the abolition of this legislative act. In May 1937, G.M. Malenkov appealed to I.V. Stalin with such a proposal. Malenkov's proposal was rejected. In April 1938, the Commission for Religious Affairs under the Presidium of the Central Executive Committee of the USSR, headed by P.A. Krasikov, was also dissolved. Only the NKVD's "church department" remained as the sole state body dealing with religious matters. This document (with subsequent additions and amendments) was the main document regulating religious life in the USSR until the end of Soviet power [4, 58-59].

After the start of hostilities, mosques and prayer rooms began to open, even without legal documents [5, 111]. Citizens began appealing with petitions and requests to reopen mosque and prayer hall buildings and to be granted permission to visit the cities of Mecca and Medina. Applications were received by the Spiritual Administration of Muslims of Central Asia and Kazakhstan, the Council for Religious Affairs under the Council of People's Commissars of the Uzbek SSR, and directly by central institutions [6, 6]. During the years of the Second World War, which was a period of severe trials for the Soviet government, all members of society took into account the religious factor in achieving victory over fascism. Religious people's activity increased due to World War II. Based on this, the right to establish religious institutions and organizations that unite religious communities has been reinstated.

After delegates from the Congress of Muslim Religious Scholars and Believers of Central Asia and Kazakhstan, held in October 1943, traveled to the regions and stated that the Soviet government would officially permit the opening of mosques, numerous applications began to be received from Muslim believers.

The procedure for reviewing public appeals regarding the opening of new mosques is regulated by the Council of People's Commissars' Resolution No. 1325 of November 28, 1943, "On the Procedure for Opening Churches," as well as the Council of People's Commissars of the USSR's Resolution No. 1603 of November 19, 1944, "On the Procedure for Opening Templar Buildings of

Religious Cults" [7, 118]. According to it, a temple registered by a representative of the Council for Religious Affairs is considered open. Mosques operating without the Council's permission or operating secretly were deemed illegal and closed.

Archival documents provide information that during 1943-1945, numerous public petitions were received in the names of regional representatives and representatives of the Republican Religious Council for the release of old mosques, permission for their renovation, and permission to open new ones. In a message sent by a representative of the Council for Religious Affairs to the representative of the Council for Religious Affairs of the USSR in August 1944, it was indicated that the government of Uzbekistan had received an application from believers to open 93 mosques. These applications were reviewed, and permission was granted to open 8 mosques in June-July 1944 with the permission of the Council of People's Commissars of the Uzbek SSR [8, 21-22]. Among them is the Khan Mosque in Chimbay, Karakalpakstan ASSR.

In some places, the Muslim population, without the permission of any official institutions, on their own initiative, renovated and restored a number of mosques and converted them into prayer rooms. Archival documents indicate that in 1945, only one mosque was permitted to open in Karakalpakstan, and that one was located in the Chimbay district, while there were no officially opened mosques in other districts. Three mosques opened in Kungrad district have been closed due to not being officially opened. There are also reports of unauthorized mosques in the Turtkul and Shabboz districts [6, 2].

Citizens submit applications to the Spiritual Administration of Muslims of Central Asia and Kazakhstan and its regional representatives, as well as to government agencies, requesting permission not only to open mosques and prayer halls but also to visit holy sites and historically significant mausoleums.

In the early post-war years, the Spiritual Administration of Muslims of Central Asia and Kazakhstan appointed imams and khatibs to mosques permitted to open, and continued to conduct religious affairs through them. Mosques were opened based on the decision of the USSR government, following the conclusion of the Council of People's Commissars of the Uzbek SSR and the recommendation of the Spiritual Administration of Muslims of Central Asia and Kazakhstan. The activities of the Spiritual Administration of Muslims of Central Asia and Kazakhstan were constantly and strictly monitored by the representative of the Council for Religious Affairs under the Council of People's Commissars of the USSR in the Uzbek SSR.

In the first post-war years, state authorities supported the policy of liberalizing relations with religious organizations: services outside of places of worship were permitted, registration of religious communities continued, and new places of worship were opened.

By 1946, the number of officially registered mosques in the regions of the Uzbek SSR and the Karakalpak ASSR had increased considerably. Before the outbreak of World War II, there was no officially registered mosque in Karakalpakstan. Mosques were opened in Chimbay in 1944 and in Turtkul in 1946 [9, 39]. However, at this time, as mentioned above, many mosques operated without the permission of the Spiritual Administration of Muslims of Central Asia and Kazakhstan. The number of mosque buildings operating legally and illegally in our republic has increased due to mosque buildings used for other purposes as a result of the Soviet government's long-standing totalitarian policy. However, most of the mosques had not yet been rebuilt. Because they were mainly occupied by warehouses, dormitories, hospitals, kindergartens, production office offices, and other purposes, empty mosques also constituted the majority [6, 2].

In the early 1950s, there were some officially unregistered mosques. According to information obtained from the website of the Qaziyat of the Republic of Karakalpakstan and the local population, the "Safo" mosque, located in the territory of the "Amirobod" rural community of the current Ellikqala district, was founded in 1954, and the construction of the mosque was carried out with the help of the local population [10]. "When the mosque was founded, a man named Mulla Sultanboy served as the imam. He lived from 1890 to 1984. The mosque was named after his father, Safo. Mulla Sultonboy served as the mosque's imam for over 30 years (1954-1984). Although the mosque has been opened, it has not been officially registered. The mosque did not serve for a long time after its

opening. The mosque building was converted by the Soviet government into a fertilizer storage facility for agricultural crops. In 1976, Mulla Sultanbay built a new building on the site of the old mosque [11].

Another such officially unregistered but serving the public mosque was the "Abdjamil Eshon" mosque, located in the territory of the present-day "Namuna" rural community in the Turtkul district. The mosque was built in 1902 under the leadership of a man named Mulla Qosim. As a result of the Soviet government's policy against mosques and madrasas in 1929, it was closed in 1929. Between 1940 and 1952, it served as the "Furkat" school and the collective farm office. In 1952, the mosque reopened and began serving the people, but it was not officially registered. When the mosque reopened in 1952, a man named Mulla Sa'dulla served as the imam. After serving for some time, the mosque building was used as a place for storing fertilizers for agricultural crops. Before his passing, Mulla Sa'dulla demolished the old mosque building and built a new one in its place [12].

One of the mosques not officially registered during the Soviet era but used by the local population as a mosque is the "Darvish Eshon Bobo" mosque, currently operating in the Shabboz rural community of Beruniy district. The mosque was opened between 1890 and 1900. Initially, Darvish Eshon and Abdiraman Eshon served as imams. As a result of the religious policy pursued by the Soviet government in 1937-1938, the mosque was closed in 1937. The mosque building was destroyed and used as a cotton cleaning and drying warehouse until the early 1940s. During the Second World War, the mosque began operating secretly again. During the war, the mosque was served by Zabi Eshon, in 1945-1952, by Atajan Mulla, and in 1952-1958, by Matyakub Eshon [13].

Another such location is the "Muhammadmurod Eshon" public mosque, located in the Keneges rural community of Takhtakupir district. The mosque used to have a reading room, known as the Babaniyoz Okhun Madrasa. Later, the reading room was named after Muhammadmurod, the eshon's eldest son. The Eshon and his family are buried in the vicinity of the madrasa. In 1928, the reading room was dismantled, and in 1932, it was converted into a building for the "Qizil Dehqon" collective farm, later transformed into a warehouse [14].

According to religious tradition, pilgrimage to the graves of ancestors is widespread. For example, by the end of the 1940s, the Sultan Baba shrine, officially registered under the Spiritual Administration of Muslims of Central Asia and Kazakhstan, was located only in the Beruniy district of our country [9, 43].

The beginning of the 1950s was a period of strict official procedures for registering mosques. For example, in the spring of 1949, their number (by the Union - R.M.) This number reached 415, the largest number since the war. Working in 1952 (in the former Soviet Union - R.M.) Of the 351 mosques, 129 are subordinate to the Spiritual Administration of Muslims of the European Part of the USSR and Siberia, meaning they are located within the RSFSR (excluding the North Caucasus), 150 are in Central Asia and Kazakhstan, and 20 are in Transcaucasia [15, 164-165].

From the beginning of the 1950s, relations between the Soviet state and Islam intensified, and atheistic propaganda and administrative pressure intensified. It was not difficult to find an excuse to close the places of worship of representatives of all religions: by 1952, the number of registered mosques throughout the country had decreased to 351, and by the end of Khrushchev's anti-religious campaign - by the beginning of 1965 - to 305.

In short, in the early post-war years, the policy towards religion and religious people changed, and in the 1950s, pressure against them intensified. In 1951-1952, repressions against religious figures intensified again in Karakalpakstan. As a result, some were sentenced to exile, while others fled their homeland and relocated to other regions of the republic.

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Rezyume: *Maqolada Ikkinchi jahon urushi va undan keying davrda Qoraqalpog‘istonda faoliyat olib brogan diniy muassasalar haqida so‘z yuritiladi.*

Резюме: *В статье рассказывается о религиозных учреждениях, действовавших в Каракалпакстане во время и после Второй мировой войны.*

Kalit so‘zlar: *O‘rta Osiyo, diniy, masjid, musulmonlar, rasmiy*
Ключевые слова: *Средняя Азия, религиозный, мечеть, мусульмане, официальный*

METHODICAL IMPROVEMENT OF ERROR ANALYSIS SKILLS IN DUTOR PERFORMANCE BASED ON METACOGNITIVE STRATEGIES

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Summary: *This article scientifically explores the role of metacognitive strategies in developing error-analysis skills in dutor performance. The study presents a methodology for applying metacognitive control, monitoring, and reflection in the process of identifying errors, analyzing their causes, and planning subsequent exercises accordingly. The results demonstrate that through a metacognitive approach, future music education teachers can consciously analyze errors, effectively organize independent practice, and deeply develop their creative expression.*

Key words: *Metacognitive strategies, Error analysis, Dutor performance, Musical thinking, Reflection, Monitoring, Technical skills, Rhythm and phrasing, Independent practice, Pedagogical competence*

Introduction

In the process of music education, developing the skill of analyzing errors in performance is of great importance. Particularly in dutor performance, timely identification and correction of technical, rhythmic, and artistic mistakes contribute significantly to the learner's mastery. Metacognitive strategies transform the student from a passive participant into a conscious agent in the performance process. These strategies, which include planning, monitoring, and reflection, create an effective methodological tool for analyzing and correcting errors. Based on this approach, future music teachers gain the ability to teach their students consciously and systematically.

Theoretical basis of error analysis skills and metacognitive strategies in dutor performance. Integrating error analysis skills with metacognitive strategies in dutor performance enables performers to manage their playing consciously and not only technically. Metacognitive strategies—planning, monitoring, and reflection—form the theoretical foundation of the performance process, and their application enhances musical proficiency. Error analysis allows learners to identify strengths and weaknesses, detect technical shortcomings, manage rhythm and phrasing correctly, and refine artistic expression [1].

Metacognitive planning supports the proactive management of error analysis. For example, before starting practice, the student identifies specific weaknesses in dutor performance: slow left-hand positions, uneven right-hand plucking, or disrupted rhythmic phrasing. Accordingly, practice is organized systematically: technical exercises first, followed by slow-paced phrasing, and finally full performance. This planning ensures the practice is purposeful and deliberate rather than random.

Metacognitive monitoring involves identifying errors in real time during performance. For instance, while playing the "Segoh" piece, the student may notice uneven timbre, check finger placement, or compare rhythm with a metronome [2]. Using video recordings, the student can review their performance and identify overlooked mistakes. This monitoring process enables learners to detect and correct errors independently, without relying on external supervision.

Metacognitive reflection represents the deep analysis phase, where errors are evaluated, and performance is refined. After practice, the student lists technical, rhythmic, and artistic shortcomings and analyzes their causes. For example, uneven rhythm caused by inconsistent left-hand positioning or insufficient pitch resolution at phrase endings due to improper phrasing is identified. Based on this analysis, a new practice plan is developed, including targeted technical exercises, slow-paced phrasing, rhythm reinforcement, and creative strategies to enhance artistic expression.

Overall, integrating metacognitive strategies in error analysis transforms the learner into a conscious performer. This approach ensures thorough technical and artistic mastery, effective independent practice, and the development of creative interpretation. It equips future music educators to teach students systematically and consciously by guiding them to detect and analyze mistakes.

Methodology for identifying and analyzing technical and artistic errors. In dutor performance, the methodology for identifying and analyzing technical and artistic errors is crucial for the conscious development of mastery. This methodology involves not only recognizing and correcting mistakes but also understanding their causes and consequences, enabling informed decisions during performance. Technical errors often relate to finger placement, plucking technique, left- and right-hand coordination, timbre, and rhythmic stability. Artistic errors arise from insufficient phrasing, pitch control, expressiveness, and creative interpretation [3].

The methodological approach to identifying technical errors encourages active observation. For example, while playing the "Tanovar" piece, the student may notice slow left-hand movement or uneven right-hand plucking. Reviewing video recordings helps determine the cause: position shifts, improper muscle use, or uneven string plucking. For each error, the student develops a targeted exercise strategy: slow-tempo position changes, finger-strength exercises, and string plucking drills. This ensures that performance is intentional and goal-oriented rather than intuitive.

Analyzing artistic errors contributes to the development of expressive and aesthetic qualities. For instance, while performing "Dugoh," the student may notice insufficiently dramatic phrasing. To correct this, the phrase is first sung internally, then played slowly, controlling pitch peaks and dips. In fast-paced pieces like "Ufor," if rhythm and phrasing are inconsistent, the student divides the piece into segments, practices each separately, and integrates them into the full performance [4]. This approach enhances both technical and artistic aspects of performance.

The effectiveness of this methodology lies in establishing a habit of continuous error detection and analysis. During practice, the student first observes errors, understands their causes and consequences, and plans subsequent exercises accordingly. As a result, learners independently identify technical and artistic errors, enrich creative expression, and master dutor performance at a high pedagogical and technical level.

This methodology not only develops students as performers but also shapes them as methodically aware and effective educators. It serves as a modern, scientifically grounded tool for the systematic, goal-directed, and creatively oriented development of dutor performance.

Enhancing independent practice and reflection for future music teachers. Improving the effectiveness of independent practice and reflection is one of the main ways to systematically and consciously develop dutor performance skills. Independent practice consolidates technical proficiency, refines rhythm and phrasing, and deepens artistic expression, but its effectiveness directly depends on the application of metacognitive strategies.

Before practice, the student engages in metacognitive planning, identifying specific weaknesses in dutor performance: accelerating left-hand positions, stabilizing right-hand plucking, and perfecting phrasing and pitch. Accordingly, the practice sequence is determined: technical exercises first, slow-paced phrasing next, and full performance last. This planning makes practice purposeful and allows learners to manage it efficiently.

During practice, metacognitive monitoring enables the student to track performance in real time. For example, while performing "Tanovar," the student may notice uneven timbre, check rhythm stability, and detect imprecise finger placement. Video recordings help accurately identify errors. The student independently focuses on problem areas and improves them through repetitive practice. For example, in fast phrases where rhythm stretches, the learner practices segments slowly and then integrates them into the full performance [5].

Reflection after practice is a critical stage for increasing effectiveness. The student analyzes errors: which phrases were rhythmically or timbrally incorrect, which lacked dramatic or expressive qualities, and how well technical elements were executed. For example, if expressive tone is insufficient in "Dugoh," the student sings the phrases internally, then plays slowly, controlling pitch dynamics. Reflection enables the learner to not only detect mistakes but also correct them and develop creative approaches.

By enhancing independent practice and reflection, future music teachers develop their performance skills while forming the ability to teach students consciously and systematically. Metacognitive strategies help learners make error detection, analysis, and correction habitual, manage

performance effectively, enrich creative interpretation, and master dutor performance technically and artistically. This strengthens the pedagogical competence of future music educators and prepares them for effective, evidence-based teaching practice.

Conclusion

Developing error analysis skills in dutor performance through metacognitive strategies transforms the learner into an active, conscious, and responsible performer. Through planning, monitoring, and reflection, the student can identify technical and rhythmic errors, analyze their causes and consequences, and develop effective strategies for subsequent practice.

For example, if left-hand positions are incorrect, the learner identifies the issue using video recordings, a metronome, or slow practice and corrects it. Similarly, irregular right-hand plucking, weak string tension, or disrupted rhythm is addressed through targeted technical exercises. If rhythmic phrasing or expressive tone is inadequate, phrases are practiced separately at a slow tempo and then integrated into the full performance. This method not only corrects mistakes but enriches the artistic and aesthetic aspects of performance.

During reflection, the student re-analyzes errors from a pedagogical perspective. For instance, if fast phrasing lacks pitch or timbre expression, the student sings internally first, then plays slowly to improve tonal and dramatic quality. This process develops conscious decision-making, artistic interpretation, and phrasing management skills.

Thus, metacognitive strategies in error analysis not only enhance independent practice but also deepen the pedagogical competence of future music teachers. This approach allows them to teach performance exercises consciously and systematically, guide students in error detection and correction, and ensures comprehensive technical, rhythmic, and artistic mastery. It serves as a modern methodological tool to significantly improve the quality of dutor performance, develop creative expression, and enhance the educational process.

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Rezyume: *Ushbu maqolada dutor ijrochilik jarayonida xatolarni tahlil qilish ko‘nikmalarini rivojlantirishda metakognitiv strategiyalarning o‘rni ilmiy asosda yoritilgan. Tadqiqotda o‘quvchining ijrodagi xatolarini aniqlash, ularning sabablarini tahlil qilish va keyingi mashqlarni shu asosda rejalashtirish jarayonida metakognitiv nazorat, monitoring va refleksiya strategiyalarini qo‘llash metodikasi ochib berilgan. Natijalar shuni ko‘rsatadiki, metakognitiv yondashuv orqali bo‘lajak musiqa ta’limi o‘qituvchilari xatolarni ongli tahlil qila oladi, mustaqil mashg‘ulotlarni samarali tashkil etadi va ijodiy ifodani chuqur rivojlantiradi.*

Резюме: *В данной статье научно обоснована роль метакогнитивных стратегий в развитии навыков анализа ошибок при игре на дуторе. Исследование раскрывает методику применения метакогнитивного контроля, мониторинга и рефлексии в процессе выявления ошибок учащимся, анализа их причин и планирования дальнейших упражнений на этой основе. Результаты показывают, что благодаря метакогнитивному подходу будущие учителя музыкального образования способны осознанно анализировать ошибки, эффективно организовывать самостоятельные занятия и глубоко развивать творческое выражение.*

Kalit so‘zlar: *Metakognitiv strategiyalar, Xatolarni tahlil qilish, Dutor ijrochiligi, Musiqiy tafakkur, Refleksiya, Monitoring, Texnik ko‘nikmalar, Ritm va frazalash, Mustaqil mashg‘ulot, Pedagogik kompetensiya*

Ключевые слова: *Метакогнитивные стратегии, Анализ ошибок, Игра на дуторе, Музыкальное мышление, Рефлексия, Мониторинг, Технические навыки, Ритм и фразировка, Самостоятельные занятия, Педагогическая компетентность*

IMPROVING DUTOR PERFORMANCE SKILLS THROUGH METACOGNITIVE STRATEGIES

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Summary: *This article provides a scientific analysis of the role of metacognitive strategies in developing practical dutor performance skills among future music education teachers. It explains how metacognitive control, planning, and reflective analysis can be applied to various components of dutor performance, including technical proficiency, rhythmic accuracy, finger placement, tonal expressiveness, and creative interpretation. The findings justify practical opportunities for enhancing conscious skill acquisition, increasing the effectiveness of independent practice, and establishing mechanisms of self-evaluation and self-monitoring within the student–teacher instructional process.*

Key words: *metacognitive strategies, dutor performance, musical thinking, reflection, metacognitive control, performance technique, rhythm and meter, finger placement technology, independent practice, musical competence.*

Introduction

Today, the process of developing performance skills in music education goes beyond merely forming technical abilities. It requires deep cognitive competencies such as conscious thinking, self-evaluation of performance, error analysis, and independent planning of practice sessions. Metacognitive strategies represent a contemporary scientific and methodological approach in this process, offering high effectiveness in mastering the complex technical and artistic aspects of playing the dutor.

Dutor performance is not only an integral part of national musical culture but also one of the key practical directions that define the professional competence of future music educators. Therefore, organizing the learning process based on metacognitive approaches and fostering students' skills in independent analysis, observation, planning, evaluation, and creative exploration fully aligns with current educational requirements.

Theoretical foundations of metacognitive strategies in dutor performance. The theoretical basis of metacognitive strategies in dutor performance involves developing not only technical skills but also the learner's abilities for conscious control, thinking, analysis, and self-regulation during performance. Essentially, these strategies help the student answer fundamental questions during musical practice: *"What am I learning?"*, *"Why am I learning this?"*, and *"How can I learn this most effectively?"* They are particularly important for dutor performance, which demands complex motor skills, rhythmic sensitivity, stylistic understanding, and creative expression.

Metacognitive planning ensures that the learner approaches each practice session with deliberate awareness. For instance, a student may set precise goals before practice: *"Today I need to reinforce finger placement in position 2,"* or *"I need to accurately feel the short rhythm pattern in the 'Buzruk' section of the Shashmaqom,"* or *"The first phrase of the melody has uneven plucking; I need to repeat exercises to correct it."* The student plans which exercises will produce the best sound resonance, allocates practice time, and determines how many repetitions of each technical element are necessary. Such deliberate planning moves the learner away from random practice and encourages a systematic study of performance.

Metacognitive monitoring refers to the student's ongoing observation of their own performance during practice. For example, if a string produces a buzzing sound when plucked, the student immediately identifies the error and investigates its cause: Is the string not pressed firmly enough, or is the finger placement incorrect? Or, if a phrase in the *Tanovar* melody is rhythmically stretched, the student notes this and pays extra attention in subsequent repetitions. Monitoring may also involve video recordings, allowing the student to detect unnoticed errors. Teachers can enhance monitoring by asking metacognitive questions: *"Listen to yourself," "Evaluate the phrase endings," "Count the rhythm internally."*

Metacognitive reflection is the most important stage of metacognitive strategies, ensuring that after practice the student thoroughly analyzes their performance, understands the causes of errors, and plans the next session with an improved strategy. For instance, a student might conclude: *"The distances between right-hand plucks were uneven, so the timbre was inconsistent. Tomorrow, I will start with string-specific exercises,"* or *"The complex transitions in the 'Segoh' melody did not work well because the left hand relaxed during position changes. Next time, I will practice slowly."* Such reflective thinking allows the student to consciously perceive every element of performance and continuously improve their skills.

The application of metacognitive strategies in dutor performance is broad: mastering finger placement, controlling smoothness of plucking, working on complex rhythmic patterns of maqom melodies, analyzing the internal meaning of a piece, planning stage expression, and even developing a refined ear for auditory perception. These strategies transform the learner from an external performer into an internal analyst, an independent musician capable of self-improvement. Thus, metacognitive approaches in dutor performance foster a structured, scientifically grounded, goal-oriented learning process rather than intuitive or random actions.

Methodology for developing technical and artistic skills through metacognitive approaches. Developing technical and artistic skills in dutor performance using a metacognitive approach enhances not only hand movement, rhythm, and technique but also musical thinking, conscious decision-making, and creative expression. The essence of the metacognitive approach is that the learner perceives practice not as mechanical repetition but as a consciously planned, monitored, and deeply analyzed creative activity. This approach enables effective integration of technical and artistic elements of dutor performance.

Before practice begins, the student sets clear goals: which technical element to focus on, which method to apply, and why the technical exercise is necessary. For example, if the student notices slow position changes of the left hand, they plan the practice session to focus on slow-tempo exercises. If right-hand plucking is uneven, the student selects single-string exercises to feel the correct resonance. Practice, therefore, becomes purposeful rather than random.

During practice, **metacognitive monitoring** allows the student to track technical shortcomings. Video recordings can be used to observe unnoticed errors, such as uneven right-hand plucks in *Tanovar* or excessive movements disrupting rhythm during position changes. Monitoring offers an objective evaluation and enhances motivation for self-improvement.

At the end of the session, **metacognitive reflection** ensures deeper internalization of technical skills. The student not only enumerates errors but identifies their causes. For instance, rhythm disruption may result from slow internal counting or inconsistent plucking; pitch inaccuracies may stem from inadequate phrasing perception. Based on this analysis, the student develops a precise plan for the next practice session, such as practicing a phrase internally, relaxing the right hand, or controlling tempo with a metronome.

In addition to technical skills, metacognitive thinking plays a leading role in forming artistic expression. Dutor performance is not only about playing notes accurately but also about feeling the spirit of the piece, consciously organizing phrasing, conveying emotional tone, and creating expressive drama. While studying a melody, the student first perceives its character—joyful, sorrowful, tender, calm, or intense—and experiments with plucking methods to enhance expressive effect. Conscious phrasing planning is essential; for example, in a *Segoh* phrase, the rise and gentle fall of pitch form a key artistic element. When planned consciously, performance becomes more natural and meaningful.

Thus, teaching technical and artistic skills through a metacognitive approach develops the student's ability to understand *why* they practice, *which methods produce results*, and *what decisions to make during performance*. This fosters independent, analytical, technically sound, and artistically expressive dutor performers.

Enhancing metacognitive reflection and independent practice in future music teachers. For future music educators, improving metacognitive reflection and independent practice relies on deliberate management of the performance process. Students learning dutor should not only execute

technical exercises but also analyze the purpose, results, strengths, and weaknesses of each exercise. The metacognitive approach effectively structures this process: planning practice, monitoring it, and reflecting afterward consolidates the student's musical thinking and performance culture.

Setting goals before practice organizes independent exercises. For example, if a student notices inconsistencies in finger placement in position 3, they plan the session to address this specifically. If rhythmic issues exist in the first phrase of *Tanovar*, the student aims to maintain tempo using a metronome. The sequence of exercises ensures gradual progression without excessive fatigue, starting with string-specific exercises, then position changes, slow-tempo practice of phrases, and finally full performance. Anticipating potential difficulties, such as finger pain or uneven plucking, the student plans countermeasures.

Metacognitive monitoring during practice focuses on timbre purity, plucking consistency, rhythm stability, and technical progress. For example, if plucking is too harsh, the student adjusts right-hand strength; if rhythm stretches, they strengthen practice with a metronome. Video feedback enhances objectivity, allowing precise observation of finger positions, body posture, left-hand placement, or plucking issues, promoting self-correction.

Post-practice metacognitive reflection is a crucial stage in musical development. The student critically evaluates their performance, identifies technical and artistic issues, and develops new strategies. For example, insufficient pitch accuracy in *Dugoh* may stem from misperceived phrasing, while noise during position changes indicates incorrect left-hand pressure. The student then plans targeted exercises at slow tempo to correct these issues.

These processes strengthen the future educator's ability to guide students effectively. Through metacognitive reflection, the teacher not only understands problems they face but can transfer this experience to students, teaching them how to plan, monitor, and analyze their own performance. Consequently, metacognitive approaches develop independent, reflective, technically and artistically competent music specialists.

Conclusion

Using metacognitive strategies in dutor performance transforms the student into an active participant in the learning process. This approach enables not only mastery of technical skills but also conscious planning, monitoring, and analysis of performance, enhancing musical thinking and creative expression. For instance, the student sets goals for specific phrases or technical elements, organizes practice sequences, monitors timbre, finger placement, and rhythm, reviews performance via video, and reflects critically on errors and artistic interpretation.

Metacognitive strategies allow self-assessment and improvement, deepening the professional competence of future music educators. Teachers trained with these approaches can instruct students on structured exercises, error detection, and artistic expression, ensuring dutor performance becomes technically flawless and artistically rich.

Additionally, metacognitive strategies facilitate independent practice, self-analysis of challenges, and creative decision-making. As a result, future music educators enhance their own skills and are prepared to employ scientifically grounded, contemporary, and effective methods to develop their students' technical and creative potential. Metacognitive strategies, therefore, are an essential and practically effective tool for dutor performance learning and professional development.

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Rezyume: *Ushbu maqolada bo‘lajak musiqa ta’limi o‘qituvchilarida dutor ijrochiligi bo‘yicha amaliy ko‘nikmalarni rivojlantirishda metakognitiv strategiyalarning o‘rni ilmiy asosda yoritilgan. Metakognitiv nazorat, rejalashtirish va refleksiv tahlil jarayonlari dutor chalishning texnik, ritmik, barmoq qo‘yish, ohangdorlikni shakllantirish hamda ijodiy interpretatsiya kabi tarkibiy jihatlarida qanday qo‘llanilishi metodik yondashuvlar orqali ochib beriladi. Tadqiqot natijalari dutor ijrochiligida ongli o‘zlashtirishni kuchaytirish, mustaqil mashg‘ulotlarning samaradorligini oshirish, o‘quvchi-o‘qituvchi hamkorligida o‘z-o‘zini baholash mexanizmlarini yo‘lga qo‘yishning amaliy imkoniyatlarini asoslaydi.*

Резюме: *В данной статье научно обоснована роль метакогнитивных стратегий в развитии практических навыков игры на дуторе у будущих учителей музыкального образования. Показано, как процессы метакогнитивного контроля, планирования и рефлексивного анализа могут применяться в формировании технических умений, ритмической устойчивости, постановки пальцев, выразительности звучания и творческой интерпретации в исполнительстве на дуторе. Результаты исследования подтверждают практические возможности повышения уровня осознанного освоения исполнительских навыков, усиления эффективности самостоятельных занятий, а также внедрения механизмов самоконтроля и самооценки во взаимодействии «ученик–учитель».*

Kalit so‘zlar: *Metakognitiv strategiyalar, Dutor ijrochiligi, Musiqiy tafakkur, Refleksiya, Metakognitiv nazorat, Ijrochilik texnikasi, Ritm va usul, Barmoq qo‘yish texnologiyasi, Mustaqil mashg‘ulot, Musiqiy kompetensiya*

Ключевые слова: *метакогнитивные стратегии, исполнение на дуторе, музыкальное мышление, рефлексия, метакогнитивный контроль, исполнительская техника, ритм и метр, технология постановки пальцев, самостоятельные занятия, музыкальная компетентность.*

PRAGMALINGUISTICS AS AN OBJECT OF LINGUISTICS

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Summary: *A central and dynamic branch of linguistics, pragmatics investigates the complex interactions between language and its use in particular social, cultural, and situational settings. While structural linguistics—which mostly addresses the internal mechanics of language—such as phonology, morphology, syntax, and semantics—pragmatics studies how meaning is actively created and interpreted in actual communication. This work presents the fundamental ideas of pragmatics, charts its theoretical development, and addresses its important uses in disciplines ranging from artificial intelligence and forensic linguistics to language education and translation.*

Key words*: pragmatics, speech act theory, implicature, deixis, politeness, context, communication, linguistics, language use.*

1. Introduction

Language is a living, dynamic medium through which human beings not only share information, but emotion, social purpose, and culture as well. Language is not merely a mechanical system of phonemes, morphemes, and syntactic rules—it is an interactive, context-sensitive tool rooted firmly in the human condition. Whereas early linguistic scholarship, especially that of the structuralist and formalist traditions, was occupied mainly with the investigation of linguistic form—phonology, morphology, syntax, and semantics—it transpired later that those analyses by themselves were not enough to account for the richness of everyday language use. Meaning, as scholars came to increasingly realize, has a tendency to get ahead of structure and is determined as much by the pragmatic context of interaction as by an utterance's literal meaning.

Consider, for instance, the seemingly straightforward sentence, "It's cold in here." On a purely semantic level, this sentence is stating the literal temperature of a room. But on the basis of situational context, speaker tone and facial expression, and speaker-to-listener relationship, the sentence could convey a myriad of intended meanings. It might be used as an explicit protest, an implicit request to shut the window or turn the heating up, or as a will-they-won't-they suggestion of coming nearer. These different degrees of latent sense cannot be fully accounted for in formal terms of the linguistic analysis itself—there must be reference to pragmatic features of communication.

Pragmatics is where this comes into the picture, linguistics as a scholarly discipline that looks at how context limits the potential range of meanings. Whereas syntax and phonology are concerned with internal language structure, pragmatics shifts the attention away from the structure itself to speakers' and hearers' roles, to situations in which language occurs, and to the communicative functions that govern speakers' selection. Pragmatics is concerned with how people use language in attempting to achieve things in interaction, how they create social convention, and how meaning is achieved through inference and shared knowledge.

Pragmatic theory tries to find answers to questions such as the following: Why would speakers choose some words or phrases in particular contexts? In what way do intonation, gesture, and body language contribute to meaning? How do hearers infer between the lines and make implied meaning more than literal meaning? Why are indirect speech forms such as hints, irony, euphemisms, and jokes so effective at everyday talk?

These are issues that underscore the salience of pragmatics to modern linguistic theory. Indeed, with communication increasingly multimodal and intercultural—especially in digital spaces—the necessity to understand how meaning is negotiated in real time has only grown stronger. Pragmatics not only educates our understanding of language-in-use but also reserves avenues for cross-disciplinary work, blending linguistics with sociology, psychology, anthropology, and communication studies.

In contemporary linguistic research, pragmatics is no longer an add-on but an essential field of inquiry. It offers the theoretical framework for understanding meaning construction from context, speaker intent, and listener interpretation. It also helps researchers and practitioners better understand the subtleties of human interaction, which can help them better understand things like miscommunication, politeness, persuasion, humor, and other subtle effects of communication.

2. Theoretical background

Midway through the 20th century, pragmatics developed in reaction to structural linguistics' constraints. Many groundbrealing researchers set the theoretical foundation for this discipline:

In his key book How to Do Things with Words, John L. Austin (1962) first proposed the idea of speech acts. He maintained that language is used for actions as well as for communication of facts. Austin distinguished among locutionary (literal), illocutionary (intentional), and perlocutionary (effect-based) acts. Building on Austin's approach, John R. Searle (1969) provided a more methodically categorized set of speech acts. Assertives, directions, commissives, expressives, and declarations—each with a different communicative purpose—are his five basic forms. Using conversational maxims—quantity, quality, relevance, and manner— Herbert Paul Grice (1975) first proposed the Cooperative Principle—that speakers and listeners cooperate. His theory of implicature clarifies how listeners deduce unstated meanings. Widely read works by Stephen C. Levinson and George Yule broadened the conversation on deixis, presupposition, implicature, and politeness. While Yule (1996) offers easily available explanations of pragmatic elements, Levinson (1983) describes several forms of deixis and implicature in depth. Geoffrey Leech (1983) proposed the Politeness Principle, which describes how indirectness and face-saving techniques preserve social peace.

By turning the emphasis from isolated language units to dynamic communicative events, these thinkers together changed linguistics.

The fundamental domains of pragmatics mirror the several ways in which context shapes meaning:

Speech Act Theory clarifies how utterances do more than just state facts—they act. The sentence "I promise to pay you back tomorrow" for instance implements the promise itself. Legal linguistics, discourse analysis, and intercultural communication are among the disciplines where this theory finds extensive application.

Grice's implicature theory stresses how listeners deduce unstated meanings. Saying, "He's got a great sense of humor" in response to a question on someone's competency could imply sarcasm. These judgments are very important in diplomacy, comedy, and negotiations.

Deictic words like "this," "that," "here," "there," and "now" need context to make sense. "Meet me here at 3" only works if both people know where to meet. The importance of deixis is extremely crucial in email writings, in communications like face to face as well as on websites.

Brown and Levinson's face theory is based on Goffman's theory of sociology. It assumes that people use language to control their "image" or "face." Direct requests, such "Would you close the window?" make people feel like they have to do it and hurt their ability to respect each other.

As Maslova (2008) notes, pragmalinguistics studies language not only as a system of signs, but also as a "means of communication and a tool of influence." Matveeva, Lenes, and Petrova (2015) connect pragmatic analysis with the structure of the communication process and scientifically explain intention, influence, and social activity carried out through language units. At the same time, in the work " Медиатекст: особенности создания и функционирования." by Dzyaloshinskiy and Pilgun (2023), the pragmalinguistic approach is also emphasized as a key component of the theory of general linguistics, and it is said that it is necessary to take into account the intention and social role of a person to understand any text. Bolotnova (2019) believes that pragmalinguistic analysis is an important way to reveal meaning, stating that "only the joint study of semantic and communicative levels in speech allows for a full understanding of the impact of words."

In Uzbek linguistics, pragmalinguistics has also formed as an independent field since the 2000s. This process was scientifically substantiated by the work of Sh. Safarov (2008) "Pragmalinguistics." In it, language activity is explained in connection with a person's intention and

social goal. Safarov considers language not only as a system of signs, but also as an expression of human psychological and social activity. M. Hakimov (2013) in his work "Fundamentals of Uzbek Pragmalinguistics" places the national-cultural and etiquette features of the word in a pragmatic analysis. As a result of these studies, pragmalinguistics in Uzbek linguistics has been formed not only as a theoretical science, but also as an important direction in the analysis of the culture of practical communication and teaching methodology.

Uzbek linguists evaluate this field as a practical and functional direction of linguistics. Sh. Safarov defines pragmalinguistics as a "direction that analyzes the possibilities of meaning creation of language in connection with the speech situation and the social role of a person" (Safarov, 2008). In his opinion, to understand the semantic and pragmatic content of speech, it is necessary to take into account not only the meaning at the lexical or syntactic level, but also the speaker's purpose, the social position of the addressee, and the influence of the context. M. Hakimov connects the emergence and development of pragmalinguistics in scientific research in the Uzbek language with the strengthening of anthropocentric ideas in our linguistics (Hakimov, 2013).

Pragmatics posits that meaning emerges from the interaction of linguistic form, speaker intent, listener interpretation, and environmental attributes, rather than being inherent in the words themselves.

The phrase "Can you pass the salt?" is understood as a request instead of an inquiry about someone's capability to do so.

Pragmatics is extensively implemented in technological, commercial, academic, and professional contexts.

- In language education, being aware how to use it in the right way is just as essential as knowing how to use it correctly. Students required to know accurate usage to dispute, ask questions, or provide compliments in other cultures.
- Translation and Interpretation: Translators should take into consideration the affection of pragmatic meaning to their work. An automatic translation that ignoring cultural etiquette and idiomatic expressions may falsify the intended meaning. Pragmatic equivalence is more enjoyable by readers than formal one.
- Linguists in the legal field use pragmatic analysis to look at threats, confessions, and language in contracts. Knowing about speech acts might help you figure out if a statement was meant to be a joke, a promise, or a threat.

Pragmatics helps people deal with disparities in language and culture. Indiscritions often occur because people have different ideas about how to be courteous, when to speak, and how direct to be, not because they don't know how to use words well.

Pragmatics is essential for navigating linguistic and cultural differences. More often than not, misunderstandings result from different expectations about politeness, turn-taking, and directness than from poor vocabulary.

4. Conclusion

By stressing that meaning is not fixed or self-contained, pragmatics has transformed language study. It lives in the interactions among form and function, language and context, speaker and listener. Pragmatics improves our knowledge of how language functions in actual communication as a focus of linguistic research. Pragmatic awareness is vital in a world growing more globalized and digital for diplomats, software developers, regular communicators, not only for linguists and teachers. Pragmatics helps us to appreciate the actual complexity of human language by stressing the need of intention, inference, and interaction.

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Rezyume: *Tilshunoslikning markaziy va dinamik bo'limi bo'lgan pragmatika til va uning qo'llanilishi o'rtasidagi murakkab o'zaro ta'sirlarni, xususan, ijtimoiy, madaniy va vaziyatli sharoitlarda o'rganadi. Fonologiya, morfologiya, sintaksis va semantika kabi tilning ichki mexanikasini ko'rib chiqadigan strukturaviy tilshunoslik esa, pragmatika haqiqiy muloqotda ma'no qanday faol yaratilishi va talqin qilinishini o'rganadi. Ushbu ish pragmatikaning asosiy g'oyalarini taqdim etadi, uning nazariy rivojlanishini ko'rsatadi va fanlarda muhim qo'llanilishini ko'rib chiqadi.*

Резюме: *Прагматика, центральная и динамичная ветвь лингвистики, исследует сложные взаимодействия между языком и его использованием в конкретных социальных, культурных и ситуативных условиях. В то время как структурная лингвистика, которая в основном занимается внутренней механикой языка, такой как фонология, морфология, синтаксис и семантика, прагматика изучает, как значение активно создается и интерпретируется в реальной коммуникации. В этой работе представлены основные идеи прагматики, схема ее теоретического развития и рассматриваются ее важные применения.*

Kalit so'zlar: *pragmatika, nutq akti nazariyasi, implikatura, deyxis, xushmuomalalik, kontekst, aloqa, tilshunoslik, tildan foydalanish.*

Ключевые слова: *прагматика, теория речевых актов, импликатура, дейксис, вежливость, контекст, коммуникация, лингвистика, использование языка.*

POLITICAL PROPAGANDA AS A MEANS OF POLITICAL MANIPULATION

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Summary: *This article demonstrates the most actively used methods and mechanisms of political communication in the election campaign, primarily the halo effect, the principle of prioritizing primary information, the principle of contrast, the transmission of discontent, the use of mediators, repetition, the presentation of facts, and the identification of elements of manipulation in political communication against threats.*

Key words: *Manipulation, election campaign, contrast principle, mediator, opinion leaders, parliament, faction*

The word "manipulation" comes from the Latin word "manus" - hand (manipulus - handful, handful, manus - hand, and ple - filling). In various dictionaries of European languages, this concept is defined as "working with specific intentions and targeted objects" [1]. There is another interpretation of the root of the word "manipulation." Manipulus is the designation of a small detachment of warriors (approximately 120 men) in the Roman army [2].

The Oxford English Dictionary defines manipulation as the appropriation of someone or something [3]. In this interpretation, medicine can be cited as an example of the use of the word "manipulation," where manipulation refers to examining a part of the body using hands or with the help of manual medical procedures. Here, agility and dexterity are emphasized in performing manipulative actions.

It is possible to try to determine how close the listed concepts are to the term "manipulation" by referring to a thematic article in a psychological dictionary. Manipulation is understood as a communicative influence that leads to the actualization of certain motivational states (and simultaneously feelings, attitudes, stereotypes) in the object of influence, encouraging it to be necessary (or beneficial) for the subject of influence; it is not necessarily considered harmful to the goal[4]. Comparing this definition with the aforementioned definitions, we can conclude that influence, influence, and suggestion are components of manipulation. Manipulation, like influence, influence, or suggestion, is a subject-object process.

The purpose of manipulation is to instill a person's attitude, goals, and behavior into the object through a specific psychological or physical influence, directly or indirectly. At the same time, manipulation and persuasion are polar concepts because, unlike manipulation, persuasion has an open nature, in which the influencing subject does not hide their purpose and position [5]. Manipulation, in turn, excludes the ability of the subject to inform the object of influence in advance about the real values, messages, and intentions present in the existing influence [6].

Among the many campaigning methods (techniques) used today, eight can be highlighted as the most actively used in the election campaign. These are, first and foremost, the halo effect, the principle of prioritizing primary information, the principle of contrast, the transmission of discontent, the use of mediators, repetition, the presentation of facts, and the creation of threats.

The Oreola effect is based on a person's tendency to think with incorrect analogies. Consists of two general stereotypes. Firstly, "close - together." In such cases, being close to a famous or high-ranking person somewhat elevates one's status in the eyes of others. Secondly, a person who has achieved significant success in a particular field is perceived by others as more capable in other areas of activity. However, many facts prove that this is a simple misconception. Nevertheless, this stereotype is actively used by candidates for the highest office in our country.

The principle of preferring primary information (the primacy effect). One of the main principles of modern propaganda is that the person who speaks the first word to the world is always right. Studies have shown that a candidate who first convincingly proves themselves a winner during the election campaign is also recognized in the public consciousness. After receiving important information, the mind is ready to perceive subsequent, more detailed information that confirms the

first impression. The person who first conveys the important message has a psychological advantage because its content reaches the addressee earlier, thereby contributing to the formation of a primary psychological attitude towards the fact or event. Subsequently, benefits are formed for this (basic) source of information.

The principle of contrast. The technique takes into account the role of the social background perceived by the individual or group. For example, against the backdrop of evil and unjust people, a kind person is always received with special sympathy. In essence, the principle of conveying similar dissent is mainly used in election campaigns and is a method of aggressive counter-propaganda, which also contributes to the formation of public opinion. This method, by displaying in the mass media individuals who support a particular candidate but evoke feelings of hatred, fear, and hostility in voters, fosters a negative attitude towards them among the population. Thus, the complaint is submitted to the relevant politician.

Use of mediators. This technique is based on two principles. Firstly, special studies have shown that propaganda campaigns in the mass media are less effective in shaping human thought than the rumors, gossip, and legends circulating in society. The second principle stems from the first: effective information influence on a person is carried out not directly through mass media, but through influential people ("thought leaders") - interpreters of opinions and other rumors - who are important to them and familiar to them. Informal personal communication is more important for people than official media reports. There are highly respected members of the group called "mind leaders" ("mediators"), whose opinions and advice on certain issues are valuable to others. These "leaders of thought" play a crucial role in shaping the public's attitude towards the problem reflected in the campaign. Mass media is ineffective at the individual level and does not change their attitude, but rather influences and changes a person's opinion by entering primary groups of neighbors, family, friends, and as a result of personal and group discussions. The government acts as an intermediary for each category of the population. These can be informal leaders, representatives of religious confessions, politicians, cultural, scientific, art figures, and others.

Repetition One of the most effective methods of propaganda is the constant repetition of the same sentences. What they memorize always seems convincing to a person, even if memorization occurs only in the process of mechanical repetition. In this case, influence influences not the enemy's ideas and theories, but rather a person's daily consciousness, daily thoughts, desires, and actions. Thus, effective campaigning should, first and foremost, be simple and repetitive [7].

Statement of Truth The expected situation is presented as true by the mass media. Such propaganda is usually presented under the guise of news or sociological research. This reduces the critical nature of perception. To give credibility to such reports, "thought leaders" are widely used: famous journalists, well-known political scientists, sociologists. For example: "The influence of the head of the administration is rapidly declining...," "More and more deputies are leaving the parliamentary faction".

Creating a threat. It refers to the number of techniques that affect the emotions of a mass audience. Its main task is to convince of the existence of a real threat and to create an imaginary one. Experts explain this phenomenon by the fact that people experiencing depression and fear engage in behavior that is not beneficial to them at all, or at least approve of it. The technology often looks like this. The imaginary or real danger of any event (for example, war) is multiplied by the mass media, thereby creating a public fear to create a favorable environment for manipulating public consciousness, primarily for political purposes. The use of this propaganda method may be necessary to divert public attention from pressing political issues, the machinations of certain political figures (leaders), or their actions (inaction) that cause negative public sentiment. In other words, redirecting an aggression means neutralizing it.

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Rezyume: *Ushbu maqola ko'plab tashviqot usullaridan saylov kampaniyasida eng faol qo'llaniladigan siyosiy muloqot usullari va mexanizmini ko'rsatilgan bo'lib, birinchi navbatda, halo effekti, birlamchi ma'lumotlarga ustunlik berish tamoyili, contrast tamoyil, norozilikni uzatish, vositachilardan foydalanish, takrorlash, faktni bayon qilish, tahdidlarga qarshi siyosiy muloqotda manipulyatsiya elementlarini aniqlashga asoslangan.*

Резюме: *В данной статье из множества методов агитации показаны наиболее активно используемые в избирательной кампании методы и механизмы политического диалога, в первую очередь, основанные на выявлении элементов манипуляции в политическом диалоге против угроз, таких как эффект хало, принцип приоритета первичных данных, принцип контраста, передача недовольства, использование посредников, повторение, изложение фактов.*

Kalit so'zlar: *Manipulatsiya, saylov kampaniyasi, kontrast printsip, mediator, fikr yetakchilari, parlament, fraksiya*

Ключевые слова: *Манипуляция, избирательная кампания, принцип контраста, медиатор, лидеры мнений, парламент, фракция*

WAYS TO IMPROVE THE PROFESSIONAL COMPETENCE OF PRIMARY SCHOOL TEACHERS

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Summary: *This article identifies the conditions that ensure the effective professional activity of primary school teachers and highlights the main ways to develop their professional competence.*

Key words: *competence, professionalism, professional development, pedagogical activity, personality, system, motivation.*

Changes in the socio-economic and cultural spheres of society today impose significant demands on the personality of a teacher. The school must not only form a holistic system of knowledge, skills, and abilities in children, but also provide students with experience in personal responsibility and independent activity. These key competencies determine the quality level that modern education should meet. Therefore, the primary focus of school work is the development of teachers' professional competence.

According to S. I. Ozhegov's Explanatory Dictionary, competence is a characteristic of a specialist who is knowledgeable, informed, and authoritative in a particular field. Thus, a professionally competent teacher can be defined as one who carries out pedagogical activities and communication at a sufficiently high level, achieving consistently strong results in students' learning and upbringing.

The development of professional competence is a dynamic process of acquiring and updating professional experience, leading to the enhancement of individual professional qualities and accumulation of professional experience, and involves continuous development and self-improvement.

"Today's teachers are those who are open to everything new, understand child psychology and the characteristics of students' development, and have a strong command of their subject. A teacher's task is to help children discover themselves in the future, becoming independent, creative, and self-confident individuals. Sensitive, attentive, and responsive to students' interests, and open to new ideas—such teachers are the key feature of the school of the future" [4].

Time does not stand still; today, schools face new tasks and encounter emerging challenges.

One of the main challenges today is the continuous professional development of teachers, which involves not only expanding subject knowledge but also rethinking the content and methods of their work in light of new requirements from pedagogical and psychological sciences. It also requires a broad awareness of politics, art, sports, and information and communication technologies. A modern educational institution needs teachers who consciously strive to enhance their professional competence and are willing and able to act effectively in new socio-cultural conditions [2].

The following conditions can be identified as ensuring the effective professional activity of primary school teachers:

1. Deep knowledge of the subject area and an understanding of the principles and conceptual ideas embedded in specific teaching technologies;
2. Fluent command of a wide range of methods, techniques, and approaches for designing, organizing, and managing the educational process in primary school;
3. Ability to correlate the logic of constructing a system of teaching methods and organizing students' activities within a pedagogical technology with the real personal characteristics of students, ensuring the correct choice of pedagogical technology;
4. Capacity for reflection during the implementation of a particular pedagogical technology and for its adjustment within the framework of its underlying principles and conceptual ideas [3].

Based on the modern requirements for teachers, the main ways to develop their professional competence can be identified as follows:

- Participation in methodological associations, creative or problem-based groups (at the school or municipal level). *Example:* Topic: "Development of Teachers' Professional Competence and Creative Potential through Student-Centered Learning and Education of Primary School Students."

- Innovative teaching activities and mastering new educational technologies. *Examples:* Technology of "Developing Critical Thinking through Reading and Writing"; Techniques such as "Cinquain," "Round-Robin Writing," "Prediction Tree," "Cluster"; Project-Based Learning technology; health-preserving technologies that foster students' conscious need to lead a healthy lifestyle.

- Participation in professional skills competitions, master classes, forums, festivals, etc. *Example:* "Teacher's Methodological Development." Topic: "Active Teaching Methods."

- Systematization and dissemination of personal pedagogical experience. *Example:* Republican Scientific and Practical Seminar "Organization of Extracurricular Activities in the Implementation of the Decree of the President of the Republic of Uzbekistan No. PP-241 'On Additional Measures for the Development of Preschool and School Education' dated March 11, 2022."

- Publications.

- Teacher certification and professional development.

- Development of professional competence through active forms of work with colleagues (methodological decade, methodological festival, business game, pedagogical KVN, training, project defense, thematic pedagogical council, open lesson).

-Independent work of teachers is acquiring a new status today as an effective means of organizing self-education and self-development. The goal of self-education is the professional growth of the teacher. The following professional qualities and skills are developed: the ability to plan objectives, define work tasks, identify difficulties, and find ways to overcome them [1].

Teachers' research activities can be categorized as follows:

1.Diagnostic studies:

- "Study of Students' Anxiety Levels"/

- "The Influence of Solving Non-Standard Problems on the Formation and Development of Core Components of Mathematical Thinking".

- "Diagnostics of Learning Outcomes to Determine and Adjust the Trajectory of a Child's Personal Development".

2. Design-oriented research (developing the ability to plan various types of work):

- Study on the topic "Ways and Methods of Developing Children's Giftedness" with the aim of creating a model for an individual educational pathway for students.

3. Exploratory-reflective research (involves searching for the most optimal conditions, technologies, methods, tools, and teaching techniques to improve the educational process and enhance the quality of subject learning):

- "The Influence of Visual Didactic Materials on Teaching the Phonetic Aspects of Speech."

- "Test Assignments as a Condition for Implementing a Competence-Based Approach in Education" [3].

4. Scientific and pedagogical research:

- "Development of Creativity in Primary School Students Using Computer-Based Learning."

- "Development of Cognitive Interest in Low-Achieving Students in Mathematics Lessons."

- Various forms of pedagogical support.

- Use of ICT and other technologies.

However, none of the above methods will be effective if the teacher does not personally recognize the need to improve their professional competence. This highlights the importance of motivation and the creation of favorable conditions for professional growth. It is necessary to create an environment in which teachers independently realize the need to enhance their own professional qualities. Analyzing one's own teaching experience stimulates professional self-development, which in turn fosters research skills that are later integrated into pedagogical practice. Teachers should be

actively involved in managing the development of the school, which contributes to the growth of their professionalism.

"As long as a teacher continues to learn, they live as a teacher. Once they stop learning, the teacher within them dies" (K. D. Ushinsky) [5]. Ushinsky succinctly characterized the professional qualities of a teacher, emphasizing the need for continuous self-improvement and the pursuit of new knowledge. These qualities remain highly relevant today.

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Rezyume: *Maqolada boshlang'ich sinf o'qituvchilarining samarali professional faoliyatini ta'minlovchi shartlar ajratib ko'rsatilgan va ularning professional kompetentsiyasini rivojlantirishning asosiy yo'llari belgilangan.*

Резюме: *В статье выделены условия, обеспечивающие эффективную профессиональную деятельность учителей начальных классов, выделены основные пути развития их профессиональной компетентности.*

Kalit so'zlar: *kompetentlik, professionallik, malakani oshirish, pedagogik faoliyat, shaxs, tizim, motivatsiya.*

Ключевые слова: *компетентность, профессионализм, повышение квалификации, педагогическая деятельность, личность, система, мотивация.*

WRITTEN AND ORAL SOURCES ABOUT THE HISTORICAL FIGURE OF TULGA KHANMAKHSIM

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Summary: *The article provides information on the life and career of Ubaydulla Bahauddinov, a historical figure and military commander who began to be officially mentioned after our country gained independence. This information is based on the chronological sequence of his life and career, his genealogy based on oral and written sources, his time and place of birth, literacy, career, and marital status.*

Key words: *historical figure, military commander, Ubaydulla Bahauddinov, genealogy, place, literacy, career path, family*

The name of the historical commander Ubaydulla Bahauddinov (Khanmakhsim, Ubaydulla mullah, Ibaykhan mullah) as a historical figure began to be officially mentioned only during the years of independence.

The names of Ubaydulla Bahauddinov, as well as his grandfather, Imamatdin Kaypnazar's son (Imam Ishan, 1754-1831), and his grandfather, Otagulla Imamatdin's son (Kum uzek Ishan, 1801-1877), are among the names of historical figures included in the new histories of Uzbekistan and Karakalpakstan, as well as in a number of scholarly and journalistic works published in recent years. [Book 2 Tashkent: Sharq, 2000; The New History of Karakalpakstan].

Unfortunately, due to the fact that some literature contains more informational materials invented along the way, rather than revealing the unknown aspects of Ubaydulla's life and work, especially his contributions to the people, to the general public, we preferred to arrange the available written and oral sources in chronological order.

1. Ubaydulla's family tree. A key characteristic of today's descendants of Ubaydulla Makhsim, unlike their contemporaries, is the preservation of a hereditary clan passed down unchanged from generation to generation in each household. The genealogical tree consists of two sections, up to and following Imam Ishan. Each section, based on the requirements of Sharia law, is divided into seven branches: "Kayipnazar Biy, his father - Bekmurat Biy, his father - Minghaydar Atalyq, his father - Jonhaydar Atalyq, his father - Saman Bahodir, his father - Postibay Bahadir, his father - Udewberdi Biy," and "Imam Ishan, his son - Otagulla Ishan, his son - Bahauddin Eshon, his son - Ubaydulla Makhsim, his son - Muptilla Makhsim, his son - Nietulla (Nietulla Ubaydullaev, born in 1957, - our informant), his son - Azat." This widespread version of the family tree differs somewhat in number, sequence, and names from the other three versions published in the official press in recent years.

Nevertheless, one phenomenon common to both oral and written sources - the family tree - indicates that Ubaydulla's ancestors, during the time of the Ashtarkhanids, were state officials (of the middle-ranking court officials - biys (community leader), bahadurs (warrior title), and atalyq (royal mentor), and his later ancestors were public figures (religious figures - ishans) in Islamic society, and his ancestors were from the Kungrad clan. Ubaydulla's father, Bahauddin Atagullayev, according to academic H. Hamidov, citing archival documents, "owned the land inherited from his father and leased his land to petty farmers" [Karlibayeva. M. Madrasah in Karakalpakstan in the 19th and early 20th centuries. Nukus: Bilim, 2002.], according to historian Sh. Babashov, "there were known eshones and numerous Sufis throughout the entire Khorezm region" [Babashev Sh. Nukus: Karakalpakstan, 2008.]. In oral sources, it is mentioned that Bahauddin Ishan (1838-1910) served as the director of the Kumuzek Ishan Madrasah for the last thirty years of his life, opened a Jadid (modern) school near the madrasah, taught students additional arithmetic and Russian language subjects at the school, and that renowned district administrators, murabbs (mentors), interpreters, and devons (council secretaries) emerged from among those who studied in this field. [Author's field notes. 2010-2012.].

We do not yet have information about Bahauddin Ishan's wife and (if any) daughters. However, it is known that the scholar had two sons: Iniyat Maqsim (firstborn, 1883-1930) and Ubaydulla Makhsim (youngest, 1887-1956). The remains of Iniyat Ishan's (1883-1930) private mosque and primary religious education school at the site of the current Khalakabad Cotton Ginning Plant were preserved until the 1950s. [Author's field notes. 2010-2012.].

2. Date (year, month, and day) and place of birth. "I was born in 1938 in Turkmenistan, in the village of Katti Oy, belonging to the Pakhtachi village council of Kubatov (formerly Telman) district, Dashoguz region. Although my ethnicity was Karakalpak, and my clan was named kanli, I lived there until 1952 and studied in Turkmen for seven years. Khanmakhsim Ata passed away of natural causes in our village on March 8, 1956, and his body was buried in the "Miskin Ata" cemetery. There, hiding from his fellow villagers, he spent 19 years in the cellar of a Turkmen named Aman Mashrik. At the funeral, the scholars who observed the period determined the deceased's lifespan as 69 years, one month, and 20 days according to the Gregorian calendar. I haven't seen any other women of him. But his last wife died before him. Khanmaksim's appearance is that of her youngest son, Rametulla, and her daughter, Abadan. (Abat) was exactly himself. I moved to Takhiatash after 1952 and have been living in this city ever since." [Author's field notes. 2010-2012.].

This information, recorded in recent years from our compatriot from Tolibay Rahmanov, who had seen Ubaydulla and served him, further confirms the existing written sources. [Usenov E. Ishan qala. Nukus: Karakalpakstan, 1992; Usenov, E. Khan Makhsim. Nukus: Karakalpakstan, 1997.]. It not only confirms but also allows for the determination of the commander's birth and death dates. Thus, Ubaydulla Bahauddinov was born on January 18, 1887, in the "Ishan qala" settlement in the territory of the present-day Kegeyli district's "Juzim bag" village citizens' assembly, into a religious family, a citizen of Imperial Russia.

3. Literacy. Ubaydulla began his primary religious education. (9-12 years old) He studied at Najim Ishan's school and received his secondary education (12-17 years old) at the Kumuzek Ishan Madrasah. A student of the Jadid school near Madrasah. In addition to his native language, he was fluent in several Turkic, Persian, and Arabic languages and spoke Russian fluently. [Author's field notes. 2010-2012.].

4. Career. Ubaydulla, who received a specialized secondary religious education at the madrasah, began his career at the age of 19 by working for officials in the Chimbay district, specializing in water management. Specifically, as a murap (local water and land manager), he led the excavation of the newly constructed "Makhsim Canal" (1906-1908, formerly the "Raykom Canal," now the "Hakim Canal") and "Tentek Canal" (1908-1910) in 1906-1910, replacing the damaged "Kumuzek" canal. As a canal elder, in 1910-1918, he worked on the division of the waters of the "Kuanish Jarma" canal into internal channels. [Author's field notes. 2010-2012.].

From July 26, 1918 to February 1920, Ubaydulla led a military formation formed in the territory of the Chimbay district, consisting of a total of 12 thousand nukers, including 2 thousand military commanders (this selected group of mingbashi, yuzbashi, ellikbashi, and onbashi was called the "wild division" by N. A. Shaydakov), a "crucial detachment" of 400 soldiers, and 40 loyal soldiers. Of these, the "hand-winged detachment," together with the Ural Kazakhs, participated in the "Ishan-Qala Siege" (27.11.1918 - 03.02.1919), the "Gravel Bridge," "Nazarkhan," and "Tozgara" events, and the "Wild Division," together with the Ural Kazakhs and the troops of Junaitkhan, participated in the "Nukus Fortress Siege." [Author's field notes. 2010-2012.]. As a result, according to archive documents, by August 19, 1919, a People's Government was established in the Chimbay district, and Ubaydulla Bahauddinov, with his military system, was also included in the government. [Shamambetov B., Yusupov Sources on the History of Uzbekistan and Karakalpakstan. Nukus, 1995 and Field notes of the author. 2010-2012.]. At the end of January 1920, in the military garrison in the old city of present-day Nukus, according to eyewitness accounts, a face-to-face meeting took place between the representative of the people's government, Khanmakhsim, and the commander of the "Red Guards," N. A. Shaydakov. Khanmakhsim, who entered the meeting with 40 mounted soldiers, was received by N.A. Shaydakov in a solemn atmosphere, in front of the lined-up soldiers, with posters and slogans hanging on the streets, in honor of whom livestock were slaughtered and dishes

were served with gurtik (Karakalpak national dish made by dividing dough typically from sorghum or wheat flour). The meeting was organized by Shiniqul Bay Kalekov, a descendant of the Beksiyiq clan of the Chinese Karakalpaks, who vouched for his two sons, Masharip and Ismail, by the people's government. [Usenov E. Ishan qala. Nukus: Karakalpakstan, 1992; Usenov, E. Khan Makhsim. Nukus: Karakalpakstan, 1997].

As a result of the meeting in Chimbay, on January 18, 1920, a treaty was signed between the people's government and the Soviet government, and a new government was elected, including Khanmakhsim. According to the terms of the agreement, prisoners from both sides were released, and an amnesty was declared for the soldiers who fought against Soviet power. [Nayimov K., Khojaniyazov G. Imam Eshon - a great scholar and enlightener of the Karakalpak people. Authors: K. Naimov and G. Khojaniyazov. Nukus: Karakalpakstan, 2005.]. Thus, in 1920, Khanmakhsim's "savage division" was disbanded. Ubaydulla Bahovaddinov competed with his aforementioned fellow villager, Shinikul boy, in the elections [Shamambetov B., Yusupov O. Sources on the History of Uzbekistan and Karakalpakstan. Nukus, 1995] held on May 31, 1920, for the position of governor of the Chimbay district, in which six thousand voters participated. [Author's field notes. 2010-2012.]. However, despite the fact that "Khanmakhsim had many supporters in the elections," he "lost" his opponent for some reasons. Nevertheless, the agreement-contract lasted only one year, and in February 1921, along with the previous 24 nukar chiefs, Khanmakhim was arrested on charges of involvement in the "Tazgara Incident" (August 8, 1919), and sent to Siberia for 15 years. The tormentor Bahovaddinov served his prison sentence in Tomsk, in the village of Salehar in present-day Krasnoyarsk Krai, and then in the villages of Igarka and Dudinka. However, the prisoner's complaint to Moscow was taken into account, and after a year and a half, he was released from prison. Along with the acquittal letter, a letter of recommendation was given to local leaders not to leave Ubaydulla unemployed anymore, to use his knowledge, work experience, and organizational skills correctly in strengthening the national economy. [(Usenov E. Ishan qala. Nukus: Karakalpakstan, 1992; Usenov, E. Khan Makhsim. Nukus: Karakalpakstan, 1997) Author's field notes. 2010-2012.]. Although dismissed from politics, Ubaydulla, on his own initiative, educated the newly literate son of the oily axe Askar qazy (judge) in Chimbay, the future doctor of science Jumek Orinbaev, and in 1922 took care of opening a primary school in Khalkabad. More precisely, he bought a seven-room mud-brick house belonging to a wealthy man named Qazayaqly Otegen qorjun (saddlebag), who lived among the Bosar Kipchaks on the southern side of Khalkabad, and gave it to the school [Author's field notes. 2010-2012.]. According to Professor J. Orinbayev, this was the first Russian-native school in the entire Karakalpak region, and the local population called the village "Red House" because its surface was painted red. Also, in 1924, Ubay Dulla held a meeting with the local population at the "closed market" of Khalkabad with the public figure Alliyar Dosnazarov, who brought a "stan" to Karakalpakstan. After the meeting, he gives the horse he was riding to Jumak and sends him to Chimbay to deliver the news that "Dosnazarov will be a little late." They say he invited the guest to the "Eshon Kala" fortress, served him a feast, slaughtered livestock in his honor, and prepared gifts as a "suyunchi." [Author's field notes. 2010-2012.].

Nevertheless, for undetermined reasons, Ubaydulla remained unemployed in 1924-1928. Having lost hope in the new government, Ubaydulla, as well as his other relatives in "Ichan Kala," sold their possessions and equipment in Khalkabad's closed market, intending to migrate abroad. [Usenov E. Ishan qala. Nukus: Karakalpakstan, 1992; Usenov, E. Khan Makhsim. Nukus: Karakalpakstan, 1997. and Author's field notes. 2010-2012.]. However, upon learning of this movement, local leaders, by decision of the Bureau of the Chimbay District Committee of the Communist Party of Kazakhstan (Bolsheviks), sent Ubaydulla with his children to the village of Amirabad, near Turtkul, as a "white-house" (those deprived of the right to travel abroad) [Shamambetov B., Yusupov Sources on the History of Uzbekistan and Karakalpakstan. Nukus, 1995 and Field notes of the author. 2010-2012.]. His cousins, Khalila Oxun Otagullayev (1855-1929), Najim Ishan Muyatdinov (1869-1929), and his accomplice Iniyat Ishan Bahouddinov (1883-1930), who were the instigators of the movement, were arrested and executed on charges of "spiritual support by giving blessings to the participants of the Takhtakupyr rebellion" (part 2 of Article 58 of the

RSFSR Criminal Code, i.e., "political criminal"). Ubaydulla himself was accused of having a connection to the "Takhtakupyr rebellion" and arrested in Turtkul in 1930 [Shamambetov B., Yusupov Sources on the History of Uzbekistan and Karakalpakstan. Nukus, 1995 and Field notes of the author. 2010-2012.]. The investigation of the criminal case against Ubaydulla, initiated on January 24, 1931, lasted three years [Shamambetov B., Yusupov Sources on the History of Uzbekistan and Karakalpakstan. Nukus, 1995 and Field notes of the author. 2010-2012.] and most of the investigation was conducted in a pre-trial detention center in Semipalatinsk [Author's field notes. 2010-2012.]. Based on the results of the investigation, Bahouddinov was sentenced to 3 years and was released only on January 27, 1934, returned to the village of Amirabad, and reunited with his family.

From 1934-1937, Ubaydulla lived in the village of Amirabad and made a living as a small trader in the Turtkul bazaar. This is the story of Kamil Adigamov (1926-2010), an honorary teacher from Khalkabad, who met a historical military commander in 1937 at the Turtkul market.

"Due to the change in the workplace of my father Rashid Galiakperovich in Central Asia, in 1937, following my father, I traveled from Bashkortostan by train to Chardzhou, and then by steamship to the cities of Turtkul. Because government agencies weren't working, my father and I wandered around the To'rtko'l market a lot. Then my father met and talked a lot with a Karakalpak man of about fifty, handsome, imposing, but; for some reason, who made a living by selling carts.

I didn't pay much attention, thinking he was probably asking about the condition of the evening dormitory. Then that man indeed took us to a house near the market and settled us there, then returned to his path. According to my father, the "merchant old man" was the legendary commander Khanmaksim. My father studied with Khanmaksim's cousin - Ismail Eshon Khalilayev (1893-1983) at the Kargaly Islamic Madrasah in Orenburg in 1908-1910. That was the first and last time I saw Khanmaksim."[Author's field notes. 2010-2012.].

The historical commander, who was forced to hide from his compatriots, spent the rest of his life in a basement in the village of "Qatti Oy" in the Kubatov (former Telman) district of the Dashoguz region of Turkmenistan in 1937-1956 [Usenov E. Ishan Qala. Nukus: Karakalpakstan, 1992; Usenov, E. Khan Makhsim. Nukus: Karakalpakstan, 1997]. Although they hadn't managed to catch them during these periods, the "red-headed" people from their former neighbors frequently came looking for them, reminding them of the "counter-revolutionary works" that had remained in 1918-1919. As a citizen of the Soviet government, Ubaydulla Bahauddinov died there on March 8, 1956, at the age of 69, and his body was buried in the "Miskin Ota" cemetery, next to the grave of his grandfather - Kayipnazar biy [Usenov E. Ishan Qala. Nukus: Karakalpakstan, 1992; Usenov, E. Khan Makhsim. Nukus: Karakalpakstan, 1997].

The criminal cases initiated against Ubaydulla Bahauddinov were reviewed at a joint meeting of the Prosecutor's Office, the State Security Committee, and the Ministry of Justice of Uzbekistan on July 28, 1986, before the collapse of Soviet power, the investigation was carried out illegally by employees of the Ministry of Internal Affairs, the accused was found not guilty before the Soviet authorities, was officially acquitted, and civil rights and freedoms were restored after his death [Noyimov K., Xo'janiyozov G. Imam Ishan - a great scholar and enlightener of the Karakalpak people. Authors: K. Nayimov and G. Khojaniyazov. Nukus: Karakalpakstan, 2005.].

5. Family conditions. Ubaydulla was married four times in his life. His wife was the daughter of Purkan Makhsum Azizov, who lived in the village of Karabuga, Karauzyak, and was of Qandakli Kungrat origin. From his first wife, Ubaydulla had the eldest son - Muptilla Makhsum (1911-1973, residing in Nukus), and daughters - Abadan (Beruni) and Biyjan (Nukus, wife of Darmen Makhsum). Of these, Abadan's name is mentioned as one of the characters in the book "Echo in the Desert" by the writer Aitbay Bekimbetov. The second wife of the military commander was the daughter of old Pana (the father of the historical figure Erniyaz Panayev), who lived in the village of Yangibazar and came from the oily axe-Kipchaks. From his second wife, he had a son - Duysek Makhsum, a daughter - Seule (in Khalkabad, wife of Usman Makhsum Sarimov) and a son - Begdulla Makhsim (who went to war and went missing). Descendants of Duysek Maksim are currently citizens of Turkmenistan.

His third wife was the daughter of Qoyip darga, who lived in the village of "Yalpoq ariq" and was of qitay aralboy origin. From his third wife, he had the youngest son - Rametulla Makhsum (1930 - 1975, Nukus).

His fourth wife was a Keneges (possibly Mangit) from the Chimbay region and had not given birth. Nevertheless, one peculiarity of his other wives is that he went to eternal sleep with his commander [Author's field notes. 2010-2012.] (The latest information was recorded from Ubaydulla Makhsim's youngest daughter-in-law, Rametulla Maxsum's wife, Anipa Ismoilova, born in 1937 and currently residing in Nukus).

Conclusion. Thus, in the process of preparing the article, based on reliable written and oral sources, we tried to develop a chronological sequence of the life and career path of the historical commander Ubaydulla Bahauddinov. We hope that the chronological sequence, in the author's view, will allow the general public interested in historiography, as well as historical science, to prevent any distortion of the truth of life, to correctly understand the image of the historical figure, draw the right conclusions, and give the correct understanding to the next generation.

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Rezyume: *Maqolada mamlakatimiz mustaqillikka erishganidan so‘ng rasman tilga olina boshlangan, O‘zbekiston va Qoraqalpog‘istonning tarix sahifalaridan o‘rin olgan tarixiy shaxs va sarkarda Ubaydulla Bahouddinovning hayoti va mehnat yo‘llarining xronologik izchilligi, og‘zaki va yozma manbalarga asoslangan shajarasi, tug‘ilgan vaqti va joyi, savodxonligi, mehnat yo‘li, oilaviy ahvoli haqida ma’lumotlar berilgan.*

Резюме:. *В статье представлена хронологическая последовательность жизни и трудовой деятельности исторической личности и полководца Убайдуллы Бахауддинова, чье имя стало официально упоминаться после обретения нашей страной независимости и которое вошло в исторические страницы Узбекистана и Каракалпакстана, включая его родословную, основанную на устных и письменных источниках, время и место рождения, грамотность, трудовой путь и семейное положение.*

Kalit so‘zlar: *tarixiy shaxs, sarkarda, Ubaydulla Bahouddinov, shajara, makon, savodxonlik, mehnat yo‘li, oila*

Ключевые слова: *историческая личность, военачальник, Убайдулла Бахауддинов, родословная, место, грамотность, трудовой путь, семья*

LEXICAL-GRAMMATICAL FEATURES OF SOMATIC PHRASEOLOGISMS IN THE UZBEKISTAN AND KARAKALPAK LANGUAGES

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Summary: *This article discusses the importance of phraseological units in distinguishing grammatical descriptions and in achieving a deeper understanding of their meanings.*

Key words: *Grammar, description, distinction, phraseme, phraseological unit, system, form, paradigmatic and syntagmatic features.*

The first general theoretical, fundamental scientific works on phraseology were written by Sh. Balli and V. V. Vinogradov. However, until the 40s-50s, phraseologisms were not widely studied either in Russian linguistics or in Turkic studies. After the 40s-50s, the study of phraseologisms was significantly influenced by the scientific research in this area of Russian linguists: V. L. Arkhangelsky, A. M. Babkin, A. I. Molotkov, V. P. Zhukov, V. M. Mokienko, V. N. Teliya, and from Turkic studies: S. Kesenbaev, Sh. Rakhmatullaev, G. A. Bayramov, G. Kh. Akhunzyanov, Z. G. Uraksin, L. K. Bayramova, M. F. Chernov, B. Yuldashev.

Phraseologisms in the Karakalpak and Uzbek languages were included in textbooks for secondary and higher education, and were also studied as a separate scientific research work.[77]. In these studies, phraseologisms in the Karakalpak language were studied from a semantic perspective, divided into four groups: phraseological units, phraseological units, phraseological units, and phraseological words.

- Phraseological combinations. Phraseological combinations are words that have lost their lexical meaning and all have the same meaning. For example: The fox, without a trace, enters the forest. In this example, the stable combination "the fox, without a trace" means "thick forest" (thick forest), and the words in it have lost their individual meaning and all have a common meaning.

Phraseological units are also found in epics:

Sol waqıtta xalıqtıń, arasına ot salǵan;
Eki qolıńdı tiǵip qaldiń murnińa;
Eli menen qosılıp, shaǵal máslik qıladi;
Jer tanabin quwırdı;
Jer menen jeksen bolarsań.

(“Qirq qiz” dostoni)

The phraseological units in these examples have the following meanings::

«arasina ot salıw» — «awızbirshiligin buzıw, bereketin qashırıw» ma’nosida,

«eki qolın murnına tıǵıp qalıw» — «heshnársege iye bolmay qalıw barınan ayırılıw» ma’nosida,

«shaǵal máslik qılıw» — «qatti quwanıw, ayshi-áshiret qurıw» ma’nosida,

«jer tanabın quwırıw» — «tez, shaqqan júriw» ma’nosida,

«jer menen jeksen bolarsań» — «qazalanıw, qaytıs bolıw» kabi ma’nolarda qo’llanilgan.

In addition to the above, the following phraseological units appear in the poem "Forty Girls": *betine kúye jaǵıw, Atına teris mingiziw, táwbe etiw, ǵayip bolıw, bir pul etiw, jigerin qum etiw, kózine qan tolıw* va boshqalar.

- Phraseological units. One of the words in the construction of stable word combinations retains its meaning in isolation. This type of phraseologisms is considered phraseological units..

For example:

[77]Eshbayev J. Qaraqalpaq tilinin’ qisqasha frazeologik so’zligi. - N. 1985. 165-6; Айназарова Г. Каракалпак гшшндеги еки комгюнентли фразеолотзмлер. —Кандпдатлык диссергадия.—Некис. 2000.

Qulaq saldı qaytadan;
Qulaǵına ilmedi;
Bende qıldıń sen arıwdi qulaq as;
Gúrmelip tili barmadı;
Mańlay shıtpay men ushın;
Bunıń kewlin alayın;
Kewlim meniń toq bolsın.

In this example, the phraseological unit "listened" means "silenced", the phraseological unit "did not listen" means "did not stop", the phraseological unit "listen" means "listen", "gürmelip tili barmaw barmaw" - "talk" "manlay shytpaw" - "ashiwlanbaw" means ma'noni, "kewlin alyw" means "kewlin shad qilyw" ma'noni, "kewli toq boliw" means "kapa kylmaw" means English. Other than these, the following phraseological combinations are used: tabaǵa qalmav, miyri qanyw, ada bolmav, shibyn jan, kóz shaladi, kózine is koriniv, arkasi kozyv, ayy alynyw, kazan uryv, tań kalyw, esi avyv, estenyw, esteniv ear piercing, kewlin côteriv, bass iyiw, awere sarsañ boliw and so on.

- Phraseological units. The meaning of the words in phraseological units is very close to their meaning in isolation.

Qabaǵin úyip Jurin taz;
Gúlayımjan, aqılımdi almasań;
Sirá moynın burmadı;
Ne qıların zalımnıń ishi ǵana biledi;
Tań atqansha qas qaqpay;
Quwanıshı sıumau qoynına.

In these proverbs, "kabaǵın úyiw" means "to be covered, to be covered", "to get wisdom" means "to listen to the broad", "to twist the neck" - "to not break", "to know the work" means "to be covered" "qas kakpaw" means "not to sleep" means "to fit his joy into his bosom" - "to rejoice with joy" means English.

This epic also contains many other phraseological units: "kózi tınıw", "tisin qayraw", "kózine korsetiw", and others.

- Phraseological words. Professor E. Berdimuratov, in his semantic analysis of phraseologisms in the Karakalpak language, considers proverbs and idioms in the Karakalpak language as a separate type of phraseologisms and calls them "phraseological words."

In the epic poem "Forty Girls", such phraseologisms are found, albeit in small quantities. For example:*Batır ańqaw er gódek;*

Jamanlıq qılsań birewge;
Sol aldıńa keledi;
Óltiremen dep birewdi;
Orlar qazsa tórt qırlap;
Sol adam burın óledi;
Sadaqanı sawda ber;
Ǵayratlanǵan qatınlar;
Qazandı da qaynatpas;
Jasaǵanda qatınnıń;
Aqılı kelte shashı uzın.

(“Qırq qız” dastanı)

The word order of the proverbs in the epic poem "Forty Girls" is used interchangeably. For example, in the Karakalpak language there is a proverb "If you do evil to someone, you will come to the left." This proverb is used in the epic poem with the word order "If you do evil to someone, you will come to the right," but its effectiveness has increased with the change of order. Also, the proverb "A woman's hair is long, her mind is long" is used as "A woman's mind is long, her hair is long." In order to increase the effectiveness, the Bakhshis who tell the epic poem made changes to the structure of the proverbs above and used them with the word order changed.

In Karakalpak linguistics, Zhiyenbay Eshbayev's "A Short Phraseological Dictionary of the Karakalpak Language" (1985), G. Aynazarova's "Two-component Phraseologisms in the Karakalpak Language" (2000), and such linguists as Sh. Abduazimov and E. Berdimuratov have carried out a number of research works in the field of phraseology.

Linguists have long noted that there are a number of difficulties in studying phraseologisms. G. Aynazarova writes about this: "Phraseologisms are diverse in terms of their genetic, functional, structural differences, and semantic properties. This creates some difficulties in determining the object of study of phraseologisms. It is important to note that phraseologisms that are related to each other are not separated from other words, and the problem of the classification of semantic types is being looked at and solved in different ways. »[78].

For example, "túbine duz yegiw", "kızıl keğirdek bölıw", "tırnaq astynan kir izlew", "avız bastırık", "asığı alşı", "pışağ arkası", "túyeniği ústinen iyt kabıw", "tüyeniği ústinen iyt kabıw", "tüyeniği quyrıgı jerge tiygende", "goy awzınan shóp almaw", "til tiygiziw", "júregininın tügi bar", "jürek shaydı bolıw", "dize bügiw", "kozdi ashıp jumgansha", "askar taw", "únine suw qıyıw", "tas túnek", "wönerlininın kolı altin" and other phraseological combinations have a special meaning, functionality, expressiveness, the meanings of ordinary words are distinguished by their functional and stylistic stands The meaning of these phraseological units cannot be changed by another word. Especially since they have their own specific manifestations in similar contexts. Also, such phraseologisms have been formed in the language for centuries and are a separate layer of stable word composition. They are one of the lexical indicators that determine the beauty of each language.

Indeed, phraseologisms or phraseological combinations serve to convey a thought in the process of everyday communication with a completely unique semantic coloring.

In short, phraseological units are based on a certain image, a specific phenomenon, an object. Such imagery increases the stylistic possibilities of expressions, turns them into one of the powerful means of expression of the language. Therefore, writers try to use the images underlying these units in a comprehensive way, and in some cases even create new expressions with the help of these images. Language is the first element, material, and main tool of fiction.

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Rezyume: *This situation is classified in sources as a separate layer and a group of assimilated layers.*

Резюме: *Данная ситуация классифицируется в источниках как отдельний слой и группа ассимилированних слова.*

Kalit so‘zlar: *Phrase, phrase, Uzbek language, Karakalpak language, lexicography, terminology, phraseological unit, somatic phraseologisms.*

Ключевие слова*: лексикография, общественніе связи, новіе слова, современная лексика, язік и культура, наука и техника, нанотехнологии, глобальній вопрос, энциклопедический словарь.*

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TECHNOLOGY FOR DEVELOPING STUDENTS' SINGING SKILLS THROUGH MODERN IT TOOLS BASED ON METACOGNITIVE STRATEGIES

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Summary: *This article scientifically examines the possibilities of using metacognitive strategies and modern IT tools to develop students' singing skills. The study demonstrates how metacognitive strategies – planning, monitoring, and reflection – are applied for conscious management of the performance process, identification and analysis of errors in voice timbre, intonation, and phrasing, as well as planning subsequent exercises. Additionally, a methodological approach for effectively developing singing skills using video recordings, metronomes, interactive music programs, and virtual platforms is presented. The results show that integrating metacognitive strategies with IT tools enables students to consciously develop singing skills, organize independent practice effectively, and deeply enhance their creative expression.*

Key words: *Metacognitive strategies, Singing skills, Musical thinking, Reflection, Monitoring, Technical vocal skills, Rhythm and phrasing, Independent practice, Modern IT tools, Pedagogical competence*

Introduction

In modern music education, singing proficiency is a crucial factor not only in developing a learner's technical vocal ability but also in enriching artistic expression, phrasing and intonation interpretation, and overall creative potential. For prospective music educators, it is essential to cultivate singing skills in a systematic, conscious, and goal-oriented manner. From this perspective, metacognitive strategies—planning, monitoring, and reflection—serve as highly effective tools for consciously regulating and improving the singing process.

The planning stage allows the learner to set clear goals for practice and determine the technical and artistic components to focus on. For example, when learning a new song, a student may first strengthen timbre and intonation, then practice phrasing at a slow tempo, and finally integrate these elements into a cohesive performance. This approach ensures that practice becomes systematic, step-by-step, and efficient.

The monitoring stage involves observing and analyzing one's performance in real time. Modern IT tools significantly simplify this process [1]. For instance, through video recording, learners can review their performance to identify issues such as timbre clarity, intonation accuracy, rhythmic stability, and phrasing errors. Interactive applications help detect weak points in singing, adjust rhythm using a metronome, and refine tonal quality. In this way, students can independently analyze their performance without relying solely on external supervision.

Reflection includes evaluating the outcomes of practice and determining the plan for subsequent sessions. For example, if phrasing and expressiveness appear insufficient, the student may first sing the melody internally, analyze each phrase, then practice it slowly, and finally integrate it into the full performance from an emotional-expressive perspective [2]. Thus, singing is refined not only technically but also artistically, aesthetically, and creatively.

Additionally, through metacognitive strategies, students can identify and strengthen their strong sides in singing practice. For instance, when working on songs requiring fast phrasing, the learner may break the material into smaller sections, analyze rhythm and intonation, and then integrate the entire piece. This approach enables students to organize independent practice more effectively and deepen their ability to consciously manage their performance.

In this way, the integration of metacognitive strategies and modern IT tools allows learners to consciously control their singing, develop technical and artistic skills, effectively structure self-directed practice, and enrich creative expression. This approach becomes an effective methodological tool for future music educators to enhance pedagogical competence and systematically improve singing mastery.

Theoretical foundations of metacognitive strategies in developing singing skills. The development of singing skills in modern music education serves not only to enhance a learner's technical vocal ability but also to cultivate artistic expression, phrasing and intonation interpretation, and overall creative potential [3]. From this perspective, metacognitive strategies function as essential tools for consciously and systematically regulating the singing process. Metacognitive strategies refer to methodological approaches aimed at understanding and managing one's own thinking, making decisions, identifying errors, and conducting self-analysis.

These strategies consist of three core components: planning, monitoring, and reflection.

Planning enables the learner to determine the purpose of the practice session and structure the singing process in an organized and systematic manner. For instance, when learning a new piece, the student may first practice phrasing and rhythmic elements at a slow tempo, then focus on strengthening timbre and intonation. Through such structured planning, practice becomes purposeful and efficient rather than random. Furthermore, planning helps the learner identify personal strengths and weaknesses—deciding in advance which phrases require repetition or where timbre needs improvement.

Monitoring refers to observing and evaluating one's performance in real time to identify mistakes and areas needing improvement. At this stage, learners can use video recordings, metronomes, audio-recording applications, and interactive musical platforms. For example, by reviewing their own vocal performance on video, a learner can detect rhythmic inconsistencies in phrasing, intonational deviations, or issues related to timbral clarity. Through this process, the student gains the ability to independently identify errors without relying solely on external supervision.

Reflection involves analyzing the results of practice, evaluating strengths and weaknesses, and planning subsequent sessions based on these observations. For example, if the singing lacks expressive melodic shaping, the learner may internally sing each phrase first, then practice it slowly, and finally integrate it into the complete performance. During this stage, the student consciously develops rhythmic stability, timbral accuracy, and the artistic elements of phrasing.

Through metacognitive strategies, the development of singing skills becomes not intuitive or accidental but consciously regulated and systematically structured. This approach equips future music educators with essential abilities such as independent thinking, analytical evaluation of mistakes, and conscious control over the performance process. As a result, the learner not only improves technically but also deepens artistic and aesthetic expression, enriches creative interpretation, and strengthens pedagogical competence.

Example: When a student learns a new folk song, they may begin by planning: first practicing each phrase separately, checking timbre and pitch accuracy through video recordings, and then integrating the entire song at a slow tempo. During the monitoring stage, rhythmic and intonational errors are identified and corrected. In the reflection stage, expressive and aesthetic elements of the performance are analyzed, and the next practice session is planned accordingly.

Thus, metacognitive strategies constitute the theoretical and methodological foundation for the development of singing skills and serve as an important tool in the professional preparation of future music educators.

Methodology for developing technical and artistic vocal skills through metacognitive strategies and it tools. The development of technical and artistic vocal skills is one of the key ways for future music educators to systematically and consciously enhance their performance mastery [4]. In this process, metacognitive strategies—planning, monitoring, and reflection—together with modern IT tools (video recordings, metronomes, interactive music applications, and virtual platforms) enable learners to manage their performance in a conscious and precise manner.

Development of technical vocal skills. Technical exercises allow learners to improve voice control, finger coordination, breath management, and phrasing accuracy. For example, when learning a new folk song, a student can record their performance using video, identify mistakes in finger positioning or timbre, and practice rhythmic exercises with a metronome to check speed and stability. Interactive music programs allow the analysis of intonational errors in phrasing, as well as

adjustments to rhythm and timbre. In this way, technical skills are developed not only automatically but consciously.

Development of artistic and phrasing skills. Artistic vocal skills involve phrasing, timbre, pitch, and the creative interpretation of expression. Using metacognitive strategies, the learner can actively control the singing process by analyzing phrases, identifying rhythmic and pitch errors, and correcting them. For example, if a rhythmic inaccuracy is detected in phrasing, the student practices the phrases slowly, checks timbre clarity via video recording, and consciously develops pitch accuracy and emotional expression.

Conscious development of timbre, intonation, and expression in singing. Metacognitive approaches and IT tools play a significant role in refining the artistic aspects of singing. The student can record their performance, analyze timbre, check intonation, and enhance the expressive elements in phrasing. For example, if intonation is not precise enough, the student first practices internally, adjusts timbre and pitch, and then gradually integrates the phrases into the full performance. This ensures that singing becomes both expressive and creative.

Theoretical conclusions. Integrating metacognitive strategies with modern IT tools is an effective method for strengthening technical and artistic vocal skills. This approach allows the learner to:

- Consciously manage their performance;
- Independently identify and correct errors;
- Perfect phrasing, timbre, and intonation;
- Deepen creative interpretation and expressive abilities.

For instance, a student may identify phrasing and timbre errors using video recording, improve rhythm with a metronome, adjust intonation through an interactive program, and then integrate all elements into the full performance. In this way, the student consciously develops both technical and artistic skills, organizes independent practice effectively, and enhances pedagogical competence.

Enhancing the effectiveness of independent practice and reflection. Improving independent practice and reflection is a crucial tool for future music educators to consciously develop performance skills [5]. This process allows learners to control performance, identify and correct technical and artistic errors, and shape creative expression.

- **Pre-Practice Planning and Goal Setting:** Each independent practice session should begin with a clear objective. The student defines the purpose of the practice and plans the sequence of exercises. For example, when learning a new piece on the dutor or another instrument, the student first practices rhythmic phrases slowly, strengthens technical aspects (finger positioning, plucking technique), and finally integrates the phrases into the complete performance. This ensures that the practice is goal-oriented, structured, and effective.
- **Monitoring Performance and Identifying Errors:** During practice, the student monitors their own performance using video recordings, metronomes, or audio playback. For instance, if rhythmic inconsistencies, timbral deficiencies, or pitch errors are detected, the student practices those sections separately, slows down the tempo, and coordinates technical and artistic elements. This process teaches the student to independently identify errors without relying on external supervision. Video recording also allows the learner to analyze timbre, intonation, and phrasing for improvement.
- **Post-Practice Reflection and Planning Future Sessions:** Reflection begins after practice. The learner analyzes performance, identifies the causes of errors, and updates the plan for the next practice session. For example, if pitch expression is insufficient, the student first practices internally, then slowly integrates phrases, and consciously shapes emotional and dramatic expression. For pieces requiring fast phrasing, the student initially practices in parts, analyzes rhythm and timbre, and then integrates the sections into the full performance. In this way, performance is improved not only technically but also artistically and aesthetically.

Theoretical conclusions: Using metacognitive strategies enhances the effectiveness of independent practice and reflection, which:

- Develops the learner’s ability to consciously manage performance;

- Cultivates skills for independently identifying and correcting errors;
- Improves timbre, rhythm, phrasing, and artistic expression in singing and instrumental performance;
- Deepens the pedagogical competence of future music educators;
- Enhances the quality of independent practice and develops creative expression.

For example, a student may identify timbre and rhythmic errors through video recording, practice phrases slowly, and then integrate them into the full performance. In this way, independent practice is organized effectively, and conscious control over performance is cultivated.

Conclusion

Developing singing skills through metacognitive strategies—planning, monitoring, and reflection—combined with modern IT tools transforms the learner into an active, conscious, and independent participant in performance. This process enables the student not only to identify technical, rhythmic, and phrasing errors but also to consciously control timbre, intonation, and artistic expression. Additionally, the learner systematically analyzes their performance and plans subsequent practice sessions in a goal-oriented manner.

For example, if rhythmic inaccuracies are detected during singing, the student practices slowly using video recordings or a metronome, strengthens rhythmic stability, and integrates phrasing into the full performance. Similarly, if deficiencies in timbre or intonation are observed, the learner first practices phrases internally, then performs them slowly, and finally integrates them into the entire piece.

As an additional example, in songs requiring rapid phrasing, the student practices in sections, checks each phrase via video recording, and refines intonation, timbre, pitch, and rhythm. In this way, the learner acquires the skills to organize independent practice effectively, identify errors autonomously, and deepen creative interpretation.

Furthermore, integrating the metacognitive approach with IT tools allows learners to enhance creative expression and consciously develop the artistic nuances of singing. For instance, while performing, the student enriches the emotional quality of pitch, refines phrasing in a dramatic and aesthetic manner, and simultaneously minimizes technical errors.

Overall, developing singing skills through metacognitive strategies and modern IT tools deepens the pedagogical and musical competencies of future music educators, increases the effectiveness of independent practice, and significantly improves the quality of singing and music education processes. This approach provides a modern methodological tool to innovatively and effectively enhance both performance and educational practices.

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Rezyume: *Ushbu maqolada o‘quvchilarning kuylash mahoratini rivojlantirishda metakognitiv strategiyalar va zamonaviy IT vositalaridan foydalanish imkoniyatlari ilmiy asosda yoritilgan. Tadqiqotda o‘quvchining ijro jarayonini ongli boshqarishi, ovoz tembrini, intonatsiya va frazalash xatolarini aniqlashi, tahlil qilishi va keyingi mashqlarni rejalashtirishda metakognitiv strategiyalar – rejalashtirish, monitoring va refleksiya – qanday qo‘llanilishi ochib beriladi. Shu bilan birga, videoyozuvlar, metronomlar, interaktiv musiqiy dasturlar va virtual platformalar yordamida kuylash mashqlarini samarali rivojlantirish metodikasi taqdim etilgan. Tadqiqot*

natijalari shuni ko‘rsatadiki, metakognitiv yondashuv va IT vositalarini uyg‘unlashtirish orqali o‘quvchilar kuylash mahoratini ongli rivojlantiradi, mustaqil mashg‘ulotlarni samarali tashkil etadi va ijodiy ifodani chuqur shakllantiradi.

Резюме: *В данной статье научно раскрыты возможности использования метакогнитивных стратегий и современных ИТ-средств для развития навыков пения у учащихся. В исследовании показано, как метакогнитивные стратегии – планирование, мониторинг и рефлексия – применяются для осознанного управления процессом исполнения, выявления и анализа ошибок в тембре голоса, интонации и фразировке, а также для планирования последующих упражнений. Кроме того, представлен методический подход к эффективному развитию навыков пения с использованием видеозаписей, метрономов, интерактивных музыкальных программ и виртуальных платформ. Результаты исследования показывают, что сочетание метакогнитивного подхода и ИТ-инструментов позволяет учащимся осознанно развивать вокальные навыки, эффективно организовывать самостоятельные занятия и глубоко формировать творческое выражение.*

Kalit so‘zlar: *Metakognitiv strategiyalar, Kuylash mahorati, Musiqiy tafakkur, Refleksiya, Monitoring, Texnik ovoz ko‘nikmalari, Ritm va frazalash, Mustaqil mashg‘ulot, Zamonaviy IT vositalari, Pedagogik kompetensiya*

Ключевые слова: *Метакогнитивные стратегии, Навыки пения, Музыкальное мышление, Рефлексия, Мониторинг, Технические вокальные навыки, Ритм и фразировка, Самостоятельные занятия, Современные ИТ-инструменты, Педагогическая компетенция*

THE WORK OF AJINIYAZ AND UZBEK LITERATURE

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Summary. *This article examines the work of the renowned Karakalpak poet Ajiniyaz, exploring the influence of Uzbek literature on Ajiniyaz's work, the world of characters, and Navoi's traditions in the poet's work.*

Keywords: *Navoi, literary influence, image, flower, nightingale, homeland, social, nation, freedom.*

As with all Turkic peoples, social phenomena that occurred in society at the end of the 19th and beginning of the 20th centuries left their mark on Karakalpak literature. Especially when studying Karakalpak literature of the 19th century, it is necessary to take into account historical, social, economic, and cultural phenomena.

From the second half of the 18th century, the Karakalpaks became closely connected with the culture, political, and economic life of Central Asia, in particular, Khorezm. This, in turn, led to the convergence of cultures and the strengthening of literary influence. It became a tradition to be inspired by the classics of Eastern literature, to follow them, and to consider them one's mentor. In the works of Berdakh and Ajiniyaz, there are instances of referring to the works of Navoi, Fuzuli, Mashrab, Makhtumkuli, or frequently mentioning their names in their own works:

Thousands of scholars have passed away,
A heartless tyrant struck hearts,
Fuzuli, Ferdowsi known to the world,
They too have passed, O mortal, through you.

As you read Ajiniyaz's works, you can see that Navoi made extensive use of characters such as Farhad and Shirin, Layli and Majnun, Zulaikha, Hotam toy, Horun ar-Rashid:

There are women and daughters with arched eyebrows,
When I compare his face, he is the sun of the world,
Those who see him are astonished,
There are hurs like Layla and Zulaikha. (Bordur)

Because the images of Layla and Majnun, Farhad and Shirin rose to artistic heights in Navoi's work, they served as a source of inspiration and an artistic garment of feelings for all Turkic-speaking creators who lived after Navoi:

Allah has guided us this way,
Don't blame anyone,
Going out into the desert like Majnun,
I remained in tears. (Inside the field)

Certainly, Ajniyaz was intimately familiar with many of Alisher Navoi's works. This is even more evident in his poems. The poet also writes that in some of his poems he read Navoi's works "Farhad and Shirin," "Layli and Majnun," and "Saddi Iskandari." For example, in the poem "Armonli dunyo":

Like Layli, you set me aflame with love,
You made me Majnun in this world of longing.

- referring to Alisher Navoi's epic "Layli and Majnun," in the poem "Bordur":

Like Alexander the Great in power and glory,
Like Prophet Solomon in authority and command.

- and also pays great attention to the image of Iskandar written by Navoi. In addition, in Alisher Navoi's prose, there are several stories about "Rich Qarun" and "Luqman the Wise." These stories have reached us based on Navoi's manuscripts. Information about them is given in Ajiniyaz's poems. For example:

The World Collected Karun,

Being the owner of the world alone,
The earth swallowed them too one day,
The dungeon world was devoid of rabbits.
Or:
Qarun's eyes were never satiated with worldly possessions,
Luqman the Wise did not die for a thousand years.

- If we know that Alisher Navoi's famous heroes, the greedy rich Qorun, whose eyes were never satisfied with the world, were satisfied with only earth at the end, we see that Luqman the Wise, who did good to people, has been living for several thousand years.

Undoubtedly, Ajiniyaz introduced these images into Karakalpak literature under the influence of Navoi. That is why Ajiniyaz learned from Navoi and knew him as his teacher.

In 19th-century Uzbek literature, the essence of classical literary images was renewed in new enlightenment and Jadid poetry. In Furkat's mukhammas with the radif "Boldi" in Avloni's ghazals with the radif "Gul", "Bulbul" the lover, the beloved, and the rival representing the content of flower, nightingale, choir (thorn) in classical poetry were interpreted in the meanings of pure social nation, freedom and colonizer. Traditional images acquired a completely new meaning. Images began to fulfill the task of illuminating the image of society, the social situation.

It is from this period that the didactic spirit prevails in Karakalpak literature. For example, Berdaq's "For the people", "Better", "Who will say", "When will you enjoy?" and Ajiniyaz's "Need", "Advice" and "Would it be" belong to this spirit and became popular among the people. These same images in Karakalpak literature also served to reflect complaints about events occurring in society, injustice, and unfairness.

Gardens where the nightingale laments,
The lover weeps without cease,
Crows and ravens roaming the sky,
Know not the value of a flower.

In the process of depicting their feelings by wrapping them in symbols, the artist creates a unique form of artistry. Along with the fact that the symbol creates the highest form of artistic poetics, it also expresses the artistic goal of the creator in a unique way.

My homeland is bereft of its people,
From its gardens, the nightingale has fled and the crow has perched,
Ziyvar says, it's a lie that I came into this world,
I never knew a time without worry.

In Uzbek national revival literature, the images of the rose and nightingale in our classical poetry are one of the most frequently used images. It would not be an exaggeration to say that the renewal of the poetic nature of these images began with the lyrics of Furqat. This is confirmed by the fact that these traditional images have acquired a social meaning in these lines of the mukhammas with the radif "Boldi":

The spring season has passed, neither flower, cypress, nor jasmine remains,
Where nightingale and turtledove once were, now only crows and ravens remain,
The blood-red tulip, without drinking the cup of death, is left enshrouded,
No trace of meadows remains, only thorns are left behind,
From the wind of death's winter, all has turned to autumn.

Here, the poem is entirely formed on the basis of the symbolism of images.

The expression "Spring has passed" expresses a full social meaning. "Spring Festival" is actually a happy moment when people lived freely and independently. Through the figurative image, it is interpreted that these blessed days have passed, and misfortunes have befallen the nation. As can be seen, spring is also one of the images with a new social meaning here. According to Professor Nurboy Jabborov, who conducted significant research on the poet's work, "Spring" is a symbol of development. According to the poet, it has already passed. That's why the nightingale and dove were replaced by the crows. The images of the nightingale and the turtledove represent national statehood, while the crow represents the image of colonizers. Through the line "No trace of meadows remains,

save for the thorns" the author indicates that the Russian colony occupied the place of national statehood. The darkness of death is a symbol of tyranny. He turned all existence into dust. Consequently, due to tyranny, the Homeland and nation faced tragedy, national traditions were trampled, and the rights and freedoms of the people were violated [Jabborov, 2004:28]. The renewal of these images, which laid the foundation in Furqat's lyrics, was further refined in Jadid poetry. This is especially evident in the poetry of Abdulla Avloni.

It is observed that Ajiniyaz, in turn, along with the effective use of images from classical literature, renewed the essence of traditional images. By this time, the images actively used in classical poetry began to acquire a completely new meaning. Images began to serve to illuminate the image of society, the misfortunes that befell the Homeland and nation, and the social situation. Now they began to express a new meaning, different from the classical traditions.

In conclusion, it should be noted that the role of Ajiniyaz's work in the substantive renewal of 19th-century Karakalpak literature, its artistic rise, as well as the synthesis of folklore and world literary traditions at one point, is of particular importance. With his works, Ajiniyaz was able to reflect the spiritual world of the Karakalpak people and the artistic image of the era to which he belonged.

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Rezyume: *Ushbu maqolada atoqli qoraqalpoq shoiri Ajiniyoz ijodi o‘rganilgan bo‘lib, Ajiniyoz ijodiga o‘zbek adabiyotining ta’siri, obrazlar olami va shoir ijodida Navoiy an’analari masalasi tadqiq qilingan.*

Резюме: *В данной статье исследовано творчество выдающегося каракалпакского поэта Ажиниёза, рассмотрено влияние узбекской литературы на его творчество, анализирован мир образов и вопрос традиций Навои в поэтическом наследии поэта.*

Kalit so‘zlar: *Navoiy, adabiy ta’sir, obraz, gul, bulbul, vatan, ijtimoiy, millat, ozodlik.*

Ключевые слова: *Навои, литературное влияние, образ, роза, соловей, родина, социальное, нация, свобода.*

THE SEMANTIC NATURE OF SOMATIC PHRASEOLOGISMS IN THE UZBEK AND KARAKALPAK LANGUAGES

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Summary: *In this article, the phraseological units in the Explanatory Dictionary of the Uzbek Language and their semantic and grammatical structure are analyzed*

Key words: *Phraseological units, phraseme, phraseological homonymy, phraseological synonymy, phraseological antonymy.*

Phraseology (from the Greek phrasis — expression, logos — teaching) is a branch of linguistics that studies linguistic units consisting of several independent lexemes combined together to form figurative meanings. Phraseology emerged as an independent field within linguistics, branching from lexicology in the 1950s.

The formation and establishment of phraseology as a separate linguistic discipline owes much to V. V. Vinogradov, who made significant contributions to the field. During the Soviet era, the study of phraseology in the languages of colonized nations developed largely based on his theories.

Other notable scholars such as A. Shakhmatov, A. Yefimov, and N. Shanskiy also contributed to the field. In Uzbek linguistics, distinguished scholars such as Sh. Rakhmatullayev, Y. Pinkhasov, M. Husainov, I. Qo‘chqortoyev, and B. Yo‘ldoshev played an important role in the development of national phraseological studies.

The systematic and scientific study of Uzbek phraseology is closely associated with Shavkat Rakhmatullayev, whose numerous works laid the foundation of modern Uzbek phraseology. Among his most important works are:

“Explanatory Phraseological Dictionary of the Uzbek Language” (Tashkent, 1978)

“A Brief Phraseological Dictionary of the Uzbek Language” (Tashkent, 1964)

“Some Issues of Uzbek Phraseology” (Tashkent, 1966)

“Modern Uzbek Language” (Tashkent, 1957)

“Main Semantic Types of Phraseological Units” (Tashkent, 1955)

A phraseme or phraseological unit consists of two or more words that form a figurative meaning when used together. In a sentence, such expressions act as a single syntactic unit—stable in structure, ready for use, and rich in imagery. The proper use of phraseological units enhances the expressiveness and aesthetic value of speech. In context, phraseological expressions typically answer a single question and function as one syntactic element.

Phraseological Homonymy

Phraseological homonymy refers to expressions that share the same structure but express different meanings. Although homonymous words are common in language, homonymous idioms occur less frequently.

Examples include:
Boshiga ko‘tarmoq I – “to make noise”: Uyni boshiga ko‘targan bolalar tinchib qolishdi.
Boshiga ko‘tarmoq II – “to honor”: Har doim sizni boshiga ko‘taradi.
Similarly:
Og‘ziga olmoq I – “to drink”
Og‘ziga olmoq II – “to mention, to talk about”

Ko‘z yummoq I – “to die”
Ko‘z yummoq II – “to ignore, to give up”

Phraseological Synonymy

Synonymy, or similarity of meaning, is also characteristic of phraseological units. Different idioms that convey similar meanings are considered phraseological synonyms**.**

Examples include:

Kayfi buzuq – moody person.

Phraseological synonyms may also correspond to single words:

Tomdan tarasha tushganday – suddenly;
Og‘zi qulog‘ida – happy;
Joni chiqmoq – to get angry;
Ta’bi xira – unhappy.

Synonymy is one of the micro-semantic systems within language, observed not only among lexemes and morphemes but also among idioms. Two idioms can be called synonymous only if they share the same meaning, though they may differ slightly in emotional or stylistic nuance.

For instance:

Yer bilan yakson bo‘lmoq – kuli ko‘kka sovurmoq both mean “to destroy completely”, but the second conveys a stronger sense of intensity**.**

Similarly, **ko‘ngli bo‘sh** and **ko‘ngli yumshoq** are synonymous, both meaning “kind-hearted, soft-hearted”, though the first emphasizes sentimentality, while the second emphasizes compassion**.**

Thus, phraseological synonymy often involves slight differences in imagery or emotional coloring, reflecting the richness of expression within a language.

Phraseological Antonymy

Phraseological antonymy refers to idiomatic expressions that convey opposite meanings**.**

Examples include: Ko‘kka ko‘tarmoq – yerga urmoq; yuzi yorug‘ – yuzi shuvut; ko‘ngli joyiga tushmoq – yuragiga g‘ulg‘ula tushmoq.

Idioms are widely used in both spoken and literary styles. They often function as equivalents of single words or simple word combinations, such as:

Qo‘li uzun – smart;
O‘pkasi yo‘q – hurried;
Tarvuzi qo‘ltig‘idan tushdi – become depressed, etc.

The phenomenon of idioms in language is based on figurative meaning, often describing actions or situations in non-literal, imaginative ways.

Examples of Uzbek Phraseological Units

Adabini berdi – punished him according ti his deeds;
Avzoyi buzilmoq – to get angry**;**

In conclusion, phraseological expressions reflect the national spirit, cultural thinking, and historical experience of every nation. They are stable units of speech that often differ in meaning from the literal sense of their components and serve as a vivid system of figurative expression. Phraseological units enhance the semantic richness and stylistic diversity of language, adding imagery and emotional depth to speech. Semantically, a phraseological unit functions as a single whole, where individual words, although grammatically independent, contribute to a unified meaning.

Studying the semantic and grammatical structure of phraseological units is crucial in linguistics, as it allows for deeper understanding of national mentality, speech culture, and linguistic identity. Phraseology thus represents one of the most complex yet fascinating layers of the lexical system—an inseparable part of both national culture and linguistic wealth

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Rezyume: *In this article, the phraseological units in the Explanatory Dictionary of the Uzbek Language and their semantic and grammatical structure are analyzed.*

Резюме: *Данная ситуация классифицируется в источниках как отдельний слой и группа ассимилированних слова.*

Kalit so‘zlar: *Frazeologik birliklar, frazema,frazeologik omonimiya, frazeologik sinonimiya, frazeologik antonimiya.*

Ключевие слова*: лексикография, общественніе связи, новіе слова, современная лексика, язік и культура, наука и техника, нанотехнологии, глобальній вопрос, энциклопедический словарь.*

SOCIO-POLITICAL FOUNDATIONS OF RELIGIOUS TOLERANCE IN UZBEKISTAN

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Summary: *In the article "Socio-political foundations of religious tolerance in Uzbekistan" the opinions, idea and concepts reflecting the scientific analysis of these judgments are provided.*

Keywords: *Zoroastrianism, Buddhism, Christianity, Judaism, Islam, faith, international consent, religions tolerance, extremism, fanaticism, fundamentalism, terrorism, missionary work, proselytism.*

As it is known from stories, on the territory of Central Asia since the most ancient times followers of various religions, such as Zoroastrianism, the Buddhism, Christianity, a Manicheism, Islam have lived in peace. In turn, in the cities of the region which were considered as the main cultural centers mosques, churches, synagogues worked. In these religions institutions representatives of the corresponding religions carried out the ceremonies, they served as the centers of development of religious thoughts. It should be noted that in the course of establishing independence by Uzbekistan and further strengthening bases for stable development there were no interreligions contradictions or conflicts on a religious basis. As the President of the Republic of Uzbekistan Sh.M.Mirziyoyev claimed: "Our country is a multi-ethnic and multi-confessional state. Today, representatives of more than 130 nations and nationalities live in peace and harmony in our country, like children of one family. Undoubtedly, the traditions of tolerance inherent in our people play an important role in this" [1,3]. In turn Uzbekistan is a striking example for manifestation of tolerance in relation to all religions and ensuring harmonious existence and salutary interfaith cooperation.

Tolerance takes an important place in providing peace and harmony between citizens, and determining of the purposes of stable development in all states. The cultural diversity, manifestation of religions and ethnic tolerance is conventional which has deep roots in our region and are considered as an inseparable part of our spiritual culture. It should be noted that on the territory of Uzbekistan since ancient times there lived peoples with various cultural, language groups, adhering different religious views. In particular, passing through the territory of Uzbekistan of the Great Silk Road connecting civilizations of the West and the East gave the chance of establishment for cultural ties on world level. In turn, the culture and customs of indigenous peoples of Uzbekistan well influenced on the development of spiritual culture of other people, religions and ethnic groups. As a result this factor formed a basis for formation of religious tolerance which deeply rooted in the culture and mentality of the region's population. The majority of world religions reflect in the essence of such idea's as virtue, peace, friendship, consent and creation. Religions call people for purity, humility, mercy, friendship and tolerance. In particular, Muslim and Christian religions comprise universal values and call for mercy, boldness, equal address to people regardless of their views, language and origin. Long since the religion is considered the most effective instrument of influence on the minds of people, and the society directly in this or that course. Religious doctrines, as it is known on the historical facts, in most cases they fruitfully influenced on cultural and spiritual life of the society and by that strengthened belief in god in the hearts of people.

Thus, they helped people to overcome tests, problems and difficulties which were found in their course of life. Since gaining independence by the Republic of Uzbekistan, on an equal basis, there have been fundamental changes in all spheres of public life including the spiritual life of the Uzbek society. As a result of the deep reforms realized in the country including the relation of society and people to the freedom of worship and religions, to religion, in general, changed. Today in the Republic all conditions are created in order that representatives of different religions freely carried out their rights to religion.

At the initiative of the President of Uzbekistan Sh.Mirziyoyev, measures have been implemented today aimed at strengthening spiritual education by ensuring peace and harmony in society, solidarity and tolerance between nations and religious groups, and vaccinating young people

with the vaccine of tolerance. It should be noted that Uzbekistan is the multi-religious country, today in the republic there are religious institutions relating to 16 faiths[2,1].

In turn, in the country all conditions for free implementation of the activity of religious institutions and their active participation in public life are created. Relying on these principles, a separate attention is paid to preservation of values of various religious groups. As a proof for it there can serve the free activity of the numerous national cultural centers. On 16 November 1995 in Paris, on 28th session of UN member countries of the UN concerning education, science and culture "the Declaration of the Principles of Tolerance" was adopted. In article 1 of this declaration the concept of tolerance is described as "respect, acceptance and understanding of various ways of expression of rich cultures of our world and demonstration of identity of a person"[3,91].

The idea of tolerance in essence means cohabitation of people – adherence to various religious doctrines and views in the unique homeland, and their cooperation on the way of implementation of high ideas and purposes. Today this idea designates mutual cooperation not only adherents to religious trends, but also all members of society. In Uzbekistan the principles of equal relation to all religions and their adherents are fixed. In the years of independence in the republic important achievements in this direction are accomplished. In particular, public authorities carried out a number of positive measures in providing an interreligious consent. Today the freedom of worship and a religious denomination, the right of citizens to confession of any religion or not confession of any religions look is completely provided and fixed in Uzbekistan's legislation. This circumstance is equitable completely to the interests of citizens of the multinational and multireligious country; it should be noted, Uzbekistan saved up rather rich and useful experience in streamlining of the public relations in this direction.

Along with other practical results it is possible to mention that in the republic such events as the International Congress of interreligious dialogue on the subject "World Religions on the Way to Peace and Culture" with the assistance of UNESCO, and the International Christian and Muslim conference "Under One Sky" together with Muslim and Christian religious figures were held. In the course of these actions the 125th anniversary of Russian Orthodox Church, the 130th anniversary of the Tashkent and Central Asian diocese, the 100th anniversary of Evangliy-Lyuteran society, the 100th anniversary of the Roman Catholic Church, the 100th anniversary of the Armenian Apostolic Church, acting in the country were widely celebrated. Since 1998 in the country the seminaries of Tashkent Orthodox and Samarkand Protestant churches have been working. In the days of independence along with all spheres of public life big positive changes in cultural and religious life of Uzbekistan are outlined. For a past short time in the country there were constructed a large number of mosques, churches, synagogues and other religious institutions were newly built. It is possible to mention, in particular, new orthodox churches in Tashkent Samarkand, Navoiy, for example, the Catholic church in Tashkent, the Armenian Apostolic Church in Samarkand, the Buddhist monastery in Tashkent.

These and other measures in this direction have promoted to strengthening the atmosphere of peace and harmony, harmonious coexistence of different religions and ensuring tolerance among citizens of the country. It is important that toleration and an international consent, providing peace and stability are an important component of national idea of the country – "The free and well- planned country, its peace and stable life". Reforms and innovations in the field of promotion of toleration and interfaith dialogue are reflected in the policy of the government. On 12 February 2008 in the international seminar on the subject: "Experience of Uzbekistan in Ensuring Interfaith Harmony" was held in Belgium, the professor of Catholic University of Leuven, Yu. Jansen noted: "Uzbekistan can serve as an example for many other countries on preservation and development of the atmosphere of tolerance and toleration"[4,2] that is the next recognition of positive results of the works which are carried out in this direction. In the policy of Uzbekistan an important place is taken by providing peace and progress. Representatives of all religions are equally interested in governing the country under the atmosphere of peace, tranquillity, stability and consent. For these noble purposes representatives of the Christian communities in the republican and international spiritual, cultural and

educational centers of Uzbekistan express the approval and all support the reforms which are carried out in the country to ensure religious tolerance and public stability[5,3].

In turn, the Muslim and Christian communities act together with unique ideas and serve for tranquillity, peace, development and prosperity. According to the former archbishop of Tashkent and Central Asia, Ikim Vasily Zakharovich – the metropolitan Vladimir, "Friendly bonds between us are shown in all spheres and as each Orthodox Christian has Muslim friends, and the friendly relations between priests and imams are strong. If we appeal to Muslim friends about the help in the sphere of business or the construction, we will surely receive necessary assistance. We have not any contradictions, but even no misunderstanding" [6,45]. The state promotes to establishments of consensus and mutual respect between the citizens who are professing different religious views, or not practising any religions, and also between all operating religious organizations, resists to the actions directed at incitement of interfaith conflicts, extremism and religions fundamentalism.

It serves directly to creation of the atmosphere of peace, stability and consent, progress, development of spiritual priorities of the society. In Uzbekistan the creation of the political parties and social movements directed at the religious purposes, but the activity of branches and offices of the religious institutions outside the republic isn't allowed. The religious organizations are obliged to follow the current legislation of the republic. Also an unstable social standing, capable to threaten the society and to cause panic, and in all other mercenary purposes directed against society, both a person and the state is strictly forbidden to use religion for promotion of anticonstitutional and antistate ideologies, for incitement of hostility between people and religions communities, violations of tranquillity of citizens and moral foundations of the society.

Activity of the religions organizations, currents and sects concerning terrorism, drug trafficking and organized crime is forbidden. The government of the republic maintains and provides peace and harmony between the religious organizations. The actions directed at propaganda of adherents of one religion to another (proselytism), and also any other types of missionary work are forbidden. Persons, guilty of similar actions, bear the corresponding responsibility specified in the legislation. This circumstance was noted by the archbishop of Tashkents and Central Asian Vladimir (Iky)who said: "Unfortunately, forces trying to use our religions in the mercenary purposes threaten the peace, unity of our people, stability in Central Asia. It is clericalism, proselytism, extremism, quasireligious politicization. These forces distort fundamentals of our religions under Christian, and Muslimmasks. Their purposes are to split society, destabilisation of spiritual life, kindling of interreligions and ethnic contradictions"[7,40].

In the country all conditions for going abroad by representatives of all non-Muslim religious organizations were created, and they use these opportunities widely. As the director of the National Center of Uzbekistan for Human Rights, the chairman of the committee of the Oliy Majlis of the Republic of Uzbekistan on democratic institutes, non-state organizations and self-governing institutions of citizens A.Kh.Saidov claims, that every year more than 150 representatives of non-Muslim religious communities go to pilgrimage to the holy sites in Israel, Greece and Russia [8,57].

Peaceful cohabitation of Muslims and Christians on the Uzbek earth can be considered as a unique and excellent example of interreligions consent and tolerance in relation to all religious. A huge contribution to these processes is made by Tashkent and Central Asian diocese. A person can't live without belief. It has very important symbolical value" today when we firmly go on the way to creation of the democratic state where equal and cultural relations between representatives of all religions reign.

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Rezyume: *“O'zbekistonda diniy bag'rikenglikning ijtimoiy-siyosiy asoslari” maqolasida ushbu masalalarning ilmiy tahlilini aks ettiruvchi fikr, g’oya va tushunchalar berilgan.*

Резюме: *В статье “Социально-политические основы религиозной толерантности в Узбекистане” приводятся мнения, идеи и концепции, отражающие научный анализ этих суждений.*

Kalit so'zlar: *Zardushtiylik, Buddizm, Nasroniylik, Iudaizm, Islom, e’tiqod, xalqaro hamkorlik, dinlar bag'rikenglik, ekstremizm, aqidaparastlik, fundamentalizm, terrorizm, missionerlik, prozelitizm.*

Ключевые слова: *Зороастризм, буддизм, христианство, иудаизм, ислам, вера, международное согласие, толерантность, экстремизм, фанатизм, фундаментализм, терроризм, миссионерство, прозелитизм.*

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CHARACTER SYSTEM IN D. AITMURATOV'S COMEDY "IN THE WORLD OF FOOLISHNESS

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Summary: *The article examines the ideological themes, genre features, problematics, and character systems of dramatic works that emerged in Karakalpak dramaturgy in the 1970s-1980s based on Daulen Aytmuratov's comedy "Aqmaqlıq dúnyasında" (In the World of Foolishness) and draws relevant conclusions. Thus, in the works of this period, the main idea is the individual, their place in society, their relationship to family, parents, traditions, and customs, as well as moral issues such as bribery and extortion, which were demonstrated through examples.*

Key words: *image, genre, drama, composition, character*

Currently, in our country, the study of Karakalpak dramaturgy issues: the ideological and thematic directions of dramas created and staged in this genre, their genre specifics, the skill of playwrights in transforming folklore works, and the general artistic aspects of dramaturgy are considered urgent tasks. On this basis, we considered it important to dwell on the stages of formation of dramaturgy in our national literature.

In Karakalpak literature, the dramatic genre was born in the mid-1920s. K. Auezov's "Tilek jolında" (On the Path of Wishes) (1925), S. Majitov's "Ernazar Alako'z" (1926), "Sońǵı selteń", "Bagdagul," "Gulim-Tayman," and M. Daribaev's dramatic works "Koklen Batir," "Arman," "Jańa adamlar" (New Comers), "Garip Ashiq," "Dawletyar," "Edige," and "Altın júzik" (Golden Ring) played a significant role in the development of our literature.

Karakalpak dramaturgy embarked on a path of significant development between the second half of the 1940s and the 1950s. During these years, S. Xo'janiyozov, J. Aymurzayev, and T. Seytjanov worked as prolific playwrights. During this period, the tradition of creating characters of real heroes, who hold a significant place in the history of the people, based on folk epics, further developed in Karakalpak dramaturgy. In the 70s and 80s of the 20th century, the ideology and themes of works created in Karakalpak dramaturgy improved, genre and formal explorations intensified, and new literary phenomena emerged (explorations in the translation genre, the holding of various congresses and cultural events, the strengthening of interethnic friendship), and through the portrayal of new realistic characters, the wave of freedom began to blow, and with the emergence of new artistic masters, this period became different and more complex than previous eras. Because our playwrights, having deeply studied the works of playwrights from around the world, as well as from the peoples of the former Soviet Union, have written significant works. As a result, Karakalpak dramaturgy acquired works with all their genre, artistic, and ideological characteristics. During these years, dramaturges such as P. Tilegenov's "Conscience" (Hujdan), D. Aytmuratov's "The Liar's Case" (Yalǵanshınıń isi revised in 1972), T. Jumamuratov's "Girls' Jokes" (Qızlar hazily), I.Yusupov's "Ajiniyaz," K.Rahmanov's "Daughter-in-law" (Kelin), "A Guest to the Other World" (O dúnyaǵa mirát) Q. Matmuratov's "Two Lives in One House" (Bir úyde eki ómir), T. Qayipbergenov's "Last name" (Familiya) dramas, comedies, tragedies, librettos, G. Abdulov and G.Bayandiyev's adaptation of "Karakalpak Girl" (Qaraqalpaq qizi), P. Tilegenov's "Begjap Tragedy" I.Yusupov and A. Shamuratov's historical drama "Forty Girls" (Qirq qiz) I.Yusupov's lyrical drama "The Actress's Fortune" (Aktrisanıń igbali) and the creation of the opera "Ajiniyaz" became significant events in the history of culture [1].

From the late 19th and early 20th centuries, the comedy genre rapidly formed and developed in the literature of all peoples of the world. In particular, comedies in the style of European literature appeared in Uzbek literature in the 20th century. Creative figures such as Hamza, Abdulla Qahhor,

Said Ahmad, Erkin Vohidov, and Sharof Boshbekov made significant contributions to the development of this genre. Comedies such as "Maysaraning ishi"(Maysara's work) "Tobutdan tovush" (Sound from the coffin), "Kelinlar qo'zg'oloni"(Brides' Revolt) "Oltin devor" (Golden Wall) and "Temir xotin"(Iron woman) are constantly staged. The comedy genre began to take shape in Karakalpak literature in the mid-20th century. While S. Khojaniyazov, J. Aymurzaev, T. Jumamuratov, and D. Aytmuratov were successful writers in this genre in the 1960s and 70s, in later periods, we can mention K. Rahmanov, O. Abdurahmanov, M. Nizanov, Q. Matmuratov, S.Jumag'ulov, and other playwrights. Among these creators is the prominent playwright Daulen Aitmuratov, whose famous comedy "Aqmaqliq dunyasinda" (In the World of Foolishness) stands out from other comedies with its thematic and plot distinctiveness. Aytmuratov's play "Aqmaqliq dunyasinda" (In the World of Foolishness) is the most famous of his comedies. The peculiarity of comedy lies in the fact that it does not have the usual artificial, outdated plot. The work is distinguished by its genre novelty, original characters, and artistic dramatic characteristics.

The characters in D. Aytmuratov's comedy "In the World of Foolishness" [2] are distinguished primarily by their realistic portrayal, lively character, and multifaceted nature. Each of them has their own unique character and behavior. The author has succeeded in creating new characters rather than familiar images that have long existed in literature. Therefore, the comedy lacks characters like the mullah, the tyrannical father, the crying girl, and the witch-in-law. All the characters in the comedy are from that era, from real life. Moreover, each of them is unique in their way of life and thoughts. The author's purpose in writing this comedy was to portray, in a humorous and satirical style, the widespread prevalence of bribery, corruption, and fraud in society during the 1980s, without directly exposing it.

The comedy depicts the experiences of the main character, Pirqaqqan Oraqov, and the characters surrounding him. Through these characters and their inappropriate actions, the main idea and theme of the work are revealed. This is the main achievement of the comedy. That is, its main theme is humanity and careerism. A person's human qualities are compared with the feelings and experiences they have after taking office. The stage life depicted in it is very close to real-life events. The playwright sharply criticizes the policies of that era, such as pushing aside the advancements in technology and science, rejecting the remnants of the past and supporting the deeply rooted brotherhood. Through this, the author intends to explain the idea of the comedy - that in human life, one should achieve happiness only through honest work and human qualities.

Another characteristic of comedy is that its storyline is structured not according to typical stage actions, but according to the characters' inner nature, revealing their inappropriate traits. For example, the director of a state farm named Berdan pleads with the leaders to advance his position. He will carry out what they say. Here, in the second act, Berdan's inner world is revealed through his monologue. He searches for someone close to Baynazarov Qoshqarbay to please him and eventually finds a distant tribal relationship with his wife. Here, the author reveals the inner character of another character.

From the second act, P. Oraqov begins to rise to the center of the comedy. At that moment, the true face of the people around him, in the village, in the institution, is revealed. People who were previously disgusted to give him water at home now want to bring him to their home as a guest, want to be close with him. Such inappropriate actions by the characters in the comedy evoke involuntary laughter in the reader. The author's main goal is to express their position on such a reality encountered in our daily lives, while simultaneously portraying this crude reality as ridiculous in a disgusting way.

When we look at the ideological and thematic direction of comedy, we see its similarity to dramatic works in other literatures. Scholar B. Tursinov, in his work "Issues of Dramaturgy and Our Theatre," [3] specifically addresses the ideological and figurative similarities between this comedy and Gogol's "The Inspector General." All the mentioned works depict a society that, while seemingly safe from the outside, is rotten internally, sinking into the mire foolishness.

A number of opinions are also presented in the research work of R. Matmuratova [4], who specifically studied the comedy genre. The researcher, in his work, served as a creative school for the author in creating the hero's character in E. Rotterdamskiy's satirical work "The Praise of Folly" and

A. Griboedov's comedy "Горе от ума" (Woe from Wit). In all three works, he sharply exposes the potential shortcomings in society through the sharp language of satire. E. Rotterdamskiy's translation of "The Praise of Folly" into Karakalpak further enhanced the playwright's experience.

The characters in the comedy "In the World of Foolhood" are distinguished primarily by their realistic portrayal, lively character, and multifaceted nature. Each of them has their own unique character and behavior. The author has succeeded in creating new characters rather than familiar images that have long existed in literature. Therefore, the comedy lacks characters like the mullah, the tyrannical father, the crying girl, and the witch-in-law. All the characters in the comedy are from that era, from real life. Moreover, each of them is unique in their way of life and thoughts.

The main character of the comedy, Pirqaqqan Oroqov, is a man who strives to acquire wealth and power through easy means without effort. Ignoring his own mother's advice, even after leaving an orphanage, he considered himself above everyone else. Thanks to some of their acquaintances and their obedient nature, they achieve positions in a short time. After this, he feels like a god and thinks he has the right to do whatever he wants. Even wherever they go, they show outrageous behavior, claiming to eat only female livestock meat and, if possible, to drink rabbit milk. Through this character, the author sarcastically portrays an orphan who has been struggling to make ends meet, having achieved a career and fundamentally changed, causing harm to others due to his illiteracy.

Palwan Dauletmuratov is the former leader of Pirqaqqan. He is a man who profits by exploiting his position and earning the government's money. He dismissed his deputy and searched for a fool who would do whatever he said in his place. At that time, P. Oraqov met him and achieved a position. Although Dauletmuratov was a bad leader, he was portrayed as a wise, self-reliant person.

The comedy also features Edige Qoyboqarov, Qoshqarbay Baynazarov, Ismoil Otegenov, and Erejep Pirlepesov, all of whom are loyal to Dauletmuratov and then to P. Oroqov.

The comedy consists of two parts, and the author titled the parts "The Origin of Folly" and "The West of Folly." This is also a unique style. The first part tells the story of Pirqaqqon's rise to prominence as head of an institution and his emergence, while the second part depicts Pirqaqqon's loss of office and even his death. The author gives this a symbolic name, calling it the west of foolishness. Thus, in the works of many playwrights of the period we have examined, the vices of bribery and fraud were depicted satirically, wrapped in paper. It is known that this method was influenced by the policies of that time. We believe that the timely elevation of such socially significant issues, regardless of genre, to the level of a topic and the creation of works is of paramount importance for the time. The comedy "In the World of Foolishness," which we discussed, became one of the best and most distinctive works of the 80s.

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Rezyume: *Maqolada 1970-1980-yillarda Qoraqalpoq dramaturgiyasida Daulen Aytmuratovning "Aqmoqlik dunyosida" komediyasi asosida paydo bo'lgan dramatik asarlarning mafkuraviy mavzulari, janr xususiyatlari, muammolari va personajlar tizimlari o'rganiladi va tegishli xulosalar chiqariladi. Shunday qilib, bu davr asarlarida asosiy g'oya shaxs, uning jamiyatdagi o'rni, oila, ota-onalar, an'analar va urf-odatlarga munosabati, shuningdek, poraxo'rlik va tovlamachilik kabi axloqiy masalalar bo'lib, ular misollar orqali namoyish etilgan.*

Резюме: *В статье рассматриваются идейные темы, жанровые особенности, проблематика и образная система драматических произведений, сформировавшихся в каракалпакской драматургии 1970–1980-х годов на примере комедии Даулена Айтмуратова «Акмаклык дунясында» («В мире глупости»), и делаются соответствующие выводы. Таким образом, в произведениях этого периода основной темой становится личность, её место в обществе, отношения с семьёй, родителями, традициями и обычаями, а также такие*

нравственные проблемы, как взяточничество и вымогательство, которые раскрываются на примерах.

Kalit so'zlar: *obraz, janr, drama, kompozitsiya, personaj*
Ключевые слова: *образ, жанр, драма, композиция, персонаж*

THE IMPORTANCE OF HISTORICAL DOCUMENTS IN TEACHING HISTORY

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Summary: *Historical sources are of great importance in the study of historical science. Without them, it is impossible to approach history correctly. This article discusses the importance of historical sources in historical science and their analysis.*

Key words: *methodology, principle of visualization in teaching history, classification of documents, dynamics of changes, treatises*

Historical documents play a special role in the study of history. Based on the analysis of the works of historians and scholars of our homeland, the importance of applying historical documents is as follows: historical documents are unique monuments of ancient times and therefore possess credibility and evidence. The document helps to feel the colorfulness of the era, helps to create vivid images of the past, creates conditions for the development of students' imagination, reduces the possibility of modernizing individual events. As a source of historical data, it requires analyzing the composition of the document, summarizing the information obtained from it, and conducting a special assessment. Working with documents teaches thinking, reasoning, and obtaining information. Documents help to assimilate the necessary facts, concepts, laws of social development, and form students' worldview.

The role of historical documents in the study of history is that they are the main source of information that helps to reconstruct past events and understand their content. Through these documents, one can see not only the facts, but also the social, cultural, and political aspects of the period in which they were created.

Written documents play a crucial role in teaching history. Historical sources include all things created by man, the results of his interaction with the environment, objects of material culture, customs, rituals, written monuments. In a broader sense, written records are referred to as documents in methodology.

What is the importance of using historical documents? Through them, the principle of visualization is implemented in teaching history, and students become familiar with the appearance of documents. The document makes the teacher's story lively and clear, and the conclusions convincing. The significance of the document lies in its ability to clarify historical material, create vivid images and portraits of the past, and instill a sense of the spirit of the times.

The classification of documents used in teaching history is much simpler than the one accepted in historical science. Based on the nature of documentary texts, they are all divided into two main groups - narrative-descriptive and act-based documents, which had practical significance in their time. These documents complement each other well.

Documents - legal, economic, political, program documents (documents, laws, decrees, applications, applications, signatures, contracts, statistical and investigative documents, programs, words). Recounting and descriptive documents - chronicles, chronicles, memoirs, letters, travels. Works of oral folk art (myths, parables, songs, winged words) belong to the oral traditions of the ancient world and the history of the Middle Ages.

Documents can be used in history lessons by both teachers and students. If it's difficult for the students, the teacher will retell the document. Students' work with documents is gradually increasing in complexity, depending on their age, knowledge capabilities, and level of preparedness. In the initial stages, the simplest narrative and descriptive materials are used; their volume does not exceed ten to fifteen lines; then the number of analyzed economic and legal documents increases; then political and policy documents become increasingly widespread.

Teaching how to work with a document includes the following stages:

1) a sample of document analysis is provided;

2) students analyze the document under the teacher's guidance;

3) works independently and under the guidance of the teacher;

4) independently studies the document at home.

The teacher introduces the students to the document and explains the content of the assignment. At home, students prepare short reports, descriptions, and creative works based on documents, text, and textbook illustrations. Of course, every student needs a document to work independently.

Working with documents also includes: reading and retelling the document and drawing up a plan for it; reading and explaining it with an introductory and concluding discussion; independently analyzing the document and answering related questions; comparing two documents that describe the same event and complement each other; and critically evaluating the document. In this process, students identify its logically concluded parts and main ideas, and learn to find evidence for one or another situation.

Preparing for the use of primary sources involves their initial selection and pedagogical processing. The more processed the document is, the easier it is for students to accept it and the easier it is for them to work independently.

Students read the document separately, while the teacher explains unusual words and phrases and asks questions to check their understanding of the content: what is the passage about? What is the meaning of this word? How do you understand the meaning of this statement? After that, the document will be re-read and disassembled. Student responses should be comprehensive and complete, and conclusions should be supported by a reference to the document.

In a brief introduction to the lesson, the teacher outlines the tasks for working with such a product. It describes the date of its creation, its goals or motives, and briefly characterizes the situation. Then, they reveal the structure of the work, its main ideas, and discuss its significance in evaluating historical events and phenomena.

Initially, a reading explaining the scientific work in conjunction with a dictionary will be conducted. The teacher asks questions about the text. Then, only the complex text is explained; the rest are studied independently by the students. They search for and characterize the main ideas in the text.

In conclusion, historical documents are the most important source of information in the study of the history of Central Asia. They allow us to create a true picture of the past, understand the causes and consequences of historical events, assess the contribution of the peoples of Central Asia to world civilization, form historical consciousness, and resist the falsification of history. Studying historical documents requires high professionalism from the researcher, critical thinking, and knowledge of various methods of analyzing sources.

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Rezyume: *Tarixiy manbalar tarix fanini o‘rganishda g‘oyat muhim ahamiyatga ega. Ularsiz tarixga to‘g‘ri yondashish mumkin emas. Ushbu maqolada tarix fanida tarixiy manbalarning ahamiyati va ularni tahlil qilish haqida so‘z yuritiladi.*

Резюме: *Исторические источники имеют большое значение в изучении исторической науки. Без них невозможно правильно подойти к истории. В данной статье рассматривается значение исторических источников в исторической науке и их анализ.*

Kalit so‘zlar: *metodika, tarixni o‘qitishda ko‘rgazmalilik tamoyili, hujjatlar tasnifi, o‘zgarishlar dinamikasi, risolalar.*

Ключевые слова: *методика, принцип наглядности в преподавании истории, классификация документов, динамика изменений, трактаты*

METHODICAL IMPROVEMENT OF PERFORMING SKILLS BASED ON METACOGNITIVE STRATEGIES

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Summary: *This article scientifically explores the role of metacognitive strategies in developing performance skills among future music education teachers. The study presents how metacognitive strategies – planning, monitoring, and reflection – are applied in the process of consciously managing performance, identifying errors, analyzing them, and planning subsequent exercises. The results indicate that through a metacognitive approach, future music teachers can consciously enhance their performance skills, effectively organize independent practice, and deeply develop creative expression.*

Key words: *Metacognitive strategies, Performance skills, Musical thinking, Reflection, Monitoring, Technical skills, Rhythm and phrasing, Independent practice, Artistic expression, Pedagogical competence*

Introduction

In music education, the learner's activity and conscious participation are crucial for developing performing skills. Metacognitive strategies—planning, monitoring, and reflection—help learners consciously manage the performance process, identify errors, and analyze them. This approach enables future music educators not only to develop their own performing skills but also to teach students consciously and systematically as pedagogues.

Theoretical foundations of metacognitive strategies in developing performing skills. The theoretical foundations of metacognitive strategies in developing performing skills provide the basis for consciously managing and effectively enhancing learners' performance activities in the music education process. Metacognitive strategies—planning, monitoring, and reflection—allow learners to consciously develop not only technical aspects but also creative and artistic expression. These strategies underpin musical thinking, error identification and correction, mastering rhythm and phrasing, and managing emotional interpretation during performance.

Metacognitive planning is applied at the initial stage of the performance process. For instance, before starting a dutor practice session, a learner sets goals for phrasing, rhythm, timbre, and technical elements. If a student is learning the "Segoh" piece, they might first plan to strengthen the left-hand positions, then align right-hand plucking, and practice phrasing at a slow tempo. In this way, exercises are not random but goal-oriented and systematic.

Metacognitive monitoring ensures that the learner observes their own performance in real time. For example, the student records their performance on video to identify irregularities in timbre, stretched rhythms, or finger placement errors [1]. This process allows the learner to detect and correct errors independently, without relying on external feedback.

Metacognitive reflection involves analyzing errors and evaluating results after performance. For example, when performing the fast-paced "Ufor" piece, if the rhythm and phrasing are not aligned, the learner divides the piece into sections, practices each separately, and then integrates them into the complete performance. Simultaneously, the learner evaluates the emotional tone and expressive quality, learning how to enrich phrases with dramatic and artistic expression.

Thus, the theoretical foundations of metacognitive strategies enable learners to manage the performance process consciously, systematically, and effectively. This approach allows future music educators not only to master performing skills but also to conduct pedagogically sound, conscious, and effective practice sessions for students, while strengthening their own creative and pedagogical competencies.

Methodology for developing technical and artistic skills using metacognitive strategies. In dutor performance, the methodology for developing technical and artistic skills using metacognitive strategies serves to consciously enhance the learner's performance abilities. Technical

skills—finger placement, plucking techniques, coordination of left and right hands, timbre, and rhythmic stability—form the foundation of performance, while artistic skills—phrasing, intonation, emotional expression, and creative interpretation—enrich it [2]. The metacognitive approach allows these processes to be conducted consciously and purposefully.

Before starting a practice session, metacognitive planning helps the learner determine which technical elements to study, the sequence of exercises, and the objectives to achieve. For example, a student learning the "Tanovar" piece may first focus on strengthening left-hand positions, then refine right-hand plucking, and practice phrasing at a slow tempo. This ensures exercises are systematic and goal-oriented, not random.

During practice, metacognitive monitoring allows the learner to observe their performance in real time. By recording their performance on video, the student can identify uneven timbre, finger placement inaccuracies, or stretched rhythms. This process enables independent detection and correction of errors without external supervision. Technical errors can be corrected through slow practice, isolated finger exercises, and repeated plucking techniques.

Metacognitive reflection plays a crucial role in developing artistic skills. For example, when performing the "Dugoh" piece, if phrasing and intonation lack sufficient dramatic or emotional expression, the student first practices phrases internally, then slowly, learning to control tone and dramatic expression. In fast-paced pieces such as "Ufor," if rhythm and phrasing are not synchronized, the student practices in sections and then integrates them into the complete performance. In this way, technical and artistic aspects are developed simultaneously.

The effectiveness of this methodology lies in the learner's ability to practice not merely by repetition but with an understanding of *why* they are practicing. As a result, the learner can consciously identify technical and artistic errors, enrich creative expression, and master dutor performance at a high level. This significantly enhances the performing and pedagogical competencies of future music educators.

Enhancing the effectiveness of independent practice and reflection. Enhancing the effectiveness of independent practice and reflection in future music educators is one of the main methods for systematically and consciously developing performing skills. Independent practice facilitates mastering technical aspects, rhythm, phrasing, and artistic expression, and its effectiveness is directly related to the application of metacognitive strategies.

Before practice, the learner engages in metacognitive planning. For example, in a dutor session, the student identifies which phrases or technical elements to focus on. If learning the "Segoh" piece, they plan to first perfect left-hand positions, then refine right-hand plucking, and practice phrasing at a slow tempo. This ensures systematic and goal-oriented exercises.

During practice, metacognitive monitoring allows real-time observation of performance. Recording the performance enables the student to detect uneven timbre, finger placement inaccuracies, or stretched rhythms [3]. This allows independent detection and correction of errors without external supervision. Techniques for correcting technical errors include slow practice, isolated finger exercises, and repeated plucking techniques.

Metacognitive reflection involves analyzing errors and evaluating results after practice. For example, in fast-paced pieces like "Ufor," the student divides the sections where rhythm and phrasing are unsynchronized, practices them separately, and then integrates them into the complete performance [4]. Simultaneously, they evaluate the emotional tone and artistic expression, learning how to enrich phrases with dramatic and aesthetic interpretation.

By enhancing the effectiveness of independent practice and reflection, future music educators develop their performing skills and gain the ability to conduct conscious and systematic practice sessions for their students. Metacognitive strategies help learners make error detection, analysis, and correction habitual, consciously manage the performance process, enrich creative interpretation, and master dutor performance technically and artistically [5]. Consequently, the effectiveness of independent practice increases, creative expression develops, and the pedagogical competence of future music educators is strengthened.

Conclusion

Developing performing skills based on metacognitive strategies transforms the learner into an active and conscious participant in performance. Through planning, monitoring, and reflection, learners can identify technical, rhythmic, and artistic errors, analyze their causes, and plan subsequent practice sessions effectively.

For example, when rhythmic inconsistencies are detected in phrasing, the student divides phrases, practices slowly, and then integrates them into the full performance. If inconsistencies in left-hand positions occur, the student strengthens string holding and finger placement, refines plucking techniques, and consciously controls each movement. Each technical and artistic element is analyzed, and subsequent practice is planned in a goal-oriented manner.

The learner also consciously manages emotional and artistic aspects of performance through a metacognitive approach. In fast-paced pieces, phrases are first practiced internally, then slowly, allowing the student to develop tonal and dramatic expression consciously. If uneven timbre is detected, microstructural exercises help stabilize tone and integrate it into the full piece.

Metacognitive strategies significantly enhance the effectiveness of independent practice, improve the learner's ability to detect and correct errors, enrich creative interpretation, and ensure mastery of the artistic, rhythmic, and technical aspects of performance. This deepens the pedagogical competence of future music educators and equips them to conduct conscious, systematic, and effective practice sessions for their students.

This approach, as a modern methodological tool, substantially improves the quality of performance and education, fostering independent thinking, conscious decision-making, and artistic expression. It can serve as a core instrument for the professional development and pedagogical effectiveness of future music educators.

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Rezyume: *Ushbu maqolada bo'lajak musiqa ta'limi o'qituvchilarida ijrochilik mahoratini rivojlantirishda metakognitiv strategiyalarning roli ilmiy asosda yoritilgan. Tadqiqotda o'quvchining ijro jarayonini ongli boshqarishi, xatolarni aniqlash, ularni tahlil qilish va keyingi mashqlarni rejalashtirishda metakognitiv strategiyalar – rejalashtirish, monitoring va refleksiya – qanday qo'llanilishi metodik yondashuvlar orqali ochib beriladi. Natijalar shuni ko'rsatadiki, metakognitiv yondashuv orqali bo'lajak musiqa ta'limi o'qituvchilari ijro mahoratini ongli rivojlantiradi, mustaqil mashg'ulotlarni samarali tashkil etadi va ijodiy ifodani chuqur shakllantiradi.*

Резюме: *В данной статье научно обоснована роль метакогнитивных стратегий в развитии исполнительского мастерства у будущих учителей музыкального образования. Исследование раскрывает, как метакогнитивные стратегии – планирование, мониторинг и рефлексия – применяются в процессе осознанного управления исполнительской деятельностью, выявления ошибок, их анализа и планирования последующих упражнений. Результаты показывают, что благодаря метакогнитивному подходу будущие педагоги музыкального образования могут осознанно развивать исполнительское мастерство, эффективно организовывать самостоятельные занятия и глубоко формировать творческое выражение.*

Kalit so'zlar: *Metakognitiv strategiyalar, Ijrochilik mahorati, Musiqiy tafakkur, Refleksiya, Monitoring, Texnik ko'nikmalar, Ritm va frazalash, Mustaqil mashg'ulot, Badiiy ifoda, Pedagogik kompetensiya*

Ключевые слова: *Метакогнитивные стратегии, Исполнительское мастерство, Музыкальное мышление, Рефлексия, Мониторинг, Технические навыки, Ритм и фразировка, Самостоятельные занятия, Художественное выражение, Педагогическая компетентность*

NURBOY JABBOROV'S SCIENTIFIC AND THEORETICAL VIEWS

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Summary: *This article discusses the roots of Nurboy Jabborov's literary and aesthetic views and the scholar's contributions to the development of literary studies. It provides a detailed analysis of the theoretical foundations of Jabborov's scientific school.*

Key words: *Nurboy Jabborov, literary and aesthetic views, Uzbek literature, artistic expression, cultural continuity, journalism, national identity.*

The main difference between modern literary criticism and classical literary criticism lies in their approaches and research methods. Classical literary criticism primarily analyzes texts based on classical works and traditional theories, focusing on the life of the author and the artistic aspects of the work. Modern literary criticism, on the other hand, adopts a broader and more interdisciplinary approach, studying texts within their social, political, and cultural contexts. It incorporates contemporary theories such as feminist, postmodernist, psychoanalytic, and other perspectives. Additionally, modern literary criticism analyzes not only classical but also contemporary literature across various genres. Overall, modern literary criticism demonstrates a more multifaceted and context-dependent approach compared to classical criticism.

Nurboy Jabborov stands out for his profound knowledge and research in both modern literary studies and classical literary criticism. He has not only thoroughly mastered the theories and traditions of classical literary scholarship but has also extensively studied and investigated new approaches, methodologies, and theories in contemporary literary studies. Throughout his academic career, Jabborov has made significant contributions to the development of artistic and aesthetic perspectives by deeply analyzing classical works alongside systematically exploring innovations and changes in modern literature. Therefore, he is recognized as a specialist who has harmonized traditional and modern literary approaches in his scientific school, providing a consistent analysis and making an important contribution to the advancement of literary studies.

Literature is one of the most delicate and profound realms of human existence a source of spiritual growth and emotional awakening. From this perspective, the creative work and artistic-aesthetic views of Nurboy Jabborov hold a significant place in Uzbek literature and culture. His life experiences, family upbringing, education, and journalistic activity have deeply influenced his understanding of literature as an art form, as well as his aesthetic taste and artistic thinking. This article explores his artistic and aesthetic views, his relationship with life and literature, and their role in contemporary culture.

The Foundation of Awe and Artistic Reflection. A central element of Nurboy Jabborov's creative outlook is the feeling of awe. From his childhood, he lived with a profound sense of wonder inspired by the beauty of nature—the snow-covered mountains, the stars, the moonlight. This feeling of awe laid the foundation for his aesthetic views and sparked his passion for literature. Artistic and aesthetic qualities in literature are often embodied in this feeling of awe because true works of art evoke deep emotions, reflections, and amazement in the reader. Jabborov's early experiences and the literary works he engaged with left a lasting impression on his artistic sensibility.

The Role of Family Environment and Attitude Toward Literature. The family played an essential role in shaping Nurboy Jabborov's artistic and aesthetic views. His father, Abdulhakim, was a skilled blacksmith known for his courage and craftsmanship, symbolizing the rich traditions and heroic aesthetics of the Uzbek people. His mother's warmth, firmness, and attitude toward life further influenced his artistic thinking.

Growing up in this environment, Jabborov drew inspiration from his parents' worldview, values, and traditions, which strengthened his love for literature and the arts. His family upbringing played a crucial role in developing his aesthetic taste and artistic judgment.

Artistic and Aesthetic Formation During School and University Years. During his school years, Jabborov's passion for literature and love for reading were key factors in shaping his artistic and aesthetic views. He memorized and deeply understood the works of famous writers and poets, developing his literary taste.

At university, his encounters with renowned professors and participation in literary activities deepened his artistic and aesthetic perspectives. Courses focused on Furqat, Alisher Navoi, and other literary greats, alongside interactions with scholars such as Aziz Qayumov and Sharif Yusupov, strengthened his scholarly and aesthetic thinking.

Journalism and Attitude Toward the Artistic Word. Throughout his journalistic career, Jabborov reflected deeply on the role of literature and mass media in society, emphasizing social justice, national life, and the place of literature in cultural education. In his articles, he highlighted the importance of literature and the press in the upbringing of the nation, valuing the responsibility and power of the word.

The respect his mentors had for artistic expression, their persistent efforts to enrich literary texts, and their reverence for the word significantly influenced Jabborov's artistic and aesthetic views. For him, words, literature, and artistic imagery serve as vital mirrors reflecting the nation's culture and spirituality.

Generational Education and Continuity of Culture. Jabborov's artistic and aesthetic views extend beyond literature to encompass generational education. He emphasized the critical role of parents and society in children's lives, highlighting the importance of education in preserving the spiritual and cultural continuity of the nation.

The achievements of his children in various fields and their cultural and artistic abilities, according to Jabborov, are the results of parental upbringing and knowledge. This belief forms a core component of his artistic and aesthetic philosophy.

Nurboy Jabborov's artistic and aesthetic views are deeply intertwined with his life experiences, academic work, and family environment. The feeling of awe serves as the foundation of his artistic and aesthetic thinking, which further developed through family upbringing, education, and intellectual-cultural surroundings. His journalistic career allowed him to appreciate the role of the word in social life and to respect the art of language.

Through his dedication to literature and art, Jabborov contributes to the spiritual upliftment of his nation, passing on his love for culture and art to future generations. In his views, literature serves as a powerful tool for nurturing the human spirit, evoking wonder, and strengthening cultural values.

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Rezyume: *Ushbu maqolada N.Jabborovning adabiy-estetik qarashlarining ildizi va olimning adabiyotshunoslik rivojiga qo'shgan hissasi haqida so'z yuritiladi. N.Jabborov ilmiy maktabining nazariy asoslari batafsil tahlil qilinadi.*

Резюме: *В данной статье рассматриваются истоки литературно-эстетических взглядов Нурбоя Джабборова и вклад учёного в развитие литературоведения. Подробно анализируются теоретические основы научной школы Джабборова.*

Kalit so‘zlar: *Nurboy Jabborov, badiiy-estetik qarashlar, o‘zbek adabiyoti, badiiy ifoda, madaniy davomiylik, jurnalistika, milliy o‘zlik.*

Ключевые слова: *Нурбой Джабборов, художественно-эстетические взгляды, узбекская литература, художественное выражение, культурная преемственность, журналистика, национальная идентичность.*

THE IMAGE OF NATURE IN THE POETRY OF HALIMA KHUDAYBERDIYEVA

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Summary:*This article examines the role of nature imagery in the lyrical poetry of Halima Khudayberdiyeva, analyzing its artistic, emotional, and philosophical dimensions. The study explores the poet's unique ability to express human emotions through natural scenes and to employ nature as a symbolic and aesthetic medium. Through the analysis of poems such as "The Weeping Willow," the article highlights the harmony between poetic imagery, emotional depth, and symbolic meaning. The research emphasizes the dialectical relationship between nature and the human soul in Khudayberdiyeva's work.*

Key words: *Nature imagery, Halima Khudayberdiyeva, lyrical hero, artistic depiction, poetic skill, unity of human and nature, symbolism, Uzbek poetry.*

The more closely a writer is connected with life, the greater the opportunities for the artistic diversity of his or her individual poetic skill. Creative individuality becomes real only through the development of artistic mastery. The poet never encounters ready-made words; everything is achieved through labor. Creativity is a continuous process of searching every stage of growth is but a step, a platform for the next renewal. Only hard work elevates the artist and prevents them from remaining stagnant. This, of course, is a known truth, yet it manifests differently in the work of every writer.

It is precisely this "different form of manifestation," as well as the fact that events and objects appear differently in the eyes of various creators, that determines the poet's individual style and artistic skill. By a poet's individual mastery, we understand their unique perception of reality, their ability to express events and phenomena through their own imagery and artistic devices.

The younger generation of contemporary Uzbek poets possesses its own poetic world; each stands out for originality of artistic skill, thematic orientation, poetic depth, and their unique use of imagery. As A. Blok noted, "Poets are interesting not because of the similarities in their work, but because of the differences that set them apart."

Studying the young poets who strive "to find what they seek through the miraculous power of poetic art" and to reveal new artistic dimensions in ancient words, B. Akramov attempted to identify and thoroughly examine the key features of the "younger generation's" poetic talent. Although he based his conclusions mainly on the poetry of Rauf Parfi, the qualities he examined can be considered important criteria for defining the creative individuality of young poets in general. Since artistic mastery is closely related to style and creative individuality, the distinctiveness of young poets today is characterized by several factors:

- striving to reveal new semantic layers of words while transforming the truth of life into artistic truth;
- holding an individual attitude toward the world and seeking new words and original poetic images;
- exploring the organic unity between the poet's inner feelings and the social issues troubling humankind;
- developing unique creative and aesthetic principles grounded in spiritual freedom and actively engaging in solutions to global issues;
- deeply sensing the unity between humans and Mother Nature and expressing this unity through clear poetic generalization;
- purifying artistic thinking alongside changing attitudes toward life's events;
- fearlessly portraying the human spiritual world with all its pains and joys, and revealing contradictions without concealment.

The individuality of young poets' artistic skill is reflected in their attitude toward nature and in the uniqueness of their descriptions of the natural world. Life's problems, natural scenes, and the feelings evoked by them are constantly at the center of their attention. They do not merely describe a

natural scene and leave the generalization to the reader; rather, natural imagery becomes a means of expressing their emotional states. Transforming a natural scene that inspires lyrical feelings into a tool of poetic perception, comparing nature with social phenomena — these are among the distinctive qualities of the younger generation's poetry.

That a particular natural event or scene stimulates unique artistic ideas in each poet is natural. Below we examine this aspect in the poetry of Halima Khudayberdiyeva, focusing on the importance of artistic mastery in developing poetic reflection about nature. For without artistic mastery, no poetic thought can become a true poetic work. Professor S. Mamajonov rightly notes: "A wide horizon of inspiration, thematic diversity, and relevance alone do not testify to a poet's great talent. Only when the horizon of inspiration merges with the horizon of mastery, and the essence of a newly chosen theme is revealed deeply and truthfully, can we speak of a writer's true talent."

Nature — we cherish it as Mother Nature, consider it the basis of our existence and our sustenance. We love it throughout our lives, seeking to enjoy its generous blessings. But is nature's beauty, its gifts and abundance, truly endless? Should we only take from it, exploit it, and consume it? We rarely think about this — or rather, many of us do not feel it. This is where poetry comes to our aid.

The poems of Halima Khudayberdiyeva, like melodies harmonizing with nature, enter the reader's heart. In particular, her poem:

Majnuntol, ey, egib shox,
Sen kimlarga sir aytding?
Baridan bo'ldim ogoh,
O'n aytdingmi, bir aytding?
Siringni suvga solma,
Bargingdan g'am arisin.
Bir siringni ololmay,
Yosh dunyolar qarisin.

The relationship between human and nature is a complex dialectical interaction. While living in constant connection with nature, humans transform it, thereby revealing their own level of cultural attitude toward the environment. A person's treatment of nature is determined by their worldview, culture, and morality.

Her next lines:

Sen ham ko'zin yoshini
Hech kim ko'rmas bir naysan.
Faqat ishqing yashirib
Mendek yig'layolmaysan.

The poem is read with deep pleasure. These simple lines involuntarily stir the heart, awakening consciousness and calling the reader to observe the environment with greater care. This is one of the invaluable functions of poetry.

Another important power of poetry is its ability to awaken dormant emotions and illuminate the inner world with vivid sensations. A good poet is one who can express the bright thoughts that arise in people's hearts yet remain unspoken or undefined. That is why, when reading certain poems, we instinctively feel how close the poet's intention is to our own hearts.

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Rezyume: *Ushbu maqolada Halima Xudayberdiyevaning lirik she'riyatida tabiat obrazining o'rni, uning badiiy-falsafiy talqini va poetik ifodalanish xususiyatlari tahlil etiladi. Shoiraning tabiatga munosabati, tabiat manzaralari orqali inson ruhiyatini yoritish mahorati hamda tabiatning ramziy mazmun kasb etishi ilmiy asosda ko'rsatib beriladi. Tahlil jarayonida shoiraning "Majnuntol" kabi she'rlaridagi badiiy tasvir, his-tuyg'u va poetik mushohada uyg'unligi alohida yoritiladi. Maqola Halima Xudayberdiyeva ijodida tabiat va inson ruhiyati o'rtasidagi dialektik bog'liqlikni ochishga xizmat qiladi.*

Резюме: *В данной статье рассматривается роль образа природы в лирике Халимы Худойбердиевой, анализируются его художественные, эмоциональные и философские аспекты. Автор исследует способность поэтессы передавать внутренний мир человека через природные картины, а также использовать природу как символический и эстетический элемент. На примере стихотворений, включая «Плакучая ива», раскрывается гармония между поэтическим образом, чувственностью и символикой. Работа подчеркивает диалектическую связь между природой и духовным состоянием человека в творчестве поэтессы.*

Kalit so'zlar: *Tabiat obrazi, Halima Xudayberdiyeva, lirik qahramon, badiiy tasvir, poetik mahorat, tabiat va inson birligi, ramziy ma'no, o'zbek she'riyati.*

Ключевые слова: *Образ природы, Халима Худойбердиева, лирический герой, художественное изображение, поэтическое мастерство, единство человека и природы, символика, узбекская поэзия.*

ECOLOGICAL CULTURE IN UZBEK POETRY

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Summary.*This article analyzes the formation, development, and artistic interpretation of ecological culture in Uzbek poetry. It explores how the ecological problems of the late 20th century—particularly the Aral Sea disaster, environmental degradation, and human negligence toward nature—led to the emergence of new poetic perspectives. Through the works of poets such as Asqad Muxtor, Erkin Vohidov, and Abdulla Oripov, the article reveals how ecological culture is expressed poetically. The study discusses themes such as the sacredness of nature, the harmony between humans and the environment, and poetic warnings about ecological consequences. The main purpose of the research is to demonstrate the role and significance of Uzbek poetry in shaping ecological thinking and ecological culture within society.*

Keywords: *Ecological culture, Uzbek poetry, Aral Sea disaster, human–nature relationship, ecological issues, ecological awareness, ecological lyricism, artistic imagery, poetic thinking, sacredness of nature.*

Poetry is a miraculous realm capable of gathering the pains of an era into its colorful lines. Any changes in our lives, the problems and torments occurring in human existence, inevitably find their reflection in poetry. Indeed, every theme in poetry is born out of the demands of its time and the necessities of life, gradually turning into a tradition. The creation of literary works dedicated to protecting nature or ecology is also connected with the environmental catastrophes caused by humanity's indifference toward nature. Since ancient times, humankind has always strived to understand the mysteries of nature, was inspired by its wondrous miracles, and the human heart, eternally marked with the pain of artistic expression, has seen its own sorrows and traces of its thoughts in the unique beauties of the external world. Thus emerged the poetic expression of the unity between nature and human beings.

Only a poet who listens to the mysterious songs of nature and feels the beauty of the environment with all his heart can create wonderful examples of landscape lyrics. For a long time, poetry was dominated by the tradition of depicting the beauties and unique features of nature through landscape lyrics, images, and symbols. In recent years, however, certain changes have appeared even in nature-themed poetry: poets no longer limit themselves to mere descriptions of the environment; instead, they strive to emphasize the sacredness, greatness, inviolability of Mother Nature and remind us that nature is a sacred place where humans live. Belief in the sanctity of nature first of all requires preserving it as the apple of one's eye. Thus, a new characteristic born from the demands of the era has risen to prominence in our poetry — understanding and portraying nature as an ecological category.

Protecting natural resources, preserving beautiful landscapes created by the "rare hands" of nature, safeguarding ecological monuments, and ending destructive misuse of nature concern the fate of every person living on our planet. Preserving the purity of the environment depends on the extent to which people feel their responsibility for the fate of the Earth. For this, it is necessary to widely promote knowledge about nature, to warn humanity about the tragic state of the environment, and to search for ways to prevent the dangers that may threaten our planet in the future. This requires properly establishing ecological education among the population and forming ecological culture. One of the factors that nurtures ecological awareness among our people is expressing through the power of artistic words the ancient unity between nature and humans and the sacredness of this bond. The emergence of a new theme in poetry — the theme of protecting nature — is associated with the development of science and technology, humanity's reckless interference in natural processes, and the contradiction of calling nature "our friend" while simultaneously harming it. The destruction of natural monuments formed over centuries and the disruption of the world's ecosystems have created a threat to life on Earth. A deep philosophical and journalistic approach to depicting the need for

humanity to awaken in time to prevent disaster has emerged. The central idea of poems on nature conservation is the artistic comprehension of the harmony between nature and human destiny.

There are objective reasons for the emergence of ecological themes in young writers' creative work. It is well known that any poem has its own life-based foundation or material. The events occurring in human life, worldview, thoughts, and emotional changes inevitably influence poetry.

So, what are the historical foundations of ecological poetic thinking in literature?

The 20th century was a time of revolutionary socio-political and scientific-technological change. Consequently, drastic changes occurred in the relationship between humanity and nature. Brutal exploitation of natural resources, blind land development, and extreme pollution caused by industrial waste disrupted the ecological balance of the Earth. Natural monuments were destroyed, lush forests and meadows turned into deserts, and ancient irrigated agricultural lands became salinized, turning into sterile salt beds.

A broad treatment of the theme of struggle for nature's purity in literature emerged as a poetic interpretation of the disruption of the ancient harmony between nature and humans. "Indeed, the selfishness and irresponsibility that have taken root in people's attitudes toward nature have been correctly identified by our writers as the root cause of ecological problems. In all regions of Uzbekistan the situation is the same: rivers have been blocked and dried up, the composition of water has worsened, soil has degraded, and living beings have perished. The result is common: labor goes to waste, and harvested crops come at a very high cost. The conclusion is this: one must treat nature with the purity shown to a mother, and with the devotion shown to a child. A person must abandon selfish philosophies and even renounce a part of the material wealth gained through destructive attitudes."

On one hand, disharmony emerged between nature and humans; on the other, as a result of many years of error and indifference toward natural resources, the drying of the Aral Sea — the sacred heart of Central Asia — brought the region's ecosystem to the brink of catastrophe. Only then, though belatedly, did humanity realize its mistakes and understand the need to protect the purity of nature as carefully as one protects the pupil of the eye. This became one of the most important factors in the formation of nature-protection themes in poetry.

Another factor underlying the rise of ecological poems is that the protection of nature has acquired a distinct social character today. In recent years, environmental protection has become a widespread concern. Recognizing that human life depends on the eternal existence of nature, people have begun to unite in safeguarding the environment. The Committee for the Protection of the Aral Sea was established, and thanks to its efforts, significant funds were gathered to save our sacred sea. Saving the Aral has risen to the level of not only a national problem but a global one. Measures have been implemented to purify industrial waste and preserve environmental cleanliness. Several decisions on rational use and protection of natural resources have been adopted. These efforts have become a nationwide concern and naturally found reflection in various genres of literature, including poetry.

Thus, due to the reasons mentioned above, a new appearance of nature's poetic image works infused with ecological philosophical reflection has emerged. Humanity's entry into space expanded the possibilities of depicting nature in figurative ways; from distant stars to microscopic particles before our eyes, everything became a poetic image. The global ecological crisis opened the way for expressing complex philosophical thoughts and anguished emotional cries in poems about nature. The unfortunate conditions created by long-term exploitative industrial practices gave way to feelings of compassion and love toward nature. Our writers boldly demonstrated that the roots of ecological disaster lay in unscientific theories that dominated natural science for years and in the consequences of a prolonged period of societal stagnation. Understanding how scientific-technical revolutions and the creation of weapons of mass destruction had devastated nature, humanity recognized the need to gently care for Mother Earth and return to the embrace of beautiful nature. All this forms the historical and social basis for the emergence of ecological themes in poetry of the 1960s–80s, turning it into one of the traditional poetic subjects.

In Uzbek poetry, the first works dedicated to ecological problems appeared in the 1960s. Writers such as Asqad Muxtor, Erkin Vohidov, Abdulla Oripov, and O‘tkir Matjon pioneered this tradition, which was later continued by Usmon Azimov, Xurshid Davron, Muhammad Solih, Shavkat Rahmon, Mirzo Kenjaboyev, Ma’ruf Jalil, Tilak Jo‘ra, S. Salimov, and other young poets.

One of the distinctive features of poems dedicated to ecological issues is the glorification of the sacredness of Mother Nature. Since ancient times, humans have cherished what they consider sacred. Therefore, one of the earliest poetic approaches to nature was the “theological” that is, perceiving nature as divine. Instead of simply calling for protection of natural phenomena and living beings, reviving ancient beliefs that sanctified them and restoring forgotten customs and traditions may yield better results. In the past, people considered many animals deer, sheep, oxen, snakes, swallows, pigeons, blue crows, storks, sparrows and many plants and trees poplars, willows, jujube trees, walnut trees, mulberries, tamarisks as sacred. Many natural monuments survived for centuries under the protection of such beliefs. After the Revolution, a mass struggle was launched against religious views in the Soviet Union. Ancient traditions tied to nature protection were dismissed as religious superstition; sacred stones, springs, holy sites, and centuries-old plane trees were destroyed, causing irreparable damage to nature. As a result, places once considered sacred became zones of exploitation and disorder. Instead of ancient sacred trees and springs, people began revering man-made “monuments” carved from stone.

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Rezyume*: Ushbu maqolada O‘zbek she’riyatida ekologik madaniyatning shakllanishi, rivojlanishi va badiiy talqini tahlil qilinadi. XX asrning ikkinchi yarmida yuzaga kelgan ekologik muammolar, xususan Aral fojiasi, tabiatning buzilishi va insonning muhitga beparvoligi shoirlar ijodida yangi badiiy qarashlar paydo bo‘lishiga sabab bo‘lgani ko‘rsatiladi. Asqad Muxtor, Erkin Vohidov, Abdulla Oripov kabi shoirlarning ekologik mazmundagi asarlari misolida ekologik madaniyatning poetik ifodalanishi ochib beriladi. Maqolada tabiatni muqaddas qadriyat sifatida anglash, inson va tabiat uyg‘unligi, ekologik ogohlantirishlarning poetik vositalar orqali yoritilishi kabi masalalar yoritilgan. Tadqiqotdan ko‘zlangan asosiy maqsad — o‘zbek she’riyatining ekologik tafakkur va jamiyatda ekologik madaniyatni shakllantirishdagi o‘rni va ahamiyatini ko‘rsatishdir.*

Резюме: *В данной статье рассматриваются вопросы формирования, развития и художественного осмысления экологической культуры в узбекской поэзии. Показано, что экологические проблемы второй половины XX века — в частности, Аральская катастрофа, разрушение природы и безответственное отношение человека к окружающей среде — стали причиной появления новых поэтических взглядов. На примере произведений таких поэтов, как Аскад Мухтор, Эркин Вохидов, Абдулла Орипов, раскрывается поэтическое выражение экологической культуры. В статье анализируются темы священности природы, гармонии человека и природы, а также поэтические предупреждения об экологических последствиях. Основная цель исследования — показать роль и значение узбекской поэзии в формировании экологического мышления и экологической культуры в обществе.*

Kalit so‘zlar.*Ekologik madaniyat, o‘zbek she’riyati, Orol fojiasi, tabiat va inson munosabati, ekologik muammo, ekologik ong, ekologik lirika, badiiy obraz, poetik tafakkur, tabiat muqaddasligi.*

Ключевые слова: *Экологическая культура, узбекская поэзия, аральская катастрофа, человек и природа, экологические проблемы, экологическое сознание, экологическая лирика, художественный образ, поэтическое мышление, священность природы.*

THE IMPORTANCE OF LEARNING ENGLISH WITH TEXTS

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Summary: *This article explains the importance of using texts in learning English. Texts help students increase vocabulary, improve grammar and pronunciation, and develop communication skills in real-life situations. By working with A2-level stories and everyday texts, learners improve reading, writing, listening, and speaking skills simultaneously. The article also presents effective teaching methods and ways to engage students actively in lessons.*

Key words: *English language, Language learning, Learning through texts, Vocabulary, Grammar comprehension, Listening and speaking, A2 level, Story.*

Learning English is very important for everyone today because it is the most widely used international language in the world. Knowing English allows a person to communicate easily with people from different countries, make new friends, and take an active part in global processes. English is also the main language of science, education, and technology. Since most scientific articles, online resources, textbooks, and technical information are written in English, knowing the language gives a person an advantage in studying, researching, and professional development.

In today's job market, knowing English provides a great advantage: it becomes much easier to find a well-paid job, work in international companies, or run a global business. English is also useful when traveling — no matter where you go, being able to speak English helps you communicate, find your way, and solve everyday problems. Additionally, many movies, songs, software, and online materials are in English, giving learners access to a wider range of information and cultural content. Therefore, learning English is not only practically beneficial but also very important for personal growth.

To teach English effectively, it is important to pay attention to several key aspects. First of all, the teaching process should match the learner's age, level, and interests. Since language learning is a communication-based process, the teacher should focus on practical activities, conversation, listening comprehension, and real-life situations. Grammar should not be taught merely as a set of rules, but through its use in real speech, which helps learners absorb it more quickly.

Motivating students and engaging them actively in the lesson is also essential. Using interactive methods, modern technologies, videos, audio materials, games, and group activities increases the effectiveness of learning. The lesson should ensure that students participate actively, express their thoughts freely, and feel comfortable making mistakes without fear.

The teacher should notice each learner's individual difficulties and apply an appropriate approach, while also providing regular feedback to support the learning process. Most importantly, learners should feel that English is useful in daily life, and they should be given opportunities to use the language in practice. This practical reinforcement is a crucial part of effective teaching.

Working with texts appropriate for each level plays a very important role in the process of teaching English. Its significance is reflected in several key aspects. Texts that match each proficiency level help learners acquire the language gradually and naturally. Simple texts allow beginners to learn new vocabulary, basic grammatical structures, and everyday expressions in an understandable way, which builds confidence and motivation. As the level increases, working with more complex texts expands learners' vocabulary, develops their ability to analyze, comprehend, and interpret meaning.

Using texts suited to each level also ensures that language elements are learned at the right time and in the correct order. If a text is too difficult for the learner, it creates confusion; if it is too easy, progress slows down. Therefore, texts selected according to CEFR levels (A1–C1) ensure that the learner is neither overwhelmed nor bored. They place the student in a "moderate challenge" zone, which creates the most effective learning environment.

Moreover, texts at each level help develop essential skills such as reading comprehension, listening comprehension, expressing opinions, and participating in discussions. Tasks such as

comprehension questions, discussions, retelling, and content analysis strengthen critical thinking and communicative abilities. Learning different topics at each stage also exposes students to cultural, social, and practical aspects of the language.

Below, we have developed several recommendations for working with texts.

Exercise 1:

Red Berry 	Mary ate a blueberry. She loved blueberries. Then she ate a blackberry. She loved blackberries. Then she ate a strawberry. She loved strawberries. Mary was confused. A blueberry is blue, so you call it a blueberry. A blackberry is black, so you call it a blackberry. A strawberry is red. So, why don't you call it a redberry? Mary asked her mom. Her mom didn't know. She asked her dad. Her dad didn't know. She asked her little brother. "Because a red berry is a cherry!" her brother said.

A2 Level Tasks

I.True or False

1. Mary likes blueberries.
2. Mary’s mom knows why a strawberry is not called a redberry.
3. A strawberry is red.
4. Mary’s brother says a red berry is a cherry.
5. A blackberry is blue.

II. Multiple Choice

1. What did Mary eat first?

a) A strawberry
b) A blueberry
c) A blackberry

2. Who answered Mary’s question?

a) Her dad
b) Her mom
c) Her little brother

3. What color is a blackberry?

a) Red
b) Blue
c) Black

III. Answer the Questions

1. Why was Mary confused?
2. What color is a blueberry?
3. Does Mary love strawberries?
4. Who didn’t know the answer to Mary’s question?

IV. Fill in the Blanks

1. Mary ate a _____, a blackberry, and a strawberry.
2. A strawberry is _____.
3. Mary asked her _____ and _____, but they didn’t know the answer.

Exercise 2:



My working day starts very early. From Monday to Friday I get up at 3:30, have a shower and a cup of coffee. I leave home at 4:10 and get to the studio at 5:00. My programme *Good Morning Britain* is from 7:00 to 9:00. I leave the studio at 10:15, go shopping, visit friends, and get home at 3:00. A woman helps me with housework and ironing. I read the newspaper and do some work. My husband comes home at 5:30 and I cook dinner. In the evening we stay at home, watch TV, and I go to bed at 8:30. I'm usually asleep by 9:00. I think my job is interesting, but I don't like getting up early.

I. True/False

1.She gets up at 3:30.
2.She leaves home at 5:00.
3.Her programme finishes at 9:00.
4.She goes shopping after work.
5.She goes to bed at 10:00.

II. Fill in the blanks

1.She gets up at _____.
2.She leaves home at _____.
3.Her programme Good Morning Britain is from _____ to _____.
4.Her husband comes home at _____.
5.She is usually asleep by _____.

III.Multiple Choice

1.Who helps her with housework?
a) Her husband
b) A woman
c) Her friend
2.What does she do in the evening?
a) Go out
b) Watch TV
c) Work
3.Why doesn't she like her job?
a) It is boring
b) She doesn't like getting up early
c) She doesn't like cooking

Learning English through texts is very useful. Texts help students improve reading skills, learn new words, and understand grammar in context. When we read stories, articles, or dialogues, we also learn how people speak and write in real life. Texts make learning interesting and give us examples we can use in our own speaking and writing. Reading regularly helps us remember vocabulary and phrases better.In conclusion, reading English texts is an effective way to learn the language and improve all skills: reading, writing, listening, and speaking.

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Rezyume: *Ushbu maqola ingliz tilini o‘rganishda matnlardan foydalanishning ahamiyatini tushuntiradi. Matnlar yordamida o‘quvchilar lug‘atni oshiradi, grammatika va talaffuzni yaxshilaydi, shuningdek real hayotiy vaziyatlarda muloqot qilish ko‘nikmalarini rivojlantiradi. A2 darajadagi hikoyalar va kundalik matnlar orqali o‘quvchilar o‘qish, yozish, tinglash va gapirish ko‘nikmalarini bir vaqtning o‘zida rivojlantiradi. Shuningdek, maqola samarali dars tashkil etish va o‘quvchini faol jalb qilish metodlarini ham ko‘rsatadi.*

Резюме: *Эта статья объясняет важность использования текстов при изучении английского языка. Тексты помогают учащимся расширять словарный запас, улучшать грамматику и произношение, а также развивать навыки общения в реальных жизненных ситуациях. Работа с рассказами уровня A2 и повседневными текстами одновременно развивает навыки чтения, письма, аудирования и говорения. В статье также представлены эффективные методы преподавания и способы активного вовлечения студентов в урок.*

Kalit so‘zlar*: Ingliz tili, Til o‘rganish, Matnlar orqali o‘qish, Lug‘at, Grammatikani tushunish, Tinglash va gapirish, A2 daraja, Hikoya.*

Ключевые слова: *Английский язык, Изучение языка, Обучение через тексты, Словарный запас, Понимание грамматики, Аудирование и говорение, Уровень A2, Рассказ.*

TECHNOLOGY FOR DEVELOPING INSTRUMENTAL PERFORMANCE SKILLS THROUGH MODERN IT TOOLS BASED ON METACOGNITIVE STRATEGIES

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Summary: *This article scientifically explores the possibilities of using* ***metacognitive strategies*** *and modern IT tools to develop instrumental performance skills in string instruments. It presents methodological approaches for learners to consciously manage their performance process, identify technical and artistic errors, analyze them, and plan subsequent practice sessions using metacognitive strategies – planning, monitoring, and reflection. Special attention is given to the application of modern IT tools, including video recordings, metronomes, virtual music platforms, and interactive educational programs, to strengthen performance skills and develop* ***singing/kuylash proficiency.*** *For example, when learning a new dutor melody, a student can record their performance, analyze errors in rhythm and phrasing, adjust timbre and vocal intonation, and then integrate these corrections into the full performance. The results demonstrate that the integration of metacognitive strategies and IT tools allows future music education teachers to* ***consciously develop performance skills, efficiently organize independent practice, and cultivate creative expression.***

Key words: *Metacognitive strategies, String instrument performance, Musical thinking, Reflection, Monitoring, Technical skills, Rhythm and phrasing, Independent practice, Modern IT tools, Pedagogical competence*

Introduction

Instrumental performance skills play a crucial role in developing students' technical ability, artistic expression, creative interpretation, and vocal mastery in modern music education. In the professional preparation of future music educators, it is essential to systematically and consciously cultivate performance competencies. From this perspective, metacognitive strategies—planning, monitoring, and reflection—serve as effective tools for controlling and improving the performance process.

Modern IT tools—video recordings, metronomes, interactive music applications, virtual platforms, and voice-analysis software—significantly enhance the efficiency of the performance process [1]. For example, when a student is learning a new piece on the dutar, they first analyze their performance using a video recording, identify phrasing and rhythm errors, and note technical inaccuracies in plucking the string or finger placement. Likewise, during vocal exercises, the student records their voice, evaluates timbre and pitch, rehearses phrases in a slow tempo, and forms a conscious expressive interpretation.

The integrated use of metacognitive strategies and IT tools enables students to consciously manage their performance, develop independently, and enrich their creative expression. For instance, in dutar or rubab pieces that require rapid phrasing, the student breaks the phrases into segments, first practices the technical components, and then sings or plays each phrase to coordinate rhythm and melody. Through this process, they independently identify errors, develop both technical and artistic mastery in an integrated manner, and add personal expression to their performance.

Furthermore, metacognitive strategies allow students to recognize their strengths and weaknesses in performance, analyze their progress, and update their practice plan accordingly. For example, if the vocal timbre is not sufficiently rich, the student listens to their own recording, practices internal vocalization of phrases, rehearses slowly to unify the sound, and refines the melodic line. In doing so, not only technical and rhythmic aspects but also artistic and vocal skills are systematically improved.

Overall, the integration of metacognitive strategies and modern IT tools supports the development of future music educators' ability to organize independent practice effectively, consciously manage performance, and deepen pedagogical competence [2]. At the same time,

students enrich their creative interpretation, significantly improve the quality of the performance process, and achieve a high level of vocal and instrumental mastery.

Theoretical Foundations of Metacognitive Strategies in Developing Instrumental Performance Skills. The process of developing instrumental performance skills involves not only improving technical abilities but also cultivating the learner's conscious thinking, decision-making in selecting performance techniques, and the ability to manage their own performance. From this perspective, metacognitive strategies—planning, monitoring, and reflection—form the theoretical basis for the systematic and conscious development of performance skills [3]. The metacognitive approach shifts the learner's actions in the performance process from automatic execution to conscious control, thereby enabling the refinement of creative expression and vocal mastery.

Planning helps the learner determine the goals and tasks of the practice session. For example, when a student begins learning a new dutar piece, they first plan to strengthen the left-hand finger positions, then work on evening out the right-hand plucking technique, and finally practice phrasing at a slow tempo. This ensures that the practice session is not random but structured and goal-oriented. Planning also plays an important role in vocal performance: the learner first internalizes the phrasing mentally, then integrates it into the full performance, consciously managing timbre and melodic expressiveness.

Monitoring refers to observing and evaluating performance in real time. The learner records their performance on video, uses a metronome, listens to recordings of their own voice, and identifies technical mistakes, rhythmic inaccuracies, and imperfections in timbre or phrasing. For instance, if rhythmic stretching occurs in fast phrases, the student isolates these segments, slows down the tempo, and reworks the technical components. Through this process, the learner acquires the habit of identifying errors independently, without relying solely on external supervision.

Reflection involves analyzing the results after practice. The student evaluates the strengths and weaknesses of their performance, identifies the causes of technical or artistic errors, and plans the next practice session accordingly. For example, if the phrasing lacks expressive melodic flow, the learner first sings the phrases internally, then performs them slowly, consciously shaping the melodic and emotional interpretation. In this way, vocal mastery is also strengthened, and the learner refines the phrasing not only technically but also artistically and aesthetically.

Theoretically, metacognitive strategies support the conscious and systematic—not intuitive—development of performance skills. This approach equips future music educators with the ability to think independently, analyze mistakes, manage performance, and consciously shape vocal mastery. As a result, the learner improves performance not only in technical terms but also in artistic, aesthetic, and vocal dimensions, deepening their professional pedagogical competence.

Methodology for developing technical, artistic, and vocal skills through it tools using metacognitive strategies. The formation of technical, artistic, and vocal skills in instrumental performance is effective not only through practical exercises but also through the learner's conscious regulation of their own performance [4]. From this point of view, metacognitive strategies—planning, monitoring, and reflection—significantly enhance the quality of performance when used in combination with IT tools. This approach enables learners to study performance systematically, identify errors, and enrich creative expression.

Planning allows the learner to structure the practice session, set goals, and define both technical and artistic elements. For example, when learning a new dutar piece, a student may first plan to strengthen left-hand positions, then refine right-hand plucking technique, and finally practice phrasing at a slow tempo. With IT tools such as interactive software or mobile applications, the learner can organize each practice stage using markers or visual diagrams. This ensures the practice session is structured and goal-oriented rather than random.

Monitoring enables real-time observation of performance. A student may record their performance on video, use a metronome app, or evaluate vocal exercises through audio recordings. This helps identify technical mistakes, rhythmic inconsistencies, and timbral imperfections. If rhythmic stretching occurs in fast passages, the learner isolates these phrases, slows the tempo, and

reworks the technique. In vocal exercises, the learner listens to recorded samples of their own voice, analyzes phrasing and emotional tone, and consciously improves vocal mastery.

Reflection involves analyzing the results after the practice session. The learner assesses strengths and weaknesses, identifies the causes of errors, and updates the next practice plan accordingly. For example, if phrasing lacks expressive melodic flow, the student first internalizes the phrases mentally, then performs them slowly, consciously shaping tone and emotional interpretation. With IT tools, learners can visually and audibly analyze errors, refine vocal expression, and enhance phrasing.

Through metacognitive strategies, technical, artistic, and vocal exercises complement one another. For instance, after completing a technical exercise to improve left-hand positioning, the learner integrates this technique into the artistic interpretation of the performance: each finger movement becomes aligned not only with accuracy but also with phrasing, rhythm, and vocal expression. In this way, the learner consciously manages performance, identifies errors, and strengthens creative interpretation.

Additionally, IT tools allow learners to analyze vocal production with visual and audio indicators. For example, using software that displays sound waves, the student examines timbre, resonance, and intensity, thereby optimizing vocal exercises and enriching emotional interpretation within phrasing.

This methodology enables future music educators to refine their own technical, artistic, and vocal skills while also equipping them to conduct structured, conscious, and effective lessons with their students in the future. Thus, the integration of metacognitive strategies and IT tools becomes an effective means of improving performance quality, developing creative expression, and deepening pedagogical competence.

Conclusion

Developing instrumental performance skills through metacognitive strategies and modern IT tools transforms the learner into an active, conscious, and independent participant in the performance process. The processes of planning, monitoring, and reflection enable the learner to identify technical, rhythmic, artistic, and vocal errors, analyze their causes, and plan subsequent practice sessions accordingly.

For example, if a rhythmic inaccuracy is detected in phrasing, the student revisits the error using video recordings or a metronome, practices the passage at a slow tempo, and then reintegrates it into the entire piece. Similarly, if deficiencies in timbre or melodic expressiveness appear in vocal production, the learner first internalizes the phrasing mentally, consciously shapes each tone and emotional nuance, and then integrates it into the full performance.

Furthermore, metacognitive strategies help learners identify strengths and weaknesses in their performance. For instance, in pieces requiring fast phrasing, the student first breaks the passage into segments and performs technical and vocal exercises separately, analyzes rhythm and timbre, and then reintegrates the components into the full piece. This approach increases the effectiveness of independent practice, strengthens creative interpretation, and deepens the pedagogical competence of future music educators.

The integration of metacognitive strategies and IT tools not only supports conscious control over the performance process but also contributes to the comprehensive development of technical, artistic, and vocal skills. In this way, the learner systematically improves their performance, independently identifies errors, enriches creative expression, and reinforces professional pedagogical competence.

As a result, metacognitive strategies and modern IT tools, as contemporary methodological resources, significantly enhance the quality of performance and music education processes. They maximize the learner’s creative and technical potential and provide opportunities for the full development of vocal mastery.

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Rezyume: *Ushbu maqolada cholg'u ijrochilik mahoratini rivojlantirishda metakognitiv strategiyalar va zamonaviy IT vositalaridan foydalanish imkoniyatlari ilmiy asosda yoritilgan. Tadqiqotda o'quvchining ijro jarayonini ongli boshqarishi, texnik va badiiy xatolarni aniqlashi, ularni tahlil qilishi va keyingi mashqlarni rejalashtirish jarayonida metakognitiv strategiyalar – rejalashtirish, monitoring va refleksiya – qanday qo'llanilishi ochib beriladi. Shuningdek, maqolada IT vositalari: videoyozuvlar, metronomlar, virtual musiqa platformalari va interaktiv ta'lim dasturlari yordamida ijrochilik ko'nikmalarini mustahkamlash metodikasi taqdim etilgan. Natijalar shuni ko'rsatadiki, metakognitiv yondashuv va IT vositalarini uyg'unlashtirish bo'lajak musiqa ta'limi o'qituvchilarining ijrochilik mahoratini ongli rivojlantirish, mustaqil mashg'ulotlarni samarali tashkil etish va ijodiy ifodani chuqur shakllantirish imkonini beradi.*

Резюме: *В данной статье научно обоснованы возможности использования* ***метакогнитивных стратегий*** *и современных IT-инструментов для развития исполнительского мастерства игры на струнных музыкальных инструментах. Рассмотрены методические подходы к сознательному управлению процессом исполнения учащимся, выявлению технических и художественных ошибок, их анализу и планированию дальнейших занятий с использованием метакогнитивных стратегий – планирования, мониторинга и рефлексии. Особое внимание уделено применению современных IT-инструментов, таких как видеозаписи, метрономы, виртуальные музыкальные платформы и интерактивные образовательные программы, для укрепления исполнительских навыков и развития* ***мастерства****. Например, ученик, осваивая новую мелодию на дутаре, может записывать своё исполнение на видео, анализировать ошибки в ритме и фразировке, корректировать тембр и вокальную интонацию, а затем интегрировать результаты в полное исполнение. Результаты показывают, что сочетание метакогнитивного подхода и IT-инструментов позволяет будущим учителям музыкального образования* ***осознанно развивать исполнительское мастерство, эффективно организовывать самостоятельные занятия и глубоко формировать творческое выражение.***

Kalit so'zlar: *Metakognitiv strategiyalar, Cholg'u ijrochiligi, Musiqiy tafakkur, Refleksiya, Monitoring, Texnik ko'nikmalar, Ritm va frazalash, Mustaqil mashg'ulot, Zamonaviy IT vositalari, Pedagogik kompetensiya*

Ключевые слова: *Метакогнитивные стратегии, Исполнение на струнных инструментах, Музыкальное мышление, Рефлексия, Мониторинг, Технические навыки, Ритм и фразировка, Самостоятельные занятия, Современные IT-инструменты, Педагогическая компетенция*

THE ARTISTIC AND AESTHETIC FEATURES OF SIROJIDDIN SAYYID'S LITERARY WORK

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Summary: *This article analyzes the artistic interpretation of the lyric "I," the poet's aesthetic worldview, and the mastery of imagery creation in the works of Sirojiddin Sayyid. His poetry forms a unified system in which themes such as Homeland, Mother, love, humanity, vigilance, and spiritual refinement are intricately interwoven. Symbolic and figurative images, national cultural elements, philosophical reflections, and inner emotional states contribute to revealing the essence of the lyrical protagonist. The study highlights the harmony between traditional and modern expressive methods in Sayyid's poetry and explores the spiritual experiences depicted through national and universal values.*

Keywords: *Sirojiddin Sayyid; lyric "I"; poetic imagery; national values; symbol and metaphor; philosophical lyricism; Homeland image; Mother figure; poetic worldview; modern Uzbek poetry.*

In Uzbek literary studies, the poet's artistic worldview and his capacity for creating poetic imagery have always been subjects of serious scholarly attention. Examining Uzbek poetry particularly the work of the talented poet Sirojiddin Sayyid from the perspective of artistic mastery, analyzing the poet's personality, worldview, expression of his own "self," the emergence of new ideological and artistic motifs, as well as traditional and modern methods of creating images and symbols, and interpreting figurative-symbolic representations all of this necessitates observations concerning the nature of lyrical experience and emotional expression. Indeed, as our great poet Cho'lpon emphasized, "to pay attention to literature, art, and culture means, first of all, to pay attention to our people, to our future; if literature and culture live, the nation can live" an idea we must never forget. Therefore, based on the new research directions emerging in contemporary Uzbek literary studies, approaching the inner world of the poet's spiritual experiences through the lens of national and universal values determines the relevance of this article.

S. Sayyid created numerous works imbued with profound ideological depth on themes such as Homeland, Mother, love and affection, and socio–spiritual issues. The unity of theme and idea reflected in his works brings together all components form and content, imagery and figurativeness, genre features, and artistic devices into a single harmonious whole, providing a solid foundation for the creation of aesthetically complete poems. Elevated patriotism, a call to vigilance, and an appeal to live with an awakened heart in accordance with true human nature form the central core of the poet's creativity. These ideas characterize his entire body of work-both the period before independence and the period that followed and determine its evolutionary development. The main ideological orientation and system of images in Sirojiddin Sayyid's poetry are revealed based on textual analysis as being consistently connected with the "I" of the lyric hero, his distinctive spiritual world, as well as the poet's own poetic vision and aesthetic–intentional aims. In poetry, depictions of the lyric hero's inner world assume unique interpretations. These interpretations, first and foremost, arise from instantaneous emotional states taking place in the psyche. By this very feature, poetry compared to other literary genres allows for a certain degree of dramaturgy, for short–lived emotional storms and conflicting reflections. At the same time, harmony and affinity between the poet's "I" and the lyric hero's experiences serve to ensure the distinctiveness and subjectivity of emotions. Consequently, in poetic works it often becomes difficult to distinguish where the poet's "I" merges with the lyric hero's identity and where they diverge. Indeed, in the creative process, the poet most often pours onto the page his own "I," his personal dreams, desires, sorrows, and pains. When these unrestrained momentary emotions assume a generalized significance in the poem and resonate deeply with the reader, the poet's "I" manifests itself as the lyric hero.

Maqsadim zar, shonga o'ranish emas,

Inson kamol topsin yer–u ko‘k aro.
Yo‘limda yastangan ruhiy cho‘llarda
O‘zing qo‘lla endi meni, jon daryo!

As we become closely acquainted with the works of Sirojiddin Sayyid, we can observe that nearly all his creative pieces embody the totality of human aspirations and desires aimed at spiritual and moral perfection. His central aim is to call people to vigilance, encourage them toward spiritual maturity, help eradicate harmful vices, remind them of the consequences of bad behavior, and inspire them to live surrounded by gratitude and constructive contemplation. Yet this is not an easy or swiftly attainable process; as the poet himself notes, in order to reach one’s goal, one must wander through “spiritual deserts.” For this reason, he wishes the river’s vigor and turbulence to serve as a lesson, a source of strength, for humankind.

The renewal of poetic imagery is intrinsically connected to the renewal of thought. In Sirojiddin Sayyid’s works, besides the lyrical “I,” we see novel methods of expressing poetic images such as Homeland, Mother, beloved, lover, world, life, and word. These images are closely intertwined with the era, with global issues of the time, with themes of peace, freedom, patriotism, and with the celebration of human emotions.

In the poem *“Vatan”* (“Homeland”), too, the poet vividly renders the image of the Homeland. Here, the artistic detail of the *chopon* (traditional coat) also carries its own symbolic weight.

Qir ustida yonboshlagan bobom chaylasi
Bu dunyoda kimlarningdir orzu–havasi.
Dimog‘imda — yulduz isi,shabnamlar isi,
Momom ekib ketgan kashnich, rayhonim, Vatan.

According to Uzbek traditions, during wedding ceremonies, festive celebrations, and similar joyous gatherings, it has long been customary to dress young men in a *zar chopon* (a gold embroidered robe). This practice instilled in them confidence, pride, and a sense of honor, while also placing upon their shoulders a greater sense of responsibility. Moreover, it served as an example for others as well.

In the passage above, qualities characteristic of brave young men such as strength, grandeur, and steadfastness are transferred to mountains and hills. Through the poet’s artistic mastery, the star–lit sky is depicted as a robe, offered as a gift to the mountains and hills of the homeland. The mountains and hills, adorned with the azure sky as their *chopon*, are portrayed as mighty young men. In doing so, the poet presents the reader with a wonderfully vivid and imaginative scene.

“Even a familiar idea becomes captivating in poetry if expressed in a way unlike anyone else’s,” writes literary scholar Qozoqboy Yo‘ldoshev in one of his articles. In my view, this very feature becomes evident in Sirojiddin Sayyid’s poems devoted to the theme of Mother. Although this theme does not occupy the largest space in the poet’s oeuvre, the thoughts expressed in these poems imbued with sincerity and a distinct manner of expression find a firm place in the reader’s heart.

“The richness of distinctive features in an artistic image does not mean depicting all the attributes of an object, event, or person; rather, it means selecting those that are the most prominent and those that reveal its essence.” While writing on the theme of Mother, the poet delicately expresses the finest qualities and virtues inherent in mothers.

Onam yanglig' mushfiq oylar yorug'ida
O'qimagay endi singlim yozgan xatim.
Qay bir aziz devorlarning yorug'ida
Xazon yanglig' qolib ketdi muhabbatim.

The emotions characteristic of the motherly figure are expressed through powerful artistic exaggeration in Sirojiddin Sayyid’s work: *“You carried the nights upon your eyelashes.”* In these images, the poet not only conveys the physical wakefulness of mothers—their eyes remaining open without sleep—but also imbues the scene with the idea of spiritual vigilance. This poetic discovery is impressive because it is grounded in real life. If the raised eyelashes indicate eyes that have not closed, then the nights lifted upon those eyelashes symbolize nightly wakefulness, helping the reader visualize the collective image of mothers who remain alert and ready to endure any hardship for the comfort of their children.

In the poet's oeuvre, unique poetic images rich with symbols such as Homeland, Mother, beloved, lover, word, and life are vividly created. These images are shaped through poetic devices and details that are deeply rooted in national lifestyle and compatible with the mentality of the people, thus forming a distinct national color and bringing the imagery closer to the reader's heart.

The theme of Homeland occupies a significant portion of the poet's work. In depicting this image poetically, the poet skillfully uses artistic elements such as the *so'ri* (raised platform), *ayvon* (veranda), fortress, ewer, swallow, staff, and ladder. At the same time, by portraying the Homeland through the figures of Mother and great historical personalities, he unites two objects into a single point of meaning, showcasing his artistic mastery .In embodying images imbued with a philosophical spirit, the poet creates unique portrayals by moving from abstraction to clarity. For example, life becomes a dangling button, a swift steed, or a swaying ship; the world becomes an old coat or a spindle.

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Rezyume: *Ushbu maqolada Sirojiddin Sayyid ijodida lirik "men"ning badiiy talqini, shoirning poetik nigohi hamda obraz yaratish mahorati tahlil qilingan. Shoir asarlarida Vatan, Ona, sevgi-muhabbat, insoniylik, ogohlik, ma'naviy poklanish kabi mavzu va g'oyalar mushtarak poetik tizimni shakllantiradi. Undagi ramziy-majoziy obrazlar, milliy turmush tarziga xos badiiy detallar, falsafiy talqinlar va ruhiy kechinmalar lirik qahramon "men"ining mazmun-mohiyatini ochib beradi. Maqolada Sirojiddin Sayyid she'riyatida an'anaviy va zamonaviy ifoda usullarining uyg'unligi, shoirning badiiy-estetik qarashlari hamda milliy va umuminsoniy qadriyatlar nuqtayi nazaridan ruhiy kechinmalar dunyosi yoritilgan.*

Аннотация: *В данной статье рассматриваются художественная интерпретация лирического «я», поэтическое мировоззрение автора и мастерство создания художественных образов в творчестве Сирожиддина Сайида. Его поэзия формирует целостную систему, где темы Родины, Матери, любви, человечности, бдительности и духовного совершенствования тесно переплетаются. Символические и образные детали, элементы национального быта, философские размышления и внутренние переживания раскрывают сущность лирического героя. В исследовании подчеркивается гармония традиционных и современных выразительных средств и анализируется духовный мир поэта с точки зрения национальных и общечеловеческих ценностей.*

Kalit so'zlar: *Sirojiddin Sayyid, lirik "men", poetik nigoh, badiiy obraz, milliy qadriyatlar, ramziy-majoziy talqin, falsafiy lirikada ruhiyat, Vatan timsoli, Ona obrazi, poetik tafakkur, zamonaviy o'zbek she'riyati.*

Ключевые слова: *Сирожиддин Сайид; лирическое «я»; поэтический образ; национальные ценности; символика и метафорика; философская лирика; образ Родины; образ Матери; поэтическое мышление; современная узбекская поэзия.*

CURRENT CHANGES AND REFORMS IN SCHOOL EDUCATION IN UZBEKISTAN

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Summary. *The author highlights current changes and reforms in school education in Uzbekistan. The article emphasizes the role of school education in the successful implementation of democratic reforms and the development of civil society. The author attempts to elucidate the mission of school education in society.*

Key words: *school education; teaching staff; reform; innovation; international relations; quality*

In the context of the development of civil society, education reform has become a priority in the development of Uzbekistan. "Special importance is attached to the development of the secondary school system. In recent years, more than 100 decrees, resolutions and orders of the President of the Republic of Uzbekistan have been adopted aimed at improving the education system. This includes a program to reform the school and preschool education system, review the school system, and adopt a concept to improve school education.

In the period of deepening the market economy, when competition has covered all areas of socio-economic development, human training through education is becoming one of the possible options for improving his intellectual and spiritual world.

The decision of the country's leadership to abolish the participation of schoolchildren and secondary school teachers in cotton harvesting and to involve them in other agricultural work is of reformational importance, which for many years hindered the educational process, since schoolchildren were busy picking cotton and participated in other unusual jobs.

One of the steps in reforming school education was the creation of Presidential Schools, the first of which opened in September 2019. Students in Presidential Schools are selected on a competitive basis and tested for critical thinking, problem solving, and English language skills. A student of the educational institution where the school opens has the right to apply, regardless of the financial situation of the family. The selection of students in the first year required huge logistical and security efforts on the part of the Ministry of Public Education of Uzbekistan and the Cambridge Entrance Exam Assessment Group to ensure that honest, relevant and reliable methods were used to select students who entered schools in September. Presidential schools are educational facilities with the best equipment for training, sports facilities, dormitories and staff. The curriculum is extensive and balanced, with an emphasis on subjects in science, technology, engineering, art, and mathematics. Students study subjects in English along with compulsory national subjects such as literature and history of Uzbekistan in Uzbek.

Additional measures are being taken to ensure that secondary school students learn foreign languages. Especially for teaching English, Russian, Chinese, and Arabic. It should be noted that rural schools do not have enough foreign language teachers. According to the Ministry of Public Education of Uzbekistan, the number of university graduates majoring in Russian language and literature does not cover 50% of the available needs. In recent years, a number of projects have been implemented in the republic to promote the study of the Russian language in educational institutions. In order to improve the study of the Russian language, the international project "Class" is being implemented. The program is aimed at improving the quality of education in Russian. Russian language teachers from Russia have been working in Uzbek schools on a regular basis since 2021, with 100 people each year. The project is being implemented with the support of the Ministry of Education of the Russian Federation and the Ministry of Public Education of Uzbekistan with the financial support of the charitable foundation "Art, Science, Sport". The performers of the special project are the Russian State Pedagogical University named after A.I.Herzen and the Republican Institute for Retraining and Advanced Training of Managers and Specialists of the Public Education System named after A. Avloni.

The main task of reforming school education is to train innovative-minded teachers who teach students based on new pedagogical technologies. Taking into account the tasks of the new stage of development, a modern teacher should be a universal specialist, not only to teach, but also at the same time to improve his qualifications, that is, to constantly work on himself, improve his professional knowledge, methodological level, pedagogical qualifications. In the context of the formation of civil society, practical decisions are being made to make the teaching profession the most prestigious and revered in the country. Government agencies allocate the necessary funds and resources to achieve this noble goal. An innovative approach to the process of reforming school education has shown that the awareness of the need to reform school education has become the most important form of expanding the admission of creative children to presidential and specialized private schools. This is also due to the fact that the country's entry into the world community has revealed the shortcomings of school education and further imposes new requirements on the quality of the educational process in schools. However, during the period of institutional transformations in a market economy, it became clear that most of the secondary school graduates were not ready for changes, and their theoretical knowledge did not meet modern requirements. A scientific analysis of the educational process in the public education system shows that many secondary school graduates are not oriented towards independent work during a new stage of development, they are poorly aware of the socio-economic problems of the profound changes taking place in the bowels of society, especially in the context of deepening market economic relations. The methodological basis for studying the problem of the process of reforming school education in the context of democratic reforms, a new stage of the country's development is the Constitution of the Republic of Uzbekistan and the adoption of the Law "On Education" of the Republic of Uzbekistan in a new edition (2020), the works of the President of the Republic of Uzbekistan Sh.M. Mirziyoyev. Valuable sources are individual studies by social scientists, philosophers, educators, and the work of scientists devoted to the problems of school education, published in scientific collections based on the results of scientific and practical conferences. It should be noted that there are separate brochures and articles where the problem of reforming school education and issues of international cooperation in the field of teacher training are partially addressed.

In the process of reforming school education, the issues of stimulating the educational and educational work of teachers in each school, the creation of new, real mechanisms for the introduction of new pedagogical technologies, and innovative achievements of teaching staff into practice are of particular importance. In this regard, it has become a new approach in the organization of secondary education, the creation of private schools. Currently, there are 700 private schools in the country, and the number of students in them is almost 150,000.

One of the indicators of the quality of education for high school students is their admission to higher education institutions after graduating from high school.

Uzbekistan has announced that by 2030 the country should be among the 30 leading countries in the world in terms of the quality of secondary education. How to achieve this indicator: first, it is necessary to raise the quality of the material and technical base of secondary schools. Secondly, to free teachers from unnecessary paperwork. Thirdly, to improve the level of teaching by teachers and their qualifications, and to master new knowledge. In order to solve the priority tasks as soon as possible, the country has identified a number of priorities for reforming school education, creating normal conditions for quality education and spiritual and moral education of school youth, strengthening the material and technical base, equipping educational laboratories with modern equipment of secondary schools. The reform of school education should restore the lost authority of school teachers. The Head of State noted that "I want to emphasize once again that the teaching profession should become the most reputable and respected in society. And the task of the state is to create all conditions for teachers to primarily take care of providing children with high-quality education, as well as self-improvement." [Message of the President of the Republic of Uzbekistan Shavkat Mirziyoyev to the Oliy Majlis, 12/29/20, P. 2].

In the process of reforming school education, it became clear that highly qualified teachers are in demand in all schools, they are respected by students and parents, they are tutors in their

subjects for students who want to enroll in higher education institutions. The measures taken by government agencies should become an important incentive to improve the quality of the educational process in schools, ensure healthy competition among teachers to systematically improve their qualifications.

Work is underway to develop a National curriculum based on the studied international experience. in coordination directly with the local councils of people's deputies.

Pedagogical universities and pedagogical research institutes are working on the further development of school education by publishing the results of research work in international indexed journals, and expanding international university relations for the exchange of new pedagogical technologies. Together with government organizations and the private sector, work is underway to organize and further introduce into practice new forms of encouragement for school teachers.

The quality of lessons taught at school primarily depends on the scientific and methodological level of the teacher.

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Rezyume: *Muallif O‘zbekistonda maktab ta’limidagi dolzarb o‘zgarishlar va islohotlarni ajratib ko‘rsatdi. Maqolada maktab ta’limining demokratik islohotlarni muvaffaqiyatli amalga oshirish va fuqarolik jamiyatini rivojlantirishdagi roli ta’kidlandi. Muallif maqolada maktab ta’limining jamiyatdagi missiyasini ochib berishga harakat qilgan*

Резюме: *Автором выделены актуальные изменения и реформы школьного образования в Узбекистане. В статье подчеркнута роль школьного образования в успешном осуществлении демократических реформ и развития гражданского общества. Автор статьи попытался раскрыть миссии школьного образования в обществе*

Kalit so’zlar: *maktab ta’limi; o‘qituvchilar kadrlar; islohot; innovatsiya; xalqaro aloqalar; sifat*

Ключевые слова: *школьное образование; учительские кадры; реформа; инновация; международные связи; качество*

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CENTRAL CITY ALONG THE SOUTHERN ARAL- KHOJELI

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Summary: *This article analyzes the Aral domain, which emerged as an independent political entity in the South Aral region during the 17th–19th centuries, as well as its major urban center — Khojeli. Written historical sources depict the Aral domain alongside the Khiva and Bukhara khanates, highlighting its importance in regional political and economic structures. Special attention is given to the economic life, urban development, and the role of caravan routes that passed through the region.*

The study examines the formation of Khojeli, its historical connection with the ancient settlement of Mizdahkan, and its development as a trade, craft, and religious-educational center from the 16th to the 19th centuries. The influence of migration processes, political dynamics, caravan networks, and changes in the Amu Darya riverbed on the life of the city is also discussed based on various written and archaeological sources.

The article incorporates valuable information from Khivan chronicles by Munis and Agahi, Russian military expedition reports, and other Eastern sources, particularly focusing on military campaigns, the functioning of caravan routes, and relations between the khans and local tribal groups. Descriptions from 19th-century travelers portraying Khojeli as the "Venice of the Amu Darya" highlight its strategic, economic, and cultural significance.

This research contributes to a deeper understanding of the urban development, economic activities, ethnopolitical processes, and cultural heritage of the South Aral region and provides new insights into the historical development of Karakalpak urban culture.

Keywords: *Southern Aral Sea Region; Aral domain; Amu Darya delta; Khojeyli; Mizdakhan; Great Silk Road; caravan routes; Khiva Khanate; Bukhara Khanate; Karakalpak tribes; trade and economy; urbanization; archaeological data; religious and educational centers; Sufism; Khoja clans; ethnopolitical processes; Russian expedition; chronicles of Munis and Agahi; military campaigns; culture of the Aral Sea region; fortification structures; irrigation canals; caravanserais; crafts; oral traditions.*

INTRODUCTION AND RELEVANCE. This article provides a comprehensive historical analysis of the political, economic, and cultural development of the central city of the Southern Aral region — Khojeli, during the XVII–XIX centuries.

Written sources describe the Aral Domain as an independent political formation within the system of the Khiva and Bukhara Khanates, and special attention is devoted to its economic life, the structure of caravan routes, and patterns of urban development.

The study explores the formation of Khojeli, its historical connection with the ancient Mizdahkan settlement, and its role as a center of trade, craftsmanship, and religious–educational life from the 17th to the 19th centuries. The influence of neighboring populations' migrations, political processes, the movement of caravan routes, and changes in river systems on urban life is analyzed through various historical sources.

Information regarding the campaigns of the Khiva khans, the security of caravan routes, and the socio-political relations among local clans and religious elites (xojas) is examined through the works of Munis, Agahi, Russian military expedition reports, and other Eastern manuscripts. Nineteenth-century descriptions that refer to Khojeli as the "Venice of the Amu Darya," a major commercial hub, a religious and educational center, and a strategic fortress further highlight the city's historical significance.

Overall, the study reveals the multifaceted history of Southern Aral Sea cities through analyses of their urban development, economic activity, oral traditions, and ethno-political processes. It

contributes to a deeper understanding of the evolution of urban culture in Karakalpakstan and lays the foundation for future research in regional history.

MAIN PART. Archaeological excavations in the Mizdakhan-Khojeli region, one of the central cities at the intersection of the Great Silk Road and the South Aral Sea since the medieval time, have revealed that the city is estimated to be 2,400 years old by old scientists. The city Khojeli was built by Antioch in the 3rd century BC as a border post and was called Antioch. It is said that in the VI-VII centuries AD it was called Mizdahkan, and from the XVI-XVII centuries the Turkic peoples, who began to live in this area, began to call it the city Gawir.

However, archeological excavations in recent years have revealed that the ancient settlements in Mizdahkan (ancient times, II centuries BC, III centuries AD) were located in the city Gawir. The VI-VIII centuries AD the people of Mizdahkan were inhabited around the city Gawir. At the beginning of the XIII century in the city Gawir the life stopped completely. In the XIII-XIV centuries between the Eastern and Western hills the city of the Golden Horde period was rebuilt. In the 17th century, the Kipchak desert tribes settled in the north-eastern part of present-day Khojeli and later joined the Mangyt-Nukus hill and became a large city [1.100-101].

The first appearance of the bastion of Khojeli as a city dates back to the end of the XVII century. At that time, Khojeli was a trade route in the center of the Aral Sea and Khiva where caravans stopped. The Amu Darya "Khoja" tribes were neighbors of the Mangyt and Nukus tribes and had one hill [2.220].

At the beginning of the XVII century, it is clear that the historical figures of the "Khoja" people had a place and role in political, social, ethnic, economic and cultural life. In 1616, the documents show that the people of Nazarkhozha were at the border checkpoint, at the stop of caravanserai. In 1622, the Russian merchant L. Yudin wrote that he met the "Jurgench hodja". It is known in the documents that "Jurgenchli khozyatul Abyz" came to the Samara trade market. There is evidence that in 1617, Yusuf Khodja was in the content of the ambassador of the Khiva khan Arab Muhammad, who raised the issue of trade in Moscow [3.26-31].

In Abulgazykhan's poem "Shazharayiturk" the places of the Aral people – khojas are shown. “the ground from the town of Mizdahkan on the left bank of the Amu Darya, till the Bakyrgan village (Hakimata) on the north side was planted with wheat and was a spring field. In the threshold, center of the Bakyrgan village there was a man from the family of Sait Ata. They called Nazirkhoja. Elbarskhan married his daughter. Nazyrkhoja came to the aid to Sultan Asfandiyar with 300-400 horsemen. One of the fighters for the throne of Khorezm, Khabash sultan was defeated in the battle and took refuge to the Karakalpaks on the Syr Darya [4.160].

It is known that the Khoja tribes settled in the lower reaches of the Amu Darya along the South Aral Sea. In the middle Ages, Hakimata (Suleiman Bakyrgani) and his disciples came to the Amu Darya basin from Turkestan to propagate Sufism under the nickname "Khoja" and settled, spread spiritual culture to the people. The khan of Khiva sent the khojas (lords) to this place in order to strengthen his rule, and since then it has been called the "land of khoja (lords)" (XVII century) [5.43].

Alemin Ishan khoja, a native of Turkestan, built a mosque in the Amu Darya basin and united the population to form the Khoja Eli settlement. Thus, there are folk legends that the formation of the Khojeli people was hindered by Turkestan clergy.

A.L. Kun, a scholar who took part in the fight of Khiva on the "History of Khojeli", met with the mayor of Khojeli Murtazahojabek, from whom he wrote the rich information about the Amu Darya, its tributaries, Kuanysh Zharma, Kegeyli, Khoja eli [6.220-221]. He said that he heard the Karakalpak genealogy from Murtazakhojabiy. The city has more than 300 shops and handicraft workshops, five mosques, five schools, a madrasah and a large caravanserai. Visitors stay and rest in this caravanserai [7. 216-217]. In the summer of 1874, the Russian artist and writer N. Karazin came to our region as part of the "Amu Darya Scientific Expedition". He visited Khojeli and described the city as the "Venice of the Amu Darya" [8. 205]. Every year from Khojeli and Kungrad to Bukhara, Samarkand, Karshi, Shahrisabz and Gissar boats filled with 50 to 200 smoked fish, including carp and catfish were sent. Smoked carp and catfish (catfish) were sold in Khojeli for 30 tenge per kilo. In Bukhara, smoked fish was sold for 60 tenge [9].

Khojeli was called Sueli in the 18th and 19th centuries. Because there were 32 large and small canals in Khojeli. This canal divided the population of the city. There are legends among the people about why they called Suenli. Khan came during the excavation of the canal. He is fed salmon from that canal. The khan later gave the name Suenli [6.44].

A traveler and merchant named Middendoraf, who came to Khojeli in the past (he wrote the book "Journey from Khojeli to Persia"), saw that the people lived in Khojeli did not have locks on their doors, and their doors were open and astonished “I saw the door’s not having locks and their openness in Rome and Khojeli."

In ancient times, there were few bread tandoors among the nation in the Khojeli region, and one tandoor was built on each street. The small number of tandoors in the city shows the unity of the country. "If you stay in Khojeli for 70 days, you will be the khoja", "the man who came on foot to Khojeli, had a horse", "the man who came to Khojeli on horseback, had a horse cart", "Khojeli's people are satisfied people", "the sparrow ate Khojeli's grain and came back from Mecca", "Khojeli is a country where the Kydyr visited "," Khojeki is a land God blessed" is often said. Alexander Nikolaevich Samoilovich [10] (1880-1938) was an academician who visited the Khiva Khanate several times. In 1908, he came to the city of Khojeli and bought from the Khojeli market an epic about the conquest of Khorezm by Chingis Khan, a biographical book by Najmiddin Kubra, the epic "Khorezm-nama". At that time in Khorezm Khojeli was famous for the quality and beauty of the desired knives. People from far away came to Khojeli to look for the desired knives and bought. A.N.Samoilovich bought 2 knives because of the high quality of the famous Khojeli knives. Leaving the market, he photographed the mausoleum Mazlymkhan and Gawirkala with his camera [11.53].

In 1825-1826, military reports stated that the distance from the fortress of the Kyzyl Khoja to the city of Gone Urgench (Karabakhana) was about 40 km. There is an old canal place near the Kyzyl Khoja fortress, which shows that the water of the Amu Darya flowed through that canal into Urgench. However, the location of the cities "Kyzyl Khoja", "Kara Khoja" is still unknown. It is known that during the period of formation and formation of the Khojaeli land it was a part of the khans of Urgench and Aral provinces [12.26-31].

The city Khojeli was located on the land and water route from Khiva to Kungrad. According to A.Vamberining, the city Khojeli was located about two hours from the banks of the Amu Darya, where there was a pier. “They consider themselves the descendants of Khoja and are very proud of it in front of other Uzbeks [13.69]. Archaeologists directly connect the history of the city with Mizdahkan. Later, the Khoja Eli (Khojeli) fortress and market became of economic importance due to its geographical location at the intersection of the river and the caravan route and the proximity of the sanctuary.

In addition, it should be noted that one of the necessary crossings over the Kok-Ozek canal was occupied by the Khoja-eli tribe. One of the first references about the city Khojeli in the Munis Chronicles of 1779 is related to the description of the strike of the Turkmen people against the government in Khiva. At that time, the government was in the hands of Muhammad Amin-inaq, who quickly appointed a detachment of two hundred men to defend the Khoja-elin. The leader of the rebellious Turkmen found allies among the Mangyts and Karakalpaks in the Aral Sea, marched with his army to Khoja-eli, and after a seven-day siege captured the city. Other references about the city Khojeli and its environs in the chronicles of the Khiva historians Munis and Agahi date back to the 19th century. Munis wrote that the Turkmen Imreli tribe, who came to Khorezm in 1804, settled by the order of Auez Inak " in the lands of Keneges, Khoja-eli district along the Oman-Kuli irrigation canal" [14.192].

According to the Khiva chronicles, the city Khojeli was located on the left bank of the Amu Darya on a dry road from Khiva to Gone-Urgench or from Khiva to Kungrad. For this reason, all the military campaigns of the Khiva khans against the Turkmen or Karakalpaks in the Kungrad province, as well as the Karakalpaks of Zhanadarya, were carried out through the city of Khojeli. It should be noted that the city was of strategic importance. Due to this, the khans of Khiva tried to defend the city of Khojeli safely and placed the submissive officials around the city as a gift. Often on the outside of the city, during military campaigns, the khans of Khiva stopped for a few days and went hunting. For

example, in 1808, during the march against Kungrad Toremurad Sufi, "... we stopped in Khoja-eli. The khan, who liked and benefited the people, left on Friday and then came to Kara-Kul." On the way back, Khan's troops again settled around Khojeli to rest [14.268].

In January 1809, Muhammad Rahimkhan personally led a military expedition to the Aral Sea region. After arriving in the city, "... the aristocracy and the people of Khoja-eli under the leadership of Sayyid Khoja-bii and the highest representatives of the Karakalpaks in the Khoja-eli region organized a meeting and came to the khan to greet the khan with gifts and to bow ..." [14.276-278]. In 1810, Khojeli was defended for some time by Kutli Muhammad -inak. When he left the direction of Aibuir to suppress the Turkmen rebels - Toremurad Sufi, his son remained defending the city [15.295-298]. According to the Khiva chronicles, the Khiva khans punished the civilian population with their armies for very few crimes. One such case took place around the Khojeli area, where Muhammad Rahimkhan's troops were deployed in November 1810 during a military campaign against the Zhanadarya Karakalpaks. The khan went hunting for four days. Several of the warriors said, "they were fed by the Khoja-eli and Karakalpak workers and the horses with hay. When this violence became known to the khan, the shah rewarded its owners with gifts, ordered the convicts to pierce their noses and ears as punishment, and ordered the heralds to announce throughout the camp that anyone who touched the property of the oppressed people without their consent would be punished. [17.329-330]. Approximately, in the middle of the 19th century, Khojeli became the place where the Khan's troops and military leaders wait for orders from Khiva, for example, during the strikes of Aidos-biy and Ernazar Alakoz the orders from Kutli Muradkhan (September 1855 - February 1856), and from Sayyid Muhammad Khan (1856-1865) were sent through messengers [15.130].

Historian Agakhi talks about the strategic location of the city Khojeli and the humiliation of the Khiva government. Thus, in January 1856, according to the order of Kutli Muradhan, Rahman Berdi-biy and Wais Niyoz-bai, who had been in the Khoja-eli fortress, returned to Khiva without permission. Two situations frightened them. About a thousand Karakalpak horsemen under the leadership of Zarlykhan came to the Yamuts to continue the strike together, and the Turkmen tribes Zhemshids began to plunder the population around Khojeli. The khan did not punish him for this crime, but Rahman Berdi-biy was curbed a little [16.558]. Munis's interesting account is that on January 2, 1811, Muhammad Rahimkhan crossed the Amu Darya from the Khoja-eli to the Shorcha Fortress on the east-east side ... [15.118]. Apparently, this is one of the few proofs of how and where the city Nukus (or Shorcha Fortress) was formed. Today, many places of worship, which were revered in the XVIII-early XX centuries, are associated with the city Khojeli [17. 20-27].

It should be noted that the city of Khojeli in the XVII-XIX centuries was one of the most important strategic, commercial and economic, and later the residence of the officials of the Khiva Khanate, as well as the central city of cultural and religious activities along the South Aral Sea.

CONCLUSION: The research findings demonstrate that the Southern Aral Sea region, particularly the urban of Khojeli, played a crucial role in the political, economic, and cultural landscape of the 17th–19th centuries. The Aral Domain functioned as an important strategic and commercial territory where caravan networks, interregional trade, and social–political relations shaped the daily life and long-term development of the region.

The study confirms that Khojeli, with its deep historical roots traced to the Mizdahkan archaeological complex, served as one of the leading cities of the Amu Darya delta. Its vibrant trade environment, craftsmanship traditions, religious institutions, and defensive structures made it a significant center within the broader system of the Khiva Khanate and neighboring states.

Furthermore, the comparative analysis of Eastern manuscripts, chronicles by Munis and Agahi, and Russian expeditionary reports reveals that shifts in political power, migration patterns, and changes in the river-irrigation system profoundly influenced regional development. These factors contributed to the transformation, resilience, and adaptability of Southern Aral Sea urban culture.

In conclusion, this study highlights the historical importance of the Aral Domain and its cities in regional history and underscores the need for continued interdisciplinary research to further uncover the cultural, social, and economic heritage of Karakalpakstan.

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Rezyume: *Ushbu maqolada XVII–XIX asrlarda Janubiy Orolbo'yi hududida shakllangan Aral mulki va uning asosiy shahar markazi — Khojeli tahlil qilinadi. Aral mulki Khiva va Buxoro xonliklari qatorida mustaqil siyosiy birlik sifatida yozma manbalarda qayd etilgan bo'lib, mazkur hududning iqtisodiy hayoti, karvon yo'llari tizimidagi o'rni va urbanistik rivojlanishiga alohida e'tibor qaratiladi.*

Tadqiqotda Khojeli shahrining shakllanish jarayoni, uning qadimgi Mizdahkan manzilgohlari bilan tarixiy bog'liqligi, XVII–XIX asrlarda savdo, hunarmandchilik va diniy-ma'rifiy markaz sifatidagi o'rni keng yoritiladi. Shuningdek, qo'shni xalqlarning migratsiyasi, siyosiy jarayonlar, karvon yo'llari harakati va daryo tizimining o'zgarishi shahar hayotiga ko'rsatgan ta'siri manbalar asosida tahlil qilinadi.

Xiva xonlari yurishlari, karvon yo'llari xavfsizligi, xojalar va mahalliy urug'lar o'rtasidagi ijtimoiy-siyosiy munosabatlar haqidagi ma'lumotlar Munis, Ogahiy, rus harbiy ekspeditsiyalari va sharq manbalari bilan solishtirilib o'rganiladi. XIX asr manbalarida Khojelining "Amudaryo Venetsiyasi", yirik savdo markazi, diniy-ma'rifiy maskan va strategik qo'rg'on sifatidagi tavsiflari alohida ilmiy ahamiyatga ega.

Ushbu tadqiqot Janubiy Orolbo'yi shaharlarining urbanistik rivoji, iqtisodiy faoliyati, xalq og'zaki ijodi va etnik-siyosiy jarayonlari orqali mintaqaning ko'p qirrali tarixini ochib beradi hamda Qoqapog'istonning shahar madaniyati taraqqiyotini yanada chuqurroq o'rganishga imkon yaratadi.

Резюме: *В данной статье исследуется Аральское владение, сформировавшееся как самостоятельное политическое образование в южной части Приаралья в XVII–XIX вв., а также его основной городской центр — Ходжейли. Письменные источники упоминают Аральское владение наряду с Хивинским и Бухарским ханствами, что подчеркивает его значимость в региональных политико-экономических процессах. Особое внимание уделено экономической жизни, городской структуре и роли караванных путей, пересекающих этот регион.*

В статье рассматривается формирование города Ходжейли, его связь с древним поселением Миздахкан и превращение в торгово-ремесленный и религиозно-просветительский центр в XVII–XIX вв. На основе широкого круга письменных и археологических источников анализируются процессы миграции, политическая динамика, функционирование караванных дорог и влияние изменения русла Амударьи на развитие города.

В работе использованы сведения из хивинских летописей Муниса и Агахи, отчетов российских военных экспедиций и восточных источников, раскрывающих военные походы, состояние караванных маршрутов, отношения ханов с местными племенными группами. Описания путешественников XIX века, называвших Ходжейли «Венецией Амударьи», отражают его стратегическую, экономическую и культурную значимость.

Данное исследование вносит вклад в глубокое понимание урбанистического развития, экономической деятельности, этнополитических процессов и культурного наследия южного Приаралья, а также открывает новые перспективы изучения истории городской культуры Каракалпакстана.

Kalit so‘zlar: *Janubiy Orolbo‘yi, Aral mulki, Amudaryo del’tasi, Khojeli tarixi, Mizdahkan manzilgohi, Buyuk Ipak yo‘li, karvon yo‘llari, Xiva xonligi, Buxoro xonligi, Qoraqalpoq urug‘lari, savdo va iqtisodiyot,, urbanizatsiya, arxeologik topilmalar, diniy-ma’rifiy hayot, Sufiylik, xojalar, etnik jarayonlar, rus ekspeditsi, Munis va Ogahiy manbalari, XIX asr manbalari, harbiy yurishlar, Orolbo‘yi madaniyati, qo‘rg‘onlar, suv tarmoqlari, karvonsaroylar, hunarmandchilik, xalq og‘zaki ijodi.*

Ключевые слова: *Южное Приаралье; Аральское владение; дельта Амударьи; Ходжейли; Миздахкан; Великий шелковый путь; караванные маршруты; Хивинское ханство; Бухарское ханство; каракалпакские племена; торговля и экономика; урбанизация; археологические данные; религиозно-просветительские центры; суфизм; роды ходжей; этнополитические процессы; российские экспедиции; хроники Муниса и Агахи; военные походы; культура Приаралья; фортификационные сооружения; ирригационные каналы; караван-сараи; ремесленничество; устные традиции.*

ARTISTIC INTERPRETATION OF THE HARMONY OF NATURE AND MAN IN THE WORKS OF ULUGBEK HAMDAM

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Summary *This article analyzes the artistic interpretation of the harmony between nature and man in the works of the modern Uzbek writer Ulugbek Hamdam. Using the novel "Muvozanat" ("Balance") as an example, the author explores the function of landscape not merely as a background, but as a vital tool for revealing the psychological state of characters and expressing philosophical ideas about cosmic order, the rhythm of life, and human destiny. Special attention is paid to the symbolic meaning of natural images, such as snow and dawn, in the context of the hero's self-discovery.*

Keywords: *Ulugbek Hamdam, modern Uzbek literature, novel "Muvozanat", landscape, psychologism, harmony of nature and man, artistic interpretation, symbol, philosophy of life.*

The creative work of Ulugbek Hamdam occupies a special place in contemporary Uzbek literature. His novels, stories, and poetry are distinguished by their deep reflection of the human psyche, spiritual and moral transformations in society, and spiritual conflicts.

In the writer's style, the means of description—landscape (scenery) and the interpretation of the human psyche—acquire special significance. Ulugbek Hamdam reveals the character's nature not through direct speech or authorial explanation, but through the artistic description of the environment and the psychological interpretation of the character's appearance. In this respect, the landscape and the human, their interconnectedness, and their mutual necessity are illuminated with wonderful skill in his works.

In the novel *Muvozanat* (*Balance*), this is described as follows:

“It had been snowing since the snow began to fall; the boy standing by the window—Yusuf—was trembling with joy that could not be contained within him. He kept asking his mother when the dawn would break, and dissatisfied with Halima aya’s answer, he climbed onto a stool and kept gazing towards the Great Mountain (Ulug‘tog‘), where the sun rises.

‘If you don’t rush so much, you’ll get enough of the snow and the playing. Get down, don’t fall and cripple yourself,’ scolded Odil aka.

‘Tell that Great Mountain of yours, father, not to keep holding it, let it release the sun! If it weren’t for the mountain, we would already be playing with Sodiq,’ Yusuf said sweetly, making his parents laugh.

‘What are you saying, my son? The mountain hasn’t blocked the sun. The sun comes out from very far away, from behind the mountain. Neither the mountain nor anything else, no one but God can hinder it. It appears when its time has come,’ the father explained.

‘Then tell God to let the sun go!..’

‘Ha-ha-ha...’ the father laughed. ‘My son, God does not act by asking me. He is his own King, his own Master. He knows His work well. He runs the world in a specific rhythm (marom). This rhythm cannot be broken; if it is broken, the Apocalypse (Qiyomat) will occur on earth.’

‘What is the Apocalypse?’

‘You will know when you grow up. Look, the dawn has brightened. Come on, get up, children! Some of you shovel snow, others look after the livestock, let’s go!..’” [1:4]

The given excerpt vividly reflects the innocent depiction of childhood characteristic of Ulugbek Hamdam’s work, the mutual harmony of nature and man, as well as a philosophical layer regarding the inevitable laws of life.

At the center of the text stands the joy of a small boy, Yusuf, and his simple dreams about snow and playing. Such a direct, sincere relationship between the child and nature corresponds to the principle of perceiving nature as a living being in Ulugbek Hamdam’s psycho-aesthetic world.

Yusuf's eager anticipation of the dawn is, in fact, a symbolic manifestation of man's striving for light, novelty, and the movement of life. He looks for a "false culprit," saying "let the Great Mountain release it." This is the unique logic of childhood—understanding the world simply, seeking causes in visible things. At the same time, through this playful thinking, the author introduces a profound philosophical idea: man is not the ruler of the processes in his life; they occur according to their own laws.

The answers of his father, Odil aka, reveal the philosophical layer of the text. His statement, "God does not act by asking me... He runs the world in a specific rhythm," signifies the cosmic order and the fact that life has its own law and rhythm. The disruption of this rhythm is a state leading to the derailment of life, chaos, and "Apocalypse."

Thus, through this small conversation within the family, the author expresses artistic thoughts about cosmic order, divine law, and the harmonious rhythm of existence. Yusuf's question, "What is the Apocalypse?" connects the natural curiosity of childhood with eternal themes of life. The father's answer, "You will know when you grow up," presents the important idea that life's truths are revealed at each age stage, and knowledge matures with time. That is, every truth has its time; time does not allow one to know or understand what is not yet ripe.

The conclusion of the excerpt—the arrival of tomorrow, the continuation of life in its own rhythm, and the children being called to labor—expresses the simple yet sacred cycle of life. Here, the brightening of the dawn is not just a natural phenomenon, but a symbol of the continuation of life, the renewal of the world, and the interconnection between human activity and existence.

In this novel, Ulugbek Hamdam provides a deep philosophical idea through the depiction of the child, the landscape of nature, and the father-son conversation: that man lives in harmony with existence, submits to the rhythm of life, and that everything happens in its own time. The artistic system, ranging from Yusuf's innocent wonder to the father's quiet wisdom, shows the value of life, the inevitability of time, and the inviolability of divine order. Thus, the excerpt is an artistically constructed bridge between the sincere joy of childhood and the eternal laws of existence.

The writer uses the landscape not merely as a background, but as a means to express the hero's mood and psychological state. In the writer's descriptions, nature is a living force, in motion, communicating with the hero.

At the beginning of *Muvozanat*, the author reveals the hero's inner experiences through the following landscape:

"As he rushed into the main street buried in snow, his mind had no worry other than to take delight. Finally, wading through snow up to his knees, he came out from the path to the main road and stopped in front of a street where no tracks had yet fallen. Had no one passed here before him? Yusuf hesitated for a moment. The snow, lying spread out like soft cotton, was so beautiful, and on top of that, it was so untouched that Yusuf asked himself, 'Should I step or not?' Finally, he walked on, crunching through it. After a while, he turned and looked back, seeing the new tracks—the new path. And ahead, snow with no tracks yet! His delight grew even more. Now he began to run." [1:5]

In Ulugbek Hamdam's work, along with the description of the inner dynamism of the childhood world and innocent delight, deep philosophical meanings are embodied. The central image in the work is Yusuf; his seeing the trackless road on the snow and his hesitation about being the first to step on it are illuminated by the author through subtle psychological observation.

The snow landscape here is not a simple natural description; it turns into a symbol of beginning, purity, and new opportunities. The description "snow lying spread out like soft cotton" brings into the text not only aesthetics but also the momentary purity of life and the innocent nature of opportunities.

Yusuf's internal question, "Should I step or not?" is, in reality, an artistic symbol of the internal hesitation a person feels before every important step in life. In this context, the absence of tracks on the snow is interpreted as an undiscovered path, a destiny no one has yet walked, and a symbol of man's opportunity to create his own path.

Yusuf's hesitation represents caution, internal dialogue, and the process of listening to oneself. Finally, his walking with a "crunch" signifies his internal decision and his daring to take the first step.

Yusuf looking back and seeing his own footprints is a symbolic view of a person beginning to understand his own path by seeing his deeds, alongside childish joy. The child does not yet understand this, but through this, the author reveals a psychological-philosophical truth of life: after every step, a person looks back—sees his tracks, understands his path, and strives forward with even more confidence.

In the final lines of the excerpt, the artistic dynamics intensify: as the trackless white path continues, Yusuf's delight increases, and he starts running. This running is not a child's play activity, but an artistic image of man rushing towards novelty in life, towards freedom, and in search of his own self.

Through childhood joy, Ulugbek Hamdam reveals a very delicate philosophical layer: these are the delight of discovery, the excitement specific to the first step of creation, and man's desire to leave his mark on the world.

The given excerpt is not only an artistic description of childhood delight but also a symbolic expression of the process of man finding his path in existence. The snow is a symbol of purity and beginning; the trackless road represents unchosen opportunities; Yusuf's hesitant step represents courage at every turn of life; and his running represents the striving for discovery, freedom, and novelty.

By describing a simple childhood state, Ulugbek Hamdam reveals the most subtle processes of the human psyche, the formation of the life path, and the need to leave one's mark with artistic-philosophical depth. As a result, the excerpt rises from the simple world of childhood to the level of generalization, appearing as a profound concept regarding man's place and purpose in existence.

The author often uses the portrait in a symbolic function. The character's external appearance serves as a tool to understand their spiritual world. The landscape expresses the hero's inner remorse through external signs. Thus, in the poetics of the work: the human reveals individual character, the landscape creates a psychological background, and together they reflect the character's inner world fully in the external appearance and atmosphere.

In the work of Ulugbek Hamdam, the description of nature and man occupies a central place in the artistic system of the work. The writer uses the landscape as a means to reveal the hero's psychological state, express changes in society, and create the mood of the event, while also using it as a tool to show the image's individual character, psychological state, and social essence.

The harmony of nature and man is one of the main features of the poetics of U. Hamdam's works, through which the author reveals the inner world of man with artistic, subtle, psychological depth.

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Rezyume:. *Ushbu maqolada zamonaviy o'zbek yozuvchisi Ulug'bek Hamdam ijodida tabiat va inson uyg'unligining badiiy talqini tahlil qilinadi. "Muvozanat" romani misolida muallif peyzajning shunchaki fon emas, balki qahramonlarning ruhiy holatini ochish, kosmik tartib, hayot maromi va inson taqdiri haqidagi falsafiy g'oyalarni ifodalashdagi muhim vosita ekanligini tadqiq etadi. Maqolada qor va tong kabi tabiat tasvirlarining qahramon o'zligini anglash jarayonidagi ramziy ma'nosiga alohida e'tibor qaratilgan.*

Резюме. *В данной статье анализируется художественная интерпретация гармонии природы и человека в творчестве современного узбекского писателя Улугбека Хамдама. На примере романа «Мувозанат»(«Равновесие») автор исследует функцию пейзажа не просто как фона, а как важнейшего средства раскрытия психологического состояния героев и выражения философских идей о космическом порядке, ритме жизни и судьбе человека. Особое внимание уделяется символическому значению природных образов, таких как снег и рассвет, в контексте самопознания героя.*

Kalit so‘zlar: *Ulug‘bek Hamdam, zamonaviy o‘zbek adabiyoti, "Muvozanat" romani, peyzaj, psixologizm, tabiat va inson uyg‘unligi, badiiy talqin, ramz, hayot falsafasi.*

Ключевые слова: *Улугбек Хамдам, современная узбекская литература, роман «Мувозанат», пейзаж, психологизм, гармония природы и человека, художественная интерпретация, символ, философия жизни.*

INDEPENDENT EDUCATIONAL ASSIGNMENTS DEVELOPMENT AND ASSESSMENT CRITERIA FOR HISTORY STUDENTS

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Summary*: The article discusses the content, methods, and tools for teaching students independent learning in higher education, the criteria for developing independent learning assignments in the teaching of Uzbekistan history, and offers proposals and recommendations.*

Key words*: knowledge, skills, competence, independent thinking, independent learning, independent reading, working with additional sources.*

In recent years, the national history of Uzbekistan has been developing alongside other fields, aligning more closely with international standards. Special attention is being paid to the development of students' skills for independent work. It is essential to ensure the right combination of classroom and independent work. The curriculum should be designed not only in terms of the sequence of learning individual courses but also from the perspective of the rational ratio of classroom and independent work. In this context, it is important to accurately determine the complexity of various independent activities, such as course projects, calculations, graphic works, and other assignments. Before preparing such a plan, it is necessary to seriously study the student's time budget, equip it with methodological exercises, and take into account national traditions in the education system. Managing independent work should not be an end in itself for the teacher but should serve as a motivating factor for the student's educational activity.

Every student, having grown up in this country, must be able to thoroughly understand the ancient and rich history of this nation and be able to convey it to their peers and future generations. The current education system, especially the methodology of teaching history, should pay attention to this aspect. Through the teaching of history, the student should develop logical thinking skills. Indeed, “Our youth must grow as individuals who can think independently, possess high intellectual and spiritual potential, and not lag behind their peers in any field on a global scale, for which our state and society mobilize all their resources and opportunities.” This emphasizes that the teaching of history imposes urgent tasks on the education system to train our youth as independent thinkers with a strong national pride.

Students' independent work is a planned educational and research activity carried out under the guidance and methodological support of the teacher but without their direct participation. Independent work of students is one of the most important components of the educational process, aimed at solving the following problems:

- Encouraging students to master educational programs;
- Developing students' general and professional competencies;
- Creating conditions for students to develop self-education, self-management, and self-improvement abilities;
- Reinforcing, expanding, and deepening knowledge gained from teachers during lessons;
- Acquiring new knowledge;
- Developing their knowledge methods and techniques;
- Fostering creative thinking in students;
- Cultivating interest in knowledge, research, and specialization among students.

Independent work is an effective means of enhancing and activating students' creative activity and is a key resource for improving the quality of specialist training. Having initial skills in independent educational activity and creating an environment of "mandatory independence" is of great importance in completing independent assignments. In particular, the application of various modern approaches in the methodology of teaching social sciences is considered effective. For a person to mature, especially for self-recognition, they must first know their history. In fact, without historical memory, there can be no development. From this perspective, the need to reform the system

of teaching history in the country is evident. In recent years, various modern methods and techniques have been actively applied in the methodology of teaching history. Traditional methods have been generalized by scholars and classified into four groups, showcasing their techniques.

The essence of independent work lies in the existence of specially organized activities by students; the results of the educational process's activities and technologies. When choosing the content of independent work, the teacher should focus on the general competencies to be mastered in the study of the subject. When planning independent work, the teacher takes into account the motivation of students and their readiness for independent work.

To increase the effectiveness of independent work, the teacher develops educational and methodological support that includes educational and control tools. Educational tools can be conditionally divided into three groups:

1) Methodological recommendations (guidelines) used to manage students' independent activities: for the subject course, on specific topics, or for completing certain types of work, including:

- Algorithms and examples for completing assignments;
- Recommendations for time management during the assignment process;
- Independent work tasks;
- Self-assessment criteria for completed work;
- A list of primary and additional literature.

2) Didactic tools that can serve as a source of independent knowledge (primary sources, documents, texts of literary works, collections of tasks and exercises, collections of journals and newspapers, popular scientific literature, educational films, videos, maps, tables, tools, materials, collections, etc.).

3) Technical tools for presenting and processing educational data (computers, audio and video equipment).

The types of independent assignments, their content, and nature can vary and be tiered to account for students' individual characteristics. The following can be used as forms of control: tests, oral or written quizzes, defense of creative works, presentation of projects, as well as seminars. A seminar is one of the forms of checking students' independent work, which provides for students to independently develop individual topics and problems in accordance with the content and outcomes of the educational subject.

The didactic objectives of the seminar include:

- Deepening, systematizing, and reinforcing knowledge;
- Checking knowledge;
- Developing skills for independent work with various sources;
- Cultivating oral communication skills, the ability to respond to listeners' questions, and the capacity to defend one's point of view rationally;
- The ability to listen to others and ask questions.

To achieve these didactic objectives, it is necessary to develop methodological materials for students' independent work, where the content, volume, and types of assignments for each topic are defined, along with the forms and methods of controlling the results.

Independent assignments should contribute to the formation of general educational competencies in independent work.

The general educational competencies of independent work are divided into:

- Reproductive competencies of students' independent work
- Effective skills of students' independent work

Reproductive competencies include:

- Identifying key points in the text;
- Breaking down the material into components;
- Creating plans;
- Formulating theses;
- Taking notes from texts;
- Creating abstract messages;

- Utilizing reference materials;
- Providing examples.

Effective competencies include:

- Identifying and formulating problems;
- Proposing hypotheses;
- Developing a plan for solving problems;
- Summarizing material and drawing conclusions;
- Systematizing material by compiling reports based on various sources;
- Implementing transcoding: translating text into diagrams or tables.

Types of Independent Assignments:

1. For mastering knowledge: Studying text-based materials, working with references, processing text-based information, searching for information using computer technologies and Internet resources.

2. For reinforcing and systematizing knowledge: Repeatedly working on educational materials by completing various tasks, creating supporting abstracts, response plans, theses, thematic crossword puzzles, diagrams, and tables, completing standard tasks, analytically processing text-based information, preparing reports.

3. For developing various levels of competencies: Solving variable problems of different complexities, preparing for business games and competitions, searching for and processing information from various sources, and more.

Seminars help deepen the study of the most complex topics and serve as the primary form of concluding students' independent work. Each practical history lesson should be structured as follows:

- Questions for which answers need to be prepared.
- Concepts you need to know (vocabulary).
- A chronological table to be filled in.
- Practical tasks in the form of comparative tables or structural and logical schemes based on sources that need to be completed.
- Questions for heuristic discussion or justifying your point of view when answering.

Criteria for Assessing Students' Independent Work Results:

- The level of mastery of the educational material;
- The ability to use theoretical knowledge in practical tasks;
- The level of development of general educational skills;
- The ability to actively use electronic educational resources, find, learn, and apply the necessary information;
- The relevance and clarity of material presentation;
- The design of materials in accordance with corporate standards;
- The ability to navigate information flows and highlight key points;
- The ability to clearly formulate a problem, propose a solution, and critically assess the solution and its consequences;
- The ability to identify and analyze alternative options and courses of action;
- The ability to formulate and justify one's position and assessment.

The universal methods for working with information are based on the taxonomy developed by B. Bloom. This taxonomy is also used in assessing activities in research.

Assessment Criteria for Practical Work Results:

A "High" grade is awarded if:

1) The student fully presents the material and correctly defines key concepts;

2) The student identifies their understanding of the material, justifies their judgments, applies knowledge in practice, and can provide necessary examples;

3) The material is presented in a sequential and correct manner.

A "Good" grade is awarded if:

- The student meets the same requirements as for a "5" mark but makes 2-3 errors that they can correct.

An "Average" grade is awarded if:

- The student discovers knowledge and understanding of the main rules of the topic but:

1) Does not present the material in full and makes ambiguities in identifying concepts, historical events, and dates.

2) Cannot adequately substantiate their judgments or provide their examples;

3) Presents the material in an inappropriate manner.

A "Poor" grade is awarded if:

- The student indicates a lack of knowledge of most of the issue, makes errors in formulating definitions and dates, distorting their meanings, and presents the material randomly and vaguely.

In conclusion, seminars in history increase the effectiveness of independent work: they reflect the requirements of state educational standards; contribute to the development of students' personal and subject-specific knowledge and skills; create opportunities for developing key competencies through mastering essential activities in the educational process.

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Rezyume: *мақолада олий таълимда тарих ўқитишда талабаларни мустақил таълим олишга ўргатишнинг мазмуни, усул ва воситаларини ишлаб чиқиш, Ўзбекистон тарихи фанини ўқитишда мустақил таълим топшириқларини ишлаб чиқиш мезонлари, таклиф ва тавсиялар ҳақида муҳокама юритилган.*

Резюме: *В статье обсуждаются содержание, методы и средства обучения студентов самостоятельному обучению в преподавании истории в высшем образовании, критерии разработки заданий для самостоятельного обучения в преподавании истории Узбекистана, предложения и рекомендации.*

Калит сўзлар: *билим, кўникма, малака, мустақил фикр, мустақил таълим, мустақил ўқиш, қўшимча манбаалар устида ишлар.*

Ключевые слова: *знания, навыки, квалификация, самостоятельное мышление, независимое образование, самостоятельная учеба, работа с дополнительными ресурсами.*

SOME CONSIDERATIONS ON THE SYSTEM OF POLYPHONIC THINKING

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Summary: *The term "polyphony" refers to the density of information and experience in this piece, in which the discursive boundary (the author's attitude, the speech of the characters, and the social context) is removed.*

Key words: *polyphonic thinking, form and style, polyphonic element, polyphonic novel, rhetorical limit, analysis and image.*

If one looks at the development of world culture and aesthetics, as the scope of artistic thinking improves, the compositional center also becomes more complex. Artistic weight acquires reality through the semantic reshaping of the object. Indeed, in this process, the degree of creative polishing given to the artistic text also varies. Novel writing, particularly Uzbek novel writing, is a continuously renewing system. Consequently, the transformations observed in the nature of the genre primarily move from essence to form and become integrated in style.

The volume of change manifested in the commonality of content, form, and style creates the complexity of artistic orderliness. In the structure of the work, the coming together of the independence of expression and the psychology of description into a mixed state brings about the polyphony of interpretation.

The expansion of the scope of imagination forms a multiplicity of discussions. Mikhail Bakhtin, a Russian literary scholar who analyzed the manner in which polyphonic elements are manifested in the system of the novel, wrote: "The polyphonic novel is entirely organized on the basis of dialogue. The discipline of the novel *(emphasis ours – G.A.)* is a relationship between all elements, and they are depicted in accordance with the principle of multi-voicedness. As is known, this dialogic relationship is a much broader phenomenon". Significantly, the astute critic places logical emphasis specifically on the fact that artistic relations determine the integrity of the work's structure.

Indeed, the works of Russian writers F. Dostoevsky and L. Tolstoy ("Crime and Punishment", "The Idiot", "The Brothers Karamazov", "Anna Karenina", "War and Peace") created a revolution in European literary-aesthetic thinking. In their works, the harmony of tone and consciousness moves from speech to thinking. Multi-voicedness occurs on the basis of the integrity of description and imagination. The spiritual inviolability of consciousness opens a wide path for the independence of thinking. And the independence of thinking creates the ground for the graduation of speech.

It appears that the system of polyphonic thinking is one of the elements ensuring artistic integrity, in which the processes of consciousness and speech are harmonized. Polyphony is a term describing the cohesion of concept, detail, and experience, in which the discursive boundary (author's attitude, character's speech, and social basis) is eliminated.

Specifically:

- cause-and-effect correlation is put to an end;
- it directs the mutual interchanges of analysis and description towards a profound essence;
- multi-layeredness of expression is ensured;
- multi-voicedness creates conditions for entering the essence.

Observations reveal that the phenomenon of polyphony has not been consistently studied in a theoretical aspect even in world and Russian literary studies. Although a number of studies and articles have been dedicated to the research of this phenomenon appearing in certain novels, most research focuses only on its quality of multi-voicedness. In reality, polyphony is a concept related to the literary system, and it encompasses polyphonic speech, the movement of the hero, the multifaceted nature within their character, as well as their positioning arising from the formation of the composition.

Indeed, certain creators writing in the novel genre in recent years are not following the path of simple description in narration. In the works created by them, we do not encounter the traditional plot, compositional structures, or the series of events and occurrences narrated on the basis of chronological consistency that we are used to. Instead of traditional methods of description, the stream of consciousness is reflected, and descriptive ways appropriate to this are chosen.

Considering these points, this chapter studied the characteristics of the "stream of consciousness" method of describing life that emerged in 20th-century modernist literature, as well as their functional role and significance in certain Uzbek novels of the latest stage, and the views of Uzbek critics on this issue.

It is understood that certain aspects of these processes related to "stream of consciousness"—understanding the human being, further expanding the possibilities of aesthetic coverage, and enriching imaginations about their psyche—did not bypass the modern Uzbek novel either. At the same time, in novels created by Uzbek writers who understood the causes of the crisis of the society of the recent past, a spirit of protest regarding the relationship between society and the individual was clearly manifested. This led to a sharpening of socio-critical pathos: an increased focus on issues such as social injustice, the trampling of the individual, chauvinism, the suppression of human freedom, and the causes of the intensification of spiritual crisis.

The important thing is that expressionism did not appear as a phenomenon completely cut off from literary-cultural traditions. Updated images and the style of expression reflected the cries within human thinking and the soul, consistent with the spirit of the times. The author considered the expression of their soul, their inner "I", to be higher than objective reality. As a result of this, expression began to be considered superior to description, and intuition superior to logic. The role of abstraction, creating generalized images, symbolism, fantasy, and the grotesque increased. That is why in modern novels, it is not the complex life problem itself, but the impression, suffering, and pain it caused that found their expression.

Undoubtedly, it was impossible for all of these processes not to fully show themselves in the composition, which performs the task of organizing and regulating clear and specific signs-features of description in one novel or another, as well as ensuring the field of action—the psyche of the state. Because composition, by its nature, artistically forms the essence of real reality and the manner of its manifestation in description. It reflects the harmony of inner essence and outer structure, the proportion of expediency and mutual influence, the organic nature of the requirement of conditions and the logic of character, and the connection of life creed and artistic description to one another.

Composition ensures the dependence of form and content, which is a necessary condition of artistry, as well as integrity. Indeed, compositional integrity achieves wholeness in the relationship of form-content-style. This is because literary essence becomes more complex from life form to artistic content, and from artistic content to stylistic distinctiveness. Logical consistency ensures the internal cooperation of the compositional center and their mutual interconnection. It becomes clear that structure is formed on the basis of the field of artistic meaning and strives for external harmony.

The commonality of these two directions reaches its climax in the stylistic approach. That is why G.P. Pospelov wrote: "The composition of the work is inextricably linked with the expression of content, ensuring that the artistic idea put forward by the author is conveyed to the reader clearly, brightly, and conveniently".

Consequently, the breadth of thinking possibilities creates the ground for the emergence of multi-layeredness. And the diversity of perception is considered its core essence. Because polyphonic thinking organizes creative integrity as a general aesthetic category. Speech polyphonism, however, strengthens internal artistic relations as a narrow private literary phenomenon. At the same time, polyphonic expression forms the harmony of the scales of description and imagination. It condenses interpretation and analysis. As a result, the degree of density of consciousness and feeling is manifested in practice.

An alliance of discussion and debate emerges. Consequently, the manner of communication in the novel turns into: "almost differently from ordinary dialogue, a universal phenomenon encompassing the intensity of relations acquiring meaning and content of the entire human behavior

and activity," in which the scale of description stabilizes and the integrity of expression brings consciousness and psyche closer to each other.

In the concept that organizes the transformations of both the environment and the person in the form of a system, the accuracy of affirmation-denial unites. Indeed, in speech polyphony built on the connection of the density of monologue and dialogue, the condensed essence of description is analyzed. Integrity between expression and members is observed in it. The breadth of the scales of inner speech confirms its equalization with important literary components.

Therefore, artistic thinking now acquires a certain partnership in the creative reshaping of the work's reality. Inter-speech synthesis directs the relationship between existence and the human being to a new status. Thus, polyphonic thinking and speech polyphony are phenomena connected to each other, in which a new content of understanding and explaining the essence is reflected.

Indirect and direct speech contact provides its basis. It brings out the possibility of evaluating reality from different angles with the help of the multi-voicedness of the concept that turns into a structural part of the hero's personality. In general, the phenomenon of polyphony, considered a product of the need for freedom of observation in the culture of thinking, introduces changes to the criteria of understanding the relationship between the world and man in a new way in description and imagination, and evaluating reality from a philosophical-aesthetic point of view.

Multi-voicedness emerges only if the form of artistic essence and the field of poetic observation are directed towards artistry. It is a legitimate case that the methods of describing reality become different in aesthetic perception. Indeed, illuminating the spiritual inviolability of the person ensures the diversity of interpretation. Thus, the mutual distinction of one writer's concept from another is also determined by their individuality specific to the level of their goals and aspirations. And the nature of the hero's concept generates the polyphony of thinking.

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Резюме: *Бу мақолада полифония тушунчаси, унинг тафсилот ҳамда кечинма жипслигини тавсифлайдиган атама эканлигини, унда нутқий чегара (муаллиф муносабати, қаҳрамон нутқи ва ижтимоий асос) бартараф этилиши борасида сўз юритилади.*

Резюме: *В этой статье обсуждается ликвидация концепции многобожника, которая описывает ее детали и опыт опыта, а также ликвидацию разговоров, героизма и социальной основы).*

Калит сўзлар: *полифоник тафаккур, шакл ва услуб, полифоник унсур, полифоник роман, нутқий чегара, таҳлил ва тасвир*

Ключевые слова: *полипоны и стили, полипонические элементы, полифонический роман, круговая граница, анализ и изображение*

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IMPROVING THE METHODOLOGY FOR THE DEVELOPMENT OF TECHNOLOGY SAFETY KNOWLEDGE OF STUDENTS OF THE TECHNOLOGICAL EDUCATIONAL DIRECTION

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Summary: *This article covers the issues of improving the methodology for the development of knowledge and skills related to the safety of technology in the educational process of students of the technological educational direction. Following the rules of technical safety in the educational process not only increases efficiency in the practical activities of students, but is also important in the formation of their professional competencies. The article analyzes the existing methodological approaches and develops methodological recommendations, which are improved on the basis of innovative pedagogical technologies, practical training and interactive methods.*

Keywords: *Technological Education, Technical Safety, labor protection, security culture, methodology, innovative pedagogical technologies, emergencies, international experience, efficiency of the educational process.*

INTRODUCTION

Today, the formation of knowledge and skills in technical safety for students of the technological education direction, their application to everyday educational and practical activities have become an important component of the higher education process. The law on labor protection No. 410 ("on labor protection") serves as the main legal framework for technical safety in our country. Also, regulatory documents such as the “general technical regulation on the safety of printing products for educational institutions”, approved by the decree of the Cabinet of Ministers of the Republic of Uzbekistan No. 726 of December 28, 2022, play an important role in the regulation of safety aspects of educational institutions[1].

The article mainly deals with the issue of improving the methodology for the development of knowledge on technical safety for students of the technological direction. The purpose of the study is to analyze existing pedagogical approaches and develop effective methodological recommendations in accordance with international experience and regulatory requirements. Within the framework of the tasks set: in the educational process, it is planned to study the current state of teaching safety knowledge, determine the mechanisms for the formation of risk assessment and prevention skills of students through innovative interactive methods.

LITERATURE ANALYSIS AND METHODOLOGY

The issue of ensuring the safety of equipment and its training in the educational process has been raised to the level of a separate state policy in Uzbekistan. In particular, the law”on labor protection " and the relevant decisions of the Cabinet of Ministers of the Republic of Uzbekistan have strengthened the legal and regulatory framework for ensuring safety in production, labor protection and safe activities in hazardous facilities. From the scientist of our country Sh.Jo ' rayev, M.Safarov, A.To ' in the scientific work of khtasinov and others, the safety of technology is covered from the point of view of more legislative requirements and theoretical concepts, and the question of the formation of a culture of security with the help of innovative methods in the educational process has not been developed in sufficient depth[3].

In the international scientific literature, however, comprehensive approaches to the issues of technical safety are proposed. In particular, the EU Labour security and health strategy for 2021-2027 (EU-OSHA) lists safety training using digital technologies, simulation and virtual learning environment as a special priority. Also, the Safety 4.0 concept, published in MDPI, emphasizes the need to develop risk predictive, analysis and management competencies in students, with security being harmonized with digital transformation processes. In research carried out in the United States

and Japan, it is scientifically substantiated that the effectiveness of gamification, problem education, laboratory simulations in teaching technology safety is high[2].

The analysis shows that although the regulatory framework for the safety of technology in Uzbekistan is sufficiently strengthened, there are some gaps in its harmonization with practice in the educational process. In international experience, however, technical safety is taught not only within the framework of labor protection, but also as an integral part of professional competencies. Therefore, the scientific novelty of this study is that it offers an effective methodology for the formation of a culture of security for students of the technological educational direction, based on national regulatory requirements, harmonizing advanced foreign pedagogical technologies[4].

The study is based on an experimental-pedagogical model, in which interactive methods, flipped classroom and virtual simulations (VR/serious games) are tested on a scientific basis with students of the faculty.he study is based on an experimental-pedagogical model, in which interactive methods, flipped classroom and virtual simulations (VR/serious games) are tested on a scientific basis with students of the facu.

DISCUSSION

Literature analysis has shown that although a solid regulatory framework for teaching technical safety in the educational process has been established in Uzbekistan, the effectiveness of methodological approaches in the practical process is insufficient. The formation of a culture of security in students is carried out through more theoretical lectures, but the skills of practical assessment of risks, correct decision-making in production conditions and safety management have not yet been sufficiently formed.iscussion

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And in international experience, interactive methods, gamification, virtual simulation and problem learning are widely used in the training of Technical Safety. For example, the Safety 4.0 concept developed new risk prediction and management techniques using digital technologies. From this point of view, there is a need to modernize the educational process on technical safety for students of the technological education direction. An important aspect is that in the process of improving the methodology, not only theoretical knowledge should be created, but also the possibility of applying safety in real conditions through practical training, laboratory work, production simulations[6].

Therefore, although the regulatory documents contained in the educational system of Uzbekistan are sufficient to form a general understanding of technical safety in students, it is possible to further develop their professional competencies by applying interactive and innovative approaches based on international experience. This not only increases the effectiveness of the educational process, but also guarantees the readiness of future specialists to create a safe working environment.

RESULTS

In the research process, the issue of improving the methodology for the development of knowledge on technical safety for students of the technological education direction was analyzed on a scientific basis, and the following results were achieved:

1. It was clarified that the law of the Republic of Uzbekistan “on labor protection”, decisions of the Cabinet of Ministers and other regulatory legal acts serve as a solid legal framework for the formation of a culture of technical safety in students.
2. Literature analysis has found that national sources are dominated by more theoretical approaches, while international research focuses heavily on the use of Applied-methodological and innovative technologies.
3. Virtual simulations, interactive methods, problematic education and gamification have proven to be effective tools in developing knowledge and skills in technical safety in students.

4. The organization of the educational process on the basis of the proposed methodological approaches was substantiated by the fact that the technological educational direction allows students to consciously apply safety rules, assess risks in advance and prepare for the creation of a safe working environment in professional activities.

CONCLUSION

In short, the results of scientific work justify the fact that in order to form a culture of safety in students, to generate deep and stable knowledge of Technical Safety, the use of interactive methods, problematic teaching methods, modern technologies in practical training becomes important in the process of training. One of the important conditions is also the harmonization of national regulatory requirements and international standards in the educational process, the constant increase in the methodological potential of educators. This approach makes it possible to train highly qualified and competitive professionals who can assess risks in production in advance, take a responsible approach to ensuring the safety of equipment.

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Rezyume: *Mazkur maqolada texnologik ta’lim yo‘nalishi talabalari o‘quv jarayonida texnika xavfsizligiga oid bilim va ko‘nikmalarini rivojlantirish metodikasini takomillashtirish masalalari yoritilgan. Ta’lim jarayonida texnika xavfsizligi qoidalariga amal qilish nafaqat talabalarning amaliy faoliyatida samaradorlikni oshiradi, balki ularning kasbiy kompetensiyalarini shakllantirishda ham muhim ahamiyat kasb etadi. Maqolada mavjud metodik yondashuvlar tahlil qilingan hamda innovatsion pedagogik texnologiyalar, amaliy mashg‘ulotlar va interfaol usullar asosida takomillashtirilgan metodik tavsiyalar ishlab chiqilgan.*

Резюме: *В данной статье освещаются вопросы совершенствования методики развития знаний и навыков по технике безопасности у студентов направления технологического образования в процессе обучения. Соблюдение правил техники безопасности в учебном процессе не только повышает эффективность практической деятельности учащихся, но и приобретает важное значение в формировании их профессиональных компетенций. В статье проанализированы существующие методические подходы и разработаны усовершенствованные методические рекомендации на основе инновационных педагогических технологий, практических занятий и интерактивных методов.*

Kalit so‘zlar: *Texnologik ta’lim, texnika xavfsizligi, mehnatni muhofaza qilish, xavfsizlik madaniyati, metodika, innovatsion pedagogik texnologiyalar, favqulodda vaziyatlar, xalqaro tajriba, ta’lim jarayoni samaradorligi.*

Ключевые слова: *технологическое образование, техника безопасности, охрана труда, культура безопасности, методика, инновационные педагогические технологии, ЧС, международный опыт, эффективность образовательного процесса.*

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IMPROVING TECHNOLOGIES FOR DEVELOPING FUTURE TEACHERS' SPECIFIC COMPETENCIES IN THE DIGITAL LEARNING ENVIRONMENT

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Summary: *The article will consider the issue of the development of special competencies of future teachers in the digital educational environment. The importance of the formation of digital competencies on the basis of national regulatory legal acts and international experience (UNESCO, OECD) is highlighted. There has also been an analysis of the possibilities of improving educational efficiency through the use of interactive methods, virtual laboratories and online platforms.*

Keywords: *digital education environment, future teacher, special competence, pedagogical technology, innovative approach, online platform, virtual laboratory, interactive method, educational efficiency, competitiveness.*

INTRODUCTION

Nowadays, digital technologies are becoming an integral part of the educational process. In the Republic of Uzbekistan, the "Digital Uzbekistan – 2030" strategy, the Law "On Education," and Presidential decrees have identified the modernization of education and the adaptation of the teacher training system to the digital environment as priority tasks. In particular, the use of the digital learning environment in the professional training of future teachers, the formation of specific competencies, and the effective application of pedagogical technologies are gaining increasing importance. This, in turn, requires the development of new methodological approaches aimed at enhancing digital competencies in higher education institutions [1,2].

In global practice, extensive scientific research is also being conducted to develop teachers' digital competencies. According to UNESCO (2021), modern teachers should play a leading role in fostering students' creativity, critical thinking, and information literacy through digital tools. In the OECD's "Future of Education and Skills 2030" project, the development of digital competencies is regarded as one of the key indicators of educational quality. Therefore, enhancing future teachers' ability to operate effectively in a digital learning environment, equipping them with modern pedagogical technologies, and developing their specific professional competencies have become some of the most pressing directions in current scientific and pedagogical research.

LITERATURE REVIEW AND METHODOLOGY

In recent years, the integration of digital technologies into the educational process has become a global priority. In particular, the Decree of the President of the Republic of Uzbekistan "On Measures to Develop Digital Education," the Law "On Education," and the National Curriculum define the formation of digital competencies among future teachers as a strategic goal. UNESCO's "Teachers' ICT Competency Framework" (2021), OECD's "Future of Education and Skills 2030" concept (2019), and the European Commission's "DigCompEdu" model have established international benchmarks for developing teachers' digital skills. The concept of the "digital generation" proposed by Prensky, Anderson's (2010) "Online Learning Model," and Redecker's (2020) research on "Digital Pedagogical Transformation" serve as key methodological foundations for contemporary pedagogical practice. The analysis of these sources indicates that achieving effectiveness in the educational process requires strengthening interactive communication between students and teachers, using digital tools purposefully, and applying a competence-oriented approach [3,4].

From a methodological perspective, this research is based on a competence-based approach, innovative pedagogical technologies, and activity-oriented methods within the framework of the digital learning environment. This approach ensures the development of not only the theoretical knowledge of future teachers but also their practical skills in applying that knowledge in real teaching contexts. During the research process, scientific and methodological methods such as comparative

analysis, a systemic approach, pedagogical experiments, monitoring, and diagnostics are employed. Additionally, methods of statistical data analysis, adaptation of international experience to national conditions, and generalization of empirical observations are utilized. Through this methodological framework, effective mechanisms for developing future teachers' specific competencies in the context of the digital learning environment are designed and validated[5].

DISCUSSION

The analysis shows that the digital learning environment creates new opportunities for developing future teachers' specific competencies. UNESCO's "ICT Competency Framework for Teachers" (2021), the OECD's "Future of Education and Skills 2030" initiative (2019), and the European Commission's "DigCompEdu" model define the development of digital literacy, creative thinking, and effective management of the teaching process as global benchmarks for educators. These international experiences indicate that the effectiveness of education in a digital environment directly depends on teachers' methodological approaches, the purposeful use of educational technologies, and the application of interactive methods. At the same time, in modern conditions, the development of digital competencies requires teachers not only to have technical knowledge but also to demonstrate innovative pedagogical thinking and the ability to make independent decisions[6].

Reforms being implemented in Uzbekistan's education system are also aimed at introducing the digital environment in harmony with international experience. In particular, the "Digital Education" concept, the National Curriculum, and the Law "On Education" set forth the tasks of widely integrating modern information and communication technologies into the educational process. The results of pedagogical experiments confirm that the use of online platforms, virtual laboratories, electronic learning resources, and interactive methods plays a crucial role in strengthening students' knowledge, developing their practical application skills, and enhancing independent thinking. It is worth noting that the digital learning environment not only facilitates the educational process but also serves as a decisive factor in shaping future teachers into competitive professionals in the labor market.

RESULTS

Based on the literature review, methodological investigations, and pedagogical experiments conducted during the research process, the following results were obtained:

1. The analysis of the literature revealed that in developing future teachers' specific competencies within the digital learning environment, it is essential to apply international experience, particularly the competency models developed by UNESCO, the OECD, and the European Commission.
2. As a result of methodological research, mechanisms for developing specific competencies based on a competence-based approach, innovative pedagogical technologies, and activity-oriented methods were developed.
3. The pedagogical experiment results revealed that the use of online platforms, virtual laboratories, electronic resources, and interactive methods enhances students' knowledge, strengthens their independent thinking, and fosters creative approaches.
4. The practical outcomes showed that, within the digital learning environment, future teachers not only improved their theoretical knowledge but also developed professional and practical skills, which contribute to shaping them into competitive specialists.

Overall, the findings confirm that the digital learning environment serves as an effective tool for developing future teachers' specific competencies, and its widespread implementation in the national education system can significantly improve the quality of education.

CONCLUSION

In conclusion, the digital learning environment serves as an effective factor in developing future teachers' specific competencies. The analysis of international experience (UNESCO, OECD, and the European Commission) and national documents (the Law "On Education" of the Republic of Uzbekistan and the "Digital Education" concept) demonstrates that the formation of digital competencies is a key condition for improving the quality of education. Pedagogical experiments confirmed that the use of online platforms, virtual laboratories, and interactive methods not only

enhances students' theoretical knowledge but also develops their practical skills. Overall, the widespread implementation of the digital learning environment and the preparation of teachers for digital literacy are essential for aligning the national education system with global standards and ensuring the competitiveness of future teachers.

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Rezyume: *Maqolada raqamli ta'lim muhitida bo'lajak o'qituvchilarning maxsus kompetensiyalarini rivojlantirish masalasi ko'rib chiqiladi. Milliy normativ-huquqiy hujjatlar va xalqaro tajriba (UNESCO, OECD) asosida raqamli kompetensiyalarni shakllantirishning ahamiyati yoritilgan. Shuningdek, interfaol metodlar, virtual laboratoriyalar va onlayn platformalardan foydalanish orqali ta'lim samaradorligini oshirish imkoniyatlari tahlil qilingan.*

Резюме: *В статье рассматривается вопрос развития особых компетенций будущих педагогов в цифровой образовательной среде. Освещается важность формирования цифровых компетенций на основе национальных нормативных актов и международного опыта (ЮНЕСКО, ОЭСР). Также были проанализированы возможности повышения эффективности обучения за счет использования интерактивных методов, виртуальных лабораторий и онлайн-платформ.*

Kalit so'zlar: *Raqamli ta'lim muhiti, bo'lajak o'qituvchi, maxsus kompetensiya, pedagogik texnologiya, innovatsion yondashuv, onlayn platforma, virtual laboratoriya, interfaol metod, ta'lim samaradorligi, raqobatbardoshlik.*

Ключевые слова: *Цифровая образовательная среда, будущий учитель, специальная компетентность, педагогические технологии, инновационный подход, онлайн-платформа, виртуальная лаборатория, интерактивный метод, эффективность обучения, конкурентоспособность.*

COMPARATIVE STUDY OF ADJECTIVE–NOUN CONVERSION IN ENGLISH AND KARAKALPAK LANGUAGES

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Summary:*This article presents a comparative analysis of the adjective–noun conversion model in English and Karakalpak languages, examining its semantic, morphological, and syntactic characteristics.*

Keywords: *conversion, substantivization, word formation, adjective–noun model, verb–noun model, semantics, syntax, morphology, comparative linguistics.*

The detailed study of the unique characteristics of languages like Uzbek and Karakalpak, their analysis through the lens of global linguistic advancements, and their comparative examination with other languages have become pivotal for fostering national identity and preserving cultural heritage. While the Karakalpak language has notably advanced its linguistic studies during this period, comprehensive, in-depth research specifically focusing on the phenomenon of conversion in its system remains limited. This scarcity is particularly evident in comparative analyses involving other languages, most notably English Conversion, a central and highly productive method of word formation, is precisely such a phenomenon warranting deeper investigation. It is defined as the process where a word shifts from one grammatical category to another, assuming its full functional capacity, without any morphological alteration or the addition of derivational affixes. This unique characteristic makes conversion a dynamic reflection of language change and lexical enrichment, a process that relies on semantic and syntactic context rather than overt morphological markers.

In English and Karakalpak languages, similarities in the adjective-noun (adj.-noun) conversion model show that words transitioning from an adjective to a noun often occur not purely through conversion, but rather with the involvement of ellipsis (omission of a word) in both languages. These converted words then perform syntactic functions, serving as both main and secondary parts of a sentence. When number category affixes of the noun word class are added to adjectives (in English, -s, -es; in Karakalpak, -lar, -ler), they typically refer to people. The provided table illustrates examples of the adjective-noun conversion model in the compared languages.

Ingliz tili: sifat-ot modeli	**Qoraqalpoq tili: sifat-ot modeli**
Don’t stand out in the **cold**.(toppr.com)	***Talaplıǵa*** nur jawar (Q. x. m.).
The resort is frequented by ***the rich*** and famous.(“The Winter Garden” L. L.)	**Abıraylı** abırayın oylasa, **biyabiray** jeńdim deydi (Q. x. m.).
Have you heard ***the news*** about Tina and Tom (G. D.)	***Awzı bostıń*** ishinde gáp qalmas. (Q. x. m.)
Many of the TV programmes are broadcast with subtitles for ***the deaf.****(M. W.)*	Balam ***ashshını*** hám tattıq, ***dushshını*** hám tattıq (“Dushpandı jeń” A.D).
You can not buy your way into the ranks of ***the good***. (G.W.)	***Aqılsızdıń*** *qásiyeti az keler,* ***Aqmaqlar*** hesh xızmet etpes xalıq ushın (“Xalıq ushın” B.)
We have a group of **Germans** staying at the hotel. (T.T)	Hámmesi gileń ***jarlılar*** *(“Qaraqalpaqnama”T.Q.).*
Children were playing on the village ***green.****(G.D.)*	Buyaqqa ketken **ashlarǵa,** Jer bermestiń hiylesi (“Posqan el” J. j.).

In English and Karakalpak languages, similarities in the adjective-noun (adj.-noun) conversion model show that words transitioning from an adjective to a noun often occur not purely through conversion, but rather with the involvement of ellipsis (omission of a word) in both languages. These converted words then perform syntactic functions, serving as both main and secondary parts of a sentence. When number category affixes of the noun word class are added to adjectives (in English, -s, -es; in Karakalpak, -lar, -ler), they typically refer to people. The provided table illustrates examples of the adjective-noun conversion model in the compared languages.

In English, nominalized (substantivized) adjectives perform a number of syntactic functions in sentence structure. Such adjectives are also referred to as substantive adjectives.

a) Nominalized adjectives function as subjects in a sentence (Adjective-Noun). “Have you read the book by Greg Palast “ “How the rich are destroying the earth”?”

b) Nominalized adjectives function as objects in a sentence (Adjective-Noun). “The judge convicted the rich of a crime in destroying the nature” (G.D.)

In the Karakalpak language, adjectives acquire the property of nominalization (substantivization) when the nouns they modify are omitted and they accept case, possessive, and plural affixes. Such nominalized adjectives are referred to in linguistics as substantivized adjectives or the substantivization of adjectives. Example: “Ómirdin ıssısına da, suwıǵına da kóngenbiz” (“Qaraqalpaqnama” T.Q.) (Meaning: We have grown accustomed to both the heat and cold of life).

Nominalized adjectives perform the following syntactic functions characteristic of the noun word class:

a) They function as subjects in a sentence.

“Haw áne jarlılar kiyatır-ǵo bizler tárepke, jawınnan keyin kóringen quyashtay qızarıp kiyatırǵanına qarasańo”- dedi ol birden kiyatırǵan gúllan xalıqtı kórsetip” (“Uyqısız túnler” T.Q.) [Meaning: "Oh, look, the poor are coming towards us, reddened like the sun seen after the rain," he said, suddenly pointing to the arriving crowd]; “Abıraylı abırayın oylasa, biyabıray jeńdim deydi” (Q.x.m.) (Meaning: If the honorable thinks of his honor, the dishonorable says "I won").

b) They function as modifiers (attributes) in a sentence. “Awzı bostıń ishinde gáp qalmas” (Q.x.m.) (Meaning: No words remain inside an empty mouth / A loose-mouthed person cannot keep a secret).

c) They function as objects in a sentence. “Balam ashshını hám tattıq, dushshını hám tattıq. Qansha kúnler tamaq tappay jılap jattıq (“Dushpandı jeń” A.D.) (Meaning: My child, we tasted both bitter and sweet, and many days we cried without finding food).

When comparing the Adjective-Noun (adj.-noun) conversion model we identified in English and Karakalpak languages, this model aligns in contemporary English and Karakalpak. Based on our research, we can consider the adjective-noun model to be a widespread, very effective, and productive method of word formation in both languages.

We established that conversion, defined as a dynamic word-formation process involving a shift in grammatical category without morphological alteration, is a pervasive and effective mechanism for lexical enrichment in both languages. The historical overview underscored its enduring relevance in linguistic scholarship, with insights from various traditions, and clarified the theoretical categorizations that frame its study.

Our detailed comparative examination of the verb-to-noun (V-N) conversion model revealed notable differences in application. In English, almost any verb can undergo conversion to a noun, expressing a wide range of meanings from psychological states to actions and their results, and readily performing various syntactic functions. Conversely, in Karakalpak, V-N conversion is more specific, primarily occurring through the nominalization of adjectival participles and verbal nouns, which take particular affixes to function as nouns, frequently enriching idiomatic expressions and proverbs. Furthermore, the productive English method of forming nouns from phrasal verbs, such as "take off" to "takeoff," lacks a direct parallel in Karakalpak's conversion processes.

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Rezyume: *Ushbu maqola ingliz va qoraqalpoq tillarida sifat–ot (adjective–noun) konversiya modelining semantik, morfologik va sintaktik xususiyatlarini qiyosiy tahlil qiladi.*

Резюме: *Данная статья представляет сравнительный анализ модели конверсии «прилагательное–существительное» в английском и каракалпакском языках, рассматривая её семантические, морфологические и синтаксические особенности.*

Kalit so‘zlar: *konversiya, substantivatsiya, so‘z yasalishi, sifat–ot modeli, fe’l–ot modeli, semantika, sintaksis, morfologiya, qiyosiy lingvistika.*

Ключевые слова: *конверсия, субстантивация, словообразование, модель «прилагательное–существительное», модель «глагол–существительное», семантика, синтаксис, морфология, сравнительная лингвистика.*

PROCEDURE FOR THE LEGAL PROTECTION OF GEOGRAPHICAL INDICATIONS

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Summary: *This article analyzes the theoretical and legal foundations of the protection of geographical indications, their place within the system of civil law, and their economic significance. It clarifies the concept of a geographical indication and examines its relationship with trademarks and appellations of origin (names of places of origin). The paper also provides a comparative analysis of the procedures for registration, legal protection, and exercise of rights in geographical indications based on national legislation and international legal instruments, including the WTO TRIPS Agreement, the Lisbon system, and the practice of the European Union. In addition, the article considers legal measures against the unlawful use of geographical indications, methods of rights protection, and issues encountered in practice. Based on the analysis, the author proposes scholarly and practical conclusions and recommendations aimed at improving national legislation, ensuring effective protection of geographical indications, and enhancing their role in economic circulation.*

Keywords: *geographical indication, legal protection, intellectual property, trademark, appellation of origin (name of place of origin), registration, TRIPS Agreement, international law, rights protection, unlawful use.*

Indications of geographical origin are used as a means of establishing a link between a product's quality and other characteristics and the geographical area from which it originates. The product–territory connection - especially where the product differs from similar goods - enables producers to differentiate their products and to implement niche marketing strategies. Signs indicating the geographical origin of products are regarded as one of the earliest types of trademarks and were created to distinguish goods possessing specific qualities. Such qualities may arise due to environmental factors, processing methods, or production skills.

Property rights in such goods are often claimed on the grounds that they are produced within a geographical area with distinctive geo-climatic features and that traditional skills are employed. This adds unique value to the product and makes it impossible to reproduce it in other regions.

Geographical indications are defined as follows: "an indication that identifies a good as originating in a specific geographical area or in the territory of a member state, or in a village, city, or locality situated within such area, where a given quality, reputation, or other characteristic of the good is essentially attributable to its geographical origin."

Pursuant to Article 4(1) of Law No. LRU-878, "the legal protection of geographical indications shall be effected on the basis of their registration in accordance with the procedure established by this Law, as well as in accordance with the international treaties of the Republic of Uzbekistan." Under the general procedure, the legal protection of GIs officially commences after the relevant certificate has been issued. Therefore, as a means of individualization, a GI is granted protection in Uzbekistan through a registered certificate, and the certificate holder acquires the right to use the respective GI.

The indication may take the form of a name, a sign, or another type of designation used to identify such goods, indicating that the products originate from a particular area and reflecting their quality or reputation.

Geographical indications entered the sphere of international intellectual property law through their inclusion in the TRIPS Agreement. The TRIPS Agreement is primarily based on two international conventions, namely the Paris Convention (the Paris Convention for the Protection of Industrial Property) and the Berne Convention (the Berne Convention for the Protection of Literary and Artistic Works).

Given the considerable commercial significance of geographical indications, their legal protection occupies an important place in commercial relations at both national and international

levels. In the absence of such protection, geographical indications may become vulnerable to unlawful use by dishonest entrepreneurs or companies.

Such actors may exploit the commercial reputation associated with a geographical indication, mislead consumers, and obtain illicit profits. This may not only cause substantial revenue losses for producers of genuine products, but may also, in the long term, undermine the reputation linked to the geographical indication itself.

States that are members of the World Trade Organization (WTO) are obliged, under the TRIPS Agreement, to protect geographical indications.

From the perspective of Uzbekistan's efforts to accede to the WTO, the country adopted the Law "On Geographical Indications" in 2022. This law was enacted to ensure the registration and protection of geographical indications.

Commentators emphasize two key aspects of the Law: (1) protecting producers against counterfeiting and misleading trade practices; and (2) ensuring a balance between the protection of trademarks and the protection of geographical indications.

Under the Law, once a geographical indication has been registered, any person claiming to be a producer of goods designated by that indication may file an application to be registered as a "lawful user."

The registration procedure for geographical indications is administered by the Department of Intellectual Property of the Ministry of Justice (responsible for patents, industrial designs, and trademarks), which also acts as the registering authority for geographical indications.

Registration is valid for a ten-year term and may subsequently be renewed for further ten-year periods. If the term of a registered geographical indication is not renewed, it is removed from the register.The protection of geographical indications has for many years remained one of the most controversial issues in the field of intellectual property rights within the framework of the World Trade Organization.

In particular, the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) - an integral part of the WTO Agreement concluded in Marrakesh in April 1994 with the participation of 117 states - sets out the rules and standards for the protection of geographical indications, as well as six other categories of intellectual property rights.

Under the Paris Convention, protection against the unlawful use of misleading indications of geographical origin applies equally to both appellations of origin and indications of source; in such cases, the name may be indicated either directly in writing or indirectly through symbols and emblems.

The Madrid Agreement expands the scope of application of this doctrine and covers "misleading" indications of source.

Misleading indications are designations that may be factually accurate yet still mislead consumers. For example, two different geographical areas may share the same name; however, if only one of them has traditionally been used as the source of a particular product, the use of that same name for products originating from the second area may cause consumers to assume that the products come from the first area. In such circumstances, that use is considered misleading.

Under the TRIPS Agreement, protection is provided against the unlawful and misleading use of geographical indications.

For wines and spirits, an even higher level of protection is provided: it is not necessary to prove that consumers have been misled; rather, if the product does not originate in the geographical area indicated, the use of that indication is prohibited altogether.

The Lisbon Agreement applies this doctrine even more strictly, ensuring protection against usurpation or imitation even where the true origin of the product is indicated, or where the indication is used together with additional terms such as "type," "style," "producer," "imitation," or similar qualifiers.

Recent trends in the global market show that, particularly in developed countries, consumers are paying increasing attention to the quality and authenticity of the products they purchase and are

giving preference to environmentally friendly and socially responsible goods. For this reason, geographical indications are becoming an important instrument in niche marketing.

This is because the information conveyed through geographical indications makes it possible to meet evolving consumer demands and enables products to be identified by the added value and specific qualities associated with their origin.

Setting aside their economic and commercial benefits, geographical indications also serve to express the cultural identity of a nation, region, or local community, adding a human dimension to goods that are increasingly subject to standardized mass production for widespread consumption.

Geographical indications are often associated with other social interests, such as the protection of traditional knowledge and the rights of local communities.

The implications of different approaches to protection, in terms of requirements, effectiveness, and costs, remain unclear. The absence of a single or harmonized international approach to geographical indications - indeed, even the lack of a common register - makes it more difficult to protect them in foreign markets. In addition, in many cases national protection regimes remain fragmented, overlapping, and uncertain.

The 167 countries that actively protect geographical indications as a form of intellectual property are generally divided into two main groups: 111 countries have a dedicated, or sui generis, system of geographical indication legislation, whereas 56 countries prefer to rely on their trademark protection systems.

The principal markets for geographical indication (GI) products - including the European Union and the United States - recognize the legitimacy and value of GIs; however, their marketing and protection systems have evolved in fundamentally different ways.

Many geographical indications have built valuable reputations over centuries, and if they are not adequately protected, they may be distorted or misrepresented by commercial operators. The unauthorized and unlawful use of geographical indications by third parties' harms both consumers and lawful producers. Without protection, anyone may market a product as originating from a particular area even when it does not, in fact, come from there.

In such cases, consumers are deceived into believing that they have purchased an authentic product with specific quality and characteristics, whereas they receive an inferior counterfeit product.

The Law "On Geographical Indications," adopted in 2002, is the principal statute enacted to ensure the registration and improved protection of geographical indications for goods.

It defines a geographical indication as follows: "an indication that identifies agricultural products, natural products, or industrial products as originating in a particular state, region, or local area within that state. A given quality, reputation, or other characteristic of such products is essentially attributable to their geographical origin. In the case of industrial products, at least one of the stages of production, processing, or preparation must take place in that state, region, or local area."

The Department of Intellectual Property under the Ministry of Justice of Uzbekistan serves as the "registering authority" for geographical indications and is responsible for implementing and overseeing the enforcement of this Law and its related regulations.

Geographical indications function as indications of source, as they help consumers identify a product's area of origin and signal attributes associated with that origin, including the product's quality, reputation, and other distinctive characteristics.

The unauthorized use and imitation of geographical indications by third parties causes serious harm to both consumers and lawful producers. In such cases, consumers may mistakenly believe that a false product is genuine and, relying on its purported quality and characteristics, purchase an inferior imitation.

At the same time, producers also suffer losses, as their valuable businesses and reputations - built over many years - are undermined.

The advantages of registering geographical indications are as follows: (1) it creates legal protection for geographical indications in Uzbekistan, which, in turn, promotes exports; (2) it prevents the unauthorized use of a registered geographical indication by others; (3) it enhances the economic

well-being of producers of goods manufactured within the relevant geographical area; and (4) it serves consumers' interests by providing them with goods of high reputation and quality.

In Uzbekistan, most registered geographical indications relate to food products, a sector in which small-scale producers predominantly operate. Experience to date with registering certain food products - such as *Gijduvon shashlik*, "Chiyal yakhna gosht," "Guzor tandir gosht," and similar items - has shown that protection granted through registration as a geographical indication has helped producers significantly increase their economic income. For this reason, Uzbekistan continues to pursue the inclusion of all products possessing geographical indications in the national register.

Entering products into the register of geographical indications is only the first step toward realizing their economic potential. In practice, however, this process has itself generated serious challenges. Many producers are small enterprises that, although located in the same area, operate separately, persuading them to unite into an association for the purpose of filing an application has often proven extremely difficult.

Moreover, to ensure quality, it has been necessary to establish standards and inspection mechanisms. Nevertheless, these difficulties are typical obstacles at the initial stage of establishing the system; once the system becomes fully operational, it can function on a self-regulating basis.

The second step consists in developing appropriate marketing strategies, particularly from an export perspective. This, in turn, presupposes that Uzbekistan's geographical indications obtain legal protection in the world's major markets.

In this context, small producers remain in a vulnerable position, as they lack the means to hire legal counsel to study foreign legal systems. They also do not have the marketing resources necessary to generate demand for their products as premium goods.

This situation differs from that observed in the wine and spirits industry in developed countries.

The initial registration of a geographical indication and the registration of an authorized user are valid for a period of ten years. However, both may be renewed for an additional ten-year term, provided that the prescribed state fee is paid and an application for renewal is filed before the expiry of the term; such renewals may be repeated from time to time. If renewal is not affected within the established period, the geographical indication or the name of the authorized user must be removed from the register. At the same time, restoration of registration is also **provided for**. Registration of geographical indications confers the following rights:

1. A registered user acquires an **exclusive (sole) right** to use the **geographical indication** in relation to goods for which the geographical indication is applied. However, this exclusive right is **subject to the conditions and limitations** specified at the time of registration.
2. The **registered owner** of the geographical indication and its **authorized users** are entitled to obtain **legal protection** in cases of infringement.

A brief analysis of the various rules relating to registration shows that **geographical indications may be registered by a group of persons**, but **any person who is a producer of the product** also has the right to **register separately as an authorized user**.

Summarizing the above, it can be said that the **owner of a geographical indication is, in essence, the producer of the goods**. However, it is necessary to introduce amendments to the Law in accordance with the rules of the Civil Code, for example: **"Any producer who has obtained a certificate for the use of a geographical indication shall be deemed its owner."** As regards disposal (transfer), the law could also expressly pin that the producer has the right - while complying with all quality requirements within the designated geographical area - to **sell, donate, or otherwise transfer the geographical indication together with the entire property complex (business as a going concern).**

It is also necessary to distinguish between the following concepts: (i) a **registered geographical indication** entered into the state register by public authorities but **not belonging to any specific entity**, and (ii) a geographical indication that, after a certificate is obtained through filing an application, **becomes the applicant's property**. In other words, a registered geographical indication

may exist even if no application is filed; however, a geographical indication for which an application has been filed and a certificate has been obtained may, subject to compliance with legal requirements, **belong to multiple owners**.

It is very important to **clearly define and** to enshrine **the owner in the law**, because this strengthens the legal protection of using the geographical indication as a means of individualizing goods and creates an effective mechanism for preventing infringements. In this way, the owner is vested with additional rights and obligations, which in turn helps to improve product quality and enhance its reputation in the international market. In general, **property relations cannot exist without an owner**. Given Uzbekistan's ongoing efforts to accede to the World Trade Organization, it is very important and necessary to pay close attention to this institution.

SCIENTIFIC AND PRACTICAL ASPECTS OF THE PRINCIPLE OF INVIOLABILITY OF PROPERTY

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Summary: *The article examines the theoretical foundations of the principle of inviolability of property and its significance in the practical application of law. The author analyzes the place of this principle within the system of civil law, the mechanisms through which it is ensured by the state, and the forms of its manifestation in the current legislation. In addition, instances of violations of the inviolability of property and the legal measures aimed at preventing and remedying such violations are explored. Through scholarly analysis, the article substantiates the role of this principle in ensuring socio-economic stability and the supremacy of law.*

Keywords: *inviolability of property, property rights, civil law, legal guarantee, expropriation, constitutional principle, property relations, rule of law.*

The principle of inviolability of property, in general terms, does not belong to the category of civil-law ideas that are little known, insufficiently studied, or subject to constant scholarly dispute. Even an observer without a legal background can, through a cursory acquaintance with the text of the current Civil Code of the Republic of Uzbekistan (hereinafter — the Civil Code), appreciate the prominent position that the inviolability of property occupies within the system of civil-law regulation. This is because the principle is expressly identified in Article 1 of the Civil Code as one of the fundamental principles of civil legislation.

At the same time, certain peculiarities become apparent, if not at the conceptual level, then at least from the perspective of legal drafting and legislative technique. By reference to its subject matter of regulation, this principle pertains not to the entirety of civil legislation, but rather to one of its specific branches—property (real) law, and more precisely to the institution of ownership. However, although the principle is mentioned in Section II of Part One of the Civil Code, it is not articulated or elaborated upon in a direct or systematic manner.

As noted above, there are three principal interpretations of the term “inviolability of property.” This diversity of interpretations is explained by the polysemy of the term “property” itself. In legal discourse, this term may be used in three distinct senses[79]:

– as a person’s socio-economic relationship to a thing;

– as a legal entitlement, that is, as a synonym for the concept of “property right”;

– as an object of dominion, meaning “property owned” or “assets held in ownership.”

If the term “inviolability” is understood as the inadmissibility of arbitrary interference, obstruction, restriction, or similar encroachments upon property belonging to a person, the expression “inviolability of property” may be interpreted in several (partially overlapping) senses:

the prohibition of interference with the legal acts exercised by a person in relation to their property, namely possession, use, and disposal;

the prohibition of the full or partial deprivation of the owner’s legally recognized status (the “title of ownership”);

the prohibition of any form of encroachment upon objects belonging to the owner.

This very idea is reflected in Part Three of Article 65 of the Constitution of the Republic of Uzbekistan, Article 166 of the Civil Code, Article 1 of the Law “On Ownership in the Republic of Uzbekistan,” and Article 23 of the Law “On Guarantees of Freedom of Entrepreneurial Activity.” However, it applies not to ownership in general, but exclusively to the right of private ownership. At the same time, the legal content of Part One of Article 65 of the Constitution is entirely different. In

[79] Рыженков А.Я. Основные начала (принципы) российского гражданского законода-ельства и смежных отраслей права. – М.: Юрлитинформ, 2015. – 54 с.

particular, it provides that “an owner may not be deprived of his or her property otherwise than in the cases and in the manner prescribed by law and without a court decision.”

At the international legal level, closely related provisions are enshrined in Article 1 of Protocol No. 1 to the European Convention for the Protection of Human Rights and Fundamental Freedoms, which states: “Every natural or legal person is entitled to the peaceful enjoyment of his possessions. No one shall be deprived of his possessions except in the public interest and subject to the conditions provided for by law and by the general principles of international law.”

As I. V. Mingazova observes, “the institution of property rights has, over recent decades, become incomparably more widespread in international relations than before. This development is associated with the transition of certain states to principles of openness and, as a result, with the expansion of the geographical area within which the integration of individuals, capital, property, rights thereto, services, and intellectual property takes place”[80].

At the same time, the practice of application of the European Convention interprets the concept of property far more broadly than does the legislation of the Republic of Uzbekistan. In particular, it encompasses not only immovable and movable property and shares, but also other tangible and intangible assets (interests). These include, for example, patents, a judgment rendered by an economic (commercial) court in respect of a claim, the right to receive a pension, the right to collect rent payments, economic interests related to entrepreneurial activity, the right to engage in a particular profession, a legitimate expectation that certain legal conditions will be applied to an individual situation, legal claims, and even such interests as the audience’s opportunity to gain access to a cinema[81].

However, despite the breadth of their substantive scope, both the Protocol to the European Convention and Article 65 of the Constitution are, in a direct and literal sense, rather distant from the idea of the “inviolability of property.” For example, Article 1 of Protocol No. 1 to the European Convention clearly indicates that, where required by the public interest, an owner may be deprived of his or her property, and that such deprivation may be determined through the norms of international law and domestic legislation. Part Three of Article 65 of the Constitution, in turn, permits the expropriation of property on the basis of a judicial decision, yet makes no reference to the public interest. At the same time, it establishes an additional condition, namely that such a decision may be adopted exclusively by judicial authorities.

Thus, it would not be an exaggeration to state that these norms, in themselves, express not so much the idea of the “inviolability of property,” but rather the opposite notion—that interference with or deprivation of property is permissible.

As a civil-law guarantee of the inviolability of property, reference may be made to Part Two of Article 166 of the Civil Code, which declares that “the inviolability of property consists in the obligation of all subjects opposing the owner to refrain from violating the owner’s property rights.” However, this conclusion is entirely negated by the construction set out in Part Three of the same article, since immediately after the formulation of the general rule an exception is introduced: “the seizure of an owner’s property, as well as the restriction of the owner’s rights, shall be permitted only in the cases provided for by law.”

According to scholars, “in order to preserve and support the solidity and stability of property relations, the legislator provides for special regulation of the grounds and procedures for the seizure of property and the restriction of property rights”[82].

As noted by A. A. Muhammadiyev, “the inviolability of property means that no one is entitled, without lawful grounds and without a court decision, to seize property belonging to the owner or to

[80] Мингазова И.В. Право собственности в международном праве. – М.: Волтерс Клу-вер, 2007. – 2 с.

[81] Карсс-Фриск М., Жеребцов А.Н., Меркулов В.В., Эртель А.Г. Европейская конвен-ция о защите прав человека и основных свобод. Статья 1 Протокола № 1. Право на собственность. – М.: Рос. акад. правосудия, 2002. – 4-5 с.

[82] Ўзбекистон Республикаси Фуқаролик кодексига шарҳ. 1-жилд (биринчи қисм) Адлия вазирлиги. – Тошкент: «Vektor-Press», 2010. – 409 б.

interfere with the exercise of property rights, and that the owner's economic dominion over the property must at all times be effectively maintained"[83].

D. A. Chinniyev defines the inviolability of property as "a condition in which the owner is able to exercise property rights in respect of his or her property without obstruction, while external interference in such exercise is eliminated, and at the same time guarantees are ensured for the restoration of these rights in the event of their violation"[84].

According to A. Q. Sharipov, "the inviolability of the right to private property is understood as a legally guaranteed protection against any unlawful infringement of the rights of an owner, as expressed in the private ownership, use, and disposal of property belonging to him or her"[85].

In our view, inviolability should be conceived as a principle of an absolute nature, and any exceptions to it must be established on the basis of exceptionally strict grounds and clearly defined limits. Accordingly, the scope of the inviolability of property extends up to the point at which property is lawfully taken from the owner on the grounds prescribed by law. Articles 197–206 of the Civil Code enumerate the grounds for the termination of ownership rights. In this regard, it must be acknowledged at the outset that the civil-law conditions governing compulsory seizure of property are by no means harmonized with constitutional limitations. For instance, Article 65 of the Constitution provides, without any qualifications, that such seizure may be carried out only on the basis of a court decision. However, from the perspective of civil-law doctrine, the seizure of an owner's property by way of enforcement of claims arising from the owner's obligations is effected on the basis of a court decision, unless otherwise provided by law or contract. Thus, contrary to the explicit constitutional norm, an extrajudicial procedure has also been legalized.

Moreover, Article 204 of the Civil Code provides as follows: "in cases stipulated by law, property may be seized from the owner without compensation by a court decision as a sanction for the commission of a crime or another offense (confiscation)."

In addition, the Law "On the Procedures for the Seizure of Land Plots for Public Needs with Compensation" establishes that compulsory seizure of property for public needs is permissible only upon prior payment of compensation. However, the current civil legislation, in addition to the purchase of property by the state, also provides for its sale through public auctions. Such a mechanism is applied, for example, where a land plot is not used for its designated purpose and, in order to seize it, it becomes necessary to terminate ownership rights to buildings, structures, or other immovable property located on that land; or where an unfinished construction object situated on land owned by the state or a municipality is seized due to the termination of a lease agreement in respect of the land plot. The conduct of public (auction) sales naturally implies that the owner receives the funds only after the completion of the auction process. Consequently, in such cases it is impossible to speak of compliance with the constitutional requirement of prior compensation (moreover, public auctions do not guarantee equivalent value).

In fact, from the standpoint of legislation and practice, these circumstances do not in themselves give rise to insurmountable problems, since any legal principle may be supplemented by exceptions that do not affect the essence and core content of the general rule. Similarly, the right of property, which forms part of the catalogue of constitutional rights, may lawfully be restricted on the broadest possible grounds. Such grounds include, inter alia, the protection of the constitutional order, morality, public health, the rights and legitimate interests of others, as well as defense and security.

In contrast to the Constitution, Protocol No. 1 to the European Convention does not treat these restrictions as exceptions to the rule, but rather as an integral part of the general principle. This is evident from the concluding sentence of Article 1, which guarantees property rights and states: "The preceding provisions shall not, however, in any way impair the right of a State to enforce such laws

[83] Мухаммадиев А.А. Фуқаролик ҳуқуқи тамойилларининг назарий ва амалий муаммолари: юрид. фан. док. дис. ... автореф. – Тошкент: 2012. – 14 б.

[84] Чинниев Д.А. Гарантии осуществления права собственности в Республике Узбекистан. Автореф. дис…канд.юирд.наук.-Ташкент: 2010.-15 с.

[85] Шарипов А.Қ. Хусусий мулк ҳуқуқининг даҳлсизлигини таъминлаш муаммолари: юрид. фан. фалс. док (PhD). дис. ... автореф. – Тошкент: 2025. – 19 б.

as it deems necessary to control the use of property in accordance with the general interest or to secure the payment of taxes or other contributions or penalties."

Indeed, both taxes and penalties clearly imply a departure from the inviolability of property. The payment of taxes or fines does not depend on the voluntary will of the taxpayer, but rather takes the form of compulsory deprivation of property in monetary form. In particular, Part One of Article 16 of the Tax Code defines a tax as "a mandatory, non-refundable payment established by this Code and payable to the State Budget of the Republic of Uzbekistan or to a state targeted fund (hereinafter collectively referred to as the budget system)." Consequently, in this context, it is not possible to speak of the seizure of property through judicial proceedings.

Thus, the principle of the "inviolability of property" manifests itself in the following three-tier structure:

the general idea of inviolability, understood as the inadmissibility of any interference with property relations (in a social or formal-legal sense);

constitutional and international legal norms that provide for a relatively broad range of cases in which property may be compulsorily taken from the owner;

provisions of civil legislation that, in comparison with constitutional and international law, define even broader possibilities for interference in property relations.

From a formal-legal perspective, such a situation is far from ideal; nevertheless, it may still appear understandable to a certain extent. Even those aspects whose legality may be called into question can arguably be given a plausible justification. This is because the criteria considered sufficient for imposing restrictions on the rights of possession, use, and disposal of property include fairness, relevance, proportionality, adequacy, and compatibility, as well as the necessity to protect constitutionally significant values, including the private and public rights and legitimate interests of other persons. In addition, such restrictions must be general and abstract in nature and must not have retroactive effect[86] and etc.

From an ideological perspective, such a situation may be assessed in only two ways.

The inviolability of property constitutes its ontological, that is, original and inherent quality. In this case, any violation of the inviolability of property—whether established in practice or through normative regulation—would lead to the loss of the very essence of property as a natural attribute.

The inviolability of property is merely a conditional construct, necessary for achieving economic or other pragmatic objectives (for example, ensuring investors' confidence in the legal system). In this understanding, inviolability may characterize the institution of property rights alongside other attributes and principles; however, in certain circumstances its application may be suspended or restricted, without altering the nature of the phenomenon it represents[87]).

The internal contradiction that is implicitly embedded in the idea of the inviolability of property and that constantly manifests itself in explicit forms, when viewed from a socio-philosophical perspective, reflects the age-old opposition between individualistic and collectivist approaches. This, in turn, ultimately leads to the philosophical categories governing the relationship between the part and the whole. The inviolability of property presupposes that objects in the material world (and, taking into account the broad understanding of property, not only material objects) belong to a specific individual or group of individuals (a distinction that is irrelevant here, since in relations with other subjects even a collective entity appears as a single unit) and therefore cannot be transformed into someone else's property without the owner's consent. Within this framework, a wide spectrum of possibilities emerges, ranging from prohibiting the use of another's property to formally depriving the owner of his or her rights. In other words, the owner, together with his or her property, is regarded as separated from other members of society by an exclusive boundary that precludes transfer or intrusion.

[86] Сагдеева Л.В. Принцип неприкосновенности собственности в актах Конституционного суда Российской Федерации // Вестн. Перм. ун-та. Юрид. науки. – 2009. – Вып.1. – С. 88–95.

[87] Гаджиев Г.А. Конституционные принципы рыночной экономики (Развитие основ гражданского права в решениях Конституционного суда Российской Федерации). – М.: Юристъ, 2004. – 284 с.

The alternative approach is based on the primacy of society as an integral whole over the elements that constitute it. Moreover, society possesses specific needs that prevail over the needs of individual persons and social groups. In this perspective, property appears merely as a social contract with a predominantly dispositive character, meaning that it may be reconsidered whenever necessity so requires.

This approach is reflected in the provision of Article 1 of Protocol No. 1 to the European Convention, which allows for deprivation of property "in the public interest." A similar idea is embodied in Article 65 of the Constitution, which requires that deprivation of property be carried out exclusively on the basis of a court decision. This is because the judiciary is associated with the notions of impartiality and justice, and it serves not individual interests but the social whole.

In essence, in its contemporary form the principle of the inviolability of property may be formulated as follows: an owner may lawfully possess property and exercise the corresponding powers in relation to it, but only for as long as the state (as sovereign) permits such exercise, taking into account the interests of society.

This situation resembles the phenomenon described philosophically by G. Agamben as "desemanticization" or "excessive semantic loading," whereby a general norm becomes almost detached from reality: "…not only language and law, but all social institutions have been formed as a result of the process of desemanticization and the suspension of concrete practices that are directly connected with reality"[88].

At the same time, such a "dilution" of the legal content of the inviolability of property does not imply its complete abolition. The inviolability of property is, above all, a conservative legal principle. This is particularly evident in our national culture, where the tradition—characteristic of Marxism—of viewing economic relations, including property, as the primary and fundamental factor underlying the entire social order has largely been preserved[89].

Because there exists a very close connection between an individual and his or her property, the protection of property constitutes a specific manifestation of the protection of social relations. In this sense, the principle of the inviolability of property signifies an aspiration to preserve a particular system of social relations in an unchanged form, that is, a rejection of radical transformations. It is therefore not accidental that revolutionary periods of social development are characterized by the greatest difficulties in implementing the principle of the inviolability of property. This phenomenon manifests itself through mass requisitions and confiscations, some of which occur spontaneously, while others are carried out on the basis of various unlawful "decisions," thereby violating citizens' property rights.

From a legal standpoint, the principle of the inviolability of property was formed precisely as an attempt to restrain revolutionary processes. This is clearly evidenced by the following quotation: "During the revolutionary period, the idea that dominated the legislator's thinking was extremely simple: it was necessary to guarantee the preservation of property held by existing owners. The legislator sought to affirm that whoever is or becomes an owner possesses a right that excludes claims that might be asserted by others, and that even the legislator itself cannot encroach upon this right without providing prior compensation to the expropriated owner"[90].

Thus, an analysis of civil legislation demonstrates a lack of conceptual and ideological coherence, a deficiency that is rooted even at the constitutional level. The inviolability of property, proclaimed as a principle, is not effectively закреπed in normative terms in practice, and the scope of its positive guarantees is not proportionate to the scope of its limitations. Consequently, in such circumstances, the very use of the term "inviolability" appears questionable, as the idea conveyed by this term risks being seriously discredited[91].

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[88] Агамбен Дж. Homo Sacer. Чрезвычайное положение. – М.: Европа, 2011. – 60 с.

[89] Имомов Н.Ф. Конституцияда мулк ҳуқуқининг ифодаланиши // https://nurillo-imomov.uz/ru/ilmiy/konstitutsiyada-mulk-huquqining-ifodalanishi/

[90] Дюги Л. Конституционное право. Общая теория государства. – М.: Тип. т-ва И.Д. Сытина, 1908. – 957 с.

[91] Рыженков А.Я. Неприкосновенность собственности в философско-правовом видении // Учен. зап. Казан. ун-та. Сер. Гуманит. науки. – 2018. – Т. 160, кн. 2. – С. 309–317.

The principle of the inviolability of property constitutes a fundamental constitutional value that ensures the economic and political stability of every democratic state governed by the rule of law. This principle protects the property rights of individuals and legal entities against unlawful interference by the state and by other persons. From a scholarly perspective, the inviolability of property is regarded as an integral element of the right of ownership, and its protection is implemented through a system of legal guarantees. From a practical standpoint, this principle requires the prevention of unlawful confiscation, expropriation, or other forms of pressure exerted in relation to property. Therefore, ensuring the inviolability of property is of crucial importance for the development of civil society and the establishment of the rule of law.

THE CONCEPT OF A TRADEMARK AND ITS DISTINCTIVE FEATURES

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Summary: *This article provides a scholarly and theoretical analysis of the legal concept of a trademark, its place within the system of civil law, and its distinctive features. It highlights the significance of a trademark as a means of individualizing goods and services and examines its legitimacy and characteristics as an object of legal protection. Particular attention is paid to such attributes of a trademark as its conventional (arbitrary) character, distinctiveness, non-deceptiveness, and its position within the system of proprietary (property) rights. The article also offers a comparative analysis of the relationship between trademarks and other means of individualization, including trade names (firm names), geographical indications, and related designations. The research findings are of both theoretical and practical value for improving mechanisms for the legal protection of trademarks and for harmonizing national legislation with international standards.*

Keywords: *trademark, intellectual property, means of individualization, civil law, exclusive right, legal protection, distinctiveness, conventionality (arbitrariness), competition relations, consumer protection.*

The development of modern economic circulation shows that a trademark is one of the principal instruments of doing business and is of crucial importance regardless of the sector in which an entity operates. For business entities, it is essential that consumers recognize the goods and services they offer, and this is ensured primarily through trademarks. For this reason, the question “What is a trademark?” and the existence of a clear legal definition are of particular significance.

From a semiotic perspective, a trademark is a perceptible sign that denotes something else - namely, the distinctiveness of a good. The recipient of a trademark is an actual or potential purchaser. Alongside its “trademark” function, a trademark also has a certain significance as a social reality and manifests itself as a legal category. Like other objects of industrial property, a trademark may exist outside the legal system and possess independent value within social relations. Accordingly, a trademark also exists as a social reality beyond the law. However, by granting legal significance and protection to trademarks that meet statutory requirements, legal rules transform them into a juridical category.

In the Law of the Republic of Uzbekistan No. 267-II of 30 August 2001 “On Trademarks, Service Marks and Appellations of Origin” (hereinafter, “Law No. 267-II”), a trademark and a service mark are defined as signs serving to individualize the goods, works performed, and services rendered by legal entities or individuals.

Based on an analysis of the applicable legislation, a trademark is understood as a designation intended to distinguish the goods of legal entities or individuals from those of others.

Interestingly, the substance of the concept of a trademark has remained almost unchanged over the past hundred years. This is evidenced by the fact that similar definitions can be found even in the legislation of the Russian Empire at the end of the nineteenth and the beginning of the twentieth centuries.

The 1903 “Industrial Statute” envisaged various types of signs and symbols as trademarks, which manufacturers and merchants would place on the goods themselves, on their packaging, or on storage containers to distinguish their goods from those of others. Such signs included stamps, seals, marks printed on or sewn into fabric, labels, covers, exhibits, slogans, tags, and distinctive forms of original packaging.

In the legal literature of that period, the concept of a trademark was interpreted mainly based on statutory definitions.

As G. F. Shershenevich noted, a trademark is an external sign used by a merchant to distinguish his goods, in the eyes of consumers, from the goods of other merchants. This sign is affixed to the product itself or to its packaging, and consumers identify the product's affiliation with a particular source through that mark.

I. M. Tyutryumov interpreted the right to a trademark as the enterprise owner's absolute right to use that mark. In his view, a trademark is a brand, seal, or other external sign affixed to distinguish one merchant's goods from those of other merchants.

V. Valdenberg, in turn, defined a trademark as one of the methods of a firm's external representation.

S. I. Raevich characterized trademarks as "a permanent sign attached to a product, yet not an inseparable part of it, and possessing an external character."

V. A. Dobrovolsky describes a trademark as an external sign that serves to distinguish the goods of one person from the goods of another, and he proposes the following classification of its types: (1) signs affixed to the goods themselves - such as a seal; (2) signs used to decorate goods - such as a label; and (3) a firm name with a graphic design - a brand/mark. In the author's view, a trademark must be protected in commerce to ensure guarantees relating to product quality.

I. E. Mamiofa interprets a trademark as a designation that reflects, in the public consciousness, an objective link between the distinctive consumer characteristics of a particular type of product and its external appearance or packaging.

In Soviet legal scholarship, definitions of trademarks largely relied on concepts developed in the legal literature of the Russian Empire period. For example, N. I. Konyaev understood a trademark (service mark) as a sign registered in accordance with the procedure established by law, which serves to distinguish the goods or services of one enterprise (organization) from similar goods and services of other enterprises, while also performing an advertising function. This also indicates the existence of a special registration procedure as a prerequisite for the legal protection of a trademark.

Modern legislation likewise continues these earlier legal traditions in regulating trademarks.

In recent scholarly works, including A. P. Rabets's research, the following definition of a trademark has been proposed: "a trademark (service mark) is a sign that possesses novelty and distinctiveness in accordance with legislative requirements, is registered in the prescribed manner, and serves the purpose of individualizing and advertising the goods (services) of a particular legal entity or individual as distinct from similar goods and services of others."

In O. Yu. Zakurdaeva's interpretation, a trademark is a distinctive sign protected by legal norms and used to distinguish the goods of legal entities and individuals from the products of other manufacturers.

A. K. Shulga explains a trademark as a sign - verbal, figurative, three-dimensional, or of another type, or a combination thereof - that distinguishes the goods of a legal entity or an individual entrepreneur from similar goods of others and enjoys legal protection.

The definitions of trademarks found in the legislation of neighboring countries likewise differ little from those in the legislation of the Republic of Uzbekistan. For example, Article 1017 of the Civil Code of the Republic of Belarus (adopted in 1998) recognizes a trademark (service mark) as a sign that helps distinguish the goods or services of one person from similar goods and services of another.

Pursuant to Article 1477(1) of the Civil Code of the Russian Federation, "an exclusive right is recognized in respect of a trademark, i.e., a sign serving to individualize goods, and this right is certified by a trademark certificate."

In the Federal Republic of Germany's 1995 Trademark Act, virtually any sign or form may be recognized as a trademark, provided it can distinguish the goods and services of one undertaking from those of others. Such signs may include words, personal names, images, letters, numerals, sounds, three-dimensional shapes, the external appearance of the product, its packaging, a color, or a combination of colors (Article 3).

In construing the concept of a trademark broadly, French legislation is likewise close to German law. In French law, a trademark is regarded as any sign capable of graphic representation that serves to identify goods or services and to distinguish them from competitors' products.

In the Republic of Moldova's 1995 Law "On Trademarks and Appellations of Origin," a trademark or service mark is recognized as any sign or combination of signs. Only one requirement is imposed: the sign must be capable of distinguishing the goods or services of one person from the goods and services of another.

Unlike many countries, Ukrainian legislation does not use the term "trademark"; instead, it employs the term "trademark". This is also reflected in Article 492 of the Civil Code of Ukraine (adopted in 2003), which defines a trademark as "any sign or combination of signs that serves to distinguish the goods and services produced (or rendered) by one person from the goods and services produced (or rendered) by other persons." The same provision indicates that letters, numerals, figurative elements, combinations of colors, and other designations may be accepted as a trademark. These correspond fully to the definitions commonly used for trademarks.

It is worth noting that certain international treaties also contain a definition of a trademark, in particular Article 15(1) of the TRIPS Agreement (Agreement on Trade-Related Aspects of Intellectual Property Rights). Under this provision, any sign, or any combination of signs, capable of distinguishing the goods or services of one undertaking from those of other undertakings may constitute a trademark. Such signs include, inter alia, words (including personal names), letters, numerals, figurative elements, combinations of colors, as well as various combinations thereof, and they may be registered as trademarks in accordance with the prescribed procedure.

In the commentaries to the Paris Convention, G. Bodenhausen offers the following definition of a trademark: a trademark is generally regarded as a sign used to distinguish the products of one undertaking from those of other undertakings. As a rule, the owner of a trademark enjoys an exclusive right to use that sign, or its variants, in relation to identical goods as well as similar products.

An analysis of the legal sources cited above shows that neither domestic nor foreign legislation contains a single, clear terminological definition of a trademark that is recognized by all countries. For example, German and Italian legislation uses the term "mark"; Russia and China use the concept of "trademark"; whereas in the practice of the United States, France, and the Netherlands the term "trademark" prevails. The principal international instrument on the protection of industrial property - the Paris Convention of 20 March 1883 - refers to the concept of a "factory or trademark."

When discussing the term "trademark," it is also necessary to consider another widely used notion, namely "brand." In academic literature and popular publications, these two terms are often used interchangeably, and debates continue as to their relationship. The term "brand" derives from the simplified English expression "brand name," popularized in American usage.

L. Afanasyeva notes that although marketers and brand managers often use the terms "trademark" and "brand" as synonyms, in practice there is a distinction between them: a "brand" is a marketing category and cannot enjoy legal protection in the same way as a trademark, whereas a trademark is an object of legal nature and therefore benefits from legal protection.

L. G. Zagorsky takes a similar position, considering the concept of a "brand" to be significantly broader in scope than that of a "trademark." A. Yu. Zotkin defines a brand as a complex encompassing the image, technical, operational, and other characteristics of a trademark; it helps the right holder attain a leading position in the market, and the mark itself may have value as a good or service.

V. I. Mukhin defines a "brand" as a trademark that is widely promoted in the market and well known to consumers and competitors. In his view, a brand is a sign that evokes a stable perception in the minds of many consumers and business partners.

Seeking to distinguish the notions of "brand" and "trademark," L. G. Zagorsky nevertheless acknowledges a certain degree of similarity between them. In his opinion, a brand may be applied to a specific product (a "brand product") or to the enterprise itself (a corporate brand).

It should also be noted that, in Uzbekistan, before specialized legislation on valuation activity was adopted, valuers used the term "brand" more frequently than "trademark." However, after the

entry into force of the "Unified National Valuation Standard of the Republic of Uzbekistan," introduced by Annex to Order No. 01/11-14/29 of the Director of the Agency for State Asset Management of the Republic of Uzbekistan dated 25 October 2023, valuers are no longer permitted to use the term "brand." As I. V. Ershova notes, the methods and approaches used by the valuation subject must strictly comply with the requirements established in the standards. For example, under the Standards, the valuation process must be based on documents confirming rights in respect of the object being valued.

In our view, the term "brand" is used in the economic sphere to express a trademark together with the set of values, quality, and information known to consumers. In the consumer's mind, a brand is formed as a particular impression or reaction associated with a trademark, because the producer, through trademarks, promises a certain quality, values, and a guarantee of services. Thus, a "brand" is the commercial expression of the reputation and reliability of a good or service in the marketplace.

In the legal field, the notion of a "brand" is used only rarely, because it is not a legal category. For this reason, it may be concluded that there is no real problem as to the relationship between the concepts of "brand" and "trademark." In practice, both terms are often used in relation to the same objects.

In many cases, trademarks are also referred to as "brand". The term "*savdo markasi"* in Uzbek is a direct translation of the English word "trademark." The word "mark" in English means "sign," "stamp," or "trademark." In the official documents of the World Intellectual Property Organization (WIPO), the term "trademark" is used, whereas the English version of the Madrid Agreement uses the word "mark."

In the original text of the Paris Convention, the term "factory or trademark" (*une marque de fabrique ou de commerce*) was used. In the legislation of many foreign states, including Ukraine, a trademark is interpreted as a name, sign, term, symbol, image, or a combination thereof that serves to distinguish the goods and services of one or more sellers from the products of other competitors.

In practice, alongside the official terms' "trademark" and "service mark," synonymous expressions such as "trademark" and "factory mark" are also used. These are direct translations of the terminology employed in the Paris Convention. During the Soviet period, the term "production mark" was also used; however, it was not registered anywhere and was not recognized as an object of intellectual property, serving only as a means of marking goods.

Considering the foregoing, it is evident that the concept of a "trademark" requires clarification. In this sense, a trademark is a unique sign registered in the prescribed manner for the purposes of individualizing a producer's goods, advertising them, and ensuring consumer confidence in product quality.

Under current legislation, a trademark that can enjoy legal protection and participate as an object of civil turnover may only be a sign that complies with the statutory requirements.

The question of the place a trademark occupies as an object of civil law is related to the general theoretical legal category of the "object of rights." According to O. S. Ioffe, the object of any phenomenon is that which is acted upon or that which can be acted upon. From this perspective, the object of a civil-law relationship is the object upon which rights and obligations are exercised.

At the same time, although the notions of an "object of civil law" and an "object of civil circulation" are interrelated, they are not fully identical.

The emergence of a trademark relates to a person's creative and intellectual activity. For this reason, trademarks are classified as "ideal objects," meaning that they exist not as material things, but as intellectual value created in the human mind.

By its nature, a trademark must be conventional (arbitrary). In other words, it reflects a certain image of the producer in the product and thereby substitutes for the producer's full name. In some cases, a trademark may coincide with the name of the producing enterprise.

One of the key general features of a trademark is its legitimacy: pursuant to Articles 3 and 19 of Law No. 267-II, a trademark is recognized as an object of civil law.

The legal definition of a trademark is set out in Article 3(1) of Law No. 267-II. This definition clearly shows that a trademark serves as a legal means of individualizing and identifying goods. As

V. A. Belov notes, a trademark functions as a socio-legal mechanism that forms a link between "product" and "producer." However, that association itself is not the object of legal protection; rather, what is protected is precisely its external sign. In this sense, a trademark is regarded as a legal instrument that formalizes such associations in the consumer's mind.

Although not all features of a trademark are expressly enumerated in Law No. 267-II, legal interpretation makes it possible to identify one of its most important characteristics - novelty. As a provision aimed at ensuring the novelty of a trademark, Article 11 of Law No. 267-II establishes a priority (preferential) regime in relation to signs that have been registered earlier. Even though the Law does not explicitly secure the criterion of "novelty," judicial practice consistently recognizes the existence of this requirement.

In the legislation of the Republic of Uzbekistan, novelty is assessed based on the principle of "relative novelty." In other words, even if a sign has been registered in another country, this does not prevent it from obtaining legal protection in Uzbekistan, unless otherwise provided by international treaties. In determining novelty, the legislation relies on such criteria as distinctiveness and the absence of similarity to other trademarks (especially to the extent that confusion may arise).

According to the definition proposed by A. P. Rabets, a trademark is "a sign that, under statutory requirements, possesses novelty and distinctiveness, is registered in the prescribed manner, and serves to distinguish and advertise the goods (services) of a particular legal entity or individual from similar goods of others." In the author's definition, the functions of a trademark and its legal requirements are expressed together.

We now consider the substance of the concept of "novelty."

In dictionaries, novelty is described as something that did not previously exist and is created for the first time. In civil-law literature, novelty is regarded as a creative result arising from a person's intellectual activity.

In the context of trademarks, "novelty" means that a particular sign has not been indicated in earlier applications and has not previously been used for the relevant category of goods. Establishing novelty prevents a trademark from being identical or confusingly like other marks. At the same time, alongside the "first-to-file" principle, legal practice also recognizes the "first-to-use" principle. Under this principle, the person who first used the trademark in practice may also enjoy a certain priority.

A. P. Sergeev equates novelty with originality. However, E. P. Gavrilov argues that while originality is a time-independent characteristic, novelty is always tied to a specific date - namely, the priority date.

In several decisions interpreting novelty and originality, economic courts have explained originality as "uniqueness" and "non-repeatability." Dictionaries define "uniqueness" as something that is the only one of its kind distinctive.

This analysis shows that in legislation and law-enforcement practice, the criteria related to "novelty" and "distinctiveness (originality)" have not been clearly separated. Therefore, it is advisable for the scholarly community and the legislator to employ terms that are appropriate for legal regulation and that have clear meaning and well-defined boundaries.

On this basis, it is preferable in practice to use a single term for evaluating trademarks - "uniqueness" (a singular, non-repeating characteristic). The uniqueness of a trademark is the set of its structural and substantive features that distinguish it from others, facilitate differentiation, and are significant and stable.

Thus, the uniqueness of a trademark is a complex quality that combines novelty, originality, and distinctiveness, transforming the trademark into an object that is singular and non-repeatable within its category.

Considering the foregoing, a trademark may be defined as follows: a trademark is a distinctive and unique sign registered in the prescribed manner for the purpose of individualizing a producer's goods, advertising them, and providing a guarantee of product quality.

THE CONCEPT OF A CONSIGNMENT AGREEMENT AND ITS SPECIFIC CHARACTERISTICS

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Summary: *This article provides a scholarly and theoretical analysis of the civil-law nature of the consignment agreement, its concept, and its distinctive features. The similarities and differences between the consignment agreement and the commission agreement are examined, and the place of the consignment agreement within the system of civil-law contracts is substantiated. Particular attention is paid to the preservation of ownership rights in consignment relations, the allocation of risks, the rights and obligations of the parties, as well as legal issues arising from the participation of third parties. The article also presents a comparative analysis of foreign legal experience and national legislation, and offers scholarly conclusions and proposals aimed at improving the legal regulation of consignment agreements.*

Key words: *consignment agreement, commission agreement, civil-law contracts, ownership rights, sale of goods, consignor, consignee, risk allocation, contractual obligations.*

The term “consignment” has two meanings. In its first sense, it refers to a special shop or trading outlet where goods owned by private individuals are sold. In its second sense, it denotes the process of selling certain types of goods on the basis of an agreement through a specially organized department or enterprise.

The term itself originates from the French word “consignation” and is used as a neologism in civil circulation and commercial relations.

A consignment agreement provides certain advantages for both parties. For the owners of goods—namely, the consignors—this method makes it possible to reduce marketing and advertising costs, as their goods are brought directly to established markets. At the same time, it also creates convenience for consignees, that is, the entities carrying out the sale: they accept the goods and sell them through their own networks, without the need to pay the value of the goods in advance. As a result, their working capital is not “frozen,” and there is no need to incur additional debt or pay interest on loans or credits.

Through consignment, various types of products may be sold, including consumer goods, clothing, footwear, handicrafts, works of art, and other types of movable property. These goods may be delivered to the consignee either in a single batch or gradually, on the basis of consecutively issued invoices and bills of lading. In the European classification, consignment activity is designated by the NACE code 4779, which refers to the “retail sale of second-hand (used) goods.”

Under a consignment agreement, one party (the consignor) transfers certain goods or movable property to another party (the consignee) for the purpose of selling them in the consignee’s own name but in the interests of the consignor. The goods may be delivered to the consignee either in a single batch or in stages, on the basis of invoices or delivery notes duly executed under the agreement. In this context, the consignment agreement constitutes a special type of commission agreement, the subject matter of which is movable property transferred by the principal to the commission agent for sale.

In legal scholarship, a consignment agreement is described as follows:

“One party (the consignor) transfers certain movable property to another party (the consignee) for sale in the consignee’s own name but on behalf of the consignor. The consignee, in turn, assumes the obligation either to remit the proceeds received at the consignor’s expense or to return the unsold goods.”

The consignment agreement differs from a general intermediary agreement in a number of respects:

1. Subject matter – the right to sell movable property transferred by the principal.

2. Manner of sale – the goods are sold at a price agreed in advance, or, in the absence of such an agreement, at the current market price.

3. Distribution of proceeds – the consignee must remit the proceeds from the sale to the consignor, or, if the goods are not sold, return them in their original condition.

4. Payment term in transactions – if the consignment agreement establishes a payment term of up to 90 days, the buyer (the operating entity) must issue a bill of exchange or promissory note to secure payment of the value of the goods.

5. Liability for sale on credit – if sale on credit is not stipulated in the agreement, the consignee bears joint and several liability with the buyer before the consignor. In this case, the commission agent, in accordance with legislation, bears personal liability and, at the principal's demand, must immediately effect payment together with interest and other benefits.

6. Right of pledge – although a commission agent has a right of pledge over receivables belonging to the principal, the consignee does not enjoy such a right. Scholars consider this distinction to be unfounded.

Legal literature identifies two types of "unauthorized mandate": an intermediary agreement and its two forms – consignment and shipment (dispatch of goods); and unauthorized mandate relations arising between private individuals.

Within the system of civil law, the consignment agreement appears as a practical form of commission relations. It facilitates the movement of goods in economic circulation and serves to enhance the efficiency of financial resources, particularly in small business and handicraft sectors. From a legal perspective, it represents a modified form of mandate and commission agreements, the subject matter, payment mechanism, and liability regime of which are governed by specific rules.

The consignment agreement possesses a number of distinctive legal features through which its legal nature and its place in actual civil circulation are determined. In particular, this agreement is classified as a principal (main) contract; synallagmatic (mutually binding); mutually beneficial; directly effective; commutative; consensual; non-transferable of ownership rights; and an unnamed (innominate) type of contract.

A consignment agreement is a principal contract with independent legal significance. Its validity and operation are not dependent on other legal relationships, and it establishes its own distinct legal regime. Accordingly, it is not an auxiliary or supplementary agreement, but rather gives rise to an independent system of obligations.

By its nature, this agreement is synallagmatic (bilateral), since upon its conclusion mutually connected and interdependent obligations arise simultaneously between the two parties. The consignor, as the owner of the goods, transfers them for sale, while the consignee undertakes the obligation to sell the goods and remit the proceeds.

Furthermore, it is considered a mutually binding (bilateral) contract, as both parties pursue specific material interests: the consignor aims to sell the goods and obtain profit, while the consignee seeks to receive an intermediary fee or remuneration. In accordance with civil-law doctrine, this confirms that the consignment agreement is of a mutually binding nature.

The consignment agreement is considered directly (immediately) effective, because it is concluded on the basis of the consignor's trust in the consignee, and this trust forms the legal foundation of the contractual relationship. Here, direct interaction between the parties takes precedence, rather than actions through an intermediary or a third party.

Under a consignment agreement, ownership of the goods does not transfer to the consignee; the consignee receives the goods temporarily only for the purpose of sale. Thus, the consignee is not the owner of the goods but acts as a custodian responsible for their safekeeping and sale. Legally, the consignee is described as a "temporary custodian of goods (bailee)."

In other words, the consignee acquires no proprietary rights over the goods and operates solely within the framework of civil-law obligations.

A consignment agreement is a remunerated contract, meaning payment is involved. From the moment it is concluded, both parties are aware of their rights and duties, and the scope of obligations

and the procedure for providing services are clearly defined. This ensures economic balance and legal certainty between the parties.

The consignment agreement is consensual (solo consensu) in nature, being concluded and coming into force solely on the basis of the parties' mutual consent. It is usually formalized in written form, which serves as evidence (ad probationem) rather than as a requirement for validity (ad validitatem), unless otherwise stipulated by law. All agreements regarding modifications, renewal, or termination of the consignment contract must be documented.

If the consignor is a natural person and the value of the goods is small, a written form is not mandatory. However, if the consignor is a legal entity and intends to sell high-value goods in stages, a written contract is required.

Some scholars classify consignment as a real contract, requiring delivery of goods for validity. In this view, the consignee cannot fulfill obligations without receiving the goods[92].

However, another perspective – which we support – is that delivery is not a prerequisite for contract formation, but rather a result of contract performance, i.e., the process of returning unsold goods[93].

The consignment agreement is an unnamed (innominate) contract, as it is not explicitly regulated in the Civil Code. This characteristic complicates precise classification and differentiates it from standard civil contracts.

In summary, a consignment agreement is an independent, bilateral, mutually beneficial, trust-based, remunerated contract, typically formalized in writing. Its essence lies not in transferring property rights, but in facilitating the circulation of goods through intermediary arrangements in civil commerce. It represents a distinct but important type of mandate and commission relationship, supporting the development of trade in a market economy.

The consignment agreement must comply with general legal requirements for any civil contract: legal capacity to conclude a contract, voluntary consent of the parties, a clear and lawful subject matter, and a legitimate legal and moral basis.

Participants must possess sufficient legal capacity and transactional competence to fulfill their obligations[94].

In particular, the consignee—who sells the goods in their own name—must be fully competent to engage with third parties and bear the resulting legal consequences independently.

At the same time, the consignor (owner of the goods) is not required to exercise such legal actions; their primary responsibility is to transfer the goods for sale and fulfill contractual obligations.

The consent of the parties to a consignment agreement must be serious, free, and informed. Consent can be explicit (expressly stated) or implicit (inferred).

Legislation provides that if a person (agent) does not refuse a mandate, they are considered to have accepted it, provided they have the capacity to perform such actions or have offered their services to the principal, either openly or implicitly.

This rule is recognized in both legal doctrine and judicial practice. For example, a court stated: "A contract can be concluded by inaction (silence); it is deemed to take effect through the performance of the mandate given by the sender to the recipient."

The material subject of a consignment agreement is the movable property transferred by the consignor to the consignee for sale. Ownership of the goods does not pass to the consignee; the property remains temporarily in their possession—from the time of transfer until it is sold to a third party. If sold, the consignee must remit the proceeds to the consignor in cash. If unsold, the goods must be returned in their original condition.

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[92] Baias, Fl. A., Chelaru, E., Constantinovici, R., Macovei, I. (2012). Noul Cod Civil. Comentariu pe articole. Art. 1 – 2664 (New Civil Code. Comment on articles. Art. 1-2664), Bucharest: C. H. Beck Publishing House.

[93] Stănciulescu, L. (2014). Curs de drept civil. Contracte (Course of civil law. Contracts), Bucharest: Hamangiu Publishing House; Cărpenaru, S.D. (2014). Tratat de drept comercial român. Procedurile de prevenire a insolvenței și de insolvență (Romanian commercial law treaty. Procedures to prevent insolvency and insolvency), Bucharest: Universul Juridic Publishing House.

[94] Boroi, G., Stănciulescu, L. (2012). Instituții de drept civil în reglementarea noului Cod Civil (Civil law institutions regulated by the new Civil Code), Bucharest: Hamangiu Publishing House

For lawful sale, the goods must meet the following conditions[95]: they must be an object of civil turnover (not withdrawn from circulation); exist at the time of contract conclusion; be specific or determinable; be legally and morally acceptable; and ownership must remain with the consignor.

These requirements ensure the validity and legal force of the contract.

Upon conclusion of a consignment agreement, rights and obligations arise between the consignor and the consignee, and its execution may also produce legal consequences with third parties.

The primary duty of the consignor is to transfer the movable property to the consignee for sale to third parties.

This can be expressed as: "The consignor undertakes to deliver the goods to the consignee for contract performance while retaining the right to inspect and supervise their condition during the contract period."

Goods may be delivered in a single batch or in stages, for example, via sequentially issued invoices or delivery notes[96].

This duty simultaneously constitutes a right of the consignee. Since the consignment agreement is consensual, it is concluded solely by the agreement of the parties; physical delivery of the goods is not mandatory for the validity of the contract.

Therefore, even if the parties have agreed, if the consignor refuses to deliver the goods, the contract is considered unexecuted. In this case, the consignee may claim reimbursement of expenses incurred from the consignor.

Non-delivery does not affect the validity of the contract but makes its performance impossible and prevents legal consequences from arising.

The consignor—the true owner—retains full control over the goods during the contract term and may reclaim the goods at any time, even if the contract specifies a fixed period. This right is explicitly recognized by law.

Thus, for a consignment agreement to be valid, the following conditions must be met: the parties must have legal capacity; consent must be free and informed; the subject matter must be specific, lawful, and morally acceptable; the goods must be delivered by the rightful owner; and the contract must be formalized in writing.

When these conditions are fulfilled, the consignment agreement acquires legal force and functions as an effective instrument in civil circulation.

The consignor is obligated to give the consignee reasonable notice to prepare for acceptance of the goods. If the consignee refuses to accept the shipment, the consignor may rely on legal remedies; otherwise, refusal could be considered theft. Under previous practice, if the consignment contract was valid, the consignor had the right to reclaim the goods once through legal channels without notifying the parties; for privately executed contracts, the notice period for reclaiming the goods began two days from the consignee's receipt. Therefore, even if the contract includes a notification clause, the consignor retains the right to reclaim the goods at any time.

Hence, ownership does not pass to the consignee under a consignment agreement. If the consignor loses solvency, the goods remain their property, and bankruptcy proceedings may be initiated. Conversely, if the consignee loses solvency, the goods do not become their property and must be returned immediately to the consignor in accordance with the law.

The consignor has the right to unilaterally adjust the sale price of the goods specified in the consignment agreement. The consignee is bound by such changes once notified in writing in accordance with legislation.

Another key obligation of the consignor is to pay the consignee the agreed fee or remuneration. Since the consignee is professionally engaged in sales, the consignment agreement is

[95] Nistorescu, C. (2013). Studiu de drept comparat cu privire la regimul juridic al intermediarilor din mediul de afaceri (Study of comparative law on the legal status of intermediaries in business), Bucharest: ProUniversitaria Publishing House

[96] Nemeş, V. (2012). Drept comercial (Commercial law), Bucharest: Hamangiu Publishing House

considered valid and equitable. At the same time, the parties may also agree to establish a consignment arrangement without remuneration, if mutually agreed.

The amount of money due to the consignor is called a "remuneration" (fee), which is determined either by a written agreement or as a specified percentage. If no agreement on the fee exists, it is calculated as the difference between the price set by the consignor and the actual sale price. In our view, the agreed price set by the consignor is combined with the fee and value-added tax, resulting in the total sale price of the movable property.

Additionally, the agreed fee may include other expenses known to the consignor, such as technical services, storage, insurance, and sales-related costs. Although these expenses may be listed separately in the price, they are considered part of the remuneration (commission) but may also be accounted for independently[97].

If the sale occurs at the prevailing market price, the fee may be determined by a court. In determining the fee, the court considers factors such as the complexity of the sale (e.g., if the goods are rare, special, historical, or culturally significant), the conscientious performance of the consignee (e.g., whether the sale is conducted through a physical or virtual store, domestic or international customers are served, auctions are held, advertisements are placed, etc.), and the applicable fee for similar goods in the relevant market[98]. These principles are reflected in legislation.

Unless otherwise specified in the consignment contract or by the consignor's instructions, payment for the sale of the goods must be made in cash, by bank transfer, or by cross-check at the prevailing market price. Accordingly, "the consignor has no right to sell or otherwise use the goods delivered for consignment beyond the terms set in the contract." The consignor retains the right to unilaterally change the sale conditions unless the contract specifies otherwise, and any changes must be communicated in writing to the consignee. If no sale conditions or written instructions are provided, the consignee may sell the consigned goods only for cash at the current market price.

Furthermore, the consignor is obliged to reimburse the consignee for expenses incurred in fulfilling contractual obligations. Unless otherwise provided in the consignment or delivery contract, legislation assigns the costs associated with storage and sale of the goods to the consignor.

If the consignor receives or arranges for the receipt of the goods and the contract becomes unfulfillable (for example, the goods remain unsold) through no fault of the consignee, all expenses incurred by the consignee under the contract are borne by the consignor. If the consignor fails to take possession of their goods, storage and maintenance costs are also their responsibility.

Additionally, if the contract is canceled due to the consignee's refusal to accept the goods, the consignee has the right to retain the goods and cover the costs of storage, insurance, and servicing until the consignor reimburses them. Legally, the consignor must accept their goods immediately.

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ANALYSIS OF METHODS FOR CIVIL LAW PROTECTION OF BIG DATA

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Summary: *This article examines the civil-law mechanisms available for protecting Big Data within the legal system of the Republic of Uzbekistan. It argues that while general methods of civil rights protection—such as recognition of rights, restoration of violated rights, compensation for damages, and judicial remedies—remain applicable, Big Data requires additional, specialized approaches. The study identifies four primary protection methods: contractual structures (including NDAs, DPAs, and SLAs), tort liability mechanisms, protection through personal non-property rights, and non-jurisdictional (alternative) methods such as consent management, encryption, anonymization, and access control. Through analysis of national legislation and comparative examination of international case law (including Lloyd v. Google LLC, Google Spain, and Carpenter v. United States), the article demonstrates how existing civil-law doctrines adapt to digital-era challenges. The author concludes that Big Data relations require both traditional and specialized legal mechanisms, and advocates for incorporating explicit provisions regarding information-related contracts and liability into Uzbekistan's emerging Information Code.*

Key words: *Big Data, civil law, methods for protection, contract, tort liability, personal non-property rights, non-jurisdictional methods*

INTRODUCTION

It is known that subjects of civil law have the opportunity to acquire and exercise various civil rights depending on their legal status. The procedure for exercising civil rights is defined in Article 9 of the Civil Code of the Republic of Uzbekistan, according to which citizens and legal entities exercise their rights at their own discretion and in pursuit of their interests. They also independently decide how to use and protect their rights. In this case, individuals make their own decisions regarding the exercise or non-exercise of their rights. Failure to exercise rights does not result in their termination, unless otherwise provided by law.

No person should infringe upon the rights and legitimate interests of others when exercising their own rights. The law requires a fair, conscientious, and reasonable approach from participants in civil legal relations. In this context, each person is presumed to have acted fairly and reasonably until proven otherwise.

When exercising their rights, citizens and legal entities are obliged to adhere to the moral principles and ethical norms of society, while entrepreneurs must observe business ethics and rules of conduct. In exercising their rights, they must not cause harm to others, abuse their rights, or act contrary to the law and legal norms. If individuals fail to comply with these requirements, the court has the right to refuse protection of their rights.

MAIN PART

One of the practical manifestations of civil rights is that if a person who bears an obligation does not fulfill it voluntarily, its compulsory fulfillment is ensured. Methods of protecting civil rights are defined in Article 11 of the Civil Code.

recognition of the right;

restoration of the situation that existed before the violation of the right and prevention of actions that violate the right or create a threat of its violation;

declaring a transaction invalid and applying the consequences of its invalidity;

invalidation of an act issued by a state body or a body of citizen self-government;

self-defense of rights;

compelling the performance of the duty in its original form (in kind);

compensation for damages;

collection of penalties;

compensation for moral harm;

termination or modification of legal relations;

non-application by the court of an unlawful act issued by a state body or a body of citizen self-government.

These methods are considered general methods for protecting civil rights. Undoubtedly, since Big Data consists of complex relationships, the aforementioned methods can be employed for the legal protection of the process. However, along with the methods listed above, it is advisable to utilize specialized methods of civil law in Big Data processes. In our opinion, these methods manifest themselves as follows:

5. *Protection through contractual structures (specific types of obligations);*
6. *Protection through mechanisms of tort liability;*
7. *Protection through personal non-property rights;*
8. *Non-jurisdictional methods (Alternative methods).*

Protection through contractual structures (specific types of obligations).

Today, Big Data technologies are widely used in various fields, including medicine, finance, industry, education, and public administration. With the help of these technologies, large volumes of digital data are analyzed, and decision-making processes are carried out effectively. However, when working with Big Data, ensuring data security, confidentiality, and integrity remains a pressing issue.

Systems storing large volumes of digital data are at risk of cyberattacks and potential information disclosure by internal personnel. In this context, ensuring data confidentiality is recognized as the primary concern. Additionally, maintaining the integrity and authenticity of data is crucial, as data corruption or manipulation can lead to incorrect decision-making. In such situations, a contractual approach to data protection is considered one of the most effective methods.

With the advancement of modern technologies, the concept of Big Data has reached an entirely new level. Big data analysis has opened up new opportunities for enterprises, research centers, and government agencies. Simultaneously, issues of data confidentiality and legal protection are becoming increasingly relevant. Particularly, ***Non-disclosure agreements (NDAs)*** have sparked serious debates among scientists and experts regarding their effectiveness in the Big Data environment.

The development of Big Data technologies is enabling companies and research centers to formulate business strategies using vast amounts of information. At the same time, the confidentiality of personal data is becoming an increasingly critical issue.

NDAs are often created to prevent the disclosure of confidential information to third parties. However, due to the constant updating and development of Big Data, debates continue regarding how to protect this information. For example, the effectiveness of data anonymization and encryption methods is still under question.

A. Tojiboev emphasizes that this agreement is widely used in startup activities and notes that the Non-disclosure agreement (NDA) is prevalent between startup owners and investors for protecting ideas, projects, technical, commercial, or organizational information.[99]

Taking into account the views of these scholars, in our opinion, the subject of the NDA contract should precisely be *the implementation of necessary measures to prevent the dissemination of any personal, commercial, or other types of information.* It is noted that all existing subjects of civil law can participate as parties to the contract. In general, this agreement defines the obligations of the parties not to disclose information. Companies reduce the risk of data leakage by signing this document before transferring their information to third parties.

Big Data and AI are closely interconnected. Training AI models requires large amounts of digital data. However, due to NDAs, access to some data may be restricted, which can affect the quality and accuracy of analyses. For example, in the medical field, real patient data is necessary for the effective performance of AI models, but this data must be kept confidential.

[99] A. Tojiboyev. Civil law regulation of startup activities. Dissertation. T., 2021, p. 72.

Big Data technologies enable organizations to collect, store, and analyze vast amounts of data. However, these processes raise important legal issues regarding the confidentiality and security of personal information. From this perspective, ***the Data Processing Agreement (DPA)*** plays a crucial role.

According to an analysis provided by WilmerHale, the DPA is essential for understanding and evaluating legal issues related to big data.[100]

An article published in the Stanford Law Review emphasized the importance of the DPA in managing and protecting personal data. [101] Additionally, a source from Washington University Open Scholarship discussed the role of the DPA in ensuring privacy in the era of big data.[102]

According to GDPR regulations, the DPA defines the rights and obligations of parties regarding the protection of personal data.

A DPA (Data Processing Agreement) is an agreement that defines the rights and obligations of parties in the process of personal data processing, concluded between the information owner (data controller) and the data processor. This agreement is necessary to ensure the legal and secure processing of personal data.

Big data technologies require the processing of large volumes of personal data, which makes the issues of confidentiality and security even more relevant. As parties to the DPA agreement, we can often see large corporations in the ICT sector acting as data processors. In general, today in our country, organizations operating in both public and private sectors are considered parties to this agreement. For example, in the mobile communications sector (Beeline, Mobiuz, Ucell), in the internet sector (Uztelecom), and my.gov.uz, the Single Portal of Interactive Public Services of the Republic of Uzbekistan (Digital Government Project Management Center), are considered data processors in accordance with the DPA agreement.

In our opinion, the DPA agreement is an important legal tool for ensuring the protection of personal data in the process of big data. The DPA clearly defines the rights and obligations of the parties and ensures the safe and lawful processing of personal data.

The development of the digital economy and Big Data technologies ***has increased the demand for Service Level Agreements (SLAs)*** . An SLA is a legal document that defines the terms of service provision based on Big Data, with its content specifying the quality of service, liability limits, and the rights and obligations of the parties.

Researchers emphasize that SLAs play a crucial role in Big Data relationships not only in terms of service quality but also in terms of data confidentiality and protection. These agreements serve as a legal foundation between service providers and users.

The subject of an SLA must clearly define the level of service provision, data confidentiality and security, responsibility and dispute resolution, as well as the boundaries of responsibility between the service provider and the client. In our view, this agreement can be manifested through collaboration with service and intellectual property agreements (such as license agreements, copyright agreements, etc.) in our national legislation. However, a natural question arises regarding which institutional rules or methods should be applied for liability in case of non-performance of obligations in this area.

If we define the SLA contract as a service agreement, special provisions may apply in addition to the general provisions on obligations. In particular, according to the rules for service provision, if the service provider (contractor) fails to fulfill the paid service contract fully or properly, they are obliged to fully compensate the customer for the damages caused. However, this compensation should not exceed twice the cost of the services specified in the contract. If this situation involves business

[100] https://www.wilmerhale.com/en/insights/publications/20230515-big-data-analytics-privacy-law-considerations
[101] Omer Tene & Jules Polonetsky. Privacy in the Age of Big Data A Time for Big Decisions. https://www.stanfordlawreview.org/online/privacy-paradox-privacy-and-big-data/
[102] Richards, Neil M. and King, Jonathan H., "Big Data and the Future for Privacy" (2016). Scholarship@WashULaw. 500. https://openscholarship.wustl.edu/law_scholarship/500

entities, enhanced civil liability is provided for. These provisions are reflected in Article 706 of the Civil Code.[103]

If it is deemed necessary to apply intellectual property protection rules to the SLA agreement, in accordance with Article 1040 of the Civil Code, the following measures can be taken: seizure of the objects through which the exclusive rights were violated, as well as the material objects created as a result of such violation; or mandatory publication of information about the violation, including details about the ownership of the violated right. The key aspect for this is the reflection of exclusive rights to the data or database that is the subject of the SLA agreement.

In general, according to the doctrine of contract law, parties may conclude a mixed contract that incorporates elements of various contracts. The rules governing the contracts that constitute its components apply to the relations between parties under such a contract. These provisions are reflected in Article 354 of the Civil Code.

In our opinion, it is appropriate to apply both service provision rules and intellectual property protection rules in SLA agreements.

Based on the principle of freedom of contract, parties are allowed to conclude contracts not provided for by legislation. This rule is enshrined in Article 354 of the Civil Code. Thus, contracts such as NDA, DPA, and SLA are also considered a separate type of obligation, and parties may conclude such contracts in the context of implementing information relations.

However, NDA, DPA, and SLA agreements (hereinafter referred to as agreements in the information sphere), their content, or closely related provisions cannot yet be found in either information legislation or civil legislation. In this case, it is advisable to include provisions related to such contracts, liability arising from them, and their protection in the draft Information Code of the Republic of Uzbekistan.

Moreover, in accordance with the doctrine of civil law, civil liability for breach of obligations consists of imposing on the debtor who failed to fulfill the obligation the duty to pay damages and penalties in favor of the creditor.[104]

Therefore, according to the general doctrine, it can be concluded that if parties fail to fulfill or properly comply with the obligations stipulated in information-related agreements, the other party is obligated to pay damages and penalties.

Protection through the mechanisms of tort law.

It is known that the existence of damage is one of the main factors in determining civil liability for a tort. In civil liability for breach of obligations, however, the presence of actual damage is not mandatory.[105] In Big Data relations, if civil rights are protected through tort, it is natural that the factor of damage comes to the forefront.

Big Data is analyzed by commercial and public sectors and used for various purposes. The need to protect Big Data is related to the confidentiality of personal data and the risk of illegal data use. According to Article 990 of the Civil Code, an act causing harm must be illegal and cause real harm to the victim. Within the framework of Big Data, such damage can manifest itself as follows:

- unauthorized disclosure of personal data;
- illegal use of data for commercial purposes;
- damage to the victim as a result of data corruption or loss.

According to Article 985 of the Civil Code, the person who caused the damage is liable for this damage and is obligated to compensate for it. Illegal collection, use, or disclosure of Big Data may infringe on personal privacy. In this case, the injured party may file a claim based on tort liability.

[103] National Database of Legislation, April 21, 2021, No. 03/21/683/0375, August 21, 2021, No. 03/21/709/0808; 10.02.2022, No 03/22/752/0113; March 30, 2022, No. 03/22/761/0250; 21.04.2022, No. 03/22/765/0332; May 18, 2022, No. 03/22/770/0424, June 7, 2022, No. 03/22/775/0477; 04.11.2022, No 03/22/800/0990; November 16, 2023, No. 03/23/878/0852; February 22, 2024, No. 03/24/911/0142; February 28, 2024, No. 03/24/914/0161; 11.09.2024, No 03/24/959/0698; 07.02.2025, No 03/25/1025/0116; 07.03.2025, No 03/25/1044/0224

[104] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 264 p.

[105] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 274 p.

Lloyd v Google LLC (2021) UKSC 50 [106] is a significant case heard by the UK Supreme Court, which addressed issues of personal data protection, the factor of harm, and class action lawsuits.

Richard Lloyd, acting as a consumer rights advocate, filed a lawsuit against Google. In the lawsuit, he alleged that during 2011-2012, Google used a mechanism called "Safari Workaround" to collect personal data from millions of users through the Apple Safari browser without their consent.[107]

Lloyd argued that this case violated the Data Protection Act 1998 (DPA 1998) and demanded general compensation from Google for English users. In the plaintiff's view, Google is obligated to pay compensation for the automatic harm caused to English users. However, in this case, the views on the degree of actual damage have already been called into question.[108]

Two main issues were discussed in this case: a) class action lawsuit - Lloyd filed a lawsuit on behalf of all English users, but under the British legal system, it is only accepted with the participation of victims who suffered actual damage; b) the fact of damage - although it was alleged during the case that Google had illegally collected users' personal data, it was not clearly proven that damage was caused to each user individually.[109]

The UK Supreme Court rejected Lloyd's claim based on the evidence in the aforementioned case, citing the lack of substantiated evidence that Google had caused harm to users.

In our opinion, *Lloyd v Google LLC* case notes that even if data is collected in the Big Data process without users' consent, the application of tort law rules should be based on the fact of actual damage.

The aforementioned court decision was a relief for companies in the Big Data sector, as if Lloyd had won, the number of similar mass lawsuits could have increased. However, it created a limitation for consumer rights advocates, as it has now become more difficult to pursue collective claims against personal data breaches.

Protection through personal non-property rights.

According to civil law doctrine, personal non-property rights cannot be valued, they are characterized by being free of charge, and their implementation does not entail equivalent property obligations of other persons. The objects of non-property benefits are intangible assets inseparable from the individual: name, honor, dignity, health, privacy, personal inviolability, and others.[110]

According to S. Gulyamov, at a time when digital technologies are becoming increasingly widespread, the vulnerabilities of personal data are opening the way for new forms of systemic corruption. Although robust data protection mechanisms are an important safeguard, they are still not sufficiently utilized in the fight against corruption.[111]

The life, health, honor, dignity, and personal inviolability of every individual are protected. Their business reputation, personal life, family secrets, rights to name and image, copyrights, and other personal non-property rights must not be violated. Moreover, intangible assets belonging to a person from birth or by law cannot be seized under any circumstances. These provisions are enshrined in Article 99 of the Civil Code.

According to the regulations on personal non-property rights, a citizen has the right to demand a refutation through the court if information damaging their honor, dignity, or business reputation has been disseminated, and the person who spread it cannot prove its truthfulness.[112] Typically, the procedure for issuing a retraction is determined by the court.

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[106] See: https://inforrm.org/2021/12/22/top-10-privacy-and-data-protection-cases-of-2021-a-selection-suneet-sharma/

[107] Gruschka, Nils & Mavroeidis, Vasileios & Vishi, Kamer & Jensen, Meiko. (2018). Privacy Issues and Data Protection in Big Data: A Case Study Analysis under GDPR. 5027-5033. 10.1109/BigData.2018.8622621.

[108] Janeček, Václav, Mass Compensation Claims for Illegal Online Tracking (March 2, 2022). (2022) 138(April) The Law Quarterly Review 205-210, Available at SSRN: https://ssrn.com/abstract=4047736

[109] See https://inforrm.org/2021/12/22/top-10-privacy-and-data-protection-cases-of-2021-a-selection-suneet-sharma/

[110] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 112 p.

[111] S.Gulyamov, Sh.Raimberdiyev. Personal Data Protection as a Tool to Fight Cyber Corruption // International Journal of Law and Policy | Volume: 1 Issue: 7, 2023

[112] Civil Law: Textbook. Part I / Collective of authors. Under the general editorship of Prof. O. Okyulov. - Tashkent: TSUL Publishing House, 2016. - 113 p.

A citizen whose honor, dignity, or business reputation has been tarnished by disseminated information has the right to demand compensation for losses and moral damages caused by its spread, in addition to the refutation of such information.

One of the specific methods of protecting personal non-property rights is compensation for moral damages.[113]

Furthermore, Article 31 of the Constitution of the Republic of Uzbekistan stipulates that everyone has the right to protection of their personal data, as well as the right to demand correction of inaccurate information and deletion of information about themselves that has been collected illegally or has lost its legal basis.[114]

In addition to the methods outlined in civil legislation, the Basic Law of our country also establishes the right to demand the deletion of illegal and unlawful information. This *"right to be forgotten" (the "Right to Be Forgotten")* essentially *Google Spain SL v. Agencia Española de Protección de Datos (2014) - CJEU*[115] entered the realm of social relations and civil law as a result of a court case.

In the Law of the Republic of Uzbekistan "On Personal Data," information relating to a specific individual or enabling their identification, recorded electronically, on paper, and (or) on other tangible media, is interpreted as personal data.[116]

In accordance with the provisions of this Law, the state, while guaranteeing the protection of personal data, implements the following methods of protecting personal data for the owner and (or) operator, as well as third parties:

ensuring the realization of the subject's right to protection from interference in their private life;

maintaining the integrity and security of personal data;

Ensuring the confidentiality of personal data;

Preventing illegal processing of personal data.[117]

In our opinion, the above measures are considered protective (preventive) and may not be of particular significance.

In the case *of Carpenter v. United States (USA, 2018),* it is also possible to observe harm caused to the victim as a result of a mobile operator disclosing personal data without the permission of the data owner and without a court warrant.[118]

In 2003, several armed robberies were committed in Detroit, USA. Law enforcement agencies demanded location history data (CSLI - Cell-Site Location Information) from mobile operators to prove that one of the suspects, Timothy Carpenter, and his accomplices were at the crime scenes.

The U.S. prosecutor's office obtained a court order to acquire this information, but a traditional warrant was not required. This order was issued based on the Stored Communications Act (SCA) adopted in 1986, which allowed obtaining information without requiring a warrant.

Using Carpenter's mobile phone signals, investigators confirmed his presence at the crime scenes, which was used as evidence in court. Carpenter was found guilty by the court and sentenced to a long-term imprisonment.

Carpenter filed an appeal, arguing that law enforcement agencies obtaining location history data stored by mobile operators without a warrant violates the Fourth Amendment to the US Constitution.[119] The amendment stipulates that a person's right to privacy, home, documents, and possessions should be protected from unreasonable searches and seizures.[120]

Carpenter and his lawyers asserted that mobile phone location history data is personal and requires a court order to obtain such information. The government, however, argued that this

[113] Internet resources: https://lex.uz/docs/-6445145
[114] National Database of Legislative Information, 01.05.2023, No. 03/23/837/0241
[115] See: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:62012CJ0131
[116] National Database of Legislation, April 21, 2021, No. 03/21/683/0375; November 29, 2023, No. 03/23/880/0905
[117] Ibid
[118] Margot E. Kaminski, Response, Carpenter v. United States: *Big Data Is Different*, GEO. WASH. L. REV. ON THE DOCKET (July 2, 2018), https://www.gwlr.org/carpenter-v-united-states-big-data-is-different.
[119] Gerald G. Ashdown, The Fourth Amendment and the "Legitimate Expectation of Privacy", 34 Vand. L. Rev. 1289, 1315 (1981)
[120] Danielle K. Citron, Mainstreaming Privacy Torts, 98 Cal. L. Rev. 1805, 1852 (2010)

information falls under *the Third-Party Doctrine*, meaning that users have no right to privacy because they have voluntarily provided such information to certain organizations (mobile operators).

In 2018, the U.S. Supreme Court ruled that mobile phone location history data is considered personal information, that law enforcement agencies must obtain a warrant to access such information, and that the Third-Party Doctrine does not apply in this case, as users do not intentionally share their location history data with operators. According to the U.S. Supreme Court, this information is automatically recorded.

According to M. Kaminski, this court case created an important precedent in *the field of digital privacy rights* by establishing that courts should protect citizens' data automatically collected through technology. Moreover, the U.S. Supreme Court set limitations on *the third-party doctrine*, indicating that even if a person has transferred data to a private company, such data may still be under constitutional protection.[121]

In our interpretation, *the Third-Party Doctrine* principles are also reflected in national legislation. For instance, according to the Law of the Republic of Uzbekistan "On Personal Data," the owner and (or) operator, as well as other persons who have been granted access to personal data, are obligated not to disclose or disseminate personal data to third parties without the subject's consent.[122]

Overall, this court case is a significant event that expands digital privacy rights, potentially limiting law enforcement agencies' access to Big Data, and in such situations, civil liability measures may be applied through tort obligations.

At the same time, registering personal data in the state register is considered necessary as a preliminary mechanism for protecting the Big Data process through personal non-property rights. In the EU, the controller and the processor are responsible for this process.[123] According to the provisions of the Regulation "On the State Register of Personal Databases," approved by Resolution No. 71 of the Cabinet of Ministers dated February 8, 2020, the owner and operator of personal databases are authorized in this matter.[124] Based on this, it is advisable to identify, as the next mechanism, a group of information that is not considered personal data by authorized persons. In this case, publicly available data that have not used automation tools and are processed based on labor legislation should not be reflected in the personal data registry.

Non-jurisdictional (alternative) methods.

In our opinion, regulatory and legal frameworks may not be sufficient to ensure security in Big Data, particularly regarding the protection of personal information. Therefore, in Big Data relationships, it is necessary to widely utilize additional non-jurisdictional methods such *as opt-in and opt-out (giving consent and withdrawing it), encryption, pseudonymization and anonymization, access control, data masking, and audit and log systems.*

Such measures are required to comply with international standards for personal data protection, particularly legislation like the European Union's GDPR, the U.S. HIPAA (Health Insurance Portability and Accountability Act), and the CCPA (California Consumer Privacy Act).

According to the GDPR, users must participate in the processing of their personal data based on full and informed consent. This makes the *opt-in* mechanism critically important. Additionally, users have the right to withdraw their consent (opt-out) at any time. This mechanism is one of the fundamental principles of personal freedom and information security.

Big Data systems, *encryption technologies* can render data unreadable by third parties during storage and transmission processes. Specifically, encrypting data in transit and at rest is an integral part of modern cybersecurity. Encryption algorithms widely employ technologies such as AES (Advanced Encryption Standard) and RSA (Rivest-Shamir-Adleman).

[121] Margot E. Kaminski, Response, Carpenter v. United States: *Big Data Is Different*, GEO. WASH. L. REV. ON THE DOCKET (July 2, 2018), https://www.gwlr.org/carpenter-v-united-states-big-data-is-different.
[122] National Database of Legislation, April 21, 2021, No. 03/21/683/0375; November 29, 2023, No. 03/23/880/0905
[123] See: https://gdpr-info.eu/art-28-gdpr/
[124] See: https://lex.uz/docs/-4729730

Pseudonymization modifies personal data, reducing the possibility of directly linking it to the user. This method plays a crucial role in protecting privacy while maintaining data value, especially in analytical and statistical processing. Anonymization, on the other hand, aims to completely eliminate the possibility of identifying an individual from a dataset. However, this method should be implemented cautiously to minimize the risk of re-identification.

RBAC (Role-Based Access Control) model grants users access rights only at levels corresponding to their roles. This approach serves to mitigate internal risks. Additionally, all actions related to data access and usage must be recorded in log files. Audit and monitoring systems can be used to observe these processes and detect actions that violate security policies.

Data Masking is a technology for creating modified but syntactically authentic-looking data used for testing or development environments instead of real data. This allows developers to work without real user data and reduces the risk of personal data leakage.

Additionally, *the "Zero Trust"*model-based infrastructure relies on verifying every action of the user and device. This model abandons the concept of a "trusted network" and constantly checks any attempt to access the system. This helps create a high level of protection in Big Data systems at both corporate and government levels.

CONCLUSION

In Big Data relations, it is essential to employ not only the general methods of civil rights protection but also specialized legal mechanisms tailored to the unique nature of digital information processes. These methods collectively ensure a balanced and comprehensive framework for safeguarding the interests of data subjects, data controllers, and all participants in information relations. In particular, protection may be achieved through Sui Generis intellectual property rights, which help secure the legal status of databases and prevent unauthorized use; through contractual structures that define specific obligations between parties and regulate data processing, confidentiality, and service quality; through tort liability mechanisms that address harm caused by unlawful data collection, disclosure, or misuse; and through the protection of personal non-property rights, which uphold the inviolability of personal data, privacy, dignity, and digital autonomy. Together, these complementary approaches form a robust legal foundation capable of addressing the challenges posed by Big Data in modern civil law.

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9. Constitution of the Republic of Uzbekistan (Article 31).

10. Cabinet of Ministers of the Republic of Uzbekistan. (2020). *Regulation on the State Register of Personal Databases* (Resolution No. 71).

11. Lloyd v. Google LLC, [2021] UKSC 50.

12. Google Spain SL v. Agencia Española de Protección de Datos, Case C-131/12 (CJEU, 2014).

13. Carpenter v. United States, 585 U.S. ___ (2018).

14. HIPAA — Health Insurance Portability and Accountability Act, U.S. Public Law 104-191.

15. California Consumer Privacy Act (CCPA), California Civil Code §1798.100 et seq.

Rezyume: *Ushbu maqolada O'zbekiston Respublikasi huquqiy tizimida katta ma'lumotlarni himoya qilishning mavjud fuqarolik-huquqiy mexanizmlari ko'rib chiqiladi. Uning ta'kidlashicha, fuqarolik huquqlarini himoya qilishning umumiy usullari - huquqlarni tan olish, buzilgan huquqlarni*

tiklash, zararni qoplash va sud orqali himoya qilish usullari qo‘llanilishi mumkin bo‘lsa-da, Big Data qo‘shimcha, maxsus yondashuvlarni talab qiladi. Tadqiqotda himoyaning to‘rtta asosiy usuli aniqlangan: shartnomaviy tuzilmalar (shu jumladan NDA, DPA va SLA), huquqbuzarlik uchun javobgarlik mexanizmlari, shaxsiy nomulkiy huquqlar orqali himoya va rozilikni boshqarish, shifrlash, anonimlashtirish va kirishni nazorat qilish kabi yurisdiksiyadan tashqari (muqobil) usullar. Milliy qonunchilikni tahlil qilish va xalqaro sud amaliyotini qiyosiy o‘rganish orqali (jumladan, Lloyd v. Google LLC, Google Spain va Carpenter v. Amerika Qo‘shma Shtatlari), maqola mavjud fuqarolik-huquqiy doktrinalar raqamli davr muammolariga qanday moslashishini ko‘rsatadi. Muallif katta ma’lumotlar bilan bog‘liq munosabatlar ham an’anaviy, ham maxsus huquqiy mexanizmlarni talab qiladi, degan xulosaga keladi va O‘zbekistonning yangi Axborot kodeksiga axborot bilan bog‘liq shartnomalar va javobgarlik to‘g‘risidagi aniq qoidalarni kiritish tarafdori bo‘ladi.

Резюме: *В данной статье рассматриваются доступные гражданско-правовые механизмы защиты больших данных в правовой системе Республики Узбекистан. Он утверждает, что в то время как общие методы защиты гражданских прав, такие как признание прав, восстановление нарушенных прав, возмещение ущерба и судебные иски, остаются применимыми, большие данные требуют дополнительных, специализированных подходов. В исследовании выделены четыре основных метода защиты: договорные структуры (включая NDA, DPA и SLA), механизмы ответственности за правонарушения, защита посредством личных неимущественных прав и неюрисдикционные (альтернативные) методы, такие как управление согласием, шифрование, анонимизация и контроль доступа. Путем анализа национального законодательства и сравнительного изучения международного прецедентного права (включая Lloyd v. Google LLC, Google Spain и Carpenter v. Соединенные Штаты), в статье показано, как существующие гражданско-правовые доктрины адаптируются к вызовам цифровой эпохи. Автор приходит к выводу, что отношения с большими данными требуют как традиционных, так и специализированных правовых механизмов, и выступает за включение четких положений о договорах, связанных с информацией, и об ответственности в формирующийся Информационный кодекс Узбекистана.*

Kalit so‘zlar: *Katta ma’lumotlar, fuqarolik huquqi, himoya usullari, shartnoma, huquqbuzarlik uchun javobgarlik, shaxsiy nomulkiy huquqlar, yurisdiksiyadan tashqari usullar.*

Ключевые слова: *Большие данные, гражданское право, методы защиты, контракт, деликтная ответственность, личные неимущественные права, неюрисдикционные методы.*

PRAGMATIC INTENTION OF "ATTRACTING THE READER'S ATTENTION" IN THE TITLES OF ENGLISH AND KARAKALPAK FAIRY TALES

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Summary: *Fairy-tale titles play a crucial communicative role, functioning not only as nominal labels but also as pragmatic instruments aimed at attracting the reader's or listener's attention. The present article examines the pragmatic intention of attention-drawing strategies observed in the titles of English and Karakalpak folk tales. Through comparative linguistic analysis, the study identifies key stylistic mechanisms such as alliteration, rhyme, metaphor, evaluative attributes, and culturally loaded lexical units.*

Keywords: *fairy tale, pragmalinguistics, stylistics, discourse, speech act, comparative linguistics, Karakalpak, English folklore.*

Fairy tales constitute one of the most enduring genres of world folklore, reflecting a community's cultural memory, worldview, and ethical system. Beyond their narrative and artistic dimensions, fairy tales are fertile ground for pragmatic and stylistic analysis, especially regarding the intentions that guide communication. Among these intentions, «the pragmatic purpose of attracting attention» is particularly important because the title is the first linguistic unit encountered by the audience.

This article investigates how the titles of English and Karakalpak fairy tales are linguistically constructed to elicit curiosity, emotional resonance, and interpretative expectations. Special attention is devoted to the role of alliteration, rhyme, metaphorical expressions, lexical repetition, and cultural symbols, all of which shape the audience's perception even before engaging with the narrative itself.

Pragmatic Purpose of Attention-Attraction in Fairy-Tale Titles

From a pragmatic perspective, a title is successful if its intended meaning and communicative aim are recognized by the audience. Many fairy-tale titles are explicitly designed to provoke interest, guide interpretation, create intrigue, or foreshadow thematic motifs. When the audience acknowledges this intention, the pragmatic effect is achieved.

In both English and Karakalpak folklore traditions, titles frequently serve as a condensed form of narrative orientation, moral framing, cultural signaling, and stylistic foregrounding. Attention-Attracting Strategies in English Fairy-Tale Titles.

Use of Alliteration and Rhyme

A salient feature of English fairy-tale titles such as "Tom Tit Tot," "Nix Nought Nothing," "Titty Mouse and Tatty Mouse,"and"The Wee, Wee Mannie" is the reliance on sound patterns—especially alliteration and rhyme.

These phonetic devices:

enhance memorability

create playful rhythm

signal light-hearted or magical tone

appeal to child audiences

produce aesthetic coherence

The repetition of consonants like t, p, and n generates a musical quality that immediately captures attention and hints at the whimsical nature of the narrative.

Lexical Mystique and Archaic Forms

Titles such as "Nix Nought Nothing" employ archaic or obscure vocabulary that enhances mystery and curiosity. These linguistic markers evoke historical layers of folklore and signal the presence of moral or symbolic meaning rooted in tradition.

Character-Based Titles

Titles like “Mouse and Mouser” foreground antagonistic or complementary pairs, preparing the audience for anthropomorphic characters and moral allegory.

Similarly, “Teeny-Tiny” and “The Wee, Wee Mannie” use diminutives to convey innocence, small-scale adventures, and a tone suitable for younger audiences.

Recurrent Lexical Themes

A particularly notable case is the pair “The Well of the World’s End” and “The Three Heads of the Well.”

The repeated use of well symbolizes:

life source

hidden knowledge

spiritual threshold

center of magical events

Thus, the title itself becomes a symbolic gateway into the tale’s deeper existential or mystical meaning.

Attention-Attraction in Karakalpak Fairy-Tale Titles

Use of Proverbs and Rhythmic Structures

Many Karakalpak titles correspond to well-known proverbs, for example:

“Aqıllı azbaydı, altın tozbaydı”

“Jaqsılıq qılsań ózińe, jamanlıq qılsań ózińe”

“Gúl gúlge ashıq, aqırısında mánisinen qashıq”

The pragmatic effect of these titles lies in:

moral authority

cultural familiarity

rhythmic parallelism

symbolic oppositions (good vs. evil, gold vs. time, beauty vs. destiny)

Unlike English titles, which are often playful or enigmatic, Karakalpak titles communicate ethical expectations and culturally shared wisdom from the outset.

Repetition of the Word **Bala** (“Child”)

The most frequent lexical element in Karakalpak fairy-tale titles is bala, observed in titles such as:

“Batır bala,” “Aqıllı bala,” “Aqılsız bala,” “Qara atlı bala”

“Sheshen bala,” “Ójet bala,” “Násiyhat satıp alǵan bala”

This recurrence serves multiple pragmatic functions:

1. Cultural archetype formation: The child represents purity, potential, and the embodiment of cultural continuity.

2. Narrative framing: The protagonist is introduced clearly and simply.

3. Moral orientation:Each child figure embodies a moral trait (courage, wisdom, foolishness), guiding interpretative expectations.

4. Audience targeting: The stories are implicitly positioned as educational material for young listeners.

Thus, the lexical repetition operates not only as a stylistic device but also as a cultural signal.

Heroic and Symbolic Titles

In heroic tales, titles such as “Qubılı batır,” “Jartıbas batır,” and “Gulbúlbil” activate traditional hero archetypes, beauty motifs, and symbolic imagery widely recognized in Turkic and Middle Eastern folklore.

In philosophical or existential tales, titles like “Bir qısım topıraq” foreground themes of land, ancestry, and the human condition.

Animal-Based Moral Titles

Titles such as “Qudaydı aldaǵan túlki” and “Sum eshek penen ańqaw túye” function pragmatically by:

emphasizing moral contrast

using humor and satire

relying on familiar cultural animal symbolism (fox = trickster, donkey = stubbornness, camel = endurance)

These titles both entertain and instruct, preparing the audience for ethical lessons delivered through animal allegory.

Comparative Findings

5.1 English Fairy Tales

Prioritize phonetic playfulness (alliteration, rhyme)

Use mysterious or archaic expressions

Titles are often character-driven

Symbolic recurrence (e.g., well) ties to mythological motifs

5.2 Karakalpak Fairy Tales

Frequently utilize proverbs as titles

Lexical repetition (bala) serves cultural and moral functions

Strong emphasis on ethical values and social ideals

Titles embody cultural continuity, especially heroism, wisdom, modesty, and beauty

5.3 Key Contrast

English titles aim to amuse and intrigue, while Karakalpak titles aim to teach and culturally orient. Both effectively attract the audience, but through distinct linguistic and cultural pathways.

Conclusion

The analysis reveals that fairy-tale titles in both English and Karakalpak folklore are intentionally constructed to perform the pragmatic function of attracting the audience’s attention. English fairy tales rely heavily on phonetic artistry, playful rhythm, and enigmatic wording, whereas Karakalpak tales foreground moral principles, cultural archetypes, and symbolic lexicon deeply rooted in tradition. Despite these differences, both traditions employ titles as powerful pragmatic tools that prepare the audience for the narrative’s tone, themes, and moral trajectory.

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Rezyume: *Ertak sarlavhalari nafaqat nominal belgilar, balki o‘quvchi yoki tinglovchining e’tiborini jalb qilishga qaratilgan pragmatik vositalar sifatida ham muhim kommunikativ vazifani bajaradi. Ushbu maqolada ingliz va qoraqalpoq xalq ertaklari sarlavhalarida kuzatiladigan diqqatni jalb qilish strategiyalarining pragmatik intensiyasi o‘rganilgan. Qiyosiy lingvistik tahlil orqali tadqiqotda alliteratsiya, qofiya, metafora, baholovchi atributlar va madaniy yuklangan leksik birliklar kabi asosiy uslubiy mexanizmlar aniqlanadi.*

Резюме: *Сказочные заголовки играют важную коммуникативную роль, выступая не только в качестве номинальных обозначений, но и в качестве прагматических инструментов, направленных на привлечение внимания читателя или слушателя. В данной статье рассматривается прагматическое намерение стратегий привлечения внимания,*

наблюдаемое в названиях английских и каракалпакских народных сказок. С помощью сравнительного лингвистического анализа выявляются ключевые стилистические механизмы, такие как аллитерация, рифма, метафора, оценочные атрибуты и культурно загруженные лексические единицы.

Kalit so‘zlar: *ertak, pragmalingvistika, stilistika, diskurs, nutqiy akt, qiyosiy tilshunoslik, qoraqalpoq, ingliz folklori.*

Ключевые слова: *сказка, прагмалингвистика, стилистика, дискурс, речевой акт, сравнительная лингвистика, каракалпакский, английский фольклор.*

A COMPARATIVE ANALYSIS OF THE PHENOMENON OF CONVERSION IN ENGLISH AND KARAKALPAK LANGUAGES

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Summary: *This scientific article is devoted to a comparative analysis of the theoretical foundations, historical development, and manifestations of the phenomenon of conversion in linguistics, particularly in English and Karakalpak languages.*

Key words: *Word formation, linguistics, comparative analysis, semantics, grammar.*

In world linguistics, the relationship between cognate languages has evolved over centuries to the present day. One of the crucial factors ensuring its inheritance by future generations is the grammatical structure and semantic nature of each word in that language. The specific characteristics of conversion, the uniqueness of its models, semantic and grammatical features, and its role in word formation are being researched across various languages. Studies on conversion indicate that the phenomenon of conversion possesses unique characteristics not only between different languages but also within a single language itself. Conversion studies contribute to improving language learning and teaching methodologies, translation theory, and lexicographical issues. The phenomenon of conversion, that is, the emergence of new lexical units through a change in word class, is an important factor reflecting the dynamic changes of language. For this reason, the study of conversion holds significant importance in modern linguistics.

In world linguistics, words, their semantic meanings, and emotional characteristics have been deeply analyzed since ancient times. This process, including the evolution of language, the changes in words, and their contextual meanings, is considered a primary object of linguistic research. Alongside this, significant attention is also paid to the unique characteristics of comparative language study. Conversion, meaning the formation of new words through a change in word class, is recognized as an effective and important method of word formation in linguistics.

Despite belonging to different genetic families, English and Karakalpak languages possess unique conversion models. Through a comparative analysis of the phenomenon of conversion in these languages, it becomes possible to identify similarities and differences in their lexica-semantic systems, uncover the universal and national characteristics of conversion, and enrich theoretical knowledge and express new concepts in this field.

Integrating and developing the phenomenon of conversion and its related issues with urgent problems in applied linguistics, while ensuring its national and international competitiveness, indicates the necessity for further development in the field of linguistics.

From the late 19th century to the present day, in the linguistics of Germanic, Russian, and Turkic languages, we find the issues of viewing conversion as a word-formation tool, resulting from the interrelation of language and culture, studied in the scientific works of M. Matzner, H. Sweet, G. Bradley, St. Robertson, O. Jespersen, Ch. Bally, and others.

One of the most productive methods of word formation is conversion – a semantic and grammatical phenomenon where a word transitions from one word class to another without changing its external form or adding any derivational affixes. In Turkic languages, the linguist A.A. Yuldashev was the first to acknowledge the derivational significance of conversion and to scientifically substantiate it. In his research, he analyzed the semantic and grammatical features of words formed through conversion, demonstrating that this method is an important source of word formation in Turkic languages. A.A. Yuldashev's works laid the theoretical foundation for studying the phenomenon of conversion in Turkic languages and paved the way for subsequent research. Following this, conversion as a word-formation method has been recognized by many modern Turkologists, including N.A. Baskakov, S.A. Beglyarova, J.M. Guzeyev, A.A. Baygarina, M.S. Asanova, I.P. Pavlov, F.A. Ganiev, and others. In Karakalpak linguistics, we encounter the phenomenon of conversion in the scientific works of N.A. Baskakov, Á. Aymurzaeva, A.

Bekbergenov, T. Ábdimuratov, E. Allanazarov, B. Ubaydullaev, Q.Bekbergenov, Q.Paxratdinov, P.Najimov.

Conversion holds a special place in the word-formation system of the Karakalpak language and requires careful study not only from a derivatological and morphological perspective but also in the lexico-semantic segments within scientific knowledge about the language.

Conversion (zero derivation) is the process of forming a new word without morphological change, but through a change in its meaning. In this process, the grammatical category or function of the word changes, but its form remains the same.

1. Change in grammatical category: During the conversion process, the word's part of speech (e.g., noun, verb, adjective) changes. For example: "run" - to move quickly (verb) → "a run" - an act of running (noun). "to cook" - to prepare food (verb) → "a cook" - a person who cooks (noun).

2. No morphological change: The form of the word does not change; only its meaning or function changes. For example: "to drink" - to consume liquid (verb) and "a drink" - a beverage (noun).

Here, in English, the word form is the same, but it performs different grammatical functions.

In the process of conversion, the new meaning of a word is often context-dependent. For example: a. "The windows are clean" (adj). b. "May you clean the windows?" (verb).

In Karakalpak: "Jaqsı (noun) - isi menen jaqsı" (adjective)

Conversion is a semantic, morphological, and syntactic method by which a word belonging to one word class assumes the full function of another word class, without changing its external form.

Conversion is a word-forming tool that involves semantic changes, a morphological paradigm, and the grammatical structure of the word. Conversion is considered an effective method for creating new lexical units in linguistics and is widely used in many languages, especially in Romance-Germanic and Turkic languages, as well as in English and Karakalpak.

Through the process of conversion in English and Karakalpak languages, it is possible to form words belonging to essential and core word classes.

The method of conversion and the transition of a word from one word class to another are named differently depending on which word class it transitions into. O.D. Meshkov categorized the phenomenon of conversion into four types:

1) verbalization; 2) substantivization; 3) adjectivization; 4) adverbialization.

Examples: From Noun to Verb: "to hand someone a paper" (verb: to give with the hand); "Water" (noun: a liquid) → "to water the plants" (verb: to pour water on)

From Adjective to Verb:

"Clean" (adjective: free from dirt) → "to clean the room" (verb: to make clean)

"Empty" (adjective: containing nothing) → "to empty the box" (verb: to make empty)

Substantivization (Noun formation from other word classes)

The process where a word (often an adjective or a verb) is used as a noun without changing its form.

From Adjective to Noun: "Poor" (adjective: lacking wealth) → "the poor" (noun: people who lack wealth); "Good" (adjective: of high quality) → "to do some good" (noun: a beneficial act)

From Verb to Noun: "Run" (verb: to move quickly on foot) → "a morning run" (noun: an act of running); "Call" (verb: to shout) → "a phone call" (noun: an act of phoning)

Adjectivization (Adjective formation from other word classes)

The process where a word (often a noun or a verb) is used as an adjective without changing its form.

From Noun to Adjective: "Gold" (noun: a precious metal) → "gold standard" (adjective: made of/related to gold); "Stone" (noun: a hard mineral) → "stone wall" (adjective: made of stone)

From Verb to Adjective (less common in simple zero derivation, often involves participles, but in pure conversion, it's rare to see a base verb form convert directly to an adjective without semantic extension):

Adverbialization (Adverb formation from other word classes)

From Adjective to Adverb: "Fast" (adjective: quick) → "He runs fast" (adverb: quickly); "Hard" (adjective: difficult) → "He works hard" (adverb: with great effort

From Noun to Adverb (less common in modern English zero derivation, often idiomatic): "Home" (noun: a place of residence) → "He went home" (adverb: to his home).

To sum up, conversion is a very important way new words are created in languages. It's a special process where a word changes its grammatical job – for example, from a noun to a verb, or a verb to an adjective – without changing its actual form or adding any endings. This makes languages flexible and helps them grow. y comparing how conversion works in different languages, such as English and Karakalpak, we can learn about both the shared rules and the unique features of languages. This knowledge isn't just for theory; it directly helps improve how we teach and learn languages, how we translate texts more accurately, and how we make better dictionaries.

In short, studying conversion helps us truly understand how languages change and adapt. It's a key area for language experts to keep researching, so we can better support the ongoing development of linguistics.

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Rezyume: *Ushbu ilmiy maqola lingvistikadagi konversiya hodisasining nazariy asoslari, tarixiy rivoji va namoyon bo‘lish shakllarining qiyosiy tahliliga bag‘ishlangan bo‘lib, ayniqsa ingliz va qoraqalpoq tillari misolida ko‘rib chiqiladi*.

Резюме: *Данная научная статья посвящена сравнительному анализу теоретических основ, исторического развития и проявлений феномена конверсии в лингвистике, в частности в английском и каракалпакских языках.*

Kalit so‘zlar: *so‘z yasash, lingvistika, qiyosiy tahlil, semantika, grammatika.*

Ключевые слова: *словообразование, лингвистика, сравнительный анализ, семантика, грамматика.*

THE EVOLUTION OF POETIC FORM IN UZBEK LITERATURE

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Summary. *This article talks about formal updates in Uzbek poetry. In particular, the emergence of free and white poems in the works of Fitrat and Cholpon was a complete renewal of traditional forms in literature.*

Key words*. poetry, classical, contemporary, enlightenment, Muqumi, Furqat, Cholpan, Fitrat.*

Enlightenment literature is of great importance as it laid the groundwork for the emergence of new Uzbek literature and served as a bridge for the emergence of modern literature. If there was no literature of enlightenment, the emergence of modern literature would have been delayed for several more centuries. It is no exaggeration to say that the literature of the Enlightenment was not only new in terms of content, but also in terms of form, genre, and poetic language.

According to these aspects, the literature of the Enlightenment became important in the development of the phenomenon of form.

The most important change in the form began with the approach of poetry to folk art, in a sense returning to the period before the Arab conquest. But the transition to the finger weight, as we noted above, occurred after passing through certain stages, that is, during the graphic formation, a specific approach to the aruz weight and introduction to the finger weight was observed.

The same situation can be found in Cholpon's poems "Soul", "Khalq", "Gozal" and many others. Regarding this kind of graphic formation in Cholpon's work, "Cholpon sought a unique new path in Uzbek poetry with centuries-old traditions, and therefore left a magnificent poetic legacy that harmoniously combines the poetic forms and tools of our national literature with the forms and tools of world poetry."[1,66]

The introduction of the band system to Aruz weight brought it closer to folk tunes and finger weight. This situation continued not only in the work of Cholpan, but also in the work of other artists. In particular, the same situation is observed in the radiative ghazal "Bo'lghonim bolg'on" in Zavqi's work, that is, the creator creates a ghazal that corresponds to the stanza system in terms of form.

Although the weight is obvious, the rhyming system of this ghazal, which corresponds to the four-line stanza system, also corresponds to the four-line poems. However, in her research SH.Karimova paid particular attention to the structure of this ghazal and said, "In our opinion, this poem entered the column of "ghazals" only by chance. In fact, he should have taken a place in the column of murabbas. Then the objections about his "violation" of the ghazal rules or his "liberties" in using the rhymes in the ghazal will be eliminated by themselves. In our opinion, this work by Zavqi is a ghazal. That's why the graphic formation of the ghazal according to the finger weight is a traditional situation in the process of renewal of the form in the new Uzbek poetry.

If we include this ghazal of Zavqi in the genre of murabba, then many other ghazals created in the new Uzbek poetry should be included in other genres. It is better to approach this state as a "transitional state" in the process of renewal of the poetic form.

In the process of formal renewal in poetry, the rhyme system also has its own importance. Unique changes were observed in the rhyme system in the new Uzbek poetry. There are now cases where the rhyme is not at the level of strict requirements in poetic forms. For example, in Fitrat's "O'git", "Buzuzin olkaga" and "Khalk" poems by Cholpon, we encounter the free structure of the rhyme system.

The rhyming system of SHer is a-b-b-a; a-a-b-b-a; It is given in the style of a-a, and the words "gupurdi" and "cut off" in the second paragraph rhyme with each other. If we focus on the rhyme system itself, poetry differs from the traditional rhyming system. This, in turn, is the result of an innovative approach to form. When talking about the renewal of the form in Cholpon's work, it is appropriate to recall the following thoughts of the literary critic D. Kuronov: "Finally, a real phenomenon related to the name of Cholpon was born in Uzbek poetry. However, if you look at it,

even he did not feel completely at ease with the finger weight, instead he used the pen in traditional forms, in a word, "reshaping" poetry from its foundations. was sought with a deep sense of necessity. He looked for tones and forms suitable for the spirit of the time.

We would like to say that, for example, the change of weight in poetry is a literary phenomenon that did not come to fruition by itself and suddenly due to the desire of poets such as Fitrat, Hamza, CHolpon, but gradually grew up behind the new socio-psychological mood that has matured in the society. "

In fact, they turned to the search for new forms due to the influence of the social environment and the fact that everything in society is in the stage of renewal. This kind of situation is a prominent literary edge in Hamza's work. In particular, Dilmurod Kuronov dwells on the formal structure of his poem "Dardiga Darman Istamas" and raises the question of the architecture of the poem.

More precisely, Hamza evaluates the poem "Dardigha darmon istamas" in his work as an example of a poem that is the basis for the emergence of a new poetic form by undergoing transformation of the existing form: "Dardigha darmon istamas" It consists of nine clauses, the first eight clauses of which are triplets, and the last ninth clause is in the form of fives. If we mentally remove the verse "Ukhlama kop, Uzbek eli, asli taraqqi zadiya" that is repeated at the end of all the paragraphs, we will have a poem in the form of a ghazal. It can be seen that new Uzbek poetry has a lot of diversity in terms of formal updates.

But it is permissible not to replace these formal changes with deformity. Literary scholar Durdona Zohidova's article on the topic "Weight characteristics of the Nihony "Devon"" talks about Hamza's murabbas written in finger weights: "Inspired by the tradition of master artists such as Hazini and Muqimi, three of the 5 murabbas in the Nihony Divan were finished in finger weights. ". But at this point it is necessary to pay special attention to one issue. Any system of stanzas written in finger weight is theoretically a poetic form. Their relation to independent genres such as murabba', mukhammas, musaddas in classical literature is only in the number of lines. But whether they were theoretically created at the weight of a finger is in any case irrelevant to the problems in classical literature. In our opinion, it is better to approach this issue with some caution.

In the process of conveying their thoughts to the people, artists began to use the simple and smooth structure of finger-weight quatrains and the melodies of folk songs. In this regard, the works of artists like Avloni and Hamza are of special importance. Scientist N. Afokova also emphasizes this: "In our opinion, the literal process of renewal of poetic forms in Uzbek literature is the emergence of poems in the form of folk songs, in addition to the changes in aruz and rhyme. It started. The phenomenon that led to the appearance of poems in the form of folk songs, which are completely unique in terms of weight, rhyme and stanza structure, and which are sharply different from the form of poems with traditional aruz weight, is, of course, the content there was a renewal, a change in the function of literature, a weakening of the tension in the rules of classical poetics. Such poems were created by Hamza, Abdulla Avloni, Cholpan; it was even organized by Hamza in several groups.

Similar formal changes are clearly visible in Hamza's work. The expression "The heart is looking for something new" from the Cholpon language was characteristic of the new Uzbek poetry, including Hamza. Hamza, like Abdulla Awlani, "instead of some ugly poems, so that our national congratulatory songs, which have been heard by ear notes, do not lose their place" will sing these folk songs with words that express the national spirit, the aspirations of the nation for independence. he set himself the task of awakening the nation. Hamza well understood that the ideas of national independence can penetrate into the hearts of the people faster and more effectively through music, folk songs, and songs." This is the reason why his works are popular and fluent.

as it can be seen, folk forms in Hamza's work also serve as an important tool to convey the wisdom of enlightenment and knowledge. Hamza's series "National Poems for National Songs" is distinguished by its compatibility with folk melodies. These lines of the poet were sung by the people when Kamchinbek from Kogan was hanged on the gallows.

The radical change of form in Hamza's work led to the renewal of genres. "In these years, literature became closer to the life of the people, became more popular and popular. Writers are ready to try their strength in new genres and forms. Old traditional forms have acquired new features.

Hamza searched for new forms and methods to express new ideas and content. He tried to express new themes in new ways. His poem "Sheri Mansur" published in the July 18, 1914 issue of the "Sadoyi Turkistan" newspaper was the first example of verlibre - free verse in Uzbek literature. Today, it is clear to everyone that this system of poetry, characterized by the names of Rimbaud, Paul Eluard, Nazim Hikmat, Pablo Neruda, Raphael Alberti, Nicholas Gilsen, is the biggest phenomenon of world poetry of the 20th century, especially revolutionary poetry.

Formative research has also caused genre changes by itself. In particular, travelogues, letters, and satires began to appear in new Uzbek poetry in purely social situations. As one of the important new genres in Uzbek poetry, the letter genre has emerged in a new content and essence. Writing letters in poetic form is also found in the past periods of our literary history.

For example, the poetic letter "Hasbi Hol" sent by Alisher Navoi to his friend Said Hasan Ardasher from Herat is an important example of this genre. However, the letter genre in the new Uzbek poetry began to emerge in a new socio-political spirit. Muqimi's 10 songs ("Hello", "Thank you", "Javabi ruq'ayi Nadim Namangani", "Nuktadonan salam", "Hello, kind people", "Hello, friends and acquaintances", "There was a message", "Prophecy" Poems such as Manzuma", "Greetings to the Sultan of Ul Husn") have come down to us and are of particular importance in the process of form renewal in poetry. In addition, Furqat's poetic letters written during his life in Fergana and Tashkent, as well as during his travels abroad, from Turkey, India and China, are known and famous. The important point of the matter is that these letters are not simple "good wishes" but are characterized by the fact that they contain valuable lines about the poet's mood, feelings, inner experiences and social environment. Thus, the letter genre emerged from the correspondence between poets of the Enlightenment. These poetic letters are an incomparable source for studying the life and works of Enlightenment poets, as well as for investigating the literary life of that time.

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Rezyume. *Ushbu maqolada yangi o’zbek sheriyatidagi shakliy o’zgarishlar haqida so’z yuritiladi. Xususan, Fitrat va CHo‘lpon ijodida erkin va oq she’rlarning paydo bo‘lishi adabiyotdagi ana’naviy shakllarning tamomila yangilanish hodisasi ekanligi tahlil qilngan.*

Резюме. *В данной статье говорится о формальных изменениях в новом узбекском шариате. В частности, проанализировано, что появление свободных и белых стихов в произведениях Фитрата и Чолпона является явлением полного обновления традиционных форм в литературе.*

Kalit so'zlar. *she'riyat, mumtoz, jadid, ma'rifatparvarlik, Muqumiy,Furqat, Cho'lpon, Fitrat.*

Ключевые слова*. поэзия, классика, современность, просветительство, Мукуми, Фуркат, Чолпан, Фитрат.*

THEORETICAL FOUNDATIONS AND PRACTICAL APPROACHES TO THE PSYCHOLOGICAL TRAINING OF VOLLEYBALL PLAYERS.

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Summary: *The article examines the features of psychological preparation of volleyball players as an important component of sports mastery. Psychological stability, concentration of attention, motivation, teamwork, and stress resistance play a key role in achieving high results in volleyball. The theoretical foundations of sports psychology, the specifics of training in team sports, and practical methods and exercises aimed at developing the necessary qualities in athletes are presented.*

Keywords: *volleyball, sports psychology, psychological preparation, stress resistance, motivation, concentration, team spirit, coach, visualization, psychological resilience*

Introduction. Modern volleyball is not only physical endurance, technical skill, and tactical preparedness, but also the high level of psychological resilience of athletes. Victory in intense matches often depends not only on physical fitness but also on players' ability to maintain concentration, overcome stress, interact with the team, and demonstrate willpower qualities during crucial moments of the game.

Psychological preparation plays a key role in ensuring the stability of sports results, especially in team sports, where not only individual mood but also the overall emotional state of the team is important. In the context of increasing competition at the professional and amateur levels, the psychological aspects of preparation are becoming an integral part of the training process.

The relevance of the topic is due to the need for a comprehensive approach to the training of volleyball players, including the development of not only physical and technical, but also psychological characteristics. At the same time, many teams and coaches still do not pay sufficient attention to psychological aspects, which can negatively affect performance effectiveness.

Purpose of the research - analyze the theoretical foundations and practical approaches to the psychological preparation of volleyball players, identify the key components of successful preparation, and offer recommendations for coaches and athletes.

Research objectives: To study the theoretical aspects of sports psychology in relation to team sports;

1. Identify the psychological qualities important for volleyball players;
2. Consider the methods and means of psychological training;
3. Develop practical recommendations for implementing psychological preparation in the training process.

Object of research - volleyball players training process.

Subject of research - psychological aspects of training athletes in volleyball**.**

Theoretical foundations of psychological training of athletes

Psychological preparation is one of the main components of sports training, along with physical, technical, and tactical training. It includes developing qualities such as emotional stability, concentration of attention, self-regulation, motivation, and teamwork skills. These qualities are especially important in competition conditions, when many stressogenic factors influence the athlete: responsibility for the result, pressure from spectators, opponents, and coaches, as well as internal anxiety.

Psychology of Sport: Sports psychology studies the patterns of manifestation of mental processes and states in the conditions of sports activity. It examines how psychological factors influence athletes' behavior and performance.

The main categories of sports psychology include:

• Mental state - the totality of emotions, motivation, and mood at a specific moment;

• Psychological resilience - the ability to maintain the effectiveness of actions under pressure and stress;

• Motivation - internal and external stimuli that motivate an athlete to take action;

• Self-regulation - the ability to manage one's emotions, behavior, and attention.

Specifics of team sports Team sports, including volleyball, place special demands on psychological preparation. A player must not only possess personal stability but also be able to interact with partners, adapt to tactics, and make quick decisions in conditions of limited time and close interaction with opponents.

The team's psychological atmosphere, the presence of trust between the players and the coach, and the level of group cohesion directly influence overall performance. Studies show that a high level of team interaction is capable of compensating for the individual weaknesses of individual players.

Influence of psyche on effectiveness According to a number of studies, up to 30% of success in competitions can depend on the athlete's psychological state. Even with high physical fitness, an unstable psycho-emotional state can lead to a decrease in performance, errors, panic in critical situations, and consequently, defeat.

The most common psychological problems in volleyball players are:

• anxiety before a game,

• loss of concentration at crucial moments,

• fear of making a mistake,

• insecurity in oneself and partners,

• conflicts within the team.

Psychological preparation is aimed at preventing and overcoming these problems, forming in the athlete resistance and readiness for any scenarios.

Specifics of psychological training of volleyball players Volleyball, as a team sport, places special demands on athletes not only physically but also psychologically. In conditions of rapid game tempo, frequent change of game situations, and high emotional tension, volleyball players must possess a certain set of psychological qualities that allow them to act effectively both individually and as part of the team.

One of the most important qualities for a volleyball player is concentration. The player must quickly orient themselves on the court, react instantly to the opponent's actions, correctly assess the trajectory of the ball, and make decisions instantly. Losing concentration, even for a short time, can lead to losing the drawing, which is especially critical in equal struggles.

Stress resistance is equally important - the ability to maintain composure and control emotions in tense situations. In a competitive environment, athletes often face high expectations from coaches, fans, and themselves. Without the skills of self-regulation and managing the emotional state, a volleyball player may make mistakes, panic, or "burn out" at crucial moments of the game.

Motivation also plays a significant role in psychological preparation. A successful volleyball player is not only a talented player but also a person with an inner drive for victory, self-development, and overcoming difficulties. Maintaining high motivation is especially important in conditions of prolonged training, when physical and emotional fatigue can reduce overall mood.

Teamwork holds a special place in psychological preparation. Volleyball is a sport where the successful execution of game actions directly depends on the coordination and interaction between the players. The psychological climate in the team, the level of trust, mutual understanding, and support between partners determine not only the comfort of the training process but also the success of the game. The presence of conflicts, mistrust, or excessive competition within the team can destroy even a well-prepared team.

A necessary element of preparation is also adaptation to the role that the player performs on the field. Different positions - passing, attacking, libero - require a different set of skills and a certain psychological type. The coach must take into account the individual characteristics of the athletes and select not only physical, but also psychological exertion according to their functions on the field.

Preparation for the competition is also of great importance. Immediately before the match, athletes may experience increased anxiety. Therefore, it is important to develop pre-competition

training rituals: psychological attitudes, breathing techniques, success visualization, and action planning. All this allows you to "involve" the athlete in the game before entering the field, minimize stress, and increase confidence.

Finally, the coach plays a key role in psychological preparation. Much depends on his ability to build trusting relationships, motivate competently, and provide proper feedback. The coach should be not only a specialist in the technical-tactical field, but also a kind of psychologist who can feel the players' state, help them overcome internal barriers, and create a favorable atmosphere in the team.

Thus, the psychological training of volleyball players is a complex and multi-level process that includes developing personal and group qualities, developing stress resistance, training attention and confidence, and creating conditions for effective team interaction. Only a comprehensive approach to training allows athletes to achieve high results and fully realize their potential.

Methods and means of psychological training of volleyball players

Effective psychological training of volleyball players requires the systematic application of various methods and tools aimed at forming stable skills of self-regulation, motivation, concentration of attention, and team interaction. These methods can be conditionally divided into psychological trainings, special exercises, psychoregulatory techniques, and organizational-pedagogical measures.

One of the most effective means is psychological training. It can be conducted both individually and in groups. The purpose of the training is to develop certain psychological qualities and skills necessary for sports activities. In lessons, game or stressful situations are modeled, which require certain reactions from participants: decision-making, team interaction, self-control. Training allows developing behavioral strategies in situations of increased tension and preparing athletes for critical moments in the game.

Exercises for developing concentration of attention and psychomotor reaction occupy a special place in the training process. For example, exercises involving sharp changes in movement directions, unexpected passes, or "temporary" tasks allow for the development of attention stability and quick reactions. These exercises imitate real game situations where a decision needs to be made instantly, without time for reflection.

To reduce anxiety levels and increase athletes' confidence, psycho-regulation methods are actively used, such as:

• **autogenic training** - aimed at relaxation and self-suggestion;

• **breathing exercises** - that allow you to control physiological excitement;

• **visualization** - mental reproduction of successful game actions, which helps the brain "rehearsal" the necessary behavior;

• **psychological attitudes** - self-support and self-suggestion formulas (for example: "I am calm and confident," "I control the game").

All these methods allow the athlete not only to maintain calmness in tense situations but also to recover faster after failures without losing motivation and self-control.

The effectiveness of psychological training also depends on the competent organization of the training process. It is important to create such conditions where athletes learn to overcome difficulties, not be afraid of mistakes, and constantly strive for improvement. This is only possible with the support of the coach, proper feedback, and the formation of an atmosphere of trust and mutual assistance within the team.

A useful tool can be maintaining psychological diaries or questionnaires, where volleyball players record their emotional states, difficulties, and successes. This approach allows tracking development dynamics, identifying problem areas, and adjusting work methods.

It is also important to implement game psychological preparation - when during control games or training, stressful situations are modeled: score on the verge of defeat, opponent's aggressive play, non-standard tactical tasks. This helps athletes learn to adapt quickly and maintain effectiveness in any conditions.

It is necessary to take into account that the methods of psychological training should be individualized. Each athlete is unique in their temperament, thinking style, and emotional response.

What helps one person may not work for another. Therefore, it is important for the coach and sports psychologist to choose methods that take into account the individual characteristics of the players.

Thus, the methods and means of psychological training are an integral part of volleyball players' overall training. Their regular and competent application allows not only to increase the level of psychological resilience of athletes but also to create conditions for the stable growth of sports results.

Conclusion. The psychological preparation of volleyball players is an integral part of the overall training process, having a significant impact on sports performance. The current realities of team sports require players to possess not only high physical and technical performance, but also developed personal and psychological qualities - stress resistance, confidence, motivation, concentration, and the ability to effectively interact with the team.

Analyzing the theoretical and practical aspects, we can conclude that systematic psychological work with the team allows:

- increase the stability of results;
- reduce the likelihood of emotional breakdowns and injuries;
- improve the atmosphere in the team;
- develop leadership qualities and mutual understanding between players;
- prepare athletes for performance in high-pressure conditions.

The integrated application of methods of psychoregulation, training, visualization, game situations, and individual work allows the volleyball player to create a stable psychological foundation capable of supporting them on their path to sports heights. The introduction of psychological training is especially relevant at the stages of preparation for important competitions, as well as in working with young athletes.

Thus, the future of sports training lies in integrating physical, technical, and psychological components into a single whole. Only with this approach is it possible to form a truly competitive team capable of achieving high results at all levels.

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Rezyume: *Maqolada voleybolchilarni sport mahoratining muhim tarkibiy qismi sifatida psixologik tayyorlashning o'ziga xos xususiyatlari ko'rib chiqiladi. Voleybolda yuqori natijalarga erishishda psixologik barqarorlik, diqqatni jamlash, motivatsiya, jamoaviy o'zaro ta'sir va stressga chidamlilik muhim rol o'ynaydi. Sport psixologiyasining nazariy asoslari, jamoaviy sport turlarida*

tayyorgarlikning o'ziga xos xususiyatlari, shuningdek, sportchilarda zarur fazilatlarni rivojlantirishga qaratilgan amaliy usullar va mashqlar keltirilgan.

Резюме: *В статье рассматриваются особенности психологической подготовки волейболистов как важного компонента спортивного мастерства. Психологическая устойчивость, концентрация внимания, мотивация, командное взаимодействие и стрессоустойчивость играют ключевую роль в достижении высоких результатов в волейболе. Представлены теоретические основы спортивной психологии, специфика подготовки в командных видах спорта, а также практические методы и упражнения, направленные на развитие необходимых качеств у спортсменов.*

Kalit so'zlar: *voleybol, sport psixologiyasi, psixologik tayyorgarlik, stressga chidamlilik, motivatsiya, kontsentratsiya, jamoaviy ruh, murabbiy, vizualizatsiya, psixologik barqarorlik*

Ключевые слова: *волейбол, спортивная психология, психологическая подготовка, стрессоустойчивость, мотивация, концентрация, командный дух, тренер, визуализация, психологическая устойчивость*

THE PHENOMENON OF INVERSION IN ALISHER NAZAR'S POETRY

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Summary.*The article summarizes the peculiarities of the phenomenon of poetic syntax, the change in the order of parts of speech in poetry, the priority of logical emphasis in inversion on the example of Alisher Nazar's work. It examines the emotional-expressive essence of artistic speech, the semantic and asemantic properties of the term, the ratio of subtle observation and vivid observation, the interplay of the tone of the spoken word and the nuance of emotion, the principles of transferring a simple model to a creative template. In fact, the replacement of parts of speech creates poetic modality, the scale of change in the order in the template disrupts the rhythm of the syntactic series, and allows for the strengthening or weakening of the creative independent tone.*

Key words: *inversion phenomenon, artistic speech, figure of speech, emotional tone, creativity, tone, model, pattern, observation, observation, ratio, comparison, word order, change, level, pattern, emotion, expression, emotional perception, essence, tradition, logical emphasis, and poetic modality.*

The phenomenon of inversion changes the order of parts of speech, the process of changing places strengthens logical emphasis. The syntactic unity that gives beauty to the language of poetry breaks up stable patterns of thought. In fact, "inversion increases the expressiveness, charm, mystery and unique nature of the language of poetry. The poet also manages to separate the more necessary concept through inversion. Inversion is not necessary for the organization of rhythm, but it often also requires the coordination of speech with meter and rhyme. An excited person sometimes cannot put the possessive part of the sentence in its place. Since poetry is an exciting speech, the widespread use of inversion in it seems natural, and it becomes one of the factors of vivid and realistic description of the extraordinary fluctuations in the human soul" [2:392]. Each part of the sentence performs a specific function, and the expression prepares the ground for analyzing the psyche. The synthesis of purpose and creative independence allows for the transition from language to the inviolability of imagination, subjectivizing the form in meaning. Color, swiftness of movement, and tightness objectify the feeling, in which creative logic directs the high pressure of speech to the philosophy of deep observation:

Yarim kecha.
Yarim dil...
Shamollar boshlar xonish.
Orzuga tilab oq yo’l,
Mudrab yotadi tashvish [3:22].

In Alisher Nazar's work, which combines high intellectual tone and deep emotional perception, the path to the heart rises to the level of an object of analysis, the right to spiritual inviolability allows the poet to rediscover words, wonder and beauty. In the nature of the creator, who understands the sensation of artistic knowledge as a means of influencing the reader's consciousness, the intimate mood line is paramount, and the direction of emotional experience to logical consistency connects expression to the psyche. The interpretation of reality, situation, image requires the materialization of imagination, and in the works "Bizga atalgan tonglar" (1999), "Kholislik nyayayi" (2012) and "Vola" (2014), the author builds the denominator of meaning, philosophy of life, and beginning and end in the human sphere. The desire for symmetrical accuracy in the direction of the image, the tendency to depict mood in the plane of action, the need to preserve passion under the veil of passion, the desire to describe literary pleasure with the help of psychological combinations, the artistic essence of the word equal to the idea, testify to the creative methodological research.

Alisher Nazar's poem "Life" begins with a description of the situation, the silence of "half a night" is interrupted by the wakefulness of "half a heart". A "white horse" comes from afar, there is hope, there is confidence in a spiritual experience that only happens in a dream, powered by

imagination! Even "wishing for a white path to a dream, anxiety lies dormant", the white horse is a symbol of goodness, happiness, in which the dreams, goals and aspirations of the lyrical hero are polished. The poet changes the usual grammatical order, this attempt allows for the liberation of feelings. "Dreams begin to read" is a hint at the transition from a mental state to the activity of action, vigilance and alertness are considered the beginning of life. During the literary interpretation, the predicate of the white horse becomes concrete and becomes a symbol of "aliveness", imagination is actually a practical sign of a person's constant and only forward striving.

"There are poets who reflect their own soul, appearance, actions, and character in their poems. They do not deceive anyone, do not write lies, and do not consider it a good idea to be happy with passing breezes. A poet with strong faith advances with a noble goal in mind. Inner integrity indicates that he is a person. Behind his stubbornness, a mysterious individuality is hidden. The lyrical hero drinks from the fountain of the poet's soul. In his symbols, the image and character of the owner of an unbending will are visible" [4:117]. Personality and poetry are actually one whole, the direction of character's will moves from worldview to creativity. The chronological order of the laws of language may change, but the development of the mental state is based on a logical sequence. Each work, being a fragment of the poet's character, is also a presenter of a high aesthetic ideal, the poetic meaning of which reveals the character of the creator. "The heavy sighs of the night" - an unfinished expression burdens the reader with suffering, and economy of words is also an important criterion for the author!

"Inversion (lat. inversion - to turn over, to replace) - a syntactic method, a stylistic figure, which occurs on the basis of changing the usual order of parts of a sentence. Inversion is used for the purpose of emphatic or logical separation of a word or phrase (part of a sentence) in a sentence, rhythmic-intonational organization of poetic speech (placing a rhyming word in the right place). Inversion is the most commonly used syntactic method in poetic speech, found in almost all poems. Inversion allows you to emphasize the word on which the meaning is stressed, to move it to the end of the line, to the accented position in the line [7:117]. A special means of imagery occupies a strong place in determining the high and low tones of emotional perception, ensuring the logical consistency of creativity opens the way to renewing poetic thinking in practice. The phenomenon of inversion at the syntactic level indicates the degree of deviation from the norm, and in the change of place, the image calendar takes on an additional function. As an artistic means, the term allows the author to express his creative intention in a specific way, the phenomenon of tone inversion determines the direction of action. The accented position changes the emotional tonality, the essence of the poem, as it were, thickens the mental state in the image:

Chayqalar,
to’lg’onar,
mavjlanar kecha,
Yurakkacha borar tunning titrog’i.
Go’yo ko’zlariga sanchilmoqchiday,
Ko’kda yaltiraydi oyning o’rog’i [3:49].

In the poem "Suffering", the poet paints a picture of the state of mind, the gradation (seagulls, waves, waves) summarizes the contrast of the night landscape. The sensation is so intense that even "the trembling of the night reaches the heart." Logical consistent expression (the evening is falling and the soul is slowly sinking) sets the theme, "the trembling of the night" prepares the reader's mood for a riot. The ratio of the "moon's sickle" taken from nature increases the intensity of expression, "the stars began to throw stones in the sky", "the winds that came from the lush gardens" create conditions for logical emphasis on the theme. The author's artistic and aesthetic goal allows for an impressive illumination of the emotional attitude, the spiritual and moral criterion, aesthetic value, philosophical generalization, logical chain of consistency interpret the nature of imagination.

"The work does not rush to tell the story of the results of poetic reflections, it seeks to preserve the primary, not yet fully realized impulse - it all began with this impulse, and poetry directs the reader to this impulse. The most important thing in it is to completely capture the author's mental state" [5:127, 128]. The fulfillment of the poet's intention is related to the intellectual level of the

reader, the essence that cannot be expressed in words is actually beyond description. In the poetic idea, which is nourished by the nature of the creator, form and content are reconciled, and the distance between the artist and the work of art ensures the psychology of creativity. The main thing is that the artist tries to convince the reader of his aesthetic ideal, and the emotional meaning and philosophical observation serve as a fragment of the connected speech. The analysis of existing reality reveals the nature of poetry. "It is known that the words in the dictionary differ significantly from each other in terms of emotional coloring. This is very useful in expressing the emotional attitude to the subject of the image. Because of this, the writer is not required to create something new in order to express his attitude to the subject of the image - he only needs to choose the most suitable words for his purpose from the existing ones" [6:270]. Poetic modality, being a product of the negation-affirmation relationship, organizes sympathy and antipathy, the limitation imposed on the scope of application also applies to poetic arts. The direction of the image controls the expressive movements, in the current case, artistic analysis regulates the size of the scales of imagination, and "infects" the emotional tonality to the reader.

In general, the phenomenon of inversion forms the poet's creative position, in which the word, construction, phrase correspond to the author's purpose. The change in the order of parts of speech, firstly, puts the emotional-expressive essence on the stage of study, secondly, in the process of exchanging lexical units, a deviation of the syntactic function is observed, thirdly, the stylistic unity creates the properties of expressiveness and attractiveness, fourthly, the figurative means serves to strengthen the poetic idea. In the lyrics of Alisher Nazar, the reform of word order is a leading factor, the phenomenon of inversion directs the poet's soul to artistic generalization, creates the basis for penetrating the socio-cultural-enlightenment-philosophical depths of the psyche.

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Rezyume. *Maqolada poetik sintaksis hodisasining o'ziga xosliklari, she'riyatda so'z turkumlari tartibining o'zgarishi, Alisher Nazar ijodi misolida inversiyada mantiqiy urg'uning ustuvorligi umumlashtiriladi. Unda badiiy nutqning emotsional–ekspressiv mohiyati, atamaning semantik va asemantik xususiyatlari, nozik kuzatuv va yorqin kuzatuvning nisbati, og'zaki so'z ohangi bilan hissiyot tusining o'zaro uyg'unligi, sodda modelni ijodiy andozaga ko'chirish tamoyillari tahlil qilinadi. Aslida, so'z turkumlarining o'rin almashishi poetik modalitetni yuzaga keltiradi, qolipdagi tartibning o'zgarish darajasi sintaktik qatordagi ritmni buzadi hamda ijodkorning mustaqil ohangini kuchaytirish yoki susaytirish imkonini beradi.*

Резюме. *В статье обобщаются особенности феномена поэтического синтаксиса, изменение порядка частей речи в поэзии, приоритет логического ударения в инверсии на примере творчества Алишера Назара. Рассматриваются эмоционально-экспрессивная природа художественной речи, семантические и асемантические свойства термина, соотношение тонкого наблюдения и яркого наблюдения, взаимодействие тона произнесённого слова и оттенка эмоции, принципы переноса простой модели в творческий шаблон. На самом деле, замена частей речи создаёт поэтическую модальность, масштаб изменений в порядке шаблона нарушает ритм синтаксического ряда и позволяет усиливать или ослаблять независимый творческий тон.*

Kalit so‘zlar: *inversiya hodisasi, badiiy nutq, badiiy san’at, emotsional ohang, ijodkorlik, ohang, model, andoza, kuzatuv, nisbat, taqqoslash, so‘z tartibi, o‘zgarish, daraja, naqsh, emotsiya, ifoda, emotsional idrok, mohiyat, an’ana, mantiqiy urg‘u, poetik modalitet.*

Ключевые слова: *феномен инверсии, художественная речь, фигура речи, эмоциональный тон, творчество, тон, модель, шаблон, наблюдение, соотношение, сравнение, порядок слов, изменение, уровень, узор, эмоция, выражение, эмоциональное восприятие, сущность, традиция, логическое ударение, поэтическая модальность.*

SPEECH VERBS IN ENGLISH AND KARAKALPAK LANGUAGES: A PRAGMATIC STUDY

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Summary: *This article investigates the usage of speech verbs in English and Karakalpak languages from pragmatic viewpoints. This study gives attention to the verbs such as say, tell, speak, talk, mention, and their Karakalpak equivalents and reveals both similarities and differences, emphasizing their cultural and linguistic importance.*

Key words: *speech verbs, pragmatics, speech acts, communicative intentions, equivalents, interaction.*

Speech verbs are pivotal in language learning process especially while speakers conveying messages and communicating both orally and written. Comparing them in two languages demands thorough analysis using a pragmatic framework. Pragmatics focuses on context matters, implied meaning, speech acts, conversational implicature and others. Learning pragmatic aspects of speech verbs crucially differentiates the meanings of them across two languages. Both languages are rich in interchangeable use in expressing communicative intentions.

As noted by several scholars, the pragmatic intention is considered the most global level to reflect the conceptual world picture, since it includes all other pragmatic functions and gives the reader an aesthetic experience [1.83]. This idea has a great relevance to the study of speech verbs in these languages, as verbs not only represent speech acts but also assist to construct an aesthetic and conceptual worldview for people. For instance, "I stood a wretched child enough, whispering to myself over and over again, 'What shall I do? – What shall I do?' " [2.56]. In this example, denotatively, it is about speaking in a low voice, but pragmatically it shows person's emotional chaos, fear. The verb *whisper* is directed to oneself not others, that shifts the speech act into an internal dialogue and emphasizes emotional detachment.

- *Сколько дал? -Jiyren shashlı, ismurın, kók kózli jigit Nızamatdinniń qulaǵına ızalı dawıs penen sıbırladı.* [3.18]. Here, in Karakalpak version the verb *sıbırladı* means *whispered* that pragmatically indicates hiddenness, restricted audience and annoyance. The content of this sentence denotes socially sensitive situation and anger is not openly expressed.

Speech verbs assist to realize illocutionary force, demonstrate communicative intentions and determine their equivalents across languages. In accordance with the theory of speech acts by Searle, expressing propositional content utterances realize various illocutionary functions. Searle classifies speech acts into five groups as:

1. Representatives – stating or asserting facts
2. Directives – asking or instructing someone to act
3. Commissives – committing oneself to a future action
4. Expressives – expressing feelings or attitudes
5. Declarations – formally changing the state of affairs [5.10-13].

These speech acts serve as a systematic framework to analyze language actions, how they perform and deliver information. They are crucial to figure out the intention of speakers, organize linguistic actions, compare different languages and contribute to the study of pragmatics and discourse. According to Mey, it is natural to search for these actions are realized through verbs The reason why numerous verbs directly convey the performance of speech acts. [4.106.] For example: *"I say that this meeting is officially closed"* - *"Men bul jıynalıs rásmiy túrde jawılatının aytaman"*. The verb *say* means a declarative speech act, rendered in Karakalpak as *aytıw*, interprets the utterance for an official closing in English and pragmatically Karakalpak conveys more explicit announcement by virtue of its lexical choice. *"I apologize for the mistake" – "Qáte ushın keshirim sorayman"*. The verb *apologize* serves an expressive act, translates as *keshirim soraw*, more formal form in English and expresses stronger interpersonal sincerity in Karakalpak language. Comparing these two

languages, in English speech act verbs are semantically differentiated as request, order, however in Karakalpak more attention is given to the context and tone of speech.

The main speech verbs in English and their closest functional equivalents in Karakalpak are analyzed through comparative pragmatic approach. The table below shows a systematic comparison of the key speech verbs, their lexical and pragmatic meanings and speech-act functions.

Speech verbs in English	Karakalpak equivalents	Literal meaning	Speech-act	Pragmatic meaning
Say	aytıw	to say /to state	Stating	Reporting information
Tell	aytıw/ xabarlaw	to tell/ to inform	Telling someone to do something	Informing, giving instructions
Speak	sóylew	to speak/ to address	Giving information	Purposeful communication, formal addressing
Talk	sóylesiw	to talk/ to converse	Stating/Giving information	Sharing ideas
Mention	aytıp ótiw/ tilge alıw	to mention/ to point out	Stating/Giving information	Introducing minor or secondary information
Declare	járiyalaw	to announce officially	Officially changing the state of something	Making official announcements
Warn	eskertiw	to warn/ to caution	Telling someone to do something	Preventing an undesired action
Promise	wáde beriw	to promise	Making a promise/ commitment	Committing to a future action
Apologize	keshirim soraw	to apologize	Expressing feelings	Expressing regret
Request	iltimas etiw	to request/ to ask for	Asking/ Telling someone to do something	Politely asking someone to perform an action.

Those verbs above are considered commonly-used speech verbs that have equivalents and similarities in both languages. In daily speech for different purposes speakers can make use of them by constructing a mixed variety of sentences. Like for instance, *"I am not a deceitful: if I were, I should say I loved you; but I declare I do not love you; I dislike you the worst of anybody in the world expect John Reed; and this book about the liar, you may give to your girl Georgiana, for it is she who tells lies, and not I"* [2.53] In this example speech verbs *say, declare* and *tell* perform various speech act functions. *Say* is a representative speech act that pragmatically demonstrates contrast between said (lying) and speaker's actual feelings. *Declare* is a declarative speech act that signals forceful, formal statement and shows person's true feelings. *Tell* indicates an expressive speech act, assigns responsibility to Georgiana for lying and denotes moral assessment of speech. As an example in Karakalpak language; *"Awa, kelin, ne aytpaqshısań? – dedi salqın dawıs penen."* [3.77]. The speech verb *dedi (said)* expresses representative speech act that the tone conveys emotional distance and interaction is socially regulated.

It should also be noted that some kinds of English speech verbs have no single-word equivalents in Karakalpak language. As an example, *remark, insist, assert, emphasize, reveal* and others. Their semantic meanings can be easily understood but it is a bit difficult to find single equivalents. It could be because these verbs convey highly specific pragmatic meanings, emotional intensity, however, in Karakalpak language those are demonstrated through multi-word constructions than dedicated verbs.

In conclusion, speech verbs in English and Karakalpak languages have great importance in pragmatics that provides a systematic comparison across languages. According to the present study, English speech verbs are lexically differentiated to deliberate distinct illocutionary functions. In contrast to this, the usage of Karakalpak speech verbs gives more attention to tone, context and social situations. Understanding the functions of them in these languages demands accurate translation as well as speaker's intention, cultural nuances and interaction strategies.

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Rezyume: *Ushbu maqola ingliz va qoraqalpoq tillarida nutq fe'llarining qo'llanishini pragmatik nuqtai nazardan o'rganadi. Tadqiqot say, tell, speak, talk, mention kabi fe'llar va ularning qoraqalpoqcha ekvivalentlariga e'tibor qaratib, ularning o'xshashlik va farqlarini aniqlaydi hamda ularning madaniy va lingvistik ahamiyatini ta'kidlaydi.*

Резюме: *В данной статье исследуется употребление глаголов речи в английском и каракалпакском языках с прагматической точки зрения. В исследовании уделяется внимание таким глаголам, как say, tell, speak, talk, mention и их каракалпакским эквивалентам; выявляются сходства и различия, подчёркивается их культурная и лингвистическая значимость.*

Kalit so'zlar: *nutq fe'llari, pragmatika, nutq aktlari, kommunikativ niyatlar, ekvivalentlar, o'zaro ta'sir.*

Ключевые слова: *глаголы речи, прагматика, речевые акты, коммуникативные намерения, эквиваленты, взаимодействие.*

WORD-CLASS FLEXIBILITY: CONVERSION PATTERNS IN ENGLISH AND KARAKALPAK LANGUAGES

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Summary: *This scientific article presents a comparative analysis of the phenomenon of conversion in English and Karakalpak languages. The study reveals both universal characteristics and language-specific patterns, noting English's broader verb-to-noun conversion and Karakalpak's reliance on nominalized adjectival participles and verbal nouns for this process.*

Keywords: *Conversion, word formation, English language, Karakalpak language, comparative linguistics, verb-to-noun conversion, nominalization, derivatology.*

During the years of independence, opportunities were created for the development of national linguistics. The study of the unique characteristics of the Uzbek language, its analysis based on the achievements of world linguistics, and its comparison with various other languages were regarded as crucial factors for fostering national self-awareness and preserving cultural heritage. The Karakalpak language also entered a new phase of its development during the years of independence, with a series of linguistic studies being conducted.

Nevertheless, specific in-depth research on the phenomenon of conversion in the Karakalpak language is scarce; in particular, comparative analyses with other languages, especially English, are limited in number. From the late 19th century to the present day, in the linguistics of Germanic, Russian, and Turkic languages, we find the issues of viewing conversion as a word-formation tool, resulting from the interrelation of language and culture, studied in the scientific works of M. Matzner, H. Sweet, G. Bradley, St. Robertson, O. Jespersen, Ch. Bally, and other scholars.

According to I.A. Batmanov, M. Zhirmunsky, S.K. Kenesbaev, N.P. Dyrenkova, E.V. Sevortyan, and other scholars, word classes in Turkic languages differ from each other. They posited that some nouns can express the meaning of both a noun and an adjective, while certain adjectives can carry the meaning of both an adjective and an adverb.

The issue of conversion appears to be a point of debate in research dedicated to word formation processes. This is because, while some scholars define conversion as the use of the same word with different functions in various word forms, others express the view that it involves the syncretism of Turkic morphemes.

Conversion holds a special place in the word-formation system of the Karakalpak language and requires careful study not only from a derivatological and morphological perspective but also in the lexico-semantic segments within scientific knowledge about the language.

Conversion is considered one of the most productive methods of word formation. Through this method, a word belonging to a certain word class, without any word-forming affixes, is used in the meaning of an object, and transitions to the noun word class by accepting number, possessive, and case category affixes in a sentence.

Nouns derived from verbs in English can be examined as follows (V-N).

1. Nouns derived from verbs, like other nouns, can express psychological states or emotions. (V-N). For example: "There was no fear in him now, only a fierce and terrible hope" (“The Lord of the Rings: The Return of the King” by J.R.T., p. 225); "He was seized by a sudden doubt of his own sanity" (“Nineteen Eighty-Four” by G.O., p. 80).

2. Nouns derived from verb word classes can express the meaning of movement and its result: (V-N). “She felt a sudden attack of nausea and ran to the bathroom”. (“Gone Girl” by G.F., p. 23); “He was alert, on edge, as if expecting an attack from a hidden enemy” (“The Hunger Games” by S.C., p. 511); “He knew it was a hopeless try, but he had to do something to save her” (“The Hunger Games” by S.C., p. 354).

3. Words derived from verb word classes indicate the nominative state of the action belonging to the noun word class in sentences. (V-N). “She was a good cook, but she hated cooking for Mr. Rochester, who was always dissatisfied with her dishes” (”Jane Eyre” by Ch.B., p. 214).

In the given example, the word "cook" indicates the object form of the action and functions as a noun.

Nouns derived from verb word classes also perform syntactic functions in sentences.

1. Nouns derived from verbs function as objects in a sentence. (V-N)

“He paid a visit to the library, hoping to find some information on the mysterious symbol” (“The Da Vinci Code” by D.B., p. 351); “Like his Biblical namesake, Noah got the call to do no less than save the world’s endangered creatures - and he doesn't even get a divine helping hand, as far as we know" ("Flight Behavior" by B.K., p. 107); “She obeyed his command without question, trusting him completely” (“Fifty Shades of Grey” by E.J., p. 123).

2. Nouns derived from verbs function as subjects in a sentence. (V-N) “The swim across the channel was a daunting challenge for the young athlete” ("The Swimmer" by J.Ch); “The long run was grueling, but she pushed through to the finish line” ("Born to Run" by Ch.M.).

Adjectival participles in the Karakalpak language, which denote the characteristic of an object through an action (derived from verbs), function as nouns and undergo the conversion process.

These adjectival participles, when used within a sentence as nouns, become nominalized. Nominalized adjectival participles serve as subjects or objects in a sentence.

In the Karakalpak language, we can often find this process in proverbs. For example: "Uyqılaǵan uyqı aladı. Uyqılamaǵan jılqı aladı" (Sleep takes sleep. The one who doesn't sleep takes the horse); "Júrgen ozar, turǵan tozar" (The walker gets better, the sitter decays); "Qıymıldaǵan qır asar" (The active one conquers the mountain); "Izlegenniń awzı asqa toladı" (The mouth of the seeker will be full); "Miynet súygen hesh waqıtta kem bolmas, Miynetten qashqandı adam dep bolmas" (The one who loves labor will never be wanting, the one who avoids labor is not a man); "Eńbekten qashqan dúmpekke jolıǵar" (The one who flees from work will meet a bump - trouble). (Q.x.m. - Proverb)

The transition of adjectival participles to nouns is considered a productive process in the contemporary Karakalpak language.

1. Adjectival participles formed from the following forms in the modern Karakalpak language become nouns:

a) Adjectival participles with the affixes - ǵan// - gen, - qan// - ken: “Biraq bergenlerdiń ishinen birewi baxıtlı ekenin adam elestirmey júriwide tájip emes. Sol ushın birew beremen dese alıp úyreniw kerek” (“Qaraqalpaq qızı” by T.Q.).

b) Adjectival participles with the affixes - ar// - er, - r: “Jatıp isher jalqaw boladı, Qosjaqpas mılqaw boladı (Q.x.m.); “Meniń sizlerge aytarım, oqıwshılar, sabaqtı tayarlap kelińiz” (“Internatta” by N.D.).

c) Adjectival participles with the affix - tuǵın: “Al sabaqların bilmeytuǵınlar, baqırısqa dawıs qosıp, tek ıńıldap otır” (“Eski mektepte” by Á.Sh.).

d) Adjectival participles with the affixes - mas// - mes, - bas// - bes, - pas // - pes: “Kórmes túyeni de kórmes”; “Oylanbastıń túbi oyran” (Q.x.m.).

e) Adjectival participles with the affixes - ıwshı// - iwshi, - wshı// - wshi: “Aytıwshı aqıl bolsa, tıńlawshı dana bolar (Q.x.m.); “Keliwshilerge esik ashıq” (“Aqdárya” by K.S.).

f) Adjectival participles with the possessive affixes - jaq: “-Qáne, ne aytajaǵıń bar? Seniń ne aytajaǵındı álle qashan-aq sezdim” (“Kelin” by J.A.).

g) Adjectival participles with the possessive and case affixes - ası / - esi: “Beresige besew kóp, alasıǵa altaw az” (Q.x.m.).

2. Nouns derived from verbal nouns. In the contemporary Karakalpak language, verbal nouns formed with the following affixes transition into the noun word class:

a) Verbal nouns with the affixes -ıw// -iw, -w:

This form of the verbal noun is sometimes used with a verb meaning, and sometimes as a noun. For example: “Juwırıw – sporttıń bir túri” (Running is a type of sport); “Júziw-dene shınıqtırıwǵa paydalı” (Swimming is beneficial for physical exercise) (“Jetkinshek” newspaper);

“Awırıw astan, daw qarındastan” (Illness is from the stomach, dispute is from a sibling - Karakalpak proverb).

b) Verbal nouns with the affixes -maq// -mek, -baq// -bek, -paq// -pek: For example: “Almaqtıń bermegi bar” (What goes around comes around / There is giving for taking - Karakalpak proverb); “Anadan bir tuwılmaq, bir ólmek bar” (There is one birth from a mother, one death) (“Meniń jolbarıslar menen jolıǵısıwlarım” by Á.Sh.).

Several similarities and differences can be highlighted in the semantic relations within the V-N (verb-noun) conversion model:

In English, any verb can undergo conversion, but in Karakalpak, not every verb undergoes conversion; rather, only adjectival participles and verbal nouns are used as nouns.

-Both English and Karakalpak languages have hybrid words that can function as both verbs and nouns.

-When nouns undergo conversion, it appears that in both languages, they are formed through a lexico-semantic method of word formation.

-In English, forming nouns by adding a preposition to a verb is a productive method. For example: take off - to ascend (verb) → takeoff - an ascent (noun); fall out - to separate, to quarrel (verb) → fallout - the consequence, radioactive debris (noun). However, in the Karakalpak language, nouns are not formed from verbs using this method.

The comparative analysis of conversion in English and Karakalpak languages reveals significant linguistic insights. While English exhibits broader verbalization, substantivization, adjectivization, and adverbialization, Karakalpak primarily utilizes conversion for adjectival participles and verbal nouns to function as nouns, often seen in rich idiomatic expressions and proverbs. Despite their genetic differences, both languages demonstrate conversion as a highly productive method, forming essential lexical units without altering word forms, highlighting a universal tendency in language evolution. Understanding these similarities and differences enriches our knowledge of word-formation and aids in improving language teaching and translation. Ultimately, the study of conversion in these languages contributes significantly to both Turkic and general linguistic theory.

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Rezyume: *Ushbu ilmiy maqola ingliz va qoraqalpoq tillarida konversiya hodisasining qiyosiy tahlilini taqdim etadi. Tadqiqot ham universal xususiyatlarni, ham tilga xos qonuniyatlarni ochib beradi, ingliz tilida fe’ldan otga kengroq konversiya va qoraqalpoq tilida bu jarayon uchun otlashgan sifatdoshlar hamda harakat nomlariga tayanilishini qayd etadi.*

Резюме: *Настоящая научная статья представляет сопоставительный анализ явления конверсии в английском и каракалпакском языках. Исследование выявляет как универсальные характеристики, так и специфические для языка закономерности, отмечая более широкое преобразование глаголов в существительные в английском языке и зависимость каракалпакского языка от субстантивированных причастий и отглагольных существительных для этого процесса.*

Ключевые слова: *Конверсия, словообразование, английский язык, каракалпакский язык, сопоставительная лингвистика, конверсия глагол-существительное, субстантивация, дериватология.*

Kalit so'zlar: *Konversiya, so‘z yasash, ingliz tili, qoraqalpoq tili, qiyosiy tilshunoslik, fe’l- ot konversiya, otlashish, derivatologiya.*

INNOVATIVE EDUCATIONAL TECHNOLOGIES IN TEACHING ENGLISH IDIOMATIC EXPRESSIONS TO SECOND-YEAR PHILOLOGY STUDENTS

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Summary*: the article examines the conceptual foundations, role, and pedagogical potential of innovative educational technologies in teaching English idiomatic expressions to second-year philology students.*

Keywords:*innovative educational technologies, interactive learning, problem-based learning, CTTRW,English idioms, idiomatic competence.*

1. Introduction

The effective teaching of English idiomatic expressions remains a complex and multifaceted problem in contemporary linguodidactics. Improving the quality of idiomatic competence among philology students requires not only methodological refinement but also the introduction of innovative educational technologies capable of activating independent, analytical, and interpretative forms of thinking.

The solution to the problems addressed in the present study presupposes a detailed examination of the current state of teaching English idioms at philological institutions. Among innovative educational technologies most promising for second-year philology students are problem-based learning, interactive technology, and the technology of developing critical thinking through reading and writing (CTTRW).

2. Methodology vs. Pedagogical Technology: Conceptual Foundations

The discussion of innovative educational technologies in teaching idioms necessitates defining the term itself.I.N. Aynutdinova notes: “The term ‘teaching technology’ is used in pedagogy to denote the sequential application of various techniques that ensure the solution of specific pedagogical tasks… teaching technology presupposes a guaranteed final result when performing a certain set of actions” [2.456]. According to the author, any methodology can theoretically be transformed into a technology, provided it undergoes multiple refinements and the optimal methodological tools are identified.

Professor L.T. Akhmedova further clarifies the distinction:

“Methodology is a set of concrete techniques used to achieve educational goals, while pedagogical technology is a scientifically justified, systematically organized instructional process designed to achieve concrete and attainable goals of teaching, upbringing, and development” [1.48].

Thus, pedagogical technology constitutes not merely a methodology but a comprehensive system of interrelated methodological ideas and procedures.

Innovativeness in education, as Aynutdinova emphasizes, entails integrating advanced scientific developments into the educational process in such a way as to prepare specialists capable of further independent innovations in their academic and professional careers [2.456].

3. Interactive Technology in Teaching English Idioms

Interactive technology is based on multidirectional interaction among all participants of the learning process. According to L.T. Akhmedova:

“Interactive teaching technology is an organization of learning activities carried out under conditions of constant active interaction among all participants… a form of mutual learning where both students and teacher are equal subjects” [16, p. 48].

Interactive learning differs from passive and active forms:

Passive form: The teacher transmits knowledge; students perceive it passively.

Active form: Students respond, ask questions, prepare presentations, but interaction remains teacher-centered.

Interactive form: Students actively engage not only with the teacher but also with each other, generating knowledge collaboratively.

Key principles of interactive technology:

1. Reconsideration of the teacher's role—from sole authority to facilitator and co-participant.

2. Mandatory active interaction among all participants.

3. Critical reflection on motivation, quality, and outcomes of learning by both students and teacher.

Key interactive methods relevant to idiom teaching:

3.1 The Discussion Method

This method involves collective investigation of a problem or phenomenon. Discussions are most effective for questions that lack a single correct answer, making them ideal for idiom interpretation. Structurally, discussions consist of four stages: preparatory, motivational, main, and reflective-evaluative.

3.2 The Empathy Method

This method requires students to imaginatively "immerse themselves" in the problem. Given the expressive and metaphorical nature of English idioms, empathy is valuable for grasping non-literal meanings and cultural nuances.

3.3 The "Lecture with Errors" Method

This "provocative lecture" includes deliberate mistakes that students must identify.

N.V. Zyleva states: "At the end of the lecture students must identify the errors; the teacher allocates 10–15 minutes for discussion" [3.214].

This method develops anticipation (linguistic guesswork), crucial for interpreting idioms whose meanings are often semantically opaque.

4. Developing Critical Thinking Through Reading and Writing (CTTRW)

Critical thinking is defined as a type of intellectual activity characterized by objectivity, deep comprehension, and analytical evaluation of information [3.48]. DCTRW aims to cultivate stable skills of independent processing of textual information.

Core cognitive stages of CTTRW:

Engagement – problem formulation

Comprehension – receiving and processing essential information

Reflection – consolidation and generalization of acquired knowledge

Key CTTRW methods applicable to idiom teaching:

4.1 "Basket of Ideas"

A metaphorical "basket" where students collect initial thoughts about the problem. Effective at both engagement and reflection stages.

4.2 "Prediction Tree"

Originally developed for literature lessons, this method is ideal for idiom interpretation and development of anticipation.

Structure:

Trunk – the topic

Branches – predictions (in "possible" and "probable" directions)

Leaves – justification of predictions

This method helps students analyze idioms whose meanings cannot be deduced from literal components.

5. Conclusion

Modern linguodidactics has accumulated some experience in applying innovative educational technologies to teaching idioms in English as a foreign language. However, the reviewed literature demonstrates that this experience is neither comprehensive nor sufficient. The integration of problem-based learning, interactive technology, and CTTRW offers a promising methodological foundation for developing a system of idiom instruction tailored to philology students.

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Rezyume: *Maqolada 2-bosqich filolog talabalariga ingliz tili idiomatik iboralarini o'rgatishda innovatsion ta'lim texnologiyalarining konseptual asoslari, o'rni va pedagogik salohiyati o'rganilgan.*

Резюме*: В статье рассматриваются концептуальные основы, роль и педагогический потенциал инновационных образовательных технологий в обучении английским идиоматическим выражениям студентов 2-го курса филологии.*

Kalit so'zlar*:innovatsion ta'lim texnologiyalari, interfaol ta'lim, muammoli ta'lim,YO'TFT , ingliz tili .*

Ключевые слова*: инновационные образовательные технологии, интерактивное образование, проблемное образование, CTTRW, английские языковые идиомы, идиоматическая компетенция.*

FORMATION SYSTEM OF ADJECTIVES IN UZBEK AND TURKISH LANGUAGES

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Summary: *This article provides a comparative analysis of the ways adjectives are formed in Uzbek and Turkish languages, which both belong to the Turkic language family. The study focuses on morphological and compositional methods of adjective formation and highlights similarities and differences in their structure and meaning. Morphological suffixes such as -li, -siz, -dor, -sal, -cı and compound forms like oqko'ngil, tatlıdil, yumuşak huylu are analyzed in terms of productivity and function.*

Keywords*: adjective, morphology, composition, Uzbek, Turkish, derivational suffix.*

In linguistics, adjectives play a crucial role in expressing the characteristics, quality, and quantity of objects and phenomena. Both Uzbek and Turkish languages, as members of the Turkic language family, have similar grammatical structures and share common historical roots. However, the processes of adjective formation in these languages have developed differently through centuries.

This article examines the system of adjective formation in Uzbek and Turkish through morphological and compositional methods, discusses the main researchers in this area, and compares the similarities and differences between the two languages.

Researchers Who Studied Adjective Formation

In Uzbek linguistics, adjectives and their derivational systems have been studied by A. G'ulomov, S. Usmonov, E. Begmatov, and M. Mirzayev. They classified adjective suffixes according to meaning and productivity, and analyzed their role in the Uzbek morphological system.

In Turkish linguistics, scholars such as Tahsin Banguoğlu, Zeynep Korkmaz, Muharrem Ergin, and Haydar Ediskun conducted detailed studies on adjective formation, describing morphological and compound structures in modern Turkish grammar.

Morphological Formation of Adjectives

Morphological formation is one of the most productive methods of adjective creation in both Uzbek and Turkish. New adjectives are formed by adding derivational suffixes to nouns, verbs, or other adjectives.

In Uzbek:

Productive adjective-forming suffixes include:

"-li" — having: suvli, toshli
"-siz" — without: suvsiz, tuzsiz, dardsiz
"-dor" — possessing: zarbdor, shoxdor
"-ona", "-dek" — similar to: qahramonona, boladek

Example: mehnatkash odam — "a hardworking person" (the suffix -li adds the meaning "having").

In Turkish:

Common morphological suffixes include:

"-li", "-lı", "-lu", "-lü" — having: sulu, taşlı, güçlü
"-siz", "-sız", "-suz", "-süz" — without: parasız, sevgisiz, umutsuz
"-sal", "-sel" — related to: kültürel, doğal
"-cı", "-li", etc. — follow vowel harmony rules.

Example: **umutlu insan — "hopeful person"; umutsuz insan — "hopeless person."**

Thus, morphological adjective formation is parallel in both languages, though Turkish strictly observes vowel harmony.

Compositional (Compound) Formation of Adjectives

Compositional formation involves combining two or more words to create new adjectives that express complex qualities.

In Uzbek:

Compound adjectives are formed as:

Adjective + Noun → oqko‘ngil, achchiqtam, yumshoqtabiat

Adjective + Adjective → olachipor, xomsemiz

Adjective + Verb → tezyurar (from tez + yurar)

These structures express metaphorical and emotional qualities, enriching the language’s expressiveness.

In Turkish:

Compound adjective patterns are similar:

Adjective + Noun → tatlıdil, açıkgöz, yumuşak huylu

Adjective + Adjective → kırmızı-siyah, yeşil-mavi

Adjective + Verb root → çalışkan (from çalış- + -kan)

Both languages use compounding as a productive way to expand their adjective vocabulary.

Comparative Analysis

Aspect Uzbek Language Turkish Language

Linguistic family Turkic Turkic

Main suffixes -li, -siz, -dor, -ona, -dek -li, -siz, -sal, -cı

Vowel harmony Weak Strong

Compound types Adjective + noun/adjective/verb Adjective + noun/adjective/verb

Productivity High High

Tendency Emotional, moral Social, cultural

Both languages have a shared morphological system but differ in the strictness of vowel harmony and suffix productivity. Turkish follows vowel harmony consistently, while Uzbek preserves older suffixes such as -dor, -ona, and -dek.

The comparative study of adjective formation in Uzbek and Turkish demonstrates that both languages have preserved a shared morphological foundation inherited from the Turkic proto-language. The morphological method (using suffixes like -li, -siz, -dor, -sal, -cı) is the most productive, while the compositional method (oqko‘ngil, tatlıdil, yumuşak huylu) enriches the expressive and stylistic potential of both languages.

Although Turkish applies vowel harmony more systematically, Uzbek retains a more diverse set of ancient suffixes. This reflects not only linguistic but also cultural continuity between the Uzbek and Turkish peoples.

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Rezyume: *This situation is classified in sources as a separate layer and a group of assimilated layers.*

Резюме: *Данная ситуация классифицируется в источниках как отдельний слой и группа ассимилированних слова.*

Kalit so‘zlar: *Sifat, morfologik usul, kompozitsion usul, qo‘shma sifat, yasovchi affiks, o‘zbek tili, turk tili, qiyosiy tahlil, O‘zbek tili, Turk tili*

Ключевие слова*: лексикография, общественние связи, новие слова, современная лексика, язик и культура, наука и техника, нанотехнологии, глобальний вопрос, энциклопедический словарь.*

UDC 82-31

SOMATIC PORTRAIT IN MODERN KARAKALPAK NOVELS

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Summary: *This article examines the portrait and its various types through examples from modern Karakalpak novels. When scholars analyze the linguistic structure of a portrait, they primarily focus on details related to the character's physical structure, clothing, and movements. Depending on the type of details involved in constructing a portrait, it is categorized into three types: somatic, vestial, and kinetic. In this article, we specifically study the somatic portrait using examples from the novels of Karakalpak writers Sh. Seitov, Q. Matmuratov, and K. Karimov. The somatic portrait in a novel not only describes the external appearance of a character but also serves several literary functions, such as ensuring plot continuity, highlighting the character's distinctive features, revealing their poetic role in the novel, and uncovering their inner world through the depiction of their physical appearance.*

Keywords: *Somatic portrait, character image, poetic function, Karakalpak literature, visual detail, psychological description, literary analysis, modern novel.*

Introduction

The portrait is a literary category that reflects the human image across all forms of fine art—literature, painting, music, cinema, theater, sculpture, photography, and other artistic expressions. A portrait not only depicts a person's external appearance but also conveys their internal emotional state and psychology. In every form of art, the creative process requires the skillful use of a portrait that aligns with the nature of the narrative and the character being portrayed.

The poetic qualities, artistic nature, and functions of the portrait in a literary work have been extensively studied within the field of world literary science. In modern Karakalpak novels, we observe three main characteristics in the process of imbuing portraits with poetic content. The details used in depicting a character's portrait fulfill key poetic functions. Descriptive elements related to a character's body structure, clothing, and movements (such as facial expressions) form the basis for identifying the types of portraits.

Scholars who study the lexical composition of portraits primarily focus on the character's physical build, attire, and specific behavioral elements. In Russian Soviet literature, especially during the 1960s–1980s, the Russian scholar G.V. Starikova conducted scientific analysis of portraits in various genres and, in her dissertation, classified the lexical structure of the portrait into three types:

1. Somatic,
2. Vestial, and
3. Kinetic [1].

Similarly, Kazakh linguist S.Zh. Tattimbetova, in her candidate dissertation titled *"The Linguostylistic Character of the Hero's Image in the Works of Q. Ysqaqov,"* also classifies the lexical composition of portrait descriptions into three major groups:

- Somatic (body parts),
- Vestial (clothing and accessories), and
- Kinetic (gestures and movements) [2.30].

Scholar E.D. Schmidt has explored this issue using examples from English literature [3].

A portrait emerges based on specific, concrete details. It is represented not in a metaphorical or figurative sense, but in a concrete and literal manner. In some portraits, the actions of the character may be likened to natural phenomena or particular objects, but the description ultimately creates a concrete visual impression. The focus on the "lexical structure" of portraits by linguists aligns with the literary theory perspective that views these components as part of the "artistic detail."

Again, when studying the lexical structure of the portrait, scholars mainly focus on descriptive elements related to the character's physical build, clothing, and gestures. Based on the type of detail involved, portraits are classified into three types:

1. Somatic – derived from the Greek word meaning "body," this type of portrait focuses on the character's physical structure and highlights distinctive bodily features. Typically, parts of the human body—such as the head, hair, eyes, eyebrows, hands, feet, fingers, etc.—are used in constructing a somatic portrait.
2. Vestial – from the Latin word meaning "clothing," this type refers to descriptions of a character's attire and belongings, often used to indicate the character's social background and material status.
3. Kinetic – from the Greek word meaning "movement," this type of portrait emphasizes the character's gestures, movements, and facial expressions, highlighting personal and often reflexive behaviors. For the sake of conciseness, concepts can also be expressed using brief movements of the eyes, hands, or head.

Methods

In modern Karakalpak novels, the somatic details used in character portraits serve not merely as descriptive elements, but also perform significant functions in enhancing the artistic value of the character within the plot context. By focusing on specific somatic traits of the character, the writer not only emphasizes distinctive features but also reflects the character's internal psychological state.

For example, when Sh. Seitov describes somatic portraits of his characters, he assigns poetic functions to each detail:

"Seeing this, he would jump instinctively. Upon sensing the danger, he would have turned back, yet something made him tremble like a wrestler driven by a sudden urge to fight Madiyar. 'Let me calm myself,' he said, but his teeth were chattering" [4.48].

In this passage, the author does not provide a complete portrait of the character. Rather, the internal anxiety, the instinctive recognition of a threat, and the emotional tension are conveyed through the comparison with a wrestler, drawing attention specifically to the detail of the teeth. Through the synecdoche of the "teeth," the entire somatic image of the character is condensed, allowing readers to visualize the psychological tension. The focus on the teeth serves as a symbolic cue for a broader emotional state.

"He removed his worn-out boots with a sideways tug and tossed them at the door. Stepping inside barefoot, he sat cross-legged and rubbed his big toes together as if in a ritual" [4.50].

In this scene, the character Jakhan is visited by Tolybay, who wishes to marry Jakhan's sister. Jakhan, assuming the role of an elder or in-law, sits rubbing his toes in a posture he associates with formal negotiation. The writer employs **antiphrasis**, where the behavior contradicts the social role being performed. Sitting "like a matchmaker" is humorously undercut by the vulgar gesture of rubbing bare toes. This contradiction highlights the character's immaturity, lack of experience, and mental superficiality through somatic portraiture.

In the novel, the character's entrance accompanied by a characteristic portrait carries a specific poetic "weight" and plays a functional role in the plot's development. Although writer Sh. Seitov avoids using static portraits, certain characters still require detailed characteristic depictions. For instance, in the novel *"Ördek qırğınnan soñ"*, the character Asqarbay is portrayed with carefully detailed somatic features:

"There was a chief named Asqarbay at Halkabad MTS—narrow eyes, wrinkled face, cheeks sunken like he had been sucking on candy, protruding irregular teeth that moved when he talked, thin hair, and an unflattering hairstyle. Although he was already forty-two, he still spoke with exaggerated enthusiasm. His waist was slim, shoulders broad, and though his clothes were formal, a tied belt suited him well. His posture was upright" [4.44].

The writer constructs this portrait based entirely on somatic details. Each feature elaborates the character's physical and facial structure, highlighting Asqarbay's outward appearance. The consistent use of somatic elements forms the foundation of the author's stylistic approach. While K.

Karimov's style emphasizes clothing (vestial portrait), K.Matmuratov tends to combine both somatic and vestial features.

In the novel, through the figure of Asqarbay, the author attempts to portray the typical social outcast. Although Asqarbay is over forty years old, his alcoholism and irresponsibility have excluded him from society. However, throughout the novel, his eventual contribution to society and his path toward recovery are symbolically represented in his sympathetic somatic features:

"His slim waist, broad shoulders, and upright posture suited him well".

The portrait of Zubayda in the same novel also bears symbolic significance:

"The smoothness of her skin, the darkness of her hair like raisins, her small round ankles like those of a baby, her slim waist, hips resembling hilltops, and the elegance of her clothing made her appear like a doll—an extraordinary creation of nature. Yet her slanted eyes and, worst of all, her crooked mouth ruined it all, ruined it entirely!" [4.118].

Like Asqarbay, Zubayda's portrait contains both sympathetic and antipathetic elements. She is initially portrayed as an exceptionally beautiful woman, yet her somatic flaws—"slanted eyes" and "crooked mouth"—form the basis for future plot lines. Through her character, other important figures (Subutai the gypsy, Ruben the Armenian) enter the storyline, and several plot complications are resolved (Izbaskan the publisher, Jamal the judge). Thus, the aesthetic structure of the portrait and its alignment with the author's objectives contribute to the novel's ideological integrity.

The writers use somatic detail not only to describe appearance but also to reveal psychology, social role, and character transformation.

In the novels of **K. Karimov**, somatic details are not described directly but are instead artistically conveyed through additional descriptive elements:

"— Say it, who do you suspect? If you name the person, we'll go and avenge Tölesin," roared Mailikhoja, the towering commander whose dark face was marked by smallpox scars and further adorned with remnants of battle wounds. His tall figure set him apart from the others" [5.83].

In this scene, the death of Tölesin, son of Kojamyar, becomes the trigger for a major conflict. Against this backdrop, the somatic portrait of commander Mailikhoja is presented. The writer uses poetic devices—epithets and comparisons—instead of direct description. For instance, **"the scars left by many battles"** is a somatic detail, visually representing his wartime experience. The physical description is harmonized with the character's speech and behavior, reinforcing his identity as a fearless warrior.

Similarly, the somatic portrait of **Aydos biy**, as seen through **Qulshi biy**'s perspective, is painted with emotional and symbolic emphasis:

"Slightly taller than average, with thick limbs and a firm body, he clearly had immense strength. His large head and wide forehead indicated intelligence. Thick eyebrows shadowed deep-set black eyes that pierced the soul when looked at directly—signs of bravery and fearlessness. His red-cheeked face, framed by a pointy beard and matched with a prominent nose, sat atop a thick neck that barely fit into the rounded collar of his linen shirt" [5.232].

Here, the writer's depiction of Aydos biy is filled with admiration, suggesting a personal **sympathetic attitude**. Through multiple epithets and specific somatic features, Aydos is portrayed as a man born for leadership. His clarity and majestic appearance make him stand out among other characters.

In these portraits, **eyes** are one of the most frequently used somatic elements. Sometimes, a single detail—such as the character's eyes—can encapsulate the whole emotional and psychological characterization:

"...On his lean face, his moustache looked dignified, but under his wobbly lambskin hat, his eyes—always darting, always playing, never looking directly—revealed his disreputable profession. He was a well-known swindler in the city" [5.131].

The character's **profession** may not be evident at first glance, but the writer crafts the portrait to expose deeper traits. The **dynamic interplay** between the character's movements and eye behavior, combined with visual metaphors (like the shaking lambskin hat), vividly conveys his cunning and nervous energy.

In K.Matmuratov's novel *"Terbenbes"*, the character **Lepes** is introduced through somatic details that initially provoke a negative impression. However, the author later reinterprets his portrait to reveal his inner world. This technique is frequently used in modern Karakalpak literature to expose characters' **psychological evolution**.

"...His round face was covered with reddish pimples. His tiny eyes were nearly invisible behind his swollen eyelids. His thick lips seemed to dominate his whole face. He constantly sniffled, and his upper lip twitched. His voice was nasal, wheezing, and rather unpleasant to hear" [6.47].

Here, the use of negative somatic traits — such as pimples, a large mouth, and nasal voice — forms a **repulsive image**. The writer deliberately constructs this portrayal to evoke aversion. Yet, over the course of the novel, Lepes gradually becomes more **sympathetic** to the reader as his deeper qualities are revealed. This transformation is achieved not through a change in appearance, but through **actions, dialogues**, and moments of internal conflict. Thus, the initial somatic portrait serves as **contrast**, highlighting the inner growth that follows.

In this regard, the **poetic function** of the somatic portrait is multifaceted:

- It reveals the **psychological condition** of the character.
- It reflects **emotional states** (anger, fear, joy, anxiety).
- It participates in the novel's **plot construction** by motivating interactions or conflicts.
- It builds **symbolic layers** to the character (e.g., external ugliness hiding inner strength or virtue).

Therefore, in modern Karakalpak novels, the **somatic portrait** is not limited to merely describing a person's physical appearance. It becomes a powerful **literary device** that shapes character, deepens theme, and sustains the narrative's poetic unity.

Results

The somatic portraits drawn by each writer possess their own distinct characteristics and carry specific **poetic functions** in the creation of character images. In the works of **Sh. Seitov**, somatic portrait details are employed as **triggers** that initiate or propel particular **plot lines** within the narrative. In the novels of **K. Karimov**, somatic portraits serve primarily to vividly illustrate the **external appearance** of the characters, thereby facilitating **visual perception** for the reader. Meanwhile, in the works of **K. Matmuratov**, the somatic details used in portraits appear to additionally reflect the **psychological emotions** and **inner spiritual turmoil** of the characters.

Thus, the somatic portrait in the modern Karakalpak novel is not confined to a mere **description of the character's outward appearance**. It also performs the following essential literary functions:

- It contributes to the **development of the plot**,
- It emphasizes the character's **unique features**,
- It carries the **poetic "burden"** of the narrative, and
- Through the character's external features (i.e., somatic portrait), it **reveals the inner world** of the character.

Discussion

In world literary studies, the **poetic function** and **significance** of the portrait in literary works have been investigated from a variety of scholarly perspectives. In this direction, notable scholars such as **N. Schneider, E.D. Schmidt, M.M. Bakhtin, A.P. Belik, E. Dobin, M.B. Khrapchenko, V. Petelin, G.V. Starikova, M.S. Imomov, Yu.I. Mineralov, M.N. Zhornikova, L.N. Dmitriyevskaya, A.G. Kulygina, P.V. Trofimova, E.M. Kaurova**, and **S.N. Kolosova** have conducted specialized studies in the field of world literary criticism.

Russian scholars have thoroughly examined the **poetic interrelationship between artistic portrait and detail**, analyzing specific works to produce fruitful results. In their analyses of the prose of **L. Tolstoy, M. Sholokhov, and A. Chekhov**, researchers have highly appreciated the **poetic function of artistic details** used in constructing portraits. These scholars have evaluated not only the **mastery of writers** in creating portraits but also the **significance of artistic detail**, emphasizing its aesthetic and functional relevance [7]. When drawing a portrait of any literary character, the author

typically attaches **poetic meaning** to certain visible and notable portrait elements that signify the character's **distinctive traits**.

The opinions of literary scholar **V. Petelin** concerning the **external portrayal** (i.e., portrait) of characters in **M. Sholokhov's** renowned novel *And Quiet Flows the Don* are especially noteworthy in assessing the **poetic value** of character portraits. He writes:

"M. Sholokhov possessed a remarkable ability to perceive and express the **most complex inner experiences** of a person, and to convey them through **external features**, such as a barely perceptible facial expression or a subtle movement" [8].

In the field of **Turkic literary studies**, including **Kazakh literary criticism**, scholars such as **B. Maytanov, Kh. Abdibayev, S.Zh. Tattimbetova**, and **G. Smagulova** have conducted relevant research. In **Uzbek literary criticism**, notable contributions have been made by **Kh. Yoqubov, M. Sultonova, M. Olimov, M. Abdurakhmonova, S. Mirvaliev**, and **U. Nosirov**. Researcher **J.T. Qurbanov**, in particular, has dedicated an entire dissertation to exploring the **portraiture skills** of the prominent Uzbek writer **O. Yoqubov**.

In **Karakalpak literary studies**, scholars such as **S. Bakhadyrova, Z. Bekbergenova**, and **Zh. Qaniyazova** have examined the **poetic properties** of the portrait within certain sections of their monographs and dissertations.

The problem of artistic detail in literature has also been investigated within **Uzbek literary criticism**. For instance:

- **M.M. Sultonova** explored this topic in her monograph *Some Issues of Abdulla Qahhor's Style* [9], **S. Umirov** [10] and **U. Normatov** analyzed the **role of detail** in artistic image construction in their respective studies [11].

However, in **Karakalpak literary criticism**, the **poetic functions of detail** in literary works have **not yet been extensively studied**. Preliminary findings related to artistic detail have been introduced into scholarly discourse by **J. Yesenov** and **Zh. Qaniyazova** [12] but a comprehensive and focused analysis of this topic remains to be undertaken.

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Rezyume: *Ushbu maqolada portret va uning turlari zamonaviy qoraqalpoq romanlari misolida ko‘rib chiqiladi. Olimlar portretning lingvistik tuzilishini tahlil qilganda, birinchi navbatda, personajning jismoniy tuzilishi, kiyimi va harakatlari bilan bog‘liq tafsilotlarga e’tibor berishadi. Portretni yaratishda qatnashadigan detallarning turiga qarab, u uch turga bo‘linadi: somatik, vestial va kinetik. Biz ushbu maqolada somatic portretni qoraqalpoq yozuvchilari Sh.Seytov, Q.Matmuratov, K.Karimov romanlari misolida o‘rganamiz. Romandagi somatik portret personajning tashqi qiyofasini tasvirlabgina qolmay, balki syujet uzluksizligini ta’minlash, qahramonning o‘ziga xos xususiyatlarini yoritib berish, romandagi she’riy rolini ochib berish, tashqi qiyofasini tasvirlash orqali ichki dunyosini ochish kabi bir qancha adabiy vazifalarni ham bajaradi.*

Резюме: *В данной статье рассматривается портрет и его различные типы на примерах из современных каракалпакских романов. При анализе языковой структуры портрета исследователи в первую очередь обращают внимание на детали, связанные с физическим строением персонажа, его одеждой и движениями. В зависимости от типа деталей, участвующих в построении портрета, он подразделяется на три типа: соматический, вестибулярный и кинетический. В данной статье мы специально изучаем соматический портрет на примерах из романов каракалпакских писателей Ш. Сеитова, К. Матмуратова и К. Каримова. Соматический портрет в романе не только описывает внешний облик персонажа, но и выполняет ряд литературных функций, таких как обеспечение сюжетной последовательности, выделение отличительных черт персонажа, раскрытие его поэтической роли в романе и раскрытие его внутреннего мира через изображение его внешности.*

Kalit so‘zlar: *Somatik portret, xarakter obrazi, poetik vazifasi, qoraqalpoq adabiyoti, tasviriy detal, psixologik tavsif, adabiy tahlil, zamonaviy roman.*

Ключевые слова: *Соматический портрет, образ персонажа, поэтическая функция, каракалпакская литература, визуальная деталь, психологическое описание, литературный анализ, современный роман.*

THE LINGUISTIC ANALYSIS OF ETHNO-CULTURAL FEATURES IN EUPHEMISMS

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Summary: *The article investigates cultural features of ephemisms in Uzbek dialects and analyzes the example with other languages. It mainly studies the traditions and customs associated with linguistic culture.*

Key words: *Euphemism; Taboo; Customs and Traditions; Program/Code; Tradition; Superstition; Linguoculture; Customs and Superstitions*

Every nation has its own unique customs, traditions, and rituals that define its national values. These are passed down from generation to generation and have been preserved over centuries. However, some of our customs may change or even disappear entirely due to social systems and the progress of society. This, of course, is closely connected to each nation's beliefs, religion, and national mentality. Therefore, when studying ethnographic euphemisms that have been preserved and refined in the language of every nation, it is important to consider the psychology, worldview, customs, traditions, superstitions, and beliefs of the people who speak that language. Below, we would like to briefly discuss some ethnographic euphemisms found in the Uzbek dialects of Karakalpakstan, as well as in other nations.

The literal meaning of the word "euphemism" comes from the Greek language and means "to speak well (about something or some event)"[6, 109]. This is because "when a particular word becomes unacceptable for some reason, taboos and euphemisms emerge"[2, 108]. In our speech, we try to soften such words or expressions.

According to the customs and traditions of all peoples, death is considered the greatest misfortune. Delivering news of this event to the closest relatives is regarded as a very heavy responsibility, and people try to convey it in a softened, euphemistic manner through words and expressions. For example, according to folk legends, the news of Guli's death was conveyed by Alisher Navoi to Sultan Husayn as follows: "The flower has withered in the shade of the cypress—what is to be done?" In response, Sultan Husayn replied: "A coffin should be made from the cypress, and a shroud from the rose,"—demonstrating how the sorrowful news was delivered gently and skillfully, without causing distress[4, 369]. There are several versions of the story, and in all of them, the cold news related to death is conveyed in a masterful manner.

From ancient times, our people have paid great attention to the tradition of delivering such grim news in a soft manner. Even now, the lexeme "to die" is conveyed in forms such as "*to pass away", "to depart from the world", "to fulfill one's destiny", "to perish", "to fall into eternal sleep", "to return to dust", and "to be killed*". Thus, lexical units united around a single integral sememe form a specific paradigm. Members belonging to a certain paradigm, while united by a common sememe, may also differ from each other by a specific differential sememe. This is, of course, clearly evident in inter-dialectal differences. Even within the Uzbek dialects of Karakalpakstan, they differ regionally. For example, in the Khujayli-Kungrad dialects, if an elder person passes away, the news is conveyed using phrases like "*qazo qildi*" (he perished) or "*otamizdan ajralib qoldik* " (we lost our father). In the Beruni-Tortkul dialects, the grim news is conveyed through one of the variants like "*qaytish bo'libdi*"(he went back), "*olamdan o'tdi*" (he departed from the world), "*bandalikni topshirdi*"(he fulfilled his destiny), "*qazo qildi*" (he perished), or "*tuproqqa qaytdi*" (he returned to dust).

As mentioned above, euphemisms united around a single integral sememe also differ in their positive and negative connotations. For example, expressions such as "*vafot etmoq*" (to pass away), "*yer tishlamoq*" (to bite the dust), "*halok bo'lmoq*"(to perish), "*kishi qo'lli bo'lmoq*" (to become handicapped), and "*harom qotmoq*"(to die unlawfully) are used. Additionally, they are applied differently depending on the age characteristic. For instance, if a young infant dies, forms such as "*chitnadi*" or "*taqoni tugadi*" are used.

Euphemisms are lexical units that demonstrate the expressive capabilities and richness of a language, and any harsh or unpleasant news is conveyed to the listener in a gentle and skillful manner. Therefore, it is essential that we preserve such lingua-cultural resources and carefully pass them down from generation to generation.

Regarding such lingua-cultural aspects, linguist A.Omonturdiev aptly emphasized: "Openly stating realities considered inappropriate, awkward, uncultured, impolite, or immoral is softened, diminished, concealed, or disguised in memory; it is expressed in a figurative-euphemistic style to make it as harmless as possible, to emotionally affect the listener, to evoke excitement, and thereby achieve speech perfection and beauty — that is, language culture. This is one of the means used for that purpose." [5, 21].

Such prohibited, taboo-indicating euphemisms are frequently found in our dialects. They are euphemisms used in place of words or expressions that have become taboo. A taboo means the restriction or prohibition of the use of a certain word under the influence of religious beliefs, superstitions, fears, and similar factors. [6, 86].

It is well known that ethnographic taboos have long been widely used among Turkic peoples. For example, words related to "husband" such as *begim* (my lord), *bu kishi* (this person), *dadasi* (his father), *xo'jayin* (master) are used. These terms are employed out of respect for one's husband and carry stylistic nuances. The first scientific study on this was conducted by N.Ismatullaev, who classified euphemisms into six semantic groups: those based on taboo; those related to superstitions; coarse words; colloquial language; stylistic euphemisms; euphemisms used in diplomatic relations. (3.24 b.).

Later, X. Qodirova and Sh.Usmanova proposed a different classification: personal names; those related to ceremonies; those expressing human body parts; those denoting biological matter; those indicating physical defects of a person; those indicating moral defects; euphemisms reflecting defects in social behavior.

Based on the provided information, here is the classification of euphemisms related to personal names in Uzbek dialects:

1. Euphemisms connected with personal names in Uzbek dialects are mainly related to kinship terms that arise after marriage. These include terms for husband, wife, mother-in-law, father-in-law, brother-in-law, sister-in-law, and others. For example, words like *begim* (my lord), *bu kishi* (this person), *dadasi* (his father), *xo'jayin* (master) are used out of respect for one's husband. Names such as *kelin* (daughter-in-law), *qayni* (brother-in-law, specifically the husband's brother), and *bekach* (sister-in-law) are considered taboo, so their direct use is avoided. Instead, various euphemistic terms are chosen to address or refer to them. This tradition of using euphemisms for kinship terms remains preserved in many Turkic languages and dialects today.

2. Euphemisms connected with ceremonies are often expressed through figurative and idiomatic phrases such as "*qo'lini so'ramoq*" (to ask for the hand), "*non sindirmoq*" (to break bread), "*boshini bog'lamoq*"(to tie the head), "*qiz ayttirmoq" (*to propose a girl), "*uzuk taqib kelmoq*"(to wear a ring), "*boshini ikkita qilmoq*" (to make the head two), and "*bo'yniga ola xurjun ildirmoq*" (to put a shopping bag around the neck). These expressions carry both positive and negative ethnographic meanings.

Examples of positive euphemisms include: "*bo'yi cho'zilmoq"* (to grow tall); "*bo'yi yetmoq*"(to reach maturity); "*uvali-juvali bo'lmoq*"(to have sons and daughters); "*ko'zi yorimoq*" (to give a birth); "*bo'shanmoq*" (to be freed from worries); "*ikki jonini bir bermoq* " (to give two souls alive)

Examples of negative euphemisms include: *oq qilmoq* (to decline one's own child); *ko'k rang kiymoq*(to wear blue), used during mourning "*oq ro'mol tortmoq*" (to wear a white scarf), indicating a mourner.

These euphemistic expressions reflect cultural attitudes and social values embedded in the rituals and ceremonies of the Uzbek people, conveying respect, emotions, and social norms in a nuanced and indirect manner.

Besides these, ethnographic taboos are also expressed through various customs and superstitions. For example, among our people, it is widely believed that if a person traveling on a journey sees a white camel on the road, their affairs will go well; however, if a cat crosses their path, a negative event will occur. Similarly, every nation has superstitions associated with positive and negative concepts. For instance, among Uzbeks: not standing a broom or arrow upright, not sweeping behind a guest, and not spitting into water are common beliefs. Among other peoples, such as the Mongols: not taking meat from a pot with a knife, not leaning on a whip; and among Koreans and Chinese: not sticking a spoon upright in a bowl of food—these superstitions are also considered ethnographic taboos.

Linguistic taboos are the prohibitions on the use of lexical units in communication due to popular superstition or the unpleasantness associated with naming for example, in the Uzbek language, words like "tiger" and "lion" are replaced with euphemisms such as "king of animals," while "pig" is considered haram (forbidden) according to the beliefs of Turkic peoples and Islam. Therefore, in the calendar year, it is also called "*qarakiyik*" (black deer). This characteristic is also found among Russian, German, and Tatar peoples. For instance, in hunting, the word "bear" is often softened by euphemisms such as "owner of the forest" or "*maymoq*".

It is known that during the primitive communal system, when the level of social production was low, people were quick to believe in various superstitions. For example, the names of the God or Spirits became taboo, and fearing to call them by their real names, people expressed them with other names like "Creator" or "Master." Even in Western countries, during the development of Christianity, the name of God "*Jehovah*" was considered the greatest taboo, so euphemisms such as *"Almighty," "Creator," and "Savior*" were used instead. [5, 22].

To avoid such taboos, even today, names of death or serious illnesses are not directly mentioned but replaced with euphemisms. For example, smallpox is called "*gul*" (flower), and diseases like scabies, tuberculosis, and leprosy are referred to by softened terms such as "*kuydurgi*", "*pes*" and "*maqov*".

Additionally, euphemisms that express politeness are considered one of the means reflecting the communicative culture of our peoples. In linguistic research, politeness is interpreted as a "category of communicative thinking and a reflection of national mentality"[5, 23]. People often prefer to use pleasant euphemistic words and expressions instead of rude or offensive ones to show respect and consideration toward others through their speech and behavior. For this reason, expressions such as "two-layered" or "heavy-footed" are used instead of directly referring to a pregnant woman; for a person with some disability, terms like "person with limited abilities" are preferred instead of "disabled"; for a mute person, the word "gung" is used; and for someone who has lost consciousness, phrases such as "half-conscious," "of sound mind," "mentally weak," "low-minded," or "lost their wits" are employed.

These euphemisms serve to soften potentially harsh or disrespectful descriptions, thereby maintaining politeness and respect in communication.

Among Turkic peoples, there has long been a strong tradition of euphemistic forms of address. For example, a wife traditionally addresses her husband using terms like *dadasi* (his father), *otasi* (his father), or *adasi* (his elder brother), while a husband addresses his wife using terms such as *onasi* (her mother), *oyisi* (her mother), or *ayasi* (her mother). These forms of address have become widespread as a sign of respect and cultural norm.

However, in recent times, it has become more common for a wife to call her husband by his personal name or to address him as "so-and-so" (e.g., "Falonchi" aka). In some families, after the birth of the first child, out of respect, the husband and wife are sometimes addressed by the name of their eldest daughter or eldest son, respectively. This shift reflects evolving social attitudes and changing norms in forms of address within Turkic cultures, balancing traditional euphemistic respect with more direct forms of communication.

The reflection of ethno-cultural differences in euphemisms has long been one of the national values passed down and assimilated from generation to generation among Turkic peoples. This is especially evident in communication with elders, dining etiquette, and various superstitions. For

example, the proverb "*Osh kattadan, ish kichikdan"* (Ehe elder has the pilaf first, the younger takes the work first) illustrates it.

Since ancient times, our ancestors have shown respect to elders and courtesy to the younger ones, always honoring the elderly. When we speak of old age, we imagine a person rich in wisdom and experience. Therefore, proverbs such as “Qarisi bor uyning parisi bor” (A house with elders has its guardian angel) and “Yosh kelsa ishga, qari kelsa oshga” (The young come for work, the old come for the pilaf) have always been upheld. Addressing elders with respectful forms such as using the polite pronoun "Siz" (you, formal), and calling them otakhon (respected father), onakhon (respected mother), or aka (older brother) has become a customary norm and an important part of etiquette.

Among Turkic peoples, especially in Karakalpakstan, various religious ethnographic customs related to Islamic beliefs have long been practiced. For example, after a deceased person’s passing, ceremonies such as uchi, yettisi, qirqi, yuzi, and yili are traditionally held. These rituals mark specific mourning periods and are deeply rooted in local religious and cultural practices. In addition, wedding and ceremonial lexicon includes customs and superstitions involving numbers such as *yetti taboq*(seven layers), *yetti qatlama* (seven tiers), and *to‘qqiz-to‘qqiz qilib* (arrangements in multiples of nine). These reflect the symbolic importance of numbers in rituals and folk beliefs.

These ethnographic traditions illustrate how Islamic faith has influenced cultural practices in Karakalpakstan and other Turkic regions, blending religious observance with local customs and linguistic expressions. In Western countries, the number 13 is considered unlucky, while in China and Korea, the number 4 is disliked. People try to avoid these numbers while buying houses, rooms, or phones with this number and refrain from setting important dates involving it whenever possible. In contrast, the number 8 is favored in China because its pronunciation is close to the word "fa," which means "to become wealthy" or "to earn money" in Chinese. [5, 20-25]. Therefore, comparative studies of euphemisms in different lculture linguistic help prevent misunderstandings and difficulties that arise during intercultural communication. They remove pragmatic barriers and ensure successful and effective communication. Euphemisms are regarded as a rich spiritual heritage that embodies the mentality, worldview, and customs of each nation.

For this reason, it is important for us to collect and preserve these euphemisms and pass them on to future generations as a noble task.

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Rezyume: *Maqolada o‘zbek lahjalaridagi efemizmlarning madaniy xususiyatlari o‘rganiladi va boshqa tillar bilan bog‘liq misol tahlil qilinadi. Unda asosan til madaniyati bilan bog‘liq an’analar va urf-odatlar o‘rganiladi.*

Резюме: *В статье рассматриваются культурные особенности эвфемизмов в узбекских диалектах и анализируются примеры из других языков. Основное внимание уделяется традициям и обычаям, связанным с культурой языка.*

Kalit so‘zlar: *Evfemizm, tabu, urf-odat,dastur, an’ana,irim, lingvomadaniyat, irim-sirim.*

Ключевые слова: *Эвфемизм, табу, обычай, программа, традиция, идиома, языковая культура, идиома.*

A COMPARATIVE STUDY OF RIDDLES IN ENGLISH AND KARAKALPAK: LINGUISTIC AND CULTURAL PERSPECTIVES

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Summary: *The present article is devoted to a comparative analysis of English and Karakalpak puzzles. Although belonging to different linguistic and cultural traditions, both English and Karakalpak peoples have developed rich repertoires of puzzles that exhibit surprising similarities as well as striking differences. The study of these puzzles offers an opportunity to explore the interplay between language, culture, and cognition across two distinct societies. It also highlights the universality of human creativity while respecting the specificity of each nation's historical and social experience.*

Key words: *riddles, puzzles, classification, linguistic, oral traditions, cultural heritage, compare.*

Introduction

Folklore forms an essential part of the cultural heritage of any nation, reflecting its people's worldview, traditions, and values. Among the diverse genres of folklore, puzzles — commonly referred to as riddles — hold a special place due to their unique combination of wit, metaphor, and cultural symbolism. A puzzle is not merely a game or pastime; it is a linguistic and intellectual exercise that encapsulates the collective knowledge, humor, and philosophical outlook of a society. Through the study of puzzles, we gain profound insights into the way people think, perceive their environment, and express abstract concepts.

Comparative folklore studies, particularly of genres like puzzles, contribute to the broader field of comparative linguistics, cultural anthropology, and education by providing authentic material for analysis and teaching. Understanding how different cultures use language creatively not only promotes intercultural competence but also enriches our appreciation of linguistic diversity. In the era of globalization and cultural interaction, the study of folklore genres such as puzzles plays a vital role in preserving national heritage and understanding cross-cultural connections. Puzzles reflect a people's worldview, collective memory, and linguistic creativity. Despite their universal presence in many cultures, there has been limited comparative research focusing specifically on English and Karakalpak puzzles.

The study of puzzles as a linguistic and cultural phenomenon requires a solid theoretical foundation, as they intersect multiple fields such as folklore, linguistics, semiotics, and cultural studies. Puzzles — particularly riddles — are one of the oldest and most enduring forms of verbal art, found in virtually every human society. They are not only tools for entertainment or education but are also rich carriers of cultural meaning, metaphor, and collective wisdom. In both English and Karakalpak traditions, puzzles play an important role in oral and literary heritage, and their comparison reveals how different communities use language creatively to reflect their worldviews, communicate values, and challenge intellect. To properly analyze and compare puzzles across these two languages and cultures, it is essential to first understand their definitions, classifications, functions, and symbolic roles within their respective societies.

Materials and Methods

The material was collected by the following groups of research methods: descriptive, comparative, and analytical methods. **As our research rely on comparison of two unrelated geterogen languages, our main used material consists of dictionaries of these languages.** The research uses Samples of English and Karakalpak puzzles are collected, classified, and analyzed to identify patterns and differences. Elements of semantic and structural analysis are applied to interpret figurative language and symbolism.

Results and Discussion

Puzzles, especially in the form of riddles, are a universal feature of human culture, appearing in oral traditions, literature, and even digital entertainment. The study of puzzles spans multiple disciplines — linguistics, folklore, anthropology, and cognitive science. The academic study of English riddles and puzzles has a long and well-established history. One of the foundational figures in this field is Archer Taylor, whose influential work "The Literary Riddle before 1600" remains a cornerstone for riddle scholarship [8: 56]. Taylor systematized the study of riddles by proposing a typological and historical framework, demonstrating that riddles were not merely trivial amusements but complex forms of literary and cognitive expression. According to Taylor, riddles occupy a significant place within the broader context of folklore and literature, reflecting philosophical, religious, and social themes of their times.

The scholarly investigation of Karakalpak riddles, though less internationally prominent, has been active and vital in the Central Asian academic context. Puzzles in the Karakalpak language, known locally as "*jumbaq*", have been preserved and studied primarily through ethnographic and folkloristic research efforts. One of the leading researchers is A.Alimov [2: 28], who compiled extensive collections of Karakalpak oral folklore, including riddles. His works analyze the linguistic structure, thematic content, and educational significance of puzzles, highlighting how they reflect the nomadic life, environmental knowledge, and ethical values of the Karakalpak people.

According to folklorists like Taylor [7: 64], riddles usually have two main parts:

1. Descriptive element (the challenge):

A metaphorical or puzzling description of an object, action, or concept.

2. Solution (the answer):

The object or idea being described, often hidden through indirect language.

For example: *"The more you take, the more you leave behind. What am I?"* Answer: Footsteps.

"Jer astında tostaǵan, qatıq uytıp taslaǵan" (There is a bowl with a clabber in it under the earth) Answer: Eye.

Here, the structure contains paradox and metaphor, common in traditional riddles.

Recent trends in comparative folklore have begun to explore connections between different riddle traditions, aiming to uncover universal features of human cognition and cultural transmission, as well as the unique adaptations that reflect each society's way of life.

This comparative perspective underlines the importance of puzzles not merely as linguistic curiosities, but as vital components of cultural identity, education, and artistic expression. Further comparative studies between English and Karakalpak traditions promise to enrich the understanding of how diverse societies use language creatively to engage minds, preserve wisdom, and entertain communities.

In our present article we'll classified puzzles by its types of linguistic features:

1. Descriptive puzzles which describe physical characteristics indirectly and often found in both children's riddles and folk traditions. Examples:

In English: "*I have hands but no fingers. I move but have no legs.*" — Clock. "*What has a neck but no head?*" — Bottle. "*The more you take, the more you leave behind*." — Footsteps. "*What has to be broken before you can use it*?" — Egg.

In Karakalpak: "*Ayaǵı joq – jùredi*." — (It has no legs, but it moves. Answer: Water). "*Qanatsız ushadı, ayaqsız júredi.*" — (It flies without wings, walks without legs. Answer: Wind or sound). "*Kókte de joq, jerde de joq, adam balası kùnde kòredi*." — (Not in the sky or ground, but people see it daily. Answer: Dream).

2. Metaphorical or Symbolic Riddles which rely heavily on metaphor, often abstract or philosophical and used to convey moral or spiritual ideas. Examples:

In English: "*What comes once in a minute, twice in a moment, but never in a thousand years?*" — The letter 'M'. "*I speak without a mouth and hear without ears. I have no body, but I come alive with wind.*" — Echo. "*What has roots as nobody sees, is taller than trees, up, up it goes, and yet it never grows*?" — Mountain (Tolkien).

In Karakalpak: "*Bir ata bar – hàmmege jetedi.*" OR "*Bir ata bar, bàrsheni teń qolına alar*" — (There's one father for all OR One father serves all the family equally) Answer: The sun. "*Bir tòbelik duz bar, onıń duzın jep bolmas*." — (There is a mountain of salt, but no one can taste it) Answer: Wisdom. "*Jatqan jerinen turmaydı, kòp adamnıń kùyinde oynaydı.*" — (It never gets up, but affects many hearts) Answer: Grave.

3. Narrative Riddles which told in the form of short stories or poetic anecdotes and common in epic literature and oral traditions. Example found in The Hobbit (Tolkien): "*A wonder on the wave, water became bone.*" — Ice. Another example found in Dastan, the hero is tested: "*Bir bar eken qaraǵan, adam joq onnan qashıp qutılǵan.*" — (There is a look no one avoids) Answer: Death. Folk narrative riddle: "*Bir jer bar, onıń axırı joq, at keseler, adam oylanar*." — (You enter a place with no end, horse stops, man thinks) Answer: Life decisions or fate.

4. Dialogue-Based Riddles (Contest Riddles) which is exchanged between two speakers, often in a competitive format (duel of wit) and seen in Karakalpak aytıs and Anglo-Saxon riddling duels. Example in English: "*Voiceless it cries, wingless flutters, toothless bites, mouthless mutters.*" — Wind. Old English riddling duels occurs often between wise men or deities. In Karakalpaks baqsıs (folk poets) are exchanging puzzles during public recitations. Poetic exchanges between two baqsıs where one ends a stanza with a question-riddle the other must answer. For example: "*Kòz kòrmeydi, qol sezbeydi, bar bolsa da, joqtay boladı*." — (Invisible to the eye, untouchable by hand, it's there yet not. Answer: Time or love)

5. Trick or Joke Riddles which is meant to confuse or amuse rather than test wisdom and based on puns, wordplay, or surprising logic. They often involve animal trickster tales or ironic setups. Examples: "*Why did the chicken cross the road?*" — To get to the other side. "*What can you catch but not throw?*" — A cold. *Tań atpay turıp adam qanday kùle aladı?*" — (How can a person laugh before dawn? Answer: In their sleep.)

6. Proverbs and Aphorisms as Riddles in other words some proverbs contain hidden or implied riddles and they are useful for cultural teaching and moral reflection. Examples: *"The pen is mightier than the sword". "The early bird catches the worm."* (Hidden wisdom: be proactive). "*Still waters run deep.*" (Simple surface hides complexity). "*Sòz – adamnıń quralı*." (Words are a man's tools) — Valuable words mean wisdom. "*Qanatsız qus, sùyeksiz til.*" (A bird without wings, a tongue without bone) — Speech can be dangerous. "*Bilim – jol kórseter, aqıl – jol baslar.*" (Knowledge shows the path, wisdom leads it) — Knowledge and wisdom creates progressive future.

The classification of puzzles is a multidimensional task that reveals not only the internal logic of the genre but also the cultural values and modes of thinking embedded in each society's use of language.

Conclusion

Puzzles play a significant role in communication and community bonding. In traditional English culture, riddles have historically been part of communal gatherings, feasts, and celebrations, serving as a means of entertainment and fostering social cohesion. Similarly, in Karakalpak culture, puzzles are integral to festive occasions, storytelling sessions, and even marriage negotiations, where the ability to solve or create a riddle demonstrates wit and readiness for adult responsibilities. This performative aspect of puzzles highlights their function in showcasing verbal skill, creativity, and cultural knowledge.

To sum up, puzzles often perform an identity-building role, reinforcing a sense of belonging to a cultural group. Mastery of culturally specific riddles signals a person's deep understanding of their community's traditions, symbols, and worldview. In Karakalpak culture, where oral tradition is a cornerstone of national identity, knowing and performing puzzles is a way to connect to ancestral wisdom. In English-speaking cultures, the preservation of ancient riddles, such as those found in the Exeter Book, also serves as a link to historical heritage and linguistic development. Therefore, puzzles not only entertain and educate but also foster cultural pride and collective memory, playing a vital role in maintaining the continuity and vitality of each culture.

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Rezyume: *Ushbu maqola ingliz va qoraqalpoq xalq topishmoqlarining qiyosiy tahliliga bag‘ishlangan. Har ikki xalq turli til va madaniy an’analarga mansub bo‘lishiga qaramay, boy topishmoq merosiga ega bo‘lib, ularda ajabtovur o‘xshashliklar hamda yaqqol tafovutlar mavjud. Ushbu janrlarni o‘rganish orqali til, madaniyat va tafakkur o‘rtasidagi o‘zaro aloqalarni ikki xil jamiyat misolida chuqur tadqiq etish imkoniyati yuzaga keladi. Mazkur tadqiqot inson ijodkorligining umuminsoniy xususiyatlarini ochib berar ekan, har bir xalqning tarixiy va ijtimoiy o‘ziga xosligiga hurmat bilan yondashadi.*

Резюме: *Настоящая статья посвящена сопоставительному анализу английских и каракалпакских загадок. Несмотря на принадлежность к разным лингвистическим и культурным традициям, как английский, так и каракалпакский народы обладают богатым репертуаром загадок, демонстрирующих как удивительные сходства, так и ярко выраженные различия. Изучение этих текстов позволяет исследовать взаимодействие языка, культуры и когниции в контексте двух различных обществ. Работа подчёркивает универсальность человеческого креативного мышления, сохраняя при этом уважение к историко-социальной уникальности каждой нации.*

Kalit so‘zlar: *topishmoqlar, muammoli savollar, tasnif, lingvistik, og‘zaki an’analar, madaniy meros, taqqoslash.*

Ключевые слова: *загадки, головоломки, классификация, язык, устные традиции, культурное наследие, сопоставление.*

ISSUE OF DEVELOPMENT OF NUKUS CITY MICROTOPONYMS

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***Summary**: In our article, we concluded that in the process of systematically studying the names of the city of Nukus, it is necessary to revise the issues of naming and changing some streets, dividing them into thematic groups. We raised the issue of reviewing the use of such names and their systematization. Based on this, we have put forward our proposals in the article.*

***Keywords**: Toponymy, toponym, microtoponym, odonym, calque, thematics.*

To date, significant achievements have been made in various fields of Karakalpak linguistics, and numerous scholarly works, monographs, and articles have been published. This work is still ongoing. Undoubtedly, all of this is aimed at showcasing the national characteristics of our language and defining its place among related and other languages. Because one of our people's national values is their mother tongue.

Information on the toponyms of Karakalpakstan is provided in the works of S.P. Tolstov, T.A.Zhdanko, B.V.Adrianov, G.I.Donidze, V.V.Bartold, L.Uspensky, N.A.Baskakov, S.Ataniyazov, H.Vambery, and other scholars [Толстов, 1947. – С. 74-232; Жданко, 1950; Адрианов, 1962. – С. 37-40; Донидзе, 1964. – С. 39; Бартольд, 1965. – С. 713; Успенский, 1973. – С. 190; Баскаков, 1978; Атаныязов, 1980; Вамбери, 2003]. They noted in their works that the study of toponyms directly contributes to the study of the history, ethnography, administrative-territorial territories, as well as the historical lexicon and morphology of the population. In the works of local scientists K.Abdimuratov, S.Kamalov, Kh.Esbergenov and M.Mambetullaev, K.Ayimbetov, U.Payzullaev, K.Kunnazarov, in the dissertations of K.Seytniyazov, A.Kudiyarov, M.Kurbanov, G.Mambetova, KhTolibaev [Abdimuratov, 1965; Kamalov, Esbergenov, and Mambetullayev, 1986. - P. 46-50; Ayimbetov, 1988; Payzullaeva, 1993; Qorayev, 2005. - P. 189-201. Kunnazarov, 2006. - P. 45-55; Tolibayev, 2018]. In Karakalpak toponymy, the semantic features and grammatical structure of district toponyms have been studied from a separate linguistic perspective [Abishev, 2019; Esemuratov, 2022].

In Karakalpak linguistics, we can see that there are still issues that need to be studied. One of them is toponyms, which constitute a large part of the lexical composition of the language. In short, all geographical objects are called toponyms. Logically, they are divided by most researchers into macrotoponyms and microtoponyms (from the Greek topos - place, micros - small, macros - large) [Neroznak, 1997. - P. 566 In this article, we will discuss microtoponyms, including street names, widely used in linguistics, history, and geography.

An odonym is a linguistic term studied within the science of toponymy. One of the most important tasks of world onomastics today is the regulation of onomastic terminology. In the 1950s, French linguists (J.Herbillon, A.Cornoy, L.S'auveur) put forward the idea of developing a terminological apparatus for the study of toponyms and, in the course of this research, introduced the term odonym (Greek ὁδὸς - "path") [Egorova, 2018. - P. 224]. An odonym is a general term for any small object in a city, including a street, lane, road, crossing, dead end, and other small toponyms. Therefore, the name of any small object in a city, regardless of whether it is large, wide, or small - barely noticeable - is considered a homonym. Using a term, that is, one word, instead of just a few such words, creates convenience in science.

Our article focuses on improving microtoponyms, including odonyms, in the city of Nukus. In the city of Nukus, there are about 1,500 streets, including about 80 crossings (long, straight, and wide streets in the city), 8 dead ends (crossings and streets without crossings), 2 streets, that is, roads with hard (asphalt-concrete, cement-concrete) pavement (I.Karimov and Uzbekistan streets), and about 1,400 streets. These streets are located in more than 70 neighborhood communities. In addition,

the city has 11 cemeteries, 3 recreation parks, and 1 square. As can be seen, there are many small facilities in our capital, but not many large ones.

In the course of studying the homonyms of the city of Nukus, we came to the opinion that it is necessary to revise the issues of naming and changing some streets. Based on this, we express the following opinions and suggestions:

1. In the course of a systematic study of the toponyms of the city of Nukus, we have seen that in their names, words from the Uzbek and Russian languages are written in their original form, without changes. For example, we can mention streets formed from Uzbek words like Fidokor, Istiqbol, Sharshara, Paxtakor, Jasorat, Kamalak, Tashabbus, Bunyodkor, Vatanparvar, and street names formed from Russian words like Veterinar, Sanatoriya, Pristan. These are words that don't exist in our lexicon and have no meaning. Therefore, we believe these terms should be changed to reflect the past and national identity of the people. Furthermore, we can mention street names derived from the Uzbek language through calquing (copying), such as "Sharshara", "Kamolot", "Mahalla", "Barkamol", and "Shifobakhsh" Words like "sharsha", "kamalat», "mahalla", "barkamol" and "shifobakhsh" are not found in the lexicon of the Karakalpak language. These are the forms of Uzbek words like "sharshara", "kamolot", "mahalla", "barkamol" and "shifobakhsh", adapted to the Karakalpak language through calquing. It is advisable to change the names of toponyms composed of words created using this calque method.

2. It is necessary to continue using the names of scholars and thinkers who have played a significant role in human civilization and figures known worldwide for their work as toponyms. Previously, in the toponymy of Karakalpakstan, in particular, in the city of Nukus, the names of such streets as Gagarin (current "Shagyrly" street), Chernyshevsky (current "Altyn Orda" street), Rudaki (current "Aspantay" street), Fizuli (current "Karateren" street), Ferdawsiy (current "Pakhtaabat" street), Shoto Rustaveli (current "Aral baliqshisi" street), Beethoven (current "Sharshara" street) have been completely changed and are being named differently. It would have been more appropriate to keep them in their original form. For example, the former name of the current Shag'irli Street in Nukus was "Gagarin," but it has been changed to Shagirli in recent years. Yu.A. Gagarin is the first astronaut to fly into space in human history. Ethnicity - Russian. We believe that the names of toponyms named after such world-renowned figures should not be changed. Because Yu.A. Gagarin is a renowned international figure not only for the Russian nation but for all of humanity.

3. When studying the toponyms of the city of Nukus, we saw that there are some repeated street names. They are used in conjunction with ordinal numbers as a sign of difference. For example, Nawqanshilar otkeli-1, Nawqanshilar otkeli-2 kosheleri, Nazlimxan otkeli-1, Nazlimxan otkeli-2 kosheleri, Taqiyatas otkeli-1, Taqiyatas otkeli-2 kosheleri, Jiydeli baysin-1, Jiydeli baysin-2 kosheleri, Quwanishli otkeli-1, Quwanishli otkeli-2, Quwanishli otkeli-3 streets. Replacing such repeated toponyms on the city map with historically and nationally significant names is of paramount importance. Because, firstly, this creates convenience for people, and secondly, it plays a major role in raising the spiritual culture of the people. Such repetition in place names should not be allowed.

4. During our research, we saw that there are no established requirements and rules for naming toponyms. When naming toponyms, geographical, historical, national, living conditions, and other local conditions must be taken into account. In the toponymy of Karakalpakstan, when naming streets, it is advisable to use terms semantically denoting the past, ethnic composition, social status, ethnocultural life, rich oral literature, and prominent figures of the population. However, some street names recently given to streets in Nukus city do not comply with the above requirements and rules, and many names have no semantic significance. As an example, it is necessary to consider the issue of renaming streets such as Parwaz, Gulbag, Aq kepter, Jaqtili, Qonar, Orinli, Iqbol, Saparli, Qosjar, Tolqin, Bulaq, Jagaliq, Saginish, Gullala, Jemisli, Jamiyet, Tayanish, Zarafshan, Gul bostan, Altin suw, Bozli, Birdem, Nurabad, Toreli, Nazli, Gazli, Nukus PMK jataqxana, Juldizsha, Talwasli, and others.

5. Toponyms should be concise, short, and convenient to use not only in terms of their meaning but also in terms of their composition. When studying the homonyms of the city of Nukus, we can see long names whose structure consists of several words. For example, toponyms such as

"Dosliq kanali otkeli", "Dosliq kanali tuyiq", "Nukus PMK jataqxanasi" "Dosliq baglari otkeli", "Aydin keleshek otkeli", "Temir jol jagasi" and "Garezsizliktin jigirma bes jilligi" are causing inconvenience for the people living there. This situation, in turn, can lead to the narrowing of the scope of street names over time, leading to their gradual disappearance

6. Among the toponyms of the city of Nukus, we have witnessed the frequent use of the toponym-forming words "o'tkel" and "tuyiq". However, there are instances of repetition in street names formed with these words. For example, street names such as Baxitli el – Baxitli el otkeli, Nazlimxan – Nazlimxan otkeli-1 – Nazlimxan otkeli-2, Shaglasin – Shaglasin otkeli, Sunqarlar – Sunqarlar otkeli, Qusbegi – Qusbegi otkeli, Xojakol – Xojakol otkeli, Nawqanshilar – Nawqanshilar otkeli-1 – Nawqanshilar otkeli-2, Manawiyat – Mánawiyat otkeli, Dosliq baglari – Dosliq baglari otkeli, Biybixanim – Biybixanim otkeli, Jana jer – Jana jer tuyiq, Aq nagis – Aq nagis otkeli, Dosliq kanali – Dosliq kanali otkeli – Dosliq kanali tuyiq, Qidirbay Saypov – Qidirbay Saypov tuyiq differ only in the words "tuyiq" and "otkel". This, in turn, leads to errors.

7. It is known that in order to immortalize the names of people who have made a significant contribution to the development of the country, a number of toponyms in the city of Nukus, that is, streets and neighborhood citizens' gatherings, are named after people. We all know that this phenomenon is called anthropotoponyms in linguistics. Some peculiarities are observed in the use of anthropotoponyms in the city of Nukus. In some anthropotoponyms, both the person's name and surname are written in full (Qalli Ayimbetov, Esjan Qospolatov, Aytjan Xojalepesov, Qidirbay Saypov, Jolimbet Seytniyazov, Hamid Olimjon, Ayimxan Shamuratova, Najim Davqaraev), while in others, the person's name is shortened and the surname is written in full (S.Majitov, Sh.Musaev, S.Nurimbetov, O.Xalmuratov, A.Dosnazarov, A.S.Pushkin). In some anthropotoponyms, one can see the combination of a person's profession, position, title, or nickname (Ernazar alakoz otkeli, General Usnatdin Utemuratov, Ormanbet biy, Jiyen jiraw, Academician Ch.Abdirov, Japaq baqsi, Academician T.Eshjanov, Qoblan batir, Murat shaykh). The issue of using such anthropotoponyms should also be reviewed and systematized.

It would be beneficial to collaborate with the Toponymic Committee under the Council of Ministers of the Republic of Karakalpakstan and linguistic specialists in the field of toponymy on the positive implementation of the aforementioned opinions and suggestions regarding the city of Nukus.

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Rezyume: *Biz maqalamızda Nókis qalası odonimlerin sistemalı úyreniw barısında olardı tematikalıq toparlarǵa ajıratıp, ayırım kóshelerge atama beriw hám ózgertiw máselelerin qayta kórip shıǵıw zárúr degen juwmaqqa keldik. Bunday odonimlerdiń qollanılıwın qayta kórip shıǵıw, olardı sistemalastırıw máselesin kóterdik. Sonnan kelip shıǵıp, maqalada usınıslarımızdı bildirdik.*

Резюме: *В нашей статье мы пришли к выводу, что в процессе систематического изучения одонимов города Нукус необходимо пересмотреть вопросы наименования и изменения некоторых улиц, разделив их на тематические группы. Мы подняли вопрос о пересмотре использования таких омонимов и их систематизации. Исходя из этого, мы высказали свои предложения в статье.*

Kalit so‘zlar: *Toponimika, toponim, mikrotoponim, odonim, kalka, tematika.*
Ключевые слова: *Топонимика, топоним, микротопоним, одоним, калька, тематика.*

FOLK MELODIES IN THE POETRY OF GULJAMOL ASKAROVA

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Summary: *This article describes the use of modern folklore in the work of the poetess Guljamol Askarova. In his poems, he skillfully used the genres of proverbs and elegies of oral folk art. The poetess's skill in creating images, her style of expressing aesthetic ideals, and how aesthetic concepts such as beauty, tragedy, and comedy are expressed through poetic thinking are highlighted.*
Keywords: *flower, sword, folklore, fairy, lyricism, purity, faith.*

In fiction, there is a stronger tendency towards particularity than universality. In scientific literature, any scientific research is based on language norms and theory, while fiction is not free from theory, it is free from grammatical limitations. This situation can be observed in many lyrical works. Because lyrics differ from other types in that they depict emotional experiences. Works created in wavy, exciting forms with the poet's desire to depict his sorrows, dreams, and feelings are called lyrics. But poets, masters of the word, form the inner and outer world of the word in unexpected discoveries in accordance with any mold. "It is known that a word means generality. It comes into contact with other words and comes alive only when it corresponds to the heart, state, actions, and behavior of the hero in a certain situation - only when it can express the feelings in that heart, the actions of the character, it moves to the heart of every reader, awakens and revives such feelings in others. Poems in a folk tone play an important role in the development of Uzbek literature. Such poems reflect the close connection between oral folk art and written literature and are distinguished by the simplicity, melodiousness of poetic speech, and the symbolic richness of images. Usually, the theme of such poems is based on a person's inner experiences, love, nature, homeland, or folk wisdom. The ideological basis of the poem consists of such values in the spirit of the people as simplicity, sincerity, purity, faith, and loyalty. In today's modern Uzbek poetry, Guljamol Askarova, one of those talents who swims in the depths of a restless, joyless ocean called the literary process, has managed to create a vast world of creativity in a short time since she entered the literary field. G. Askarova was born on March 5, 1978 in the village of Beshdargat, Kattakurgan district, Samarkand region. The poet's interest in literature led her to the National University of Uzbekistan. Her creative pursuits bore fruit, and in 2001 she became the laureate of the Zulfiya State Prize in the field of literature. Her first collection of poems was published in 1998 under the title "Dil fasli". After that, the poet's poetry collections, such as "Ro'shnolik" 2000, "Bedor qong'iroq" 2003, "Bakht dastxati" 2004, "Uygotguvchi alla" 2007, "Gulnoma" 2008, "Turnalar yoli" 2011, began to be published one after another. The poet's poems are unique in that the spirit invested in the words is embodied in the reader's mind in various forms. The similes used in Guljamol Askarova's poetry attract the reader with their uniqueness and attractiveness, giving him pleasure and delight. In the poem "Folk Melodies", she skillfully uses the genre of proverbs belonging to folk oral literature to further reveal the content of the poem:

Kuyarmish ko‘rgan ko‘ngil,
Ishqqa yuz burgan ko‘ngil,
Yoshlikda bergan ko‘ngil,
Yomon bo‘lar deydilar.

The meaning of this poem is that the fate of a heart that is burned by the pain of love, that is, a heart that has fallen in love and that has fallen in love in youth is bad, according to the folk interpretation. It expresses the idea that these feelings can lead to serious consequences. The third verse contains the proverb "A heart given in youth is an inextricable trouble." The poetess tried to reveal the essence of the meaning without directly repeating the folk wisdom.

Yuzlarimni yorug‘ qildi Xudoyim,
Dardlarimdan forig‘ qildi Xudoyim,
Sabrlardan sariq ko‘ylak kiydirib,

Bardoshimdan chorig‘ qildi Xudoyim.

This poem expresses gratitude for the blessings of God Almighty and his gifts. The poem expresses the positive influence of God in human life, that is, the way he brightens the face, relieves pain, and patiently tests and makes us strong. Our wise people have a wise saying: “Patience is yellow gold.” The proverb says that patience is like a precious stone, followed by good results. Guljamol Askarova skillfully uses folklore imagery in her work, showing youth not only as a biological period, but also as a world of spiritual beauty.

O‘n sakkiz yosh – go‘zal dunyo,
Pari bo‘ldim uning bahrida
Qo‘llarida qilich, gul tutgan
Shahzodam bor uning bag‘rida

If we pay attention to the lines in this poem, we can see the poetess's vision of the age of 18. This age is interpreted as the purest period of beauty, dreams, innocence, and feelings. The lyrical "I" feels this period so attractive that she resembles a "fairy" - that is, a being light, pure, and full of dreams. The above lines use folklore images - a fairy, a prince, a sword, a flower. This gives the poem a fairy-tale, romantic, national spirit. The image of the “Prince” is a symbol of a young man with a romantic ideal. The fact that he has a “sword” and a “flower” in his hands at the same time symbolizes the two-faced qualities of a young man:

sword - courage, protection, strength;

flower - tenderness, tenderness, love. The poet wants to emphasize that the ideal partner for the lyrical hero should be both strong and kind.

In conclusion, it can be said that Guljamol Askarova, who occupies a worthy place in the annals of Uzbek poetry of the period of national independence, created a spiritual climate in life, along with her generous poems. The poet's lyrics acquire originality with her constant attempt to renew aesthetic boundaries. This was her own spiritual climate. G. Askarova's lyrics acquire their own uniqueness with her desire to qualitatively elevate advanced Uzbek artistic traditions. In the work of the poetess, belonging to the literary generation of the 90s, the scope of poetic themes is wide and diverse, the depth of ideas is heavy and deep, the range of lyrical expression is wide and colorful.

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Rezyume: *Mazkur maqolada shoira Guljamol Asqarova ijodida zamonaviy folklorizmning ishlatilishi bayon qilingan.* ***She’rlarida xalq og’zaki ijodiga mansub maqol, marsiya janrlardan mohirona foydalangan. Shoiraning obraz yaratish mahorati, estetik ideallarni ifodalash uslubi va poetik tafakkuri orqali go‘zallik, fojiaviylik, komiklik kabi estetik tushunchalarning qanday ifoda topgani yoritiladi.***

Резюме: *В данной статье описывается использование современного фольклоризма в творчестве поэтессы Гульджамол Аскаровой. В своих стихах он мастерски использовал жанры пословиц и элегий, относящиеся к устному народному творчеству. Через мастерство поэтессы в создании образов, стиль выражения эстетических идеалов и поэтическое мышление освещается, как выражаются такие эстетические понятия, как красота, трагичность, комичность.*

Kalit so‘zlar: *gul, qilich, folklorizm, pari, lirika, poklik, ishonch.*
Ключевые слова: *цветок, меч, фольклоризм, фея, лирика, чистота, вера.*

THE IMPACT OF STUDENT-CENTERED LEARNING ON ACADEMIC MOTIVATION IN HIGHER EDUCATION

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Summary: *The present study investigates the impact of student-centered learning (SCL) approaches on academic motivation among undergraduate students. The research is grounded in constructivist learning theory and self-determination theory. A mixed-methods design was employed, involving a quasi-experimental study with 120 university students divided into experimental and control groups. Quantitative data were collected using the Academic Motivation Scale (AMS), while qualitative data were obtained through semi-structured interviews. The findings indicate that students exposed to student-centered learning strategies demonstrated significantly higher levels of intrinsic motivation, autonomy, and engagement compared to those taught using traditional teacher-centered methods. The study highlights the pedagogical value of student-centered learning and provides practical recommendations for higher education instructors.*

Key words: *student-centered learning, academic motivation, higher education, pedagogy, constructivism*

1. Introduction

Modern educational systems increasingly emphasize the need for teaching approaches that foster learner autonomy, critical thinking, and lifelong learning skills. Traditional teacher-centered instruction, characterized by passive knowledge transmission, has been criticized for its limited effectiveness in motivating students (Freire, 1970). In contrast, student-centered learning (SCL) prioritizes active participation, collaboration, and personal relevance of learning content.

Academic motivation plays a crucial role in students' academic success and persistence in higher education. According to self-determination theory, motivation is enhanced when learners experience autonomy, competence, and relatedness (Deci & Ryan, 2000). This study aims to examine how student-centered learning influences academic motivation among university students.

Research Question:

How does student-centered learning affect academic motivation in higher education students?

2. Literature Review

Student-centered learning is rooted in constructivist pedagogy, which views learning as an active process of knowledge construction (Vygotsky, 1978). Previous studies have shown that SCL strategies—such as project-based learning, collaborative tasks, and problem-solving activities—positively affect student engagement and achievement (Prince, 2004).

Research on academic motivation indicates that instructional methods significantly influence students' motivational orientations (Pintrich, 2003). However, empirical studies examining the direct relationship between SCL and motivation in higher education remain limited, particularly in non-Western educational contexts.

3. Methodology

3.1 Research Design

A mixed-methods approach was adopted, combining quantitative and qualitative data to provide a comprehensive understanding of the phenomenon.

3.2 Participants

The sample consisted of 120 undergraduate students from a педагогical university. Participants were randomly assigned to:

Experimental group (n = 60): student-centered learning

Control group (n = 60): traditional lecture-based instruction

3.3 Instruments

Academic Motivation Scale (AMS)

Semi-structured interview protocol

3.4 Procedure

The intervention lasted one academic semester (14 weeks). The experimental group engaged in group discussions, project-based tasks, and reflective activities, while the control group received conventional lectures.

3.5 Data Analysis

Quantitative data were analyzed using t-tests, while qualitative data were thematically analyzed.

4. Results

The results revealed statistically significant differences between the two groups. Students in the experimental group demonstrated higher levels of:

Intrinsic motivation ($p < 0.01$)

Perceived autonomy ($p < 0.05$)

Academic engagement ($p < 0.01$)

Qualitative findings supported these results, with students reporting increased interest, responsibility for learning, and positive emotional involvement.

5. Discussion

The findings confirm that student-centered learning positively influences academic motivation. These results align with self-determination theory, suggesting that SCL environments satisfy students' psychological needs. The study contributes to pedagogical research by providing empirical evidence supporting the motivational benefits of learner-centered instruction.

6. Conclusion

Student-centered learning represents an effective pedagogical approach for enhancing academic motivation in higher education. Educators are encouraged to integrate interactive and learner-focused strategies into their teaching practices. Future research should explore long-term effects and applicability across different disciplines.

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Rezyume: *Mazkur tadqiqot oliy ta'lim muassasalarida talabalarning akademik motivatsiyasiga talabaga yo'naltirilgan ta'lim yondashuvlarining ta'sirini o'rganishga bag'ishlangan. Tadqiqot konstruktivistik ta'lim nazariyasi va o'zini o'zi aniqlash nazariyasiga asoslangan. Tadqiqotda 120 nafar universitet talabasi ishtirokida kvazi-eksperimental usul qo'llanilib, ular tajriba va nazorat guruhlariga bo'lingan. Miqdoriy ma'lumotlar Akademik motivatsiya shkalasi (AMS) yordamida to'plangan, sifatli ma'lumotlar esa yarim tuzilgan intervyular orqali olingan. Tadqiqot natijalari talabaga yo'naltirilgan ta'lim asosida o'qitilgan talabalarda an'anaviy o'qitish usullarida ta'lim olgan talabalarga nisbatan ichki motivatsiya, avtonomiya va o'quv jarayoniga jalb etilish darajasi sezilarli darajada yuqori ekanligini ko'rsatdi. Tadqiqot natijalari talabaga yo'naltirilgan ta'limning pedagogik ahamiyatini tasdiqlaydi hamda oliy ta'lim o'qituvchilari uchun amaliy tavsiyalarni taqdim etadi.*

Резюме: *В данном исследовании рассматривается влияние студентоцентрированного обучения на академическую мотивацию студентов высших учебных заведений. Исследование основано на конструктивистской теории обучения и теории самодетерминации. В работе использован смешанный метод исследования, включающий квазиэксперимент с участием 120 студентов университета, разделённых на экспериментальную и контрольную группы. Количественные данные были собраны с использованием Шкалы академической мотивации*

(AMS), а качественные данные — посредством полуструктурированных интервью. Результаты исследования показали, что студенты, обучавшиеся с применением студентоцентрированных методов, продемонстрировали значительно более высокий уровень внутренней мотивации, автономии и учебной вовлечённости по сравнению со студентами, обучавшимися традиционными преподавательско-ориентированными методами. Полученные данные подтверждают педагогическую ценность студентоцентрированного обучения и содержат практические рекомендации для преподавателей высшей школы..

Kalit so‘zlar: *talabaga yo‘naltirilgan ta’lim, akademik motivatsiya, oliy ta’lim, pedagogika, konstruktivizm.*

Ключевые слова: *студентоцентрированное обучение, академическая мотивация, высшее образование, педагогика, конструктивизм.*

N. TAWMURATOV IS A SCHOLAR AND SOCIAL ACTIVIST

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Summary: *This article is devoted to the life and activities of Nawrızbay Tawmuratov, who was engaged in research on the history of the Department of Internal Affairs in Karakalpakstan and dedicated almost his entire life to this field, as well as his scientific services.*

Keywords: *N. Tawmuratov, KKASSR, MPOP (Autonomous Soviet Socialist Republic, Ministry of Public Peace Protection), Nukus city internal affairs department, Kungirat District*

There are different ideas about life. Long-lived people have experienced that it is too short, and if it is only a tuft of hair, then from a philosophical point of view, life is identified with matter without head or legs. In any case, according to the sages, a life is like a hotel where one spends the night. After all, is a child born to experience life's precious moments?

In our article, we will talk about the life of Nawrızbay Tawmuratov, a veteran of the Internal Affairs Department of the Republic of Karakalpakstan, a retired lieutenant, a lawyer who contributed to Karakalpakstan, candidate of historical sciences.

Nawrizbay Tawmuratov was born in March (Nawriz) in 1931 in a village near Tillakol, one of the paradise lands of Karakalpakstan. The child born into the Tawmurat family was named Nawrızbay because he was born shortly after Navruz traditional meal. In his autobiography, which tells about his life, Tawmuratov recalls that in the post-war years (in 1948) the fishery in Karakalpakstan was well developed, and he gradually began to gain fame by working as a "receiver" of fish caught from fishermen.[3. 14]

In 1952, after successfully passing the exams, Nawrizbay Tawmuratov enrolled as a cadet in the secondary special two-year militia school under the Ministry of Internal Affairs located in Tashkent. N. Tawmuratov studied at this educational school with Usnatdin Utemuratov, Rajapbay Khasanov, Oldash Karasaev, Sarsenbay Sharipov.

In 1954, Nawrızbay Tawmuratov brought a secondary special police training institute diploma from Tashkent to Karakalpakstan. Initially, Tawmuratov was hired as a senior duty inspector in the internal affairs department of Nukus. In 1956, Tawmuratov was demoted to the position of senior operational representative of the Nukus Ministry of Internal Affairs. During this time, Qalimov, who held this post, demanded and received rice from the Koreans. Koreans complained against Qaliymov. This incident causes Qalimov to be fired. Because of this incident, Qalimov was fired and N. Tawmuratov, who previously worked as an inspector on duty, then started working as an operational representative of DFPSP since 1956.

In his autobiography, Nawrizbay Tawmuratov remembered that he got married in 1957 to a girl named Rakhiyma, who lived on Frunze street, Chimbay chayxana settlement, Nukus city. At that time, Rahiyma was studying at the institute, while Nawrizbay was working as an inspector of GDFPSP at the police station of Nukus city.

At the beginning of 1962, N. Tawmuratov's workplace was changed. He says about himself this: "Since the beginning of 1962, the jobs of all the employees of the GDFPSP in the republic have been changed. U. Utemuratov was transferred to the Khojeli district police department as the head of the police department, and I was transferred to the Kungirot district police department as the chief operative representative of the police department". Before the change, Tawmuratov had to choose between Kungirat and Amiwdarya districts. With the advice of Borisov Mikhail Savelevish, who worked as the head of the political department in the Ministry of Internal Affairs of the Republic of Karakalpakstan, he went to work in the Kungirat district DFPSP department. [3. 25]

Tawmuratov arrived in Kungirat district in May 1962. From the day he arrived, he began to get acquainted with the conditions of the district. On those days, Tawmuratov talked with the head of the police department of Kungirat district, Ermakbay Emlikbergenov, about the work that needed to be done in the district. In the end, at the suggestion of Emlikbergenov, he agreed to start work on the

former Sverdlov state farm. At that time, Tilew Mamitov was working as a regional representative of this state farm. Together with Tilew Mamitov, Tawmuratov went to the Sverdlov state farm on horses.

When Tawmuratov was working in the city of Nukus, he often remembered Borisov's advice, which caused him to move to Kungirat district. On the way to Kungirat, the head of the personnel department told Borisov Tavmuratov that most of the robberies in Kangirat district are in the field of cattle breeding, and warned that investigations should be started in this area. Having listened to this advice, Tawmuratov decides to start work on the Sverdlov state farm in Kungirat district with crimes in the field of cattle breeding.

By the decree of the Presidium of the Supreme Council of the USSR dated February 22, 1964, Kungirat district was reorganized, the center of which is the city of Kungirat. By the joint decision of the Karakalpakstan Regional Committee of the Karakalpakstan Oblast and the Council of Ministers of the Soviet Socialist Republic of Karakalpakstan on March 16, 1964, which was related to the organization of Kungirat district as a new district, the police department of Kungirat, which was part of the Khojeli district Soviet executive committee of the deputies, was dissolved. Instead, a police department was established within the Kungirat District Soviet Executive Committee of People's Deputies. On April 4, 1964, the QQASSR MPOP (Ministry of Public Order Protection) related to the establishment of the Kungirat district police department confirmed the staff of the Kungirat district police department at 27 people, and with this order, N. Tavmuratov of the Kungirat district was appointed deputy head of the police department for operational affairs. On February 5, 1964, by decision of the Council of Ministers, the first construction of the 7th compressor station was started on the Ustirt Plain, and the urban settlement of Ustirt "Komsomolek of Ustirt" was built in Caracal on the service of the Bukhara-Uralgas Highway Karakalpakistan ASSR was established. In February of the same year, QQASSR MPOP was instructed to open an operational police station in the village. On July 7, 1964, according to the order of the MPOP of QQASSR, one operative representative, one regional representative, GAI officer and rank-and-file police officers were allocated to the police station of the Kungirat district police station on the Ustirt plain. According to the order of the JTQM of Uzbekistan on May 25, 1965, Nawrizbay Tawmuratov was appointed as the first deputy of the head of the police department of Kongirot for operational affairs and the head of the police department of Komsomolek village in Ustirt. Thus, N. Tawmuratov became the deputy leader and the head of the village department, and he went to work once or twice a week. [3. 47]

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EPIC "EDIGE" AS A HISTORICAL SOURCE ON THE HISTORY OF THE TURKIC PEOPLES

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Summary: *The article analyzes the epic "Edige" as a historical source on the history of the great states of the Turkic tribes of the era – the Golden Horde and the Timurid Empire in Maverannahr, which had significant importance on a global scale as powerful Turkic states.*

In the 14th–15th centuries, Turkic-speaking tribes possessed exceptionally rich folk creativity in various genres. In the 15th century, the Turkic peoples who were part of the Golden Horde created the epic "Edige." The main characters of the epic, dedicated to the history of the Golden Horde, are Amir Temur, Edige, and Tokhtamysh. Amir Temur made a great contribution to history: he managed to unite the fragmented feudal states under his banner and laid the foundation for a great centralized state.

In the Karakalpak version of the epic "Edige," Amir Temur is mentioned under the names Satemir and Shah Temur, and is portrayed as a just, truthful, courageous, caring, and humane ruler. This is the genuine assessment given to him by the people.

Tokhtamysh, a descendant of Jochi, appears in both folklore and history as a great figure who, despite the contradictions of his personality, made tremendous efforts as the khan of Desht-i Qipchaq and the Golden Horde to strengthen and enhance the power of his state.

Edige is one of the prominent figures in the life of the Golden Horde in the late 14th and early 15th centuries. He was a great hero of the Turkic peoples who ruled the Golden Horde for a quarter of a century, dedicating all his strength and wisdom to strengthening the state. A brave, wise, and courageous man, his merits and military feats became legendary.

Key words: *History, folklore, Turkic-speaking peoples, epic, historical image of "Edige," Emir Timur, Edige, Tokhtamysh.*

The 14th–15 th centuries represent an era in history that was exceptionally rich in great events. The history of the great states of the Turkic tribes of this period – the Golden Horde and the Timurid Empire in Maverannahr – holds worldwide significance, as they were powerful Turkic states.

In the 14th–15th centuries, the Turkic-speaking tribes possessed extraordinarily rich folklore in a variety of genres. A special place among them was held by the folk epic, where historical events of the past are vividly depicted with the unique features of the epic genre. In them, the people portray their heroes – loyal sons – as true defenders of the homeland, ready to sacrifice their lives for their native land. The main hero of a folk epic was usually formed as the perfect ideal of that people. The Turkic peoples have every reason to be proud of their world-famous epics Kitabi Dede Korkut (The Book of My Grandfather Korkut), Alpamys, Edige, and others.

In the 15th century, the Turkic peoples of the Golden Horde created the epic Edige. The exceptional importance of this epic, which narrates the history of the Golden Horde of the late 14th and early 15th centuries in a vivid and colorful epic language, lies in the fact that it serves as a living historical source for the history of the Turkic peoples.

The main heroes of the epic Edige, dedicated to the history of the Golden Horde, are Emir Timur, Edige, and Tokhtamysh. Emir Timur was born on April 9, 1336 in a village near Shahrisabz and died in 1405 in the city of Otrar. In other words, he lived only 69 years. Emir Timur's contribution to history is immense. He managed to unite the fragmented feudal state under his banner and laid the foundation of a great centralized state. Without realizing it, Emir Timur helped a number of peoples and countries free themselves from colonial despotism. His final defeat of Lightning Bayezid between 1389–1402 brought freedom to the countries of the Balkan Peninsula. Timur's victories over the Golden Horde khan Tokhtamysh between 1376–1396 accelerated Russia's liberation from the Mongol yoke by 300 years. [3,5–6]

In the Karakalpak version of the epic Edige, Emir Timur is referred to as Satemir or Shah Timur and is portrayed as an exceptionally just, truthful, courageous, caring, and humane ruler. This was the genuine evaluation given to Timur by the people. Only today do we clearly understand that such an assessment is closely tied to historical reality. Of course, the epic embodies historical reality through its own style, techniques, and artistic means. Episodes of the epic in which Edige comes to Timur from the Nogai land after being defeated by Tokhtamysh, where Emir Timur together with Edige sets out against Tokhtamysh, correspond exactly to historical reality. Edige's request for help from Timur, and Timur's assistance in overthrowing Tokhtamysh, are depicted in the epic precisely as they occurred in history. This is an exceptionally great and essential value of the Edige epic in its reflection of historical reality. In the epic, Timur deposes Tokhtamysh and proclaims Edige as khan, thus fulfilling Edige's request. As depicted in the epic, Edige so greatly earned the favor and sympathy of Emir Timur that Timur even gave him his daughter, Akbilek, in marriage. In general, the relations between Timur and Edige are portrayed in the epic in as positive a light as they appear in history. The epic Edige is of great importance in the study of Timur's personality and in assessing him as a ruler, commander, and great military leader.

Tokhtamysh came from the Jochid lineage. In 1376, fearing the wrath of Urus Khan, he came to Emir Timur, who received him with honor and respect. With Timur's help, Tokhtamysh seized Otrar, Sauran, and later, thanks to the same support from his benefactor, he achieved final victory over Urus Khan. After this, in 1376–1395, Tokhtamysh first became khan of the White Horde, and later of the entire Golden Horde. Having gathered great power, Tokhtamysh began seizing lands subject to Timur. Tokhtamysh's army clashed repeatedly with Timur's warriors. Eventually Tokhtamysh repented of his unworthy deeds, remembering the help Timur had given him, and sent envoys to ask for forgiveness. Timur received his envoys in 1405 and magnanimously forgave Tokhtamysh. But fate decreed otherwise: Timur's death in 1405 in that same city of Otrar prevented their personal meeting and clarification of the misunderstanding between them.

In the Karakalpak version of the epic Edige, it is told how Tokhtamysh becomes the great khan of the Nogai land (the Golden Horde), how Edige is raised in his household as a son, how the khan, fearing that Edige might later seize his throne, plots to kill Edige with poison, how Edige, having learned of the plot of the beys to destroy him, goes to the land of Khan Satemir (Timur), how with Satemir's help he defeats Tokhtamysh, how Edige becomes ruler of the Nogai land (the Golden Horde), how Tokhtamysh flees, how Edige's son Nuraddin pursues him on his father's orders, and how Nuraddin, having caught up with Tokhtamysh, kills him. Aside from some folkloric details and artistic embellishments, we clearly see how the content of the events described above astonishingly coincides with historical reality.

Almost all materials published so far have presented the personality of Khan Tokhtamysh in a one-sided manner, interpreted negatively, with denigration and vilification. However, objective historical patterns cannot be ignored. Researchers have failed to recognize both the positive and negative qualities in Tokhtamysh's actions, behavior, and character even to the extent that the zhyrau – performers of the epic – were able to do.

Khan Tokhtamysh, both in folklore and in history, appears as a great figure who, despite all the contradictions of his personality, made tremendous efforts as the khan of Desht-i Qipchaq, the Golden Horde, to strengthen, enhance the power, and ensure the stability of his state. Even Timur himself at first acknowledged that the military power of Khan Tokhtamysh exceeded his own forces. The good and bad qualities of Tokhtamysh should not be evaluated solely in terms of his relations with the Russians or Lithuanians. There were cases when Khan Tokhtamysh even maintained good neighborly relations with them. When Edige fought Tokhtamysh, the latter's sons were under the protection of the Moscow principality. One of Tokhtamysh's great achievements was his attempt to strengthen the power of the Golden Horde. The profound meaning lies in the very fact that, although he could not reach an agreement with either Edige or Timur on this issue, and even fought them repeatedly, toward the end of his life Tokhtamysh asked Timur for forgiveness and even awaited his help. At the sunset of his life, he became an advocate of unity with Timur.

Edige was one of those who played a significant role in the life of the Golden Horde at the end of the 14th and beginning of the 15th centuries. Edige's father did not descend from khans. However, Edige was that high-ranking statesman who concluded marriage alliances with the highest representatives of the ruling dynasty, thereby increasingly strengthening his prominent position at court. He also held enormous influence in the White Horde. Since Edige was not of khanly descent, he did not sit on the throne as sovereign. Only descendants of Chinggis Khan could become khans. This tradition of succession continued up to the beginning of the 20th century.

Through his wisdom, political foresight, bravery, and courage, Edige won the favor and sympathy of the khans, who readily listened to his words. Edige was a man who could proclaim khans, place them on the throne, and even depose them whenever state interests required it.

In historical sources of that time, Edige is mentioned under the title "emir," referred to as "Uzbek Edige," and also as Edige from the Manghit tribe. In some sources, even Ibn Arabshah calls him a Qongrat. For a quarter of a century, Edige played a decisive and exceptionally important role in the Golden Horde. Emir Timur gave Edige enormous support in acquiring fame, in occupying key positions in the state administration, and in conquering the White Horde. Here, of course, Timur had his own plan – to keep the Golden Horde under his influence and constant control. Timur respected Edige because he saw in him his future reliable supporter. Although misunderstandings might have existed between Timur and Edige, Timur supported him in every way, helping him occupy a high, privileged position. This cannot be denied. What is most striking is that this interpretation of Timur's role in Edige's rise exists both in the Karakalpak version of the Edige epic and in history itself.

The struggle between Edige and Tokhtamysh and his sons for supremacy in the Golden Horde, their clashes and disagreements, represent a natural continuation and a vivid manifestation of that ancient tradition of succession which had long existed among the members of the khanly dynasty, when the struggle for the throne was waged to the death, even between brothers, fathers, and sons. It is necessary to emphasize that Edige did not fight to become khan himself, but to proclaim and enthrone a khan of his own choosing. Despite all the contradictions of his nature, Edige accomplished what none of the khans of the Golden Horde before him could achieve. He established good relations with Egypt, with the state of Shahrukh (the son of Timur), and with other countries. He devoted all his efforts to turning the Golden Horde into a great united and centralized state. His campaign against Moscow, his struggle with the Lithuanian prince Vytautas, his conquest of Khorezm, his persistent and courageous resistance to his enemies, and when necessary, the crushing defeats he inflicted on them, his ability to skillfully conduct military campaigns, and to employ diplomacy when needed – all these testify to the fact that Edige proved himself to be a great ruler, a skilled military commander, a wise emir, and an outstanding diplomat, and to the extraordinary strength and might of the state he led. This was acknowledged across Europe, including by German scholars, as well as by Arab and Persian historians. Yet one cannot agree with the opinion of some Russian scholars who, even today, continue to misinterpret Edige's personality solely as an enemy of Russia. Indeed, in the past, who did not attack others? Who did not conquer foreign lands? It is difficult to clearly separate all this, portraying one as good and another as evil. Every people glorifies as a hero the one who fought for the honor and dignity of their native land and for the interests of their compatriots. Aside from the undesirable bloodshed of war, war itself is a kind of contest in which the stronger prevails and the weaker falls before the stronger.

During Edige's rule in the Golden Horde, the relations between the Golden Horde and Russia or the Golden Horde and Lithuania appeared extremely complicated. All three states sought the weakening of the opposing side, regardless of the reasons. For example, if the Russian principalities eagerly awaited the fall of the Golden Horde and the Lithuanian principality, then the Lithuanians likewise sought the weakening of both the Russian principalities and the Golden Horde, or their subjugation to Lithuanian influence. Both the Russian principalities and the Lithuanian prince intended to weaken the Golden Horde, overthrow Edige, and place one of Tokhtamysh's sons, favorable to them, on the throne of the Golden Horde. Edige waged an uncompromising struggle against the hypocritical policies of the Russian principalities. At the same time, he pursued a flexible policy toward them. Edige was a great man who valued friendship. It is well known how strongly he

desired peace with neighboring countries, despite the extremely tense events that occurred at the end of his life.

The wise teachings and sayings of Edige gained wide popularity among the people. They occupy a significant place in the folk epic Edige. The great charters (yasaks) issued during his reign recall the noble deeds of his contemporary and benefactor, the great Timur, especially the famous Temur Tuzuklari (Timur's Codes).

Edige is a great hero of the Turkic peoples who ruled the Golden Horde for a quarter of a century, devoted all his strength and intellect to strengthening his state, and was a courageous, wise, and valiant man whose merits and military feats became proverbial. The people greatly admired his achievements, merits, and wise practical judgment. That is why the people loved him and composed an epic about him. This alone convincingly shows how firmly the image of Edige was fixed in the hearts of the Turkic peoples, and what a grateful monument was erected to him forever in folk creativity.

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Rezyume: *Maqolada «Edige» eposi tarixiy manba sifatida tahlil qilinadi. U buyuk turkiy qabilalar davlatlari tarixi – Oltin O'rda va Movarounnahrdagi Temuriylar imperiyasi tarixi haqida ma'lumot beruvchi manba sifatida ko'riladi. Bu ikki davlat butun dunyo miqyosida katta ahamiyatga ega bo'lgan qudratli turkiy davlatlar hisoblangan.*

XIV–XV asrlarda turkiy tilli qabilalar o'ziga xos boy xalq og'zaki ijodining turli janrlarini yaratgan. XV asrda Oltin O'rda tarkibiga kirgan turkiy xalqlar «Edige» eposini yaratdilar. Oltin O'rda tarixiga bag'ishlangan ushbu eposning bosh qahramonlari Amir Temur, Edige va To'xtamishdir. Amir Temur tarix oldida ulkan xizmat qilgan shaxs sifatida ta'riflanadi, u parokanda bo'lib ketgan feodal davlatlarni o'z bayrog'i ostiga birlashtirib, yirik markazlashgan davlat asosiga tamal qo'ygan. Qaraqalpoqcha «Edige» eposida Amir Temur «Satemir» yoki «Shoh Temur» nomi bilan tilga olinib, adolatli, rostgo'y, jasur, g'amxo'r va insonparvar podsho sifatida tasvirlanadi. Bu xalq tomonidan berilgan haqiqiy baho va adolatli bahodir sifatidagi tasvirdir.

To'xtamish Jochiy avlodidan bo'lib, folklor va tarixda qarama-qarshi fazilatlariga qaramay, Oltin O'rda va Dashti Qipchoq xoni sifatida o'z davlatini mustahkamlash va qudratini oshirish yo'lida katta sa'y-harakat qilgan buyuk shaxs sifatida ko'rsatiladi.

Edige esa XIV–XV asr boshlarida Oltin O'rda hayotida muhim o'rin egallagan ulkan qahramon sifatida namoyon bo'ladi. U chorak asr davomida Oltin O'rdani boshqarib, barcha kuch va aqlini o'z davlatini mustahkamlashga sarflagan, dovyurak, dono va mard shaxs bo'lib, uning xizmatlari va jangovar jasoratlari afsonaga aylangan.

Резюме: *В статье анализируется эпос «Едиге» как исторический источник истории великих государств тюркских племен эпохи – Золотой Орды и Тимуридской империи в Мавераннахре которые имели большое значение во всемирном масштабе, так как они были могущественными тюркскими государствами.*

В XIV-XV веках тюркоязычные племена имели свое исключительное богатое народное творчество разнообразных жанров. В XV веке входившие в состав Золотой Орды тюркские народы создали эпос «Едиге». Главными героями посвященного истории Золотой Орды эпоса «Едиге» выступают эмир Тимур, Едиге, Тохтамыс. Эмиру Тимуру принадлежит большая заслуга перед историей. Он сумел объединить под своим знаменем раздробленное на отдельные части феодальное государство, положить основу великому централизованному государству. В каракалпакской версии эпоса «Едиге» эмир Тимур упоминается под именем Сатемир, Шах Тимур, изображается как исключительно справедливый, правдивый,

мужественный, заботливый, человечный царь. Эта та подлинная оценка, которую народ дал Тимуру. Тохтамыс происходит из Джучиева рода. Хан Тохтамыс, как в фольклоре, так и в истории предстает как великий человек, который, несмотря на всю противоречивость его личности, прилагал огромные усилия, как хан Дешти Кипчака, Золотой Орды, к укреплению, усилению могущества, становлению подвластного ему государства. Едиге является одним из тех, кто занимал большое место в жизни государства Золотая орда конца XIV – начала XV веков. Едиге – это великий герой тюркских народов, который четверть века правил Золотой Ордой, употреблял все свои силы и весь свой ум на укрепление своего государства, отважный, мудрый, мужественный человек, чьи заслуги, ратные подвиги стали притчей во языцех.

Kalit so‘zlar: *Tarix, folklor, turkiyzabon xalqlar, doston, “Edige” tarixiy* obrazi, Amir Temur, *Edige, To‘xtamish.*

Ключевые слова: *История, фольклор, тюркоязычные народы, эпос, исторический образ «Едиге», эмир Тимур, Едиге, Тохтамыс.*

LINGUOSTYLISTIC FEATURES OF EXPRESSIVENESS IN INFORMATIVE GENRE TEXTS ABSTRACT

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Summary: *This article provides a comprehensive analysis of the role of expressiveness and its communicative-functional features in the informative genre. The study explains how the persuasiveness, emotional tone, and impact of journalistic texts are directly related to the expressive potential of language. The theoretical approaches of scholars such as G.N. Akimova, D.M. Teshaboyeva, M.A. Glazkova, O.A. Pentina, and A.D. Gavrilov are examined to highlight the function of expressiveness in contemporary media discourse. Particular attention is given to the role of expressive devices—metaphor, epithet, rhetorical question, inversion, and repetition—in shaping an influential communicative environment. As a result, the article substantiates that in informative genre texts, expressiveness functions as a stylistic mechanism that enhances communicative efficiency and activates both the emotional and cognitive reception of the reader.*

Key words: *expressiveness, informative genre, journalistic style, media text, impact, rhetorical devices, intention.*

Introduction

In modern stylistics, the communicative approach plays a central role in the study of text as a speech unit. The text is not merely regarded as a collection of grammatical and lexical structures but as a means of communication created by the speaker and directed toward the listener with a specific purpose. Within this framework, the meaning, style, and impact of a text are intrinsically linked to its social and pragmatic context. From this perspective, journalistic texts stand out for their strong emotional evaluation and persuasive power, both characteristic of the expressive function of language.

Methods and Materials

In such texts, the author's personal attitude, inner emotional state, and intention to influence the reader are clearly manifested. Emphasizing this scientific direction, G.N. Akimova notes:

"The elements of expressivity should be sought in those forms of written speech in which the purpose of exerting a pre-planned influence is embodied" [1].

In other words, journalistic discourse goes beyond simply transmitting information—it aims to evoke a particular thought, emotion, or attitude in the reader. This feature distinguishes publicistic writing as a style that often combines the liveliness, vividness, and appeal of spoken communication. Expressive devices in the text—metaphors, epithets, rhetorical questions, and amplifying constructions—strengthen the author's communicative intention and make interaction with the reader more effective.

D.M. Teshaboyeva, in her studies, interprets expressiveness not only as a stylistic device but also as a **semantic mechanism** that reflects culture and mentality. According to her, expressiveness in media texts is closely related to national mentality, social values, and cultural codes. Through such means, the text conveys the nation's worldview, moral consciousness, and collective emotional atmosphere [2]. Hence, expressiveness not only reveals the aesthetic potential of language but also mirrors the cultural mindset and the spiritual state of society.

Teshaboyeva regards expressiveness as the **core element** of stylistic and pragmatic functions in the informative genre. In her view, it is not limited to conveying information—it also determines the emotional tone, persuasiveness, and cultural positioning of the message. This approach enables media linguistics to treat expressiveness not only as a stylistic but also as a conceptual category, occupying a central place in the semantic, communicative, and cultural structure of media texts.

Results and Discussion

With the growing influence of mass media and communication technologies, linguists have increasingly focused on expressiveness in modern media discourse. Scientific research in this field

encompasses both the traditional forms of journalistic style—such as print newspapers and analytical articles (studied by M.A. Glazkova, A.V. Mikhalcheva, and O.A. Pentina)—and its modern manifestations in online media (examined by A.D. Gavrilov).

M.A. Glazkova emphasizes that in socio-political analytical articles, under the influence of extralinguistic factors, the persuasive function of speech often prevails over the informative one. In such texts, the primary goal is not merely to convey data but to form specific opinions, emotions, and attitudes in the reader [3].

Research indicates that in Russian and English socio-political texts, **rhetorical and expressive constructions**—such as inversion, zeugma, litotes, elliptical sentences, and rhetorical questions—are widely used. These stylistic means not only enhance the overall expressiveness of the text but also help realize the author's pragmatic intention—to shape the reader's perception and response.

Scholars have also noted that various types of **repetition**—lexical, semantic, and syntactic—play an essential role in maintaining textual coherence and semantic unity. The choice of repetition depends on the author's communicative goal. If the writer aims to emphasize an idea, create an emotional tone, or strengthen an impression, lexical or syntactic repetitions are used. If the goal is to deepen meaning and reinforce semantic connections between concepts, semantic repetitions become dominant.

Thus, repetition serves as a multifunctional stylistic tool in structuring the text and realizing the author's communicative intention.

O.A. Pentina, based on English-language materials, examines the expressive function of news discourse and its influence on readers. Her research analyzes reports on three major natural disasters to explore the expressive impact of media language [4]. According to Pentina, in the multimedia information environment, news texts do not merely transmit facts—they are structured through functional-semantic devices that evoke emotional reactions in readers. She identifies several key expressive constructions:

- **Lexical repetitions** — emphasizing and reinforcing meaning through the repeated use of specific words or units;
- **Segmentation and parcellation** — syntactic division that highlights separate components of thought;
- **Stylistic rhetorical devices** — such as anadiplosis, hyperbole, comparison, metaphor, and other tropes.

These tools play an active role in constructing the expressive perspective of news discourse. Through them, the author not only describes events but also shapes readers' emotions, attitudes, and interpretations. Such stylistic strategies make media texts more vivid, dynamic, and emotionally engaging.

Researchers have pointed out that expressiveness most often appears in the **strongest semantic positions** of the text—particularly in the **headlines**. A.D. Gavrilov, analyzing the headlines of Russian, Chuvash, and English print media and their online versions, highlights the use of expressive syntactic models—especially those conveying surprise and emotional emphasis. He considers expressiveness in headlines as a primary means of speech influence on the mass audience. In the digital environment, headlines not only present information but also attract attention, evoke emotion, and reflect the author's intention [5].

According to Gavrilov, expressive syntax—intensifying structures, exclamatory intonation, parcellation, inversion, and even punctuation—plays a key role in creating lively, impactful, and emotionally charged headlines. He concludes that such constructions "increase the level of expressivity of meaning and allow the author to achieve multiple communicative goals: to convey personal emotions, to shape the reader's perception of events, and to motivate the audience toward specific reactions or actions."

Conclusion

In recent years, scholarly interest in journalistic texts has increasingly focused on the phenomenon of **expressive syntax**. The high degree of expressiveness observed in contemporary

media discourse can be explained by the gradual deviation of such texts from traditional linguistic norms. In the media environment, journalistic language often departs from the rigid rules of the formal style, incorporating features typical of spoken language—liveliness, emotionality, and spontaneity.

This tendency reflects the genre's close connection with oral communication and its influence on the perception of mass audiences. Comparative studies show that the use of expressive syntactic constructions differs across languages—Russian, English, Uzbek, and others—depending on stylistic conventions and communicative traditions.

Overall, expressiveness in informative genre texts acts as a bridge between linguistic form and social meaning, ensuring that the language of media remains not only a tool of information but also a vehicle of cultural emotion and intellectual engagement.

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Rezyume: *Mazkur maqolada axboriy janrda ekspressivlikning o'rni va uning kommunikativ-funksional xususiyatlari har tomonlama tahlil qilinadi. Tadqiqotda publitsistik matnning ta'sirchanligi, emotsional ohangi va ishontirish kuchi tilning ekspressiv imkoniyatlari bilan bevosita bog'liqligi asoslab beriladi. Shuningdek, G.N. Akimova, D.M. Teshaboyeva, M.A. Glazkova, O.A. Pentina va A.D. Gavrilov kabi olimlarning nazariy yondashuvlari tahlil qilinib, ularning ilmiy qarashlari asosida zamonaviy media diskursda ekspressivlikning o'rni yoritiladi. Maqolada, ayniqsa, metafora, epitet, ritorik savol, inversiya va takror kabi ekspressiv vositalarning ta'sirchan kommunikativ muhitni shakllantirishdagi roli alohida e'tirof etiladi. Xulosa qilib aytganda, axboriy janr matnlarida ekspressivlik muloqot samaradorligini oshiruvchi hamda o'quvchining hissiy va aqliy qabulini faollashtiruvchi stilistik mexanizm sifatida namoyon bo'lishi ilmiy asosda isbotlanadi.*

Резюме: *В данной статье проводится всесторонний анализ роли экспрессивности и её коммуникативно-функциональных особенностей в информационном жанре. В исследовании раскрывается, что убедительность, эмоциональный тон и воздействие публицистических текстов напрямую связаны с экспрессивным потенциалом языка. Рассматриваются теоретические подходы таких учёных, как Г.Н. Акимова, Д.М. Тешабоева, М.А. Глазкова, О.А. Пентина и А.Д. Гаврилов, с целью выявления функций экспрессивности в современном медиадискурсе. Особое внимание уделяется роли экспрессивных средств — метафоры, эпитета, риторического вопроса, инверсии и повтора — в формировании эффективной коммуникативной среды. В результате обосновывается, что в текстах информационного жанра экспрессивность выступает как стилистический механизм, повышающий коммуникативную эффективность и активизирующий как эмоциональное, так и когнитивное восприятие читателя.*

Kalit so'zlar: *ekspressivlik, axboriy janr, publitsistik uslub, media matn, ta'sirchanlik, ritorik vositalar, kommunikativlik.*

Ключевые слова: *экспрессивность, информационный жанр, публицистический стиль, медиатекст, воздействие, риторические средства, интенция.*

WAYS OF PREPARING STUDENTS FOR ORGANIZING SPIRITUAL AND EDUCATIONAL ACTIVITIES

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Summary: *This article analyzes the role and importance of spiritual and educational activities organized in educational institutions in shaping students' spiritual and moral worldview. The effectiveness of such activities in forming the student's personality, fostering respect for national and universal values, and developing cultural and aesthetic perspectives is substantiated. The stages of planning, organizing, implementing, and evaluating spiritual and educational work, as well as the collaboration between teachers and students in this process, are examined. The article concludes with practical recommendations aimed at developing students' spiritual immunity, cultural behavior, and social responsibility.*

Keywords: *spiritual and educational upbringing, student personality, spiritual values, lessons of spirituality, cultural and aesthetic education, interactive methods.*

Strengthening the Spiritual World of Youth in the Era of Globalization

In today's process of globalization, strengthening the spiritual world of young people and educating them in the spirit of national ideology and patriotism is one of the main factors ensuring the stability of society. In the current conditions of rapidly developing information technologies, various ideological movements, Western lifestyles, and the growing culture of consumerism that directly and quickly influence the consciousness of youth require updating the content and methods of spiritual education.

From this point of view, the systematic organization of spiritual and educational activities in higher education institutions and the active involvement of students in this process serve as important factors in shaping their independent thinking, social activity, moral stance, and life values.

Students' preparedness for spiritual and educational activities not only enhances their personal responsibility, creativity, and initiative but also contributes to the formation of a healthy spiritual environment in society. This, in turn, strengthens the spiritual immunity of the younger generation and helps them develop a stable ideological position against various alien ideas. Therefore, studying this topic scientifically and developing practical recommendations is of great relevance.

In the large-scale reforms implemented by the President of the Republic of Uzbekistan, **Shavkat Mirziyoyev**, based on the principle of *"New Uzbekistan – New Spirituality"*, ensuring the spiritual maturity of young people has been defined as one of the priority directions of state policy. [1;45]

In particular, the following political and legal documents form the normative basis for this direction:

- Decisions on improving the activities of the "Center for Spirituality and Enlightenment";
- State programs on "Enhancing Youth Spirituality";
- The Concept for the Development of Education in the Republic of Uzbekistan (until 2030);
- The "Youth – Our Future" and "Youth Register" programs;
- Orders on improving spiritual and educational work in higher education institutions. [2;67]

These political directions are aimed at educating young people to become well-rounded individuals who think independently, are aware of their national identity, and actively participate in the development of society. Preparing students to organize spiritual and educational activities is a practical expression of these strategic tasks set by state policy.

Today, globalization, the speed of information flows, and the intensification of cultural and ideological processes directly affect the educational process. Especially, external ideological pressures, various ideological movements in cyberspace, and manifestations of mass culture that influence the minds of young people demand that they possess strong spiritual immunity. From this

perspective, organizing the spiritual and educational upbringing of students systematically and preparing them to organize educational events are among the most urgent issues of our time. [3;87]

Spiritual and educational upbringing is a continuous pedagogical process aimed at shaping an individual's inner world, consciousness, system of values, aesthetic taste, and cultural attitudes. It helps students develop an active life position in society. A student should not only be a passive recipient of knowledge but also become a **subject**—an organizer—of spiritual and educational activities. (Table 1)

Table 1

Psychological qualities explaining students' activeness in the spiritual and educational process

Psychological Quality	Explanation
Spiritual responsibility	The student's level of awareness of their duty and values toward society
Social activity	Initiative and participation in public or community activities
Communicative culture	The ability to communicate, exchange ideas, and listen to others within a group
Reflection	The ability to analyze one's own activity and draw conclusions

Thus, spiritual and educational activities are not only organizational processes but also systems of students' socio-psychological development. [4;112]

In the Republic of Uzbekistan, youth education has been defined as one of the priority directions of state policy, and the following documents constitute its legal foundation:

- **Law "On Education" (2020)**
- **Law "On State Youth Policy" (2016)**
- **The Concept for the Development of Education until 2030**
- **The principle "From National Revival to National Progress"**

These documents emphasize the necessity of enhancing the spiritual maturity of young people and educating them in the spirit of patriotism, social activity, and initiative. [5;124]

According to official statistical data as of 2024, there are more than **1.4 million students** in Uzbekistan, **64%** of young people use the Internet regularly, and **86%** are active on social networks. Over the past three years, the number of spiritual and educational events held in higher education institutions has increased by **2.3 times** (based on Ministry data). [6;90]

This indicates that the sources influencing the consciousness of young people have also intensified. Therefore, spiritual and educational work needs to be improved both methodologically and technologically. In this process, **interactive methods** such as *"Debate," "Brainstorming," "Master Class," "Role Play,"* and *"Extracurricular Discussion Circles"* increase effectiveness. [7;45]

Preparing students to organize spiritual and educational activities is the main means of nurturing them into culturally, morally, ideologically, and socially mature individuals. When this process is carried out systematically:

- Students develop **spiritual immunity**;
- **Respect for national values** is strengthened;
- **Creative thinking and initiative** are enhanced;
- A **stable spiritual environment** is formed within society.

Therefore, improving the spiritual and educational activities of higher education institutions should be carried out based on **modern pedagogical approaches** and **innovative technologies**. [8;54]

In the current process of globalization, preparing students to organize spiritual and educational activities is of particular importance. The growing external ideological pressures on young minds, the active spread of mass culture, and the rapid increase of information flows in cyberspace demonstrate the need to strengthen their spiritual world. Careful planning and effective organization of spiritual and educational events develop students' personal responsibility, creativity, moral conviction, social activity, and national self-awareness.

The following recommendations can be made to further develop the process of preparing students for organizing spiritual and educational activities:

- **Systematize** spiritual and educational work in educational institutions. Activities should not be spontaneous but continuous, planned, and scientifically-methodologically grounded.
- **Encourage student initiative.** Students should not only be participants but also idea authors, organizers, and evaluators of activities.
- **Use interactive and creative methods.** Debates, discussion circles, dramatized performances, "open forums," and role-playing sessions increase student engagement.
- **Effectively use digital information space.** Creating educational content, videos, podcasts, and blogs on social media platforms enhances youth interest.
- **Integrate local culture and national traditions** into activities to positively influence young people's national identity.

The research shows that university students can become not only performers of spiritual and educational activities but also their **active and creative organizers**. In this process, the **methodological preparedness of teachers**, the **role of educational institutions** in shaping a moral-spiritual environment, and **collaboration with cultural and artistic organizations** play crucial roles. Spiritual and educational activities are among the key factors influencing students' worldview, sense of patriotism, understanding of human values, and self-identification within society.

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Rezyume: *Mazkur maqolada talabalarning ma'naviy-ma'rifiy dunyoqarashini shakllantirish jarayonida ta'lim muassasalarida tashkil etiladigan ma'naviy-ma'rifiy tadbirlarning o'rni va ahamiyati tahlil qilinadi. Talabaning shaxs sifatida kamol topishi, milliy va umuminsoniy qadriyatlarga hurmat ruhida tarbiyalanishi, madaniy-estetik qarashlarini rivojlantirishda bunday tadbirlarning samaradorligi asoslab beriladi. Shuningdek, ma'naviy-ma'rifiy faoliyatni rejalashtirish, tashkil etish, amalga oshirish va baholash bosqichlari hamda ushbu jarayonda o'qituvchi va talabalarning o'zaro hamkorligi ko'rsatib o'tiladi. va madaniy xulq me'yorlarini shakllantirishga qaratilgan amaliy tavsiyalar berilgan.*

Резюме: *В данной статье анализируется роль и значение духовно-просветительских мероприятий, проводимых в образовательных учреждениях в процессе формирования духовно-нравственного мировоззрения студентов. Обоснована эффективность таких мероприятий в становлении студента как личности, воспитании уважения к национальным и общечеловеческим ценностям, развитии его культурно-эстетических взглядов. Также рассмотрены этапы планирования, организации, реализации и оценивания духовно-просветительской деятельности, а также сотрудничество преподавателей и студентов в данном процессе. В завершение приводятся практические рекомендации, направленные на формирование духовного иммунитета, культурного поведения и социальной активности студентов.*

Kalit so‘zlar: *ma’naviy-ma’rifiy tarbiya, talaba shaxsi, ma’naviy qadriyatlar, ma’naviyat darslari, madaniy-estetik tarbiya, interfaol metodlar*

Ключевые слова: *духовно-просветительское воспитание, личность студента, духовные ценности, уроки духовности, культурно-эстетическое воспитание, интерактивные методы*

DIRECTIONS FOR IMPROVING THE EFFICIENCY OF THE USE OF LABOR RESOURCES IN RURAL AREAS (ON THE EXAMPLE OF THE REPUBLIC OF KARAKALPAKSTAN)

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Summary: *This article examines the possibilities and significance of increasing the population's income through utilizing the labor potential of the rural population. It analyzes the opportunities for employing innovative approaches to ensure employment in rural areas. The article also develops prospective forecast indicators for the utilization of labor resources in rural regions.*

Key words*: rural labor resources, labor efficiency, employment, agriculture, rural development*

1. Introduction. Rural areas are an important component of the economy in many countries of the world. The rural population mainly works in agriculture, animal husbandry, fish farming, and other natural resource processing sectors. However, many rural areas have problems such as low incomes, high unemployment rates, and underutilization of labor potential. This section discusses the possibilities of increasing the income of rural residents through the effective use of their labor potential.

The Decree of the President of the Republic of Uzbekistan dated February 7, 2017 No. UP-4947 "On the Action Strategy for the Further Development of the Republic of Uzbekistan" was adopted, and the State Program for the implementation of the Action Strategy on five priority areas of development of the Republic of Uzbekistan in 2017-2021 in the "Year of Dialogue with the People and Human Interests" was approved. In the fourth direction of this Strategy of Actions, entitled "Development of the Social Sphere," the Programs for the Comprehensive Development of Territories, approved by the chambers of the Oliy Majlis of the Republic of Uzbekistan, are defined. In order to ensure the unconditional implementation of the Employment Program, the issue of strengthening the activities of regional, district, and city khokimiyats for the development of industry (5440 projects with 131 thousand jobs), agriculture (55.8 thousand jobs in 8430 projects), and the service sector (11 thousand projects with 69.5 thousand jobs) is envisaged.

2. Materials and Methods

In this work, methods such as economic analysis, abstract thinking, graphics, questionnaires, monographic observation and expert assessment, inductive analysis, deductive analysis, economic analysis, statistical analysis, regression-correlation analysis, and forecasting were used.

In order to assess the changes in the above-mentioned problems in the future period, the forecast values of a number of indicators were considered. One of the main problems is the change in the rural population. Positive and sufficiently high rates of population growth in rural areas contribute to an increase in labor resources and the number of economically active population. This, in turn, serves to increase the relevance of the above-mentioned problems.

3. Results

To determine the change in the rural population of the Republic of Karakalpakstan over the next five years, we will consider the forecast values. Due to the fact that the data are presented as of January 1, statistical data for 2010-2025 were used. Initially, the results of the graph were considered, and it was determined that the use of a trend model for forecasting is the most optimal option due to the uniform growth of the rural population.

$$QA=804.9+14.6*time \quad (5)$$

where,QA - rural population of the Republic of Karakalpakstan (thousand people); time - represents a trend and starts from 2010.

To justify the adequacy of the determined coefficients, the results of the Student's t-test are presented, and it can be observed that the table value is 2.15, while the given values are greater. At the same time, the coefficient of determination equal to 0.99 shows that the rural population changes

at the same rate depending on time, in other words, the time factor fully covers the changes in the resulting factor. The fact that the value determined by the Fisher criterion is equal to 4916.4 indicates that there is no need to refer to the table value. The probability indicator determined by this criterion serves as confirmation of our opinion. The result of the Durbin-Watson criterion, equal to 1.9, justifies the absence of the need to cite the table values (Table 1).

Table 1

Results of the developed trend model for calculating the forecast values of the rural population of the Republic of Karakalpakstan

Model 2: OLS, using observations 2010-2025 (T = 16)
Dependent variable: QA

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
Const	804.900	2.02083	398.3	<0.0001	***
Time	14.6537	0.208989	70.12	<0.0001	***

Mean dependent var	929.4562	S.D. dependent var	69.86472
Sum squared resid	207.8998	S.E. of regression	3.853568
R-squared	0.997160	Adjusted R-squared	0.996958
F(1, 14)	4916.388	P-value(F)	3.12e-19
Log-likelihood	−43.21876	Akaike criterion	90.43751
Schwarz criterion	91.98269	Hannan-Quinn	90.51664
Rho	−0.112110	Durbin-Watson	1.926391

The MAPE value of 0.27 indicates that the model's compliance with actual indicators is almost 100%. This means that the development of forecast values based on this model is scientifically based. Therefore, we present the forecast results developed on the basis of the model (Table 2).

Table 2

Forecast values of the rural population of the Republic of Karakalpakstan, calculated using the trend model

For 95% confidence intervals, t(14, 0.025) = 2.145

Years	**Prognosis**	**Growing rate**	**Standard Error**	**Interval of 95%**
2025	1054,0	101,4	4,4	(1044,68, 1063,35)
2026	1068,7	101,4	4,4	(1059,14, 1078,19)
2027	1083,3	101,4	4,5	(1073,59, 1093,05)
2028	1098,0	101,4	4,6	(1088,02, 1107,93)
2029	1112,6	101,3	4,8	(1102,43, 1122,82)

The forecast results show that stable growth rates of the rural population in the Republic of Karakalpakstan will continue. In particular, the average growth rate over the next five years is 1.4 percent, which indicates a 7% increase in the rural population.

4. Discussion

According to the results of the analysis carried out on the basis of the graph, it was established that the change in the number of labor resources in rural areas in the region is unstable compared to the change in the population. At the same time, a relative decrease in their growth rates is observed

in subsequent periods. In general, it can be seen that it is advisable to use the trend model, which has a growth trend.

5. Conclusion

In conclusion, the low growth rate of the number of labor resources relative to the population in rural areas leads to a decrease in their share. This is, of course, associated with an increase in the level of urbanization. Because part of the labor resources move to urban areas in search of work. However, the high growth rates of the economically active population indicate that this problem will be eliminated in the coming years. In our opinion, the establishment of deep processing of products grown in rural areas will solve the problem of efficient use of labor resources in rural areas and ensuring their employment.

Based on the possibilities of increasing the population's income through the use of the labor potential of the rural population, the following important directions for increasing employment can be identified:

- firstly, the expansion of paid public works;
- secondly, vocational training, retraining and advanced training;
- thirdly, ensuring the labor rights of workers;
- Fourthly, it is necessary to pay more attention to categories of the population with low competitiveness in the labor market.

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USING DIGITAL LEARNING ENVIRONMENTS IN THE EDUCATIONAL PROCESS

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Summary: *The article deals with the tasks of organizing a digital educational environment in the educational process in terms of its advantages over traditional teaching methods.*
Key words: *digital, service, cloud technology, environment, tools.*

INTRODUCTION

After studying the main functional and pedagogical features of cloud services, the question arises of developing a digital learning environment (DLE) for teachers and choosing the most suitable one for effective work in it.

So far, there is no single definition of a digital learning environment.

In general, space is understood as "a fundamental concept in human thinking, reflecting the multiplicity and heterogeneity of the existence of the world." [7]

The degree of study of the topic.

E.O. Ivanova considers the information and educational space as "an indivisible unity that provides subjects with information, means of its storage and production, methods and techniques of work, as well as information for educational purposes."[5]

In this space of educational activity, the main thing is the relationship between two purposeful activities - teaching and learning, defined as follows "This relationship organizes the entire system of didactic relations and their concrete manifestation in the learning process."[6]

In these didactic relations, according to Ya.M. Riihelainen, digital teaching aids are increasingly interfering. "The classical didactic relationship teacher - material - student is expanding at the expense of the educational environment of the school, society and the world" [1].

The educational environment is increasingly acquiring signs of digitalization, thereby integrating value, motivational, emotional and reflexive mechanisms for the formation of the subject of education. Therefore, many authors consider the digital educational environment as a result of the transformation of education in the process of informatization [2].

Speaking about the content of the environment itself, O.P. Zhigalova presents it as a set of conditions focused on the development of the student's ability to function in conditions of multilevel interaction [3].

It should be noted that many authors seek to highlight the main goals of creating and using DLE in educational institutions. So, for example, A.E. Ibraimov believes that distance learning works best as one of the aspects that should be integrated into parallel learning [4]. Such goals include, for example, the creation of individual educational trajectories for students, the ability to access the latest educational resources and platforms, and the expansion of the boundaries of educational organizations to a global scale.

CONCLUSION

The analysis shows that the Google Drive cloud service is most suitable for teachers to create a DLE. The service offers a range of free tools (eg Google Docs, Google Classes, Google Forms) and has low barriers to entry, making it accessible to educators. Another advantage of this service is that Google Drive allows you to modify the platform in accordance with the educational program of a particular educational institution. The difference from traditional platforms is that Google Drive functions can be used to solve practical problems.

For example, Google Classroom allows educators to create courses that practice their own methodologies. Here they can publish learning materials, organize online and offline collaboration, and evaluate their work automatically or manually.

It is important to understand the differences between Google tools and use them appropriately in the classroom; Google tools are varied and versatile. For example, in Google Docs, you can work individually or do collaborative projects that only the owner of the document has access to.

Information tasks and Google tools that help you perform these tasks can be seen in the following table as an example.

Information Tasks and Google Tools

Tasks	**Tools**
Storage of documents, audio, video and photographic materials, data transfer	Google Drive, Google Photos, Embedded Google Mail, Embedded YouTube Video Hosting, Embedded ZIP Extractor
Create text, voice and graphic reminders	Google Keep, Google Calendar
Organization of individual work	Google Docs, Google Sheets, Google Slides.
Organization of project work	Google Slides, Google Docs, Google Sheets, Google Classroom
Provision of information, creation of information platforms	Google Classroom, Google Site
Data collection	Google Forms
Social media communications and blogging	Google Blogger, Google Chat, Google Meet, Google Duo, Google Jamboard
Information sources	Google Search, Google News, Google Podcasts

Thus, Google Cloud has on its platform a number of universal tools for solving a variety of educational tasks. These tools allow you to exchange email, access the world's largest video hosting service, create and edit documents, share information with colleagues and students, work remotely with each other on the same projects, and create your own information platform and educational environment.

Nowadays, almost all subjects are studied using modern computer technology. Computer technologies make it possible not only to perform complex calculations, but also to use global networks. The development of computer technology has contributed to the creation of numerous application software products that are used or can be used in the educational process. It is not uncommon for teachers to have special software for the courses they teach but are unable to install it due to the type of computer equipment installed in the classroom.

The use of cloud computing to a greater or lesser extent solves this problem. Most classrooms in educational institutions use local area networks, which provide access to the corporate network of the educational institution (with access to a private cloud, if one has been created), as well as to the Internet (with access to public cloud and hybrid cloud resources). The benefits of cloud computing include:

The benefits of cloud computing include

- interaction and collaboration with colleagues regardless of their location - creation of web laboratories in specific subject areas (for example, mechanisms for adding new resources, interactive access to modeling tools and information resources, user support, etc.)
- Implementation of various forms of monitoring
- Migration of used learning management systems (LMS) to the cloud;
- New opportunities for researchers to organize access, develop and disseminate applied models.

Providing students with a virtual machine in the cloud abstracts the resource capabilities of the computer from which they connect to the virtual machine using Remote Desktop Protocol (RDP). Even if the computer is not up to date, it has enough power to display remote desktop.

Here are some tasks specific to the educational process that can be solved using server virtualization technology

1. Providing students with access to computer resources outside of school hours
2. student access to one or more virtual computers with administrator rights
3. the ability for students to stop and save the state of their virtual machines, making the learning process more flexible
4. offer students studying computer science, extensive programs of modern

educational institutions, including the study of various operating systems and application software.

CONCLUSION

The opportunities presented by DLE, when properly used, can significantly improve the efficiency of the educational process by reducing mechanical operations, optimizing the interaction between the teacher and the student, as well as using cloud service applications.

At the same time, when considering the possibility of using cloud solutions in the educational process, one should keep in mind the difficulties of their implementation, as well as the existing shortcomings. Teachers of the discipline, in which students study, may not have sufficient qualifications to manage cloud resources as part of the task of organizing the educational process. They have to rely on a network connection and back up important information to local computers or portable media. You can trust the cloud only with data that can be disposed of retroactively.

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Rezyume: *Maqolada an'anaviy o'qitish usullariga nisbatan afzalliklari nuqtai nazaridan ta'lim jarayonida raqamli ta'lim muhitini tashkil etish vazifalari ko'rib chiqiladi.*

Резюме: *В статье рассматриваются задачи организации цифровой образовательной среды в образовательном процессе с точки зрения ее преимуществ перед традиционными методами обучения.*

Kalit so‘zlar: *raqamli, xizmat ko'rsatish, bulut texnologiyasi, atrof-muhit, asboblar.*

Ключевые слова: *цифровые технологии, сервис, облачные технологии, среда, инструменты.*

ANALYSIS OF ORTHODOX RELATIONS TOWARDS WOMEN IN ISLAMIC PHILOSOPHY

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Summary: *This article discusses the spiritual heritage of a number of prominent representatives of classical Eastern philosophy, their mystical and mystical views. The issue of orthodox attitudes towards women in Islamic philosophy and the Muslim world is analyzed from a socio-philosophical perspective. Also, orthodox approaches to the rights of women, their value and status in Islam are scientifically and theoretically illuminated.*

Key words: *oriental education, Islamic philosophy, orthodoxy, feminism, mysticism, gnosis, enlightenment, orifa, love.*

INTRODUCTION

As a result of the development of Eastern philosophy, a number of Sufi poets and philosophers have emerged. Their masterpieces and rich scientific heritage are valued as the intellectual property of humanity both in their time and today. In our country, special attention is paid to such issues as studying the scientific heritage of our great ancestors, paying tribute to the personality and work of scholars. As our President Sh.Mirziyoyev noted: “It is known that our region, first of all, the land of today’s Uzbekistan, is one of the ancient cradles of Islamic science and culture. Together with respected scholars, imams-khatibs, and representatives of the public, we must continue the work we have begun to study and promote the history of our religion, the heritage of our great scholars and saints”. [7.-P.76-77.]

LITERATURE ANALYSIS

As we get to know the spiritual heritage of a number of mature representatives of classical Eastern philosophy, their mystical and mystical views, we can get acquainted with the figures of a number of noble women who became famous for their asceticism and piety, their dedication to knowledge and enlightenment, and their upbringing of children. In fact, in the holy hadiths, it is said: “Fear Allah, for you have received them as a trust from Allah”. In the Avesta: “On the first day, Ahuramazda commanded women: O woman! I created you to create men of faith and courage, and to nurture you in your loving embrace. So that they may eradicate the root of injustice and impurity from the face of the Earth”, [2. P.76-77.] The lines are quoted. A woman is a great gift from the Creator, she is a mother, a wife, a sister, and an active member of society. If we look back, we can see that women were looked down upon, even considered devils. “During the era of ignorance, the polytheists were ashamed of their female children and buried them alive. Medieval Europe declared: “Poison, sword, death are better than a woman, because she is a servant of the devil.” Some peoples burned a woman with her dead husband in a fire along with her corpse. The lustful, who did not recognize the spirit and were greedy for material things, turned a woman into a toy, a game for entertainment”. [1.-P.18.] Also, in ancient India, women were completely deprived of the right to inherit, while the Sumerians threw women who wanted to break their marriage into the river, that is, in Babylon, the right to conclude and break marriage was given only to men. And the ancient Chinese, according to sources, were even ashamed to give women names.

In Islam, women’s rights, their value and status are treated in an orthodox manner. Islam has promoted feminist views on women and has firmly rejected contrasting ideas such as humiliation and discrimination against women. Sharia law also strictly defines women’s rights and freedoms, as well as their rights in property and legal relations. To this day, some Muslim countries prohibit women from acquiring secular knowledge and actively participating in the social life of society. In fact, women are more responsible for raising children, so the more educated, skilled and intelligent they are, the more spiritually mature the children growing up in that family will be. The Arab scholar Olimat al-Banot writes in his famous book “Etiquette of Intercourse”: “Half of the people in the world

are women. The happiness and well-being of the family also depends on the intelligence and knowledge of the women. Women raise well-mannered children.

RESEARCH METHODOLOGY

It is inevitable that great people will grow up in the world through their upbringing.

"If a woman is educated, she knows without a doubt who she is and what her role is. She will raise her children well, treat her husband well, and ultimately live her life in accordance with the command of Allah Almighty. And because of this, she, her husband, and her children will be happy in this world and the Hereafter". [5.-P.6.] A woman should study in the field she wants and is interested in, acquire a profession, and make her worthy contribution to the prosperity of society. After all, the Holy Quran states: "Men will have a share from their work, and women will have a share from their work" [6.-5:32.] blessed. Because it is the personal right of every person to acquire a profession or trade, to work and to earn a halal livelihood from it.

In Islam, women are treated with great respect and attention. The use of the word woman in thirty-five surahs and one hundred and two verses of the Holy Quran, and the fact that one of the surahs is called "Nisa", that is, "Women", serves as an important source in the formation of orthodox views on women in the Muslim world.

There are a number of hadiths narrated from the Prophet (peace and blessings of Allah be upon him) about respecting and showing respect to women. For example, it is narrated from Abu Hurayrah (may Allah be pleased with him) that a man came to the Prophet (peace and blessings of Allah be upon him) and asked: "O Messenger of Allah! Which of the people is most deserving of my good treatment?" The Prophet (peace and blessings of Allah be upon him) said: "Your mother." He said: "Who is next?" He said: "Your mother." He said: "Who is next?" He said: "Your father".

ANALYSIS AND RESULTS

Islam has changed society and given women many opportunities. It has prohibited violence, discrimination, and restrictions on their rights. Another important aspect of the rights granted to women in Islam is their participation in education and science. Islamic culture and traditions support education and active engagement in science. The following sentences are found in the authentic hadiths quoted from Imam Bukhari: "Seeking knowledge is obligatory upon every Muslim, male and female". In Islam, women have wide opportunities and rights in obtaining education. Examples of such women include famous scientists and philosophers such as Alisia Al-Hannu or Fatima al-Fihri, who lived in the 9th and 10 th centuries. Alisia Al-Hannu was a mathematician and astronomer, and also developed a calendar that was used in the Islamic world until the beginning of the 20th century. Fatima al-Fihri was the founder of the University of Fez, which is still one of the leading educational institutions in the Muslim world. Even in today's modern world, many Muslim women have higher education and are successfully working in various fields such as politics, business, medicine, and law. They play an important role in the development of Muslim societies and economies, and their contributions to various aspects of life cannot be ignored.

Among the reforms being carried out in our country today, a number of works are being carried out to care for women, pay attention to the health of mothers and children, and strengthen the position of women in society. As our President Sh.Mirziyoyev noted: "We are always indebted to our respected mothers, our respected women. Therefore, a special place in our program is to alleviate the burden of our women and sisters, who carry the heavy burden of life on their delicate shoulders, faithfully fulfill both family chores and social duties, and always live with gratitude". [4.-P.101.] Also, the First President of the Republic of Uzbekistan, I.Karimov, especially recognizing the role of women in the development of society and the well-being of the family, said: "There is nothing small for us in terms of easing the living conditions of our women and there will never be one. If a woman is in a good mood, if she is satisfied with life, the family will be satisfied with life. If the family is satisfied, the neighborhood, the whole nation will be satisfied".

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Rezyume: *Ushbu maqolada klassik Sharq falsafasining bir qator taniqli vakillarining ma'naviy merosi, ularning mistik va tasavvufiy qarashlari muhokama qilinadi. Islom falsafasi va musulmon dunyosida ayollarga nisbatan munosabat masalasi ijtimoiy-falsafiy nuqtai nazardan tahlil qilinadi. Shuningdek, ayollar huquqlari, ularning Islomdagi qadriyatlari va mavqeiga pravoslav yondashuvlar ilmiy va nazariy jihatdan yoritilgan.*

Kalit so'zlar: *sharq ta'limi, islom falsafasi, pravoslavlik, feminizm, tasavvuf, gnosis, ma'rifat, orifa, sevgi.*

SEMANTIC FEATURES OF THE ENGLISH ASPECT SYSTEM: A COMPARATIVE ANALYSIS

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Summary: *This article investigates the semantic characteristics of the four primary aspects in English grammar: simple, progressive, perfect, and perfect progressive. It applies a qualitative and comparative method to explore how each aspect expresses internal temporal meanings such as duration, habituality, completeness, and relevance in discourse. Drawing on examples and definitions from major grammar references – such as The Cambridge Grammar of English, The Oxford English Grammar, and Longman Grammar of Spoken and Written English – and supported by theoretical insights from Blokh, Barkhudarov, Comrie, Quirk, and Yule, the study provides a structural and functional overview of aspect. Sample sentences are analyzed across past, present, and future tenses to demonstrate how meaning shifts depending on the aspectual form. The findings highlight both similarities and distinctions among the four aspects, emphasizing their role in shaping how events and actions are temporally understood in English. The study aims to deepen the understanding of aspect as a key grammatical and semantic category.*

Key words: *category, aspect, simple, progressive, perfect, perfect progressive, tense.*

INTRODUCTION. A *grammatical category* is a class of units – such as nouns, verbs, or their features like number and case – that share a common set of formal or functional properties. These categories form the foundation of linguistic structure, shaping how meaning is constructed and conveyed. However, as R.L. Trask (1993) notes, the notion of "category" in linguistics is so fluid that "no general definition is possible; in practice, a category is simply any class of related grammatical objects which someone wants to consider." One such grammatical category that challenges both theoretical linguists and language learners alike is *aspect*.

In English, aspect is a grammatical category which reflects how an action, event or state unfolds in time. Unlike tense, that defines the time of the action or places it within the time frames (past, present, future), aspect provides information about the internal temporal structure of the event, whether it is completed, ongoing, habitual, repeated or still in progress. These differences are important for accurate communication and to acquire nuanced expression in both written and spoken English.

The English verb system expresses both tense and aspect to locate actions in time and show their internal structure. While tense relates to the *when*, aspect refers to the *how* – how the action unfolds or extends over time. This article focuses on the semantic dimension of the four primary aspects in English: simple, progressive, perfect, and perfect progressive. It explores how each aspect contributes meaning about duration, completeness, repetition, and temporal relevance, as described in major grammar references and scholarly works. Understanding these distinctions is essential for a deeper comprehension of English verbal behavior and event representation.

The notion of aspect has been described using different categories and terminologies in most of English grammar books. According to Cambridge Grammar of English (Carter & McCarthy): "Aspect refers to the speaker's/writer's perspective on the time of an event. In English, aspect is concerned mainly with how the speaker perceives the duration of events, and how different events relate to one another in time." (p. 411) The book categorizes aspect into two: progressive (continuous) aspect and perfect aspect. The Oxford English Grammar also divides the same two aspect types and describes that "aspect refers primarily to the way that the time of the situation is regarded rather than its location in time in absolute terms. The aspects are expressed by a combination of an auxiliary and a following verb". (p. 253) On the other hand, Longman Grammar of Spoken and Written English focuses on more than two aspects, includes four aspects:

simple (unmarked), perfect, progressive and perfect progressive. The book further defines aspect in relation to the completion or lack of completion of events or states described by a verb." (p. 460)

METHODS. This study adopts a qualitative and comparative approach to analyze the semantic features of the four primary aspects in English language: simple, progressive, perfect and perfect progressive. The analysis is based on the examples from major grammar references, such as "The Cambridge Grammar of English" (Carter & McCarthy, 2006), "The Oxford English Grammar" (Greenbaum, 1996), and "Longman Grammar of Spoken and Written English" (Biber et al., 1999). Theoretical descriptions and comparisons are supported by the works of prominent scholars, including Blokh, Barkhudarov, and Quirk et al., Comrie and Yule.

The main goal is to identify how each aspect conveys internal and temporal meanings (duration, habituality, completion and temporal relevance) through distinct structural patterns. Additionally, the study aims to clarify similarities and unique semantic features and to highlight how aspect choice affects the interpretation of actions and events in the context.

The study involves structural breakdown of aspectual forms across tenses (past, present, future).

Example sentences were selected from both grammar books to reflect common and illustrative uses of each aspect. Furthermore, the study entails semantic interpretation of each aspect and how meaning can be altered by usage of these aspectual forms. A comparative analysis was conducted across the four aspects to identify patterns in their usage and the meanings they convey. This approach allows the study to uncover semantic and structural distinctive features of all aspects.

RESULTS. Classification of aspect has been a topic of discussion among linguists for less than a century. Blokh (1983) approaches aspect in terms of two categories: perfective and imperfective aspects. The perfective aspect expresses completed actions, while imperfective describes actions that are still in progress or habitual. Barkhudarov (1975) also distinguished in the same way, focusing on the relationship between actions and time. Swan (2005) focuses primarily on the progressive and perfect aspects and adds the distinction of future aspect. In his classification, progressive aspect reflects the action in progress, perfect aspect represents completion with relevance to the present (e.g. He has studied) and future aspect expresses actions in the future with the auxiliary verb "will" (e.g. She will read). Quirk and his colleagues categorize three major aspects in English grammar: progressive, perfect and perfect progressive, which refers to ongoing and completed actions indicating both duration and relevance (e.g. We have been walking). The extended classification of aspect provided by Biber and his colleagues: simple (indefinite), progressive (continuous), perfect and perfect progressive. Nowadays, these four aspect types are widely recognized and consistently described in most authoritative English grammar books.

The Simple Aspect. Each aspect in English grammar has a distinct structure and conveys meanings that others cannot fully represent. Simple (or indefinite) aspect is the most basic and structurally straightforward. This aspect is built on the auxiliary verbs "do" (present/past), "be" (mainly for passive and other construction) and "will" (for future). The structure in affirmative sentences is mostly unmarked, except in third person and future:

1) Past Simple: $S + V_{2/-ed}$

Used for all persons in the past tense, defining habitual or once-happened actions. Moreover, simple aspect in the past tense is widely used in storytelling, making it easy to follow and understandable for the listeners by avoiding complex structures.

e.g. I watched a movie. / They had a dinner together.

2) Present Simple: $S + V_{(-s)}$

Used in the present tense for first, second, and third plural persons. This aspect expresses habitual, general or factual features of sentence.

e.g. I read a book. / You play football. / She speaks English.

4) Future Simple: S + will + V

Used to express planned arrangement or possible actions in the future.

e.g. She will go to the library. / They will sign a contract.

These examples demonstrate the simple aspect's role in expressing general or habitual actions. The focus is not on when the action happened or whether it is completed, but on its timeless or regular nature in all three tenses.

The Progressive Aspect. The progressive aspect, also referred to as the continuous aspect, is used to describe ongoing actions, temporary actions and actions that are in progress at a specific period or time. Structurally, the progressive aspect is formed using the auxiliary verb "be" followed by present participle (verb + -ing). This structure is applied to all tenses by changing the auxiliary verb according to the tense of the sentence.

1)Present Progressive: S + am/is/are + V_{-ing}

This form is used for the ongoing action that is occurring currently.

e.g. I am eating pizza. / She is reading a book.

2)Past Progressive: S + was/were + V_{-ing}

This structure is for the action within the specific period in the past

e.g. He was writing a letter. / We were cleaning the house.

3)Future Progressive: S + will + be + V_{-ing}

This form expresses probable continuous action or process in a certain frame of period in the future.

e.g. I will be drawing my project work from art. / You will be travelling to Italy.

All the given structures highlight the continuous and incomplete nature of the action relative to a specific moment in time. When it comes to its semantic meaning, it emphasizes duration, incompleteness or temporariness of an action or situation. The action always unfolds at a particular moment and mostly carries implications, like background action, change in progress or emotional involvement. According to Carter and McCarthy (2006) the progressive delivers a sense of limited duration of time and sometimes emotional coloring, which reveal dynamic feature of progressive distinguishing it from the more static aspect. Progressive aspect reflects a dynamic perspective of an event and focuses on the process rather than the result (Barkhudarov. 1971).

The Perfect aspect. The perfect aspect in English Grammar relates the past action to later point in the past, present or future, emphasizing the connection between the time of the action and its result or relevance. The perfect aspect that it reflects current-relevant past actions or a connection between the past and present (Quirk et al.1985). It is formed with the help of auxiliary verb have and past participle form of the verb. The structure is adjusted accordingly to the tense:

1)Past Perfect: S + had +$V_{3/-ed}$

Perfect aspect in the past tense is used for the expression of an action which has already started before the stated past time and the result or completion is perceived in the past.

e.g. She had done her homework, when her mother came. / We had entered the building before 10 a.m.

2) Present Perfect: S + have/has + $V_{3/-ed}$

The aspect of perfect in the present simple is much more understandable rather than other types as it is logically relevant to everyday life events. This perfect explains actions launched in the past and have results in the present.

e.g. He has passed the English exam. / They have lost their keys.

3) Future Perfect: S + will + have + $V_{3/-ed}$

Perfect aspect in the future tense is more complicated and error-prone structure for second language learners due to its semantic complexity and misinterpreting the meaning. This structure represents the beginning of the initial action in the future and its result or completion before the second stated action or specifically mentioned time in the future.

e.g. You will have eaten all the chocolates by the time I give you another.

I will have submitted my project work on December 28.

The Perfect Progressive aspect. The perfect progressive aspect combines both perfect and progressive aspect features to express an action that was ongoing over a period of time and

relevant to another point in time. Yule (2010) explains that this aspect explains how long the action was happening before a specific time or another event. This makes it particularly useful in narrative and descriptive contexts where continuum and time are significant. This aspect is formed with the auxiliary verbs “have” and “been” followed by present participle:

1) Past Perfect Progressive: S + had been + V_{-ing}

The perfect progressive in the past tense reflects two actions in the past, in which the first started before and continued by the time the second started or specific given moment or time. The latter is used in the perfect progressive form while the former is structured in the simple past tense.

e.g. I had been cleaning the house by the time you came.

We had been doing the homework.

2) Present Perfect Progressive: S + have been + V_{-ing}

In present perfect progressive the first action also has started in the past but from then the process is continuing and the result has not released yet.

e.g. She has been studying German since January.

Jack and Ann have been attending violin lessons for three months.

3) Future Perfect Progressive: S + will + have been + V_{-ing}

Perfect progressive in the future tense explains an ongoing process which starts in the future and continues by the time the second actions starts or specific time.

e.g. He will have been reading this book by the time you arrive.

I will have been checking essays by the time you come to use.

Among the various aspectual forms, the Perfect and Perfect Progressive aspects are especially complex due to their abstract temporal and interpretive meanings – often signaling result, duration, or continuity in relation to another time point. These subtle semantic features, coupled with their formal structures, make them among the hardest part for second language learners.

DISCUSSION AND CONCLUSION. This paper set out to analyze the semantic features encoded by the four grammatical aspects in English: simple, progressive, perfect, and perfect progressive. The goal was to explore how each aspect represents different temporal perspectives, such as duration, completion, repetition, and relevance.

The simple aspect semantically denotes events that are habitual, timeless, general or factual. It does not convey information about the internal duration or completion of the event, but instead focuses on the occurrence as a whole. For example, in the sentence I study math at school, the verb expresses general truth or repeated action without time boundaries. Some adverbs are used to emphasize repeated or regular occurences: usually, always, often (e.g. I always go to park on Sundays). According to Biber et al. (1999), the simple aspect is neutral in regard to the temporal flow of an event and often presents actions as punctual or regular occurrences. Additionally, besides the abovementioned meanings of the aspect, sports commenting and scheduling are also expressed in simple aspect. This provides clarity, immediacy and effectiveness during the process and helps to avoid misinterpretation of long and complex grammar structures. For instance, "He shoots… he scores!". Semantically, it is the default aspect and contrasts with the marked aspects that encode additional temporal or durative information.

The progressive aspect indicates that an action is ongoing at a particular moment and typically not completed. It possesses a dynamic sense of incompleteness, temporariness and subjective involvement. Adverbs “now”, “at the/that moment” and “currently” express that the action is in progress at the reference time. For instance, I am reading now, in this sentence the verb is occurring now and still in progress. The progressive also adds emotional or attitudinal coloring to the utterance, especially when combined with adverbials (e.g., She is always losing her keys conveys mild irritation) Carter and McCarthy. 2006). Barkhudarov (1971) argues that the progressive aspect introduces a processual perspective, foregrounding the internal phase of the event rather than its endpoint, which means the ongoing feature of the event is more significant than the start or the end. As an example, she was writing a letter, in this sentence the attention is

on her writing process not on the beginning or the ending of it. The progressive is essential for expressing actions in development, temporal framing, or narrative backgrounding.

Semantically, the perfect aspect in English serves to establish a temporal relationship between a past event and a subsequent reference point – most often the present. It does not merely express that an action occurred in the past; rather, it emphasizes that the outcome or relevance of that action continues to affect the present moment. This aspect introduces layers of meaning beyond simple past narration, making it a crucial grammatical tool for expressing result, experiential relevance, and recent completion. For instance, in the sentence *We have finished the project*, the perfect aspect signals that the action began in the past, reached completion, and now has significance in the current context – perhaps the project is now ready for submission or review. The present relevance of the completed action is a key semantic feature of the perfect that distinguishes it from the simple past, which merely situates an action at a prior point in time without implying any current consequence. According to Quirk et al. (1985), the simple past generally reflects occurrence or habitualness, offering no implication of the event's impact on the present.

Comrie (1976) similarly explains that the perfect aspect functions to relate a past situation to a present state, emphasizing either its result or its continuing relevance. For example, in *He has broken his leg*, the speaker is not only referring to the breaking event in the past but is also highlighting its present consequence – namely, that his leg remains broken. The emphasis lies on the aftermath of the action and how it continues to influence the current state of affairs. This feature of the perfect aspect provides speakers with a means to indicate that a past event is not isolated but instead connected to the ongoing temporal flow of discourse.

In addition to resultative meaning, the perfect aspect also captures experiential relevance. This use is illustrated in a sentence such as *I have travelled to Paris*, where the temporal location of the event is unspecified and irrelevant. The focus is not on when the experience took place, but on the fact that it happened at some point prior to the present. The sentence implies that the speaker possesses a particular kind of experience or knowledge based on that action, which may now be relevant in conversation or decision-making. Thus, the perfect aspect adds semantic depth, allowing speakers to express nuances of time, experience, and consequence that would otherwise be unavailable through more basic verb forms. It allows past actions to be represented as meaningfully bound to the present moment, thereby enriching communicative precision.

The perfect progressive aspect, on the other hand, is a composite structure that combines semantic elements from both the perfect and the progressive aspects. It is used to denote an action that began before a reference point (again, usually the present) and continued up to it, often with a strong emphasis on duration and ongoing process. A sentence such as *He has been working all day* conveys that the action started in the past, persisted over a stretch of time, and is still relevant now – perhaps because he is tired, still working, or has just finished. This aspect allows the speaker to express not only the temporal span of an activity but also its effect or connection to the present situation.

Yule (2010) emphasizes that the perfect progressive aspect is particularly valuable in narrative and descriptive contexts where the speaker needs to convey how long an activity was ongoing prior to a given time frame. This temporal layering introduces greater complexity, as the aspect blends the imperfective viewpoint of the progressive – focusing on process and incompletion – with the perfect's concern for result and current relevance. In contrast to the perfect aspect, which often implies a completed action, the perfect progressive typically suggests that the action was in progress for a duration and may not yet be fully completed. For example, *I have been reading that book* suggests that the reading occurred over a period of time and may still be continuing or was only recently interrupted.

Together, the perfect and perfect progressive aspects enable English speakers to express not only when an action happened but how it unfolded over time and whether its effects or relevance persist. Their structural complexity is matched by their semantic richness, offering subtle

tools for linking past events with the present in ways that are both functionally and communicatively precise.

The four aspects in English – simple, progressive, perfect, and perfect progressive – interact to express subtle distinctions in how time and action are viewed. For instance, compare the following set of sentences:

1) Simple: She writes novels.
2) Progressive: She is writing a novel.
3) Perfect: She has written a novel.
4) Perfect Progressive: She has been writing a novel.

Each sentence refers to the act of writing, yet the semantic focus shifts:

1) The simple aspect expresses a general or habitual activity, timeless and unmarked for internal structure.
2) The progressive highlights the ongoing nature of the action, focusing on the middle of the process rather than its beginning or end.
3) The perfect introduces completion with present relevance – the novel is finished, and the result matters now.
4) The perfect progressive merges the ongoing duration with a relevant connection to the present, implying she's been writing for some time and may still be doing so or has just finished.

Findings indicate that, each aspect builds a different temporal frame and emphasizes a different semantic feature, such as habit, process, result, or duration.

Understanding the semantic distinctions between English aspects provides insight into how time, process, and completion are encoded in grammar. While structurally distinct, these aspects interact in subtle ways to enrich expression and clarify meaning.

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Rezyume: *Ushbu maqola ingliz tilidagi to'rtta asosiy aspekt: oddiy (simple), davomiy (progressive), tugallangan (perfect) va tugallangan-davomli (perfect progressive) aspektlarning semantik xususiyatlarini o'rganadi. Aspektlar voqea davomiyligi, takrorlanishi, yakunlanganligi va zamoniy dolzarbligini qanday ifodalashini aniqlash uchun "qualitalitative" va qiyosiy tahlil usuli qo'llanilgan. The Cambridge Grammar of English, The Oxford English Grammar va Longman Grammar of Spoken and Written English kabi asosiy grammatik manbalar hamda Blokh, Barxudarov, Komri, Kvirk va Yul kabi mashhur olimlarning asarlari asos qilib olingan. Aspektlar turli zamonlarda (o'tmish, hozirgi, kelasi) qanday ishlatilishini ko'rsatish uchun namunaviy gaplar tahlil qilingan. Tadqiqot natijalari har bir aspektning o'ziga xos semantik va strukturaviy xususiyatlarini ochib beradi, hamda voqealar ifodalanishida aspekt tanlovi qanday semantik*

farqlarni yuzaga keltirishini ko‘rsatadi. Maqola grammatik aspekt kategoriyasining chuqur semantik rolini yoritishga xizmat qiladi.

Резюме: *В статье рассматриваются семантические особенности четырех основных аспектов английской грамматики: простой (simple), длительный (progressive), перфектный (perfect) и перфектно-длительный (perfect progressive). Исследование основано на качественном и сравнительном методе анализа, направленном на выявление того, как каждый из аспектов выражает значения продолжительности, повторяемости, завершенности и временной актуальности. Использованы материалы из таких авторитетных грамматик, как The Cambridge Grammar of English, The Oxford English Grammar, Longman Grammar of Spoken and Written English, а также труды Блоха, Бархударова, Комри, Квирка и Юля. Анализируются примеры употребления аспектов в разных временных формах (прошедшее, настоящее, будущее), чтобы показать, как изменяется значение при смене аспекта. Результаты подчеркивают уникальные и общие черты аспектов, а также их влияние на интерпретацию действий в контексте. Цель работы – углубить понимание аспекта как важной грамматической и семантической категории.*

Kalit so‘zlar: *kategoriya, aspekt, sodda, davomiy, tugallangan, tugallangan-davomiy, zamon*

Ключевые слова: *категория, аспект, простой, продолженный, совершенный, совершенный продолженный, время*

LEVELS OF CLOUD TECHNOLOGIES IN VIRTUALIZATION OF THE EDUCATIONAL PROCESS

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Summary: *This article describes a structure that qualitatively changes the relationship between the teacher and the student in the educational process, gives them additional mobility, expands the possibilities of constant monitoring of the implementation of tasks and provides assistance when necessary.*

Keywords: *cloud, technology, virtualization, services, platform.*

INTRODUCTION

Cloud technologies are data processing that provides users with power and resources in the form of Internet services. The essence of cloud computing is to provide users with remote access to computing resources, services, and various applications based on the Internet.

In the field of educational process organization, compared to traditionally organized educational processes, cloud services allow managing a large infrastructure within a single cloud and serving multi-level user groups (for example, teachers and students), but at the same time cloud service providers, from which they are very dependent. Currently, it is customary to distinguish three main models of cloud services, sometimes called “cloud layers”[11]. These three layers - infrastructure services, platform services, and application services - reflect not only the structure of cloud technologies, but also information technologies in general.

First layer: infrastructure as a service (IaaS), which is the basis of cloud computing.

At this level, users completely create the infrastructure they need. This means that they use outsourced or leased facilities. Users manage not the basic cloud infrastructure, but the operating system, storage system, and applications they install.[1]

A medium-level software platform (Platform as a Service - PaaS) is an integrated platform as a service for the development, testing, deployment, and storage of web applications. Users can access the infrastructure defined by already configured hardware and software. Users cannot control the infrastructure configuration, but they can manage the applications placed on the platform[1].

The ability to create and share source code in the development team significantly increases the efficiency of creating PaaS applications.

The most popular example of such a platform is Google AppEngine, which offers the ability to install web applications and purchase additional computing resources (for example, for high-loaded tests).

The high level (Software as a Service - SaaS) allows the seller to develop and manage the web application itself and provide clients with access to the software via the Internet [10].

Currently, four models are used in the deployment of cloud computing. These are:

- Private cloud. According to I. V. Ananchenko, private clouds are often used in education, since they provide better control over data and student behavior and do not require the placement of information in other sources[2].

- Public cloud. is intended for public use. It can belong to commercial, academic, or government organizations and is an IT infrastructure that is simultaneously used by many businesses and services.

- Hybrid cloud. (A hybrid cloud is a combination of two or more different cloud infrastructures (private, public, and public) that remain unique objects but are associated with standardized or private data and application processing technologies (e.g., short-term use of a shared cloud). Resources for balancing the load between them) [9].

From the point of view of different types of clouds, a public cloud is a type of infrastructure intended for use by a certain group of clients of an organization with a common task. Community Clouds may be jointly owned, managed, or belonged to a third party (or a combination of both) by

one or more public organizations and may physically exist within or outside the jurisdiction of the owner.

Despite the success of the above-mentioned platform models, according to D.A. Krylov, the task is still to create a cloud platform that includes all components of a cloud-based intelligent system and tools for supporting their integration tools [4].

Virtualization of the learning process using cloud technologies.

To date, the term "virtualization" has many definitions, according to A.A. Malyuk, virtualization is correctly described as the abstraction of resources from the platform on which they are presented. A virtual machine should be understood as a simple computer or server that can combine various operating systems into parts by imitating system calls to hardware resources. From a software standpoint, there is no distinction between physical and virtual machines [6].

L.K. Mamadalieva calls virtualization one of the ways to solve the digital divide: "Learning in the language of texts is equivalent to learning on the Internet" [7].

A good example of hardware virtualization for educational purposes is CISCO (Cisco Learning Labs) [12]. For example, in Cisco Learning Labs, Cisco IT users can access basic routing configuration laboratory keys and conduct practical laboratory sessions over the Internet due to the convenience of their personal computers.

Cloud technologies and cloud computing should be divided into two concepts:

Cloud technology is a technology for remote storage and processing of information that provides end-users with computing infrastructure and services via the Internet [3].

Cloud computing (CS) is a model whose main goal is to provide users with convenient and ubiquitous access to network data on demand, which can be quickly provided to them at minimal cost [5].

M.A. Muydinova believes that "Cloud computing is a model whose main goal is to provide convenient and ubiquitous access to data on demand via the Internet, which can be quickly provided to users with minimal costs" [8].

According to L.K. Mamadalieva and I.S. Sobirjonov, the most important feature for cloud technologies is the uneven demand of users for Internet resources. To eliminate this unevenness, another intermediate layer is used - server virtualization. Thus, the load is distributed between virtual servers and computers [7].

Director of the Higher School of Electronic and Computer Science Gleb Radchenko notes that "Personal Virtual Computers is a unique system that allows students to use all the software necessary for their studies. In addition, students of South Ural State University can use the capabilities of a supercomputer anywhere in the world. Each user of the program has their own name and password and can access system resources from any device, including mobile phones" [13].

CONCLUSION

Based on the foregoing, it can be concluded that the virtualization of the educational process will be effective if it is based on a system for implementing cloud technologies. In our opinion, it should contain the following main points:

For all students studying at the university, it is necessary to create a personal virtual computer (PVC) with an individual profile, depending on the specialty chosen by the student.

Teachers must gradually fill the student's PMC on their personal virtual computers (in accordance with the educational program they have mastered) with the necessary educational services, including video recordings and lecture texts, electronic learning tools and tests, methodological guidelines, etc.

Here, the teacher can save all electronic files where students have completed the tasks offered to them. At the end of the semester or at the end of the academic year, students can receive everything they have done during their time in the PMC.

Students, in turn, can create and store their documents and files in the PMC, using them to report on learning tasks.

Thus, a structure is being created that qualitatively changes the relationship between teacher and student in the educational process, gives it additional mobility, and expands the possibilities of constant monitoring of the completion of tasks and provides assistance when necessary.

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Rezume: *Ta’lim jarayonida o‘qituvchi va talaba o‘rtasidagi o‘zaro munosabatlarni sifat jihatidan o‘zgartiradigan, unga qo‘shimcha harakatchanlik beradigan va vazifalarning bajarilishini doimiy nazorat qilish imkoniyatlarini kengaytiradigan va kerak bo‘lganda yordam ko‘rsatadigan tuzilma yaratilmoqda.*

Резюме: *В данной статье описывается структура, которая качественно изменяет отношения между учителем и учеником в образовательном процессе, предоставляет им дополнительную мобильность, расширяет возможности постоянного контроля за выполнением заданий и оказывает помощь при необходимости.*

Kalit so‘zlar: *bulut, texnologiya, virtualizatsiya, xizmatlar, platforma.*
Ключевые слова: *облако, технологии, виртуализация, сервисы, платформа.*

THE ROLE OF EQUIVALENCE IN MODERN TRANSLATION STUDIES

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Summary: *The concept of equivalence has long been central to translation theory and practice. From early linguistic approaches to modern functionalist and deconstructionist perspectives, equivalence continues to shape the way translators understand and reproduce meaning across languages. This article examines the evolution of equivalence in modern Translation Studies, identifies its key types-including lexical, semantic, pragmatic, dynamic, and functional equivalence-and analyzes their relevance in contemporary translation practice. The study also explores the limitations of equivalence-based models in the era of globalization, cultural hybridity, and machine translation. Findings suggest that while equivalence remains an important analytical tool, modern translation requires a more flexible and multidimensional approach that integrates cultural, cognitive, and communicative factors.*

Key words. *equivalence, translation studies, functionalism, semantic equivalence, dynamic equivalence, cross-cultural communication, translation theory.*

Introduction. Equivalence is one of the most frequently discussed concepts in Translation Studies. Traditionally, equivalence was understood as a correspondence or sameness between the source text (ST) and the target text (TT). Early structuralist linguists attempted to define equivalence through a strict linguistic framework, while modern scholars acknowledge its complexity and relativity.

In the 21st century, translation occurs across increasingly diverse cultural, technological, and communicative environments. As a result, the role of equivalence has evolved from a rigid requirement to a dynamic principle that guides translators in achieving appropriate meaning, function, and effect.

The aim of this article is to provide a comprehensive analysis of the role of equivalence in modern Translation Studies, discuss different viewpoints, and highlight current trends affecting its theoretical and practical value.

2. Historical Development of Equivalence in Translation Theory

2.1 Early Linguistic Approaches

Linguistic theories of the mid-20th century-represented by Catford, Jakobson, and Nida-attempted to define translation equivalence as a measurable linguistic phenomenon.

Roman Jakobson (1959) classified translation into intralingual, interlingual, and intersemiotic, arguing that equivalence in meaning is never absolute but always approximate.

J. C. Catford (1965) introduced the term “textual equivalence” and emphasized linguistic structure as the basis for equivalence.

2.2 Nida’s Dynamic Equivalence

Eugene Nida (1964) made a major shift by proposing formal equivalence (focus on form) and dynamic equivalence (focus on effect).

Dynamic equivalence aimed to achieve the same response in the target audience as the source text produced in its own audience. Nida’s approach is especially influential in literary and religious translation.

2.3 Functionalist Approaches

In the 1980s and 1990s, scholars such as Skopos theorists (Vermeer, Reiß, Nord) argued that translation should be guided by the purpose (skopos) rather than by equivalence. This approach reduced equivalence from a central principle to one of many possible strategies.

In functionalist translation, equivalence is sought only if required by communicative purpose.

3. Types of Equivalence in Modern Translation Studies

3.1 Lexical Equivalence

This refers to the replacement of a word with another word of the closest meaning.Challenges arise in translating culture-specific items, idioms, terms, and realia.

3.2 Semantic Equivalence

Semantic equivalence involves preserving meaning relations between words and sentences. It takes into account polysemy, connotations, and semantic fields.

3.3 Pragmatic Equivalence

Pragmatic equivalence focuses on communicative intent.

For example, polite forms, speech acts, and implicatures must be adapted to the target culture.

3.4 Dynamic Equivalence

Modern translators apply dynamic equivalence when the emotional or psychological impact is more important than literal accuracy.

3.5 Functional Equivalence

Functional equivalence preserves the purpose and function of the text.

This approach is widely used in legal, technical, and business translation.

4. The Relevance of Equivalence in Contemporary Translation Practice

4.1 Equivalence in Literary Translation

In literary translation, equivalence is flexible and subjective.

Translators often balance:

Author’s style

Emotional effect

Cultural references

Symbolism

Complete equivalence is impossible, but functional and dynamic equivalence help to preserve artistic value.

4.2 Equivalence in Technical and Legal Translation

Here equivalence is far more rigid. Technical terminology, legal terminology, and safety instructions require high-level semantic accuracy.

Even minor deviations can cause legal or technical errors.

4.3 Equivalence in Audiovisual Translation

Subtitling and dubbing face constraints of space, time, and cultural expectations.

Pragmatic and functional equivalence help to maintain humor, tone, and cultural references.

4.4 Equivalence in Machine Translation

Neural Machine Translation (NMT) technologies such as Google Translate, DeepL, and ChatGPT rely heavily on probabilistic equivalence.

However:

Cultural nuance

Pragmatic intent

Idiomatic expressions are still challenging for machines.

Human post-editing remains essential.

5. Criticism and Limitations of Equivalence

Despite its importance, equivalence has been criticized for several reasons:

Equivalence is relative, not absolute - no two languages encode reality in the same way.

Cultural differences prevent full equivalence - especially in metaphors, idioms, humor, and realia.

Deconstructionist scholars (e.g., Derrida) argue that perfect equivalence is impossible.

Functionalist theorists claim that translation purpose is more important than equivalence.

Machine translation models cannot capture subtle human meanings or cultural contexts.

In modern theory, equivalence is no longer considered a strict requirement but a guiding principle.

Conclusion. Equivalence remains a fundamental yet evolving concept in Translation Studies. While early theorists viewed it as a form of linguistic sameness, modern scholars interpret it as a flexible and multidimensional relationship between texts. Contemporary translation practice-shaped by globalization, cultural exchange, and technological advancement-requires an approach to equivalence that combines linguistic, cultural, pragmatic, and functional considerations.

Equivalence continues to play a crucial role, especially in technical, legal, and academic translation, but its limitations highlight the need for integrative frameworks that reflect the complexities of modern communication.

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Rezyume: *Ekvivalentlik tushunchasi uzoq vaqt davomida tarjima nazariyasi va amaliyotining markazida bo'lib kelgan. Dastlabki lingvistik yondashuvlardan tortib zamonaviy funksional, kognitiv va dekonstruktiv qarashlargacha, ekvivalentlik g'oyasi tarjimonlarning ma'noni talqin qilish, ko'chirish va qayta yaratish jarayonlariga sezilarli ta'sir ko'rsatib kelmoqda. Ushbu maqolada zamonaviy Tarjima tadqiqotlarida ekvivalentlikning tarixiy rivojlanishi tahlil qilinadi va uning asosiy turlari — leksik, semantik, pragmatik, dinamik va funksional ekvivalentlik yoritiladi. Shuningdek, maqolada globallashuv, madaniy gibridlik va mashina tarjimasi texnologiyalari sharoitida ekvivalentlikka asoslangan yondashuvlarning qo'llanishi va cheklovlari muhokama qilinadi. Tadqiqot natijalari shuni ko'rsatadiki, ekvivalentlik hali ham muhim nazariy va tahliliy tushuncha bo'lib qolayotgan bo'lsa-da, zamonaviy tarjima jarayoni madaniy, kommunikativ va kognitiv omillarni o'z ichiga olgan moslashuvchan va ko'p o'lchovli yondashuvni talab qiladi.*

Резюме: *Понятие эквивалентности долгое время занимает центральное место в теории и практике перевода. От ранних лингвистических подходов до современных функционалистских, когнитивных и деконструктивистских концепций идея эквивалентности продолжает влиять на то, как переводчики интерпретируют, передают и воссоздают значение в разных языках и культурах. В статье рассматривается историческая эволюция эквивалентности в современных переводоведческих исследованиях, а также анализируются её основные виды — лексическая, семантическая, прагматическая, динамическая и функциональная эквивалентность. Кроме того, обсуждаются роль и ограничения эквивалентностных моделей в условиях глобализации, культурной гибридизации и развития технологий машинного перевода. Результаты исследования показывают, что, несмотря на сохраняющуюся значимость эквивалентности как теоретической и аналитической категории, современная переводческая практика требует более гибкого и многомерного подхода, учитывающего культурные, коммуникативные и когнитивные факторы.*

Kalit so'zlar. *ekvivalentlik, tarjimashunoslik, funksionalizm, semantik ekvivalentlik, dinamik ekvivalentlik, madaniyatlararo kommunikatsiya, tarjima nazariyasi.*

Ключевые слова. *эквивалентность, переводоведение, функционализм, семантическая эквивалентность, динамическая эквивалентность, межкультурная коммуникация, теория перевода.*

HUMAN MORAL QUALITIES AND THEIR SOCIAL SIGNIFICANCE IN ISLAM

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Summary: *This article discusses the moral qualities of a person in Islam to gain a place in society, and how to behave in situations that arise in human life. In order to achieve perfection, a person must be spiritually, physically, and spiritually mature, and must cleanse his heart and soul of bad vices. Doing good to his brothers around him as much as he can, being polite, obeying his parents, and pleasing them adorns a person's morals. In the hadith, one of the sacred sources of our religion, it is narrated by our narrators, who have learned lessons from the events that happened in their lives.*

Keywords: *religion, Islam, hadith, goodness, hospitality "Al jame as sahih", honesty, kindness.*

Islam, as a comprehensive way of life, places a significant emphasis on moral qualities and ethical behavior. The teachings of Islam provide a framework for individuals to cultivate virtues that not only enhance personal character but also promote social harmony and justice. This article explores key moral qualities highlighted in Islamic teachings and discusses their social significance.

Religion plays a very important role in human life, and any faith should be able to call a person to goodness, enlightenment, humanity, and serve as a beacon for a person in his life. The religion of Islam, with its similar characteristics, has become a beacon for all humanity for centuries. All religions, including Islam, have taught that a person's moral qualities should be beautiful, that his words should match his deeds. People whose morals are as beautiful as their hearts have been glorified at all times, and those around them and in our society have a positive attitude towards them.

Hard work, hospitality, always speaking the truth, honesty, openness, compassion and similar moral qualities add beauty to a person's appearance and decorate his heart. In Islam, the moral qualities of a person are emphasized many times in the Holy Quran and the hadiths of our Prophet Muhammad (peace be upon him). Below are some examples of them:

“It was narrated that the Messenger of Allah (peace and blessings of Allah be upon him) commanded us to do seven things and forbade us from seven. He commanded us to visit the sick, attend the funeral, respond to a sneeze, respond to a greeting, help the oppressed, go to the place where you are called, and do not break your oath.”

The deeds mentioned in this hadith are just a few of the most beautiful morals in the Muslim world. Visiting the sick is considered one of the most highly meritorious deeds. After all, a sick person is happy to see his loved ones caring for him. Visiting the sick is like visiting the heart, which is considered the house of Allah. Our scholars encourage attending funerals, whether familiar or unfamiliar, and reminding us once again that this world is fleeting. Greetings are a mirror that shows a person's true humanity. The way your interlocutor greets you shows what kind of character and manners he has. Even the fact that there is a separate etiquette for greetings among manners indicates that he is a perfect character. We should not forget that wishing your brother good health by saying "Assalamu alaykum" is also considered an obligation. Next, we all know that the term oppressed refers to someone who has been oppressed, tortured, or subjected to injustice.

The fact that a separate chapter entitled “The Book of Injustice” is dedicated to the great scholar Imam al-Bukhari in his book “Al-Jame’ as-Sahih”, which is considered the source of the above hadith, indicates that injustice is the worst vice in human behavior. The following hadith is quoted regarding showing mercy to the oppressed and not being among the oppressors: “Abdullah ibn Umar (may Allah be pleased with him) narrated: “The Messenger of Allah (peace and blessings of Allah be upon him) said: “A Muslim should not oppress his Muslim brother or leave him in the hands of an oppressor! Whoever fulfills the need of his Muslim brother, Allah will fulfill his need. Whoever relieves a Muslim of a hardship, Allah will relieve him of a hardship on the Day of Judgment. Whoever conceals the fault of a Muslim, Allah will conceal his fault on the Day of

Judgment.” The essence of this hadith, in addition to the virtue of helping the oppressed, also embodies the idea that a Muslim should help his brother as much as he can and should cover up his faults or shortcomings in a good way and not expose them to the public.

We believe that one of the topics mentioned in the above hadith is also very useful in the relationship between mother-in-law and daughter-in-law, which has become a hot topic in our time. The hadith states that a person should hide the faults of his brother or close person. If the intelligent and intelligent mother-in-law, who is called a mother-in-law, does not criticize the shortcomings in the family and the mistakes made by the daughter-in-law, but leaves them “as if the pot is closed” without blaming others, it can contribute to reducing the division of families in our society. It is not for nothing that the principle of living in families by “enhancing the good and hiding the bad” has been adopted as the main criterion. Only at certain times can these wise words be forgotten.

We should touch on another important topic. This is obedience to parents. We need this virtue more than ever, as it is becoming less and less common in the morals of today's youth. After all, our Prophet Muhammad (peace be upon him) also said the following about obedience: We have enjoined on man to be obedient and kind to his parents! Shaybani pointed to the courtyard of Abdullah (al-Ansari) with his hands and said: "This is what the owner of this courtyard told me." "I asked the Prophet (peace be upon him): Which deed is most beloved to Allah, the Almighty?" - The Prophet (peace be upon him): "It is to perform the prayer on time." I asked: “What other deed?” The Messenger of Allah (ﷺ) said: “To obey one’s parents.” I asked: “What other deed?” The Messenger of Allah (ﷺ) said: “To strive in the way of Allah.” The Messenger of Allah (ﷺ) answered my questions in this way. If I had asked him again, he would have answered again. “One of the qualities that pleases Allah in every Muslim servant is to treat his parents well. Obeying one’s parents, not being offended when they give him a task, and being ready to serve when they call him is both an obligation and a duty. After all, parents are invaluable and unique people who care about us and think about the happiness and peace of their children until their last breath. The Muslim community is also a society that promotes respecting our parents and pleasing them.

A person should be kind not only to his parents, but also to his relatives. It is mentioned in our hadiths that a true person is not to break relations with relatives because of wealth and worldly pleasures, but rather to restore broken ties. Abu Sufyan narrated: “The Messenger of Allah (peace be upon him) said: The one who does not show kindness to relatives is not a relative, but the one who restores broken ties is a relative!” Our religion also encourages us to invite relatives and spend time with them on every holiday or family event, to hear from our elders and to make them happy.

In the hadiths, along with being kind to relatives and relatives, neighborly manners are also mentioned. We will give clear examples from the hadiths. Abu Shurayh narrated: “The Prophet, may God bless him and grant him peace, said: “He who disbelieves in the right of Allah, he who disbelieves in the right of Allah, he who disbelieves in the right of Allah!” The people asked: “O Messenger of Allah, who is a disbeliever?” The Messenger of Allah replied: “He who does not protect his neighbor from calamities.” It is not for nothing that the proverb “Do not take a neighbor, take a neighbor” has not lost its power among our people. The person who is with you in any trouble or calamity that befalls a person and who informs you about it is our neighbor. Our proverbs, passed down from generation to generation, such as "A neighbor is a neighbor in a soul", "A neighbor's peace is your peace", did not come into the world by chance. The tested life experiences of our ancestors prove that neighborliness plays an important role in human life.

We continue to turn to hadiths. Abu Hurayrah said: “The Messenger of Allah, may Allah bless him and grant him peace, said: ‘O Muslim women, do not speak ill of your neighbor, even if you quarrel over a sheep.’” Another negative evil that is prevalent in our society is speaking ill of your neighbor, as mentioned in the hadith.

Our sacred sources say that a person who believes in Allah and the Last Day should not harm his neighbor: “Abu Hurayrah narrated: “The Messenger of Allah, may Allah bless him and grant him peace, said: ‘Whoever believes in Allah and the Last Day should not harm his neighbor. Whoever believes in Allah and the Last Day should honor his guest. Whoever believes in Allah and the Last Day should speak good words or remain silent!’” One of the first conditions of faith is belief in Allah

and the coming of the Last Day. If these conditions are not met, that person is an unbeliever. Unbelief is like a real punishment or curse for a Muslim. Therefore, not harming one's neighbor, honoring one's guest, and speaking good words to people (being good to others) are narrated as signs of a believer.

Another virtue that adorns human morality in Islam is doing good to one another. In this regard, Imam Bukhari cites in his hadiths that Allah Almighty says that whoever helps someone do good will receive a good share, and whoever helps someone do evil will receive a bad share. The Prophet (peace and blessings of Allah be upon him) also ordered his followers to help those who come to him for help and guaranteed that he would be rewarded for this help. Allah Almighty also promised that a servant who helps his Muslim brothers and does good will fulfill his desires and fulfill his needs.

Islam is a religion that leads a person to perfection, both spiritually, mentally and physically. Islam is a beautiful religion that honors a person and beautifies his morals, and can turn a person into the crown of society with its rules and commands.

Key Moral Qualities in Islam

1. Honesty (Sidq)

Honesty is a fundamental virtue in Islam. The Quran emphasizes the importance of truthfulness, stating, "And do not mix the truth with falsehood or conceal the truth while you know [it]" (Quran 2:42). Honesty fosters trust within communities, enabling cooperation and reducing conflicts. A society built on honesty is more likely to thrive and maintain social order.

2. Compassion (Rahmah)

Compassion is a core attribute of Allah (SWT), and Muslims are encouraged to emulate this quality. The Prophet Muhammad (PBUH) was known as "the Mercy to the worlds" (Quran 21:107). Compassionate behavior towards others, including acts of charity and kindness, strengthens community bonds and creates an environment where individuals support one another.

3. Justice (Adl)

Justice is a cornerstone of Islamic ethics. The Quran commands believers to uphold justice, even if it is against themselves or their kin: "O you who have believed, be persistently standing firm in justice, witnesses in equity" (Quran 4:135). A just society ensures that rights are upheld, grievances are addressed, and individuals feel valued and respected, thereby promoting social stability.

4. Forgiveness (Maghfirah)

Forgiveness is highly regarded in Islam. The Quran encourages believers to forgive others, stating, "And let not those of virtue among you swear not to give [anything] to their relatives and the needy and the immigrants…" (Quran 24:22). Forgiveness helps to heal relationships and fosters an atmosphere of reconciliation, reducing animosity and promoting peace within society.

5. Humility (Tawadu)

Humility is an essential quality that prevents arrogance and fosters respect among individuals. The Prophet Muhammad (PBUH) exemplified humility throughout his life, treating everyone with respect regardless of their status. Humble individuals contribute to a more equitable society where people are valued for their character rather than their wealth or power.

Social Significance of Moral Qualities

The moral qualities emphasized in Islam have profound social implications:

• Community Cohesion: When individuals embody qualities such as honesty, compassion, and forgiveness, they contribute to a cohesive community where trust and mutual respect flourish. This cohesion is essential for collective well-being and social stability.

• Conflict Resolution: Justice and forgiveness play crucial roles in resolving conflicts. A society that prioritizes justice ensures that disputes are handled fairly, while forgiveness allows for healing and moving forward after disagreements.

• Social Responsibility: Islamic teachings encourage individuals to be socially responsible, caring for the less fortunate and contributing to the welfare of the community. This sense of responsibility fosters solidarity and collective action towards common goals.

• Moral Guidance: The moral framework provided by Islam serves as a guide for individuals navigating ethical dilemmas in their personal and professional lives. This guidance helps maintain moral integrity within society.

Conclusion. The moral qualities promoted by Islam are not only essential for individual character development but also play a vital role in shaping a just and harmonious society. By embodying these virtues-honesty, compassion, justice, forgiveness, and humility-Muslims can contribute positively to their communities, fostering an environment where social justice prevails, relationships are nurtured, and collective progress is achieved. Ultimately, the integration of these moral qualities into daily life is crucial for achieving the ideals of a peaceful and prosperous society in accordance with Islamic teachings.

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Rezyume: *Ushbu maqolada islom dinida insonning qanday axloqiy sifatlari bilan jamiyatda o`z o`rniga ega bo`lmog`i, inson hayotida uchraydigan vaziyatlarda o`zini qanday tutmoqligi haqida so`z boradi. Inson komillikka erishmoq uchun ham ma'nan, ham jismonan, ham Ruhan yetuk bo`lishi, qalbini hamda ruhini yomon illatlardan tozlamog`I kerak. Atrofidagi birodarlariga qo`lidan kelgancha yaxshilik qilishi, xushmuomala bo`lishi, ota-onasiga itoatda bo`lib, ularning ko`nglini xushnud etishi insonning axloqini bezaydi. Dinimizdagi muqaddas manbalardan hadisi sharifda ham bu xususda payg`ambarimiz Muhammad (s.a.v) buyurgan va hayotlarida bo`lib o`tgan voqealardan saboq chiqargan holda roviylarimiz tomonidan rivoyat qilinadi.*

Резюме: *В данной статье рассматриваются моральные качества человека в исламе, необходимые для достижения им своего места в обществе, а также то, как вести себя в ситуациях, возникающих в жизни. Для достижения совершенства человек должен быть духовно, физически и духовно зрелым, а также очистить своё сердце и душу от дурных пороков. Делать добро окружающим братьям, быть вежливым, слушаться родителей и угождать им – вот что украшает человека. В хадисах, одном из священных источников нашей религии, эти хадисы передаются нашими передатчиками, извлекшими уроки из событий своей жизни.*

***Kalit so`z:*** *din, Islom dini, hadis, yaxshilik, mehmondo`stlik "Al jome as sahih", halollik, mehr-shafqat.*

Ключевые слова: *религия, ислам, хадис, доброта, гостеприимство, «аль-джаме ас-сахих», честность, доброта.*

IMPROVING THE PROFESSIONAL CULTURE OF FUTURE PHYSICAL EDUCATION TEACHERS BASED ON ACTION GAMES

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Summary*: This article analyzes the role of action games in forming the professional culture of future physical education teachers. A complex of specific games aimed at developing students' communicative, organizational, and pedagogical skills was developed for the study. Experimental results demonstrate that the systematic use of action games significantly enhances the professional readiness and culture of future educators.*

Keywords*: Physical education, professional culture, action games, pedagogical skills, students, higher education, communicative skills.*

Introduction

In the modern educational landscape, the preparation of physical education (PE) teachers requires more than just the transmission of athletic skills and theoretical knowledge of human physiology. The contemporary paradigm shifts the focus towards the formation of a holistic "professional culture" of the educator. Professional culture in this context is defined not merely as technical competence, but as a synthesis of pedagogical ethics, leadership qualities, organizational capabilities, and the ability to interact effectively with students [1, p. 12].

Despite the extensive curriculum in Higher Education Institutions (HEIs), there is often a gap between theoretical knowledge and practical pedagogical application. Future teachers may know *how* to perform a sport, but they often struggle with the soft skills required to manage a class, resolve conflicts, and motivate students. This is where action games (movement games) serve as a unique and underutilized pedagogical tool.

Action games are historically rooted in human culture as a primary means of socialization and physical development. However, their potential extends beyond early childhood education. For future PE teachers, action games simulate a micro-pedagogical environment. As noted by Huizinga in his seminal work *Homo Ludens*, play is a primary function that predates culture and is essential for social bonding [2, p. 45]. In the context of teacher training, action games require the future teacher to act simultaneously as a participant, a referee, and an organizer, thereby testing their professional culture in real-time.

The objective of this study is to theoretically substantiate and practically verify the effectiveness of using action games to improve the professional culture of future physical education teachers. The hypothesis posits that integrating a structured program of action games, designed to assign leadership roles to students, will lead to statistically significant improvements in their professional culture components compared to traditional training methods.

Materials and Methods

Participants

The study involved 60 third-year students from the Faculty of Physical Culture at a State Pedagogical Institute. The participants were divided into two groups:

1. **Control Group (CG):** 30 students who followed the standard curriculum for the subject "Theory and Methodology of Physical Education."
2. **Experimental Group (EG):** 30 students who, in addition to the standard theory, participated in a specialized module "Pedagogical Mastery through Action Games."

Research Design

The research was conducted over one academic semester (16 weeks). The methodology relied on the concept of "Activity Theory" developed by A.N. Leontiev, which suggests that human psychology and culture are shaped through active engagement in meaningful activities [3, p. 88].

The experimental intervention consisted of three stages:

1. **Diagnostic Stage:** Assessing the initial level of professional culture using surveys, expert observation checklists, and self-assessment questionnaires. The components measured were:
   - *Gnostic Component:* Knowledge of game rules and pedagogical theory.
   - *Communicative Component:* Ability to explain rules clearly and resolve conflicts.
   - *Organizational Component:* Ability to manage the group and space.
2. **Formative Stage:** Implementation of the special program for the EG. The program utilized action games categorized by pedagogical intent:
   - *Team-building games:* To foster cooperation (e.g., "Knot," "Team Tag").
   - *Leadership games:* Where students took turns being the absolute leader/referee (e.g., "Commander," "Traffic Controller").
   - Cognitive-motor games: Requiring quick strategic thinking (e.g., "Chess Tag," "Numbers").

Unlike the CG, where games were played for recreation, in the EG, every game was followed by a "debriefing" session where students analyzed the pedagogical behavior of the student-leader [4, p. 102].

3. **Control Stage:** Post-test assessment using the same criteria as the diagnostic stage to measure growth.

Statistical Analysis

Data were analyzed using standard statistical methods, including the Student's t-test, to determine the significance of differences between the pre-test and post-test results of the two groups.

Results

The initial diagnosis revealed that both groups had similar baseline levels of professional culture. Most students scored average or low in the "Communicative" and "Organizational" components, despite having high scores in physical fitness.

Table 1. Comparative Analysis of Professional Culture Components (Pre- and Post-Experiment)

Component of Professional Culture	Group	Pre-Test Score (Avg. out of 10)	Post-Test Score (Avg. out of 10)	Growth (%)
Gnostic (Theoretical Knowledge)	CG	6.2	6.8	+9.6%
	EG	6.1	8.4	+37.7%
Communicative (Verbal/Non-verbal)	CG	5.4	5.9	+9.2%
	EG	5.5	8.9	**+61.8%**
Organizational (Management)	CG	5.1	5.8	+13.7%
	EG	5.2	8.7	**+67.3%**

Note: Differences in EG growth are statistically significant at $p < 0.05$.

As shown in Table 1, the Experimental Group demonstrated substantial improvement. The most significant growth was observed in the **Organizational** component (+67.3%). In the Control Group, improvements were marginal and attributed to natural maturation during the semester.

Qualitative analysis of the results indicated that students in the EG became more confident in their voice projection, instruction delivery, and error correction. During the pedagogical internship which followed the experiment, supervisors noted that students from the EG were able to engage school children in activities 40% faster than their peers from the CG [5, p. 210].

Furthermore, the "Reflective" capacity of the EG students increased. When asked to critique their peers, EG students used professional terminology and offered constructive feedback, whereas CG students mostly focused on whether the game was "fun" or "boring," lacking pedagogical depth [6, p. 115].

Discussion

The results of this study confirm the hypothesis that action games are a potent instrument for enhancing the professional culture of future PE teachers. Several factors contribute to this outcome.

1. Simulation of Professional Reality:

Action games create a simplified model of the pedagogical process. A student leading a game faces immediate feedback: if their explanation is unclear, the game fails; if they are unfair, conflict arises. This immediate loop constitutes what Mosston and Ashworth describe as the "Reciprocal Style" of teaching, where the learner (in this case, the student-teacher) makes decisions and sees immediate consequences [7, p. 55]. In traditional lecture halls, this practical feedback loop is absent.

2. Development of Communicative Competence:

The significant rise in communicative scores in the EG can be attributed to the dynamic nature of action games. Unlike static drills, games are unpredictable. The teacher must communicate constantly, adapting their tone and instructions to the changing situation. This aligns with Vygotsky's "Zone of Proximal Development," where students are pushed slightly beyond their comfort zone in social interactions, facilitating rapid growth [8, p. 201].

3. Emotional Intelligence and Ethics:

Professional culture includes the ethical management of competition. Through games, future teachers learned to manage not only their own emotions but also the emotions of participants. They practiced "fair play" and learned to mediate disputes, which is a critical skill in modern school environments [9, p. 78].

4. The Role of Reflection:

The debriefing sessions included in the methodology were crucial. As noted by Schön in The Reflective Practitioner, professional growth occurs not just through doing, but through reflecting on the action [10, p. 30]. By analyzing the games, students transitioned from being "players" to being "educators using play."

Conclusion

Improving the professional culture of future physical education teachers is a multifaceted process. This study demonstrates that action games should not be viewed merely as recreational content for children, but as a serious methodological tool for teacher training. The systematic inclusion of student-led action games, coupled with reflective analysis, significantly boosts organizational and communicative skills.

It is recommended that higher education curricula for Physical Education faculties integrate modules where students systematically design, lead, and critique action games. This approach ensures that graduates enter the workforce not just as athletes, but as culturally competent pedagogues ready to inspire the next generation.

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Rezyume: *Ushbu maqola bo'lajak jismoniy tarbiya o'qituvchilarining kasbiy madaniyatini shakllantirishda harakatli o'yinlarning o'rnini tahlil qiladi. Tadqiqotda talabalarning kommunikativ, tashkilotchilik va pedagogik qobiliyatlarini rivojlantirishga qaratilgan maxsus o'yinlar majmuasi ishlab chiqildi. Tajriba natijalari shuni ko'rsatadiki, harakatli o'yinlardan muntazam foydalanish bo'lajak pedagoglarning kasbiy tayyorgarligi va madaniyatini sezilarli darajada oshiradi.*

***Резюме**: В данной статье анализируется роль подвижных игр в формировании профессиональной культуры будущих учителей физической культуры. В исследовании разработан комплекс специальных игр, направленных на развитие коммуникативных, организаторских и педагогических способностей студентов. Результаты эксперимента показывают, что систематическое использование подвижных игр значительно повышает профессиональную подготовку и культуру будущих педагогов.*

***Kalit so‘zlar**: Jismoniy tarbiya, kasbiy madaniyat, harakatli o‘yinlar, pedagogik mahorat, talabalar, oliy ta’lim, kommunikativ ko‘nikmalar.*

***Ключевые слова**: Физическое воспитание, профессиональная культура, подвижные игры, педагогическое мастерство, студенты, высшее образование, коммуникативные навыки.*

WORTHY EXAMPLES OF OUR MATERIAL CULTURE

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Summary: *This article explores the cultural heritage of the Karakalpak people that has survived to the present day.*

Key words: *Cultural heritage, karauy (traditional dwelling), otau (yurt), iyt arka (dog's back-shaped roof), pakhsa (rammed earth wall), shopker zhay (wooden-framed house), ozhire (room).*

The decree of the President of the Republic of Uzbekistan, dated 22 December 2018, on measures for the fundamental improvement of the protection of tangible cultural heritage will undoubtedly bring joy to the heart of every person who cares about their country and people.

Our remarkable heritage, passed down through many centuries and still revealing itself to future generations, constitutes an important part of our tangible cultural heritage. Among these are the dwellings built by our ancestors for themselves. Our forefathers, who raised their sons with the saying, "At fourteen, one becomes the master of the yurt," encouraged them to take responsibility for their homes at an early age and constructed dwellings in various forms, adapted to the needs of their time.

The first information about the dwellings of the Karakalpaks in the Khorezm oasis can be found in the records and articles of the Russian Butakov expedition (1858–1859), the works of Kaulbars (1873), and the accounts of participants in the Amu Darya expedition (1874–1875). These written sources indicate that, in the mid-to-late 19th century, the dwellings of the Karakalpaks in the Khorezm oasis were mainly yurts. It can also be noted that S.P. Tolstov, who began his expedition across the entire Khorezm lowlands in 1937, conducted a detailed study of the ancient periods of this region [1].

Since ancient times, our lands have been rich in forests. White poplar, black willow, turang (a local Central Asian tree), willow, and kegay poplar (poplar species), which formed the main forest species, were durable and highly suitable for building homes. A vivid example of this is the traditional yurt of the Karakalpak people, used since ancient times. The main parts of the yurt were made from the aforementioned trees. The yurt was primarily constructed of wood. Craftsmen who built yurts were called "*uyshi"*, and the wood used for the yurt was called "*uy tal"*. While the "*kerege"*, "*uyk"*, and "*shanarak*" support the yurt's frame, the threshold, door (*ergenek*), and lintel serve as its entrance elements.

The craftsmen who built yurts were called "*uyshi"*, while those who made doorposts, thresholds, and upper beams were called "*usta*"(master craftsman). Karakalpak yurt builders inherited the art of yurt construction from their ancestors. During a long-term historical and ethnographic expedition, we spoke with craftsmen of various nationalities who specialized in yurt making. Many of these craftsmen were skilled in constructing Karakalpak, Kazakh, Turkmen, and Uzbek yurts [2].

The Karakalpak yurt differs from Kazakh, Turkmen, and Uzbek yurts in both exterior and interior design [3] (Figures 1–2).



Figure 1 (Exterior)



Figure 2 (Interior**)**

The "*otau"*, which for many centuries has been regarded as the finest and most sophisticated example of the rich culture and craftsmanship of our people, is also valued as a distinctive national feature of the Karakalpak people. Karakalpakstan is divided into northwestern, eastern, southern, and central regions, and the buildings constructed by residents of these areas reflect adaptations to local environmental conditions. For example, in Muynak, one of the northwestern regions of Karakalpakstan, there has long been a tradition of building houses using reeds as a primary material (Figures 3–4). Due to the coastal climate, rainwater does not accumulate on the roof but flows downward. The building is called "*iyt arka"*, or "dog's back," because the top of the house has a pointed shape. Wood and reeds were the main materials used for constructing these houses.



Figure 3 (Exterior)



Figure 4 (Interior**)**

First, a foundation pit is dug and firmly reinforced with reeds and thorny branches to prevent moisture penetration. Then, white poplar logs are laid on the foundation and nailed in four places along their length. Another white poplar log is placed parallel to those on the foundation. In this way, a similar structure is built for each room, stakes are driven between the logs, and bundles of reeds are secured with wire. After this, the walls are coated with clay. Constructing such a dwelling in Muynak does not require much time, and it can be completed in a maximum of one week.

Rammed-earth houses are widespread in the southern and central regions of Karakalpakstan. The term "*atpa"* comes from the practice of passing prepared clay to the master builder by throwing it. Depending on local traditions, these houses are also called "*pakhsa jay"* in popular speech.



Figure 5 (Exterior)



Figure 6 (Exterior)

"Pakhsa" is primarily used for building walls. Each structure consists of four layers of "*pakhsa"*, with the first layer built to a height of more than one meter. The following three layers gradually decrease in height: the second is one meter, the third ninety centimeters, and the fourth approximately seventy to eighty centimeters. Each layer is dried before constructing the next. Once the "*pakhsa"* is completed, the walls are leveled—a process of smoothing the wall with a special trowel, performed by the lead master during construction. After the "*pakhsa*" walls are finished, wooden beams are laid, and partitions are erected (Figures 5–6).

In Karakalpak culture, the residential rooms or spaces within a building are called "*ozhire"*. It is said that if there are four rooms, they consist of three "*ozhire"* and one corridor. Thus, while the "*ozhire"* serve as spaces for daily life, the corridor functions as a connecting link between these rooms.

Among the Karakalpaks, the most common type of dwelling is the "*shopker jay"*. Its foundation is made of concrete or natural stone (previously baked clay was used). Hewn white poplar logs are laid on the foundation to create the wall frame. The upper parts of the walls, like the lower, are also made of hewn white poplar logs and are joined to the frame. The spaces between the frame are filled with clay. White poplar and black willow were the main materials used for constructing a "*shopker jay"*.



Figure 7 (Exterior)



Figure 8 (Exterior)

Among the people, there is a proverb about the durability of reed houses: "A reed house stands crooked for forty years" (Figures 7–8).

In addition, in popular language, there are other names for dwellings, such as "*kakyra"*, "*shatpa"*, and "*kos"*. These were mostly temporary shelters on summer pastures, associated with seasonal farming or livestock. A "*kakyra"* consisted of one or two rooms and was made of reeds. A "*kos"* was a summer dwelling where wooden posts were buried at four corners, topped with beams, thinly covered with reeds, and all four sides wrapped with a reed mat made of chia. In some cases, it was also called "*yktyrma"*. The term "*yktyrma"* comes from the fact that it served as shelter from strong winds and provided shade from the summer sun.

As for "*shatpa"*, in literary colloquial language, people referred to their homes by saying, "Look at our *shatpa"* or "Our *shatpa"*, The "*kos"* or "*tole"* were dwellings for poorer households with limited property.

It has long been recognized that humans naturally seek suitable dwellings and arrange them for comfort. The proverb "Your own home is a bed of grass" emphasizes the superiority and convenience of one's own house, comparing it to a soft grassy bed.

In the early and medieval periods in our country, there were people who designed historical architectural monuments as well as houses for daily living. Although they were not called architects, they were respected as masters of their time, and their work met the architectural standards of the era.

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MANIFESTATION OF INTEGRATION IN MODERN TECHNOLOGIES

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Summary: *The article studies the theoretical foundations of integration processes and their practical aspects in the context of the development of modern technologies. The role of information and communication technologies, artificial intelligence, IoT systems, cybersecurity and cloud computing platforms in the creation of innovative solutions is scientifically analyzed. The effectiveness of technological integration processes in production, education, healthcare and other areas, and their importance in accelerating digital transformation are also revealed.*

Key words: *modern technologies, integration processes, artificial intelligence, information and communication technologies, innovative solutions, digital transformation, integrated systems.*

In the digital economy, the integration of modern technologies is an important factor in innovative development and cross-sectoral cooperation. The “Digital Uzbekistan – 2030” strategy, approved by the President of the Republic of Uzbekistan (October 5, 2020), raised the introduction of modern technologies and their integrated use to the level of state policy [1]. In particular, the integrated use of artificial intelligence, IoT (Internet of Things), cloud technologies and cybersecurity is one of today's global trends, allowing for high efficiency in production, education, healthcare and service sectors. According to the analysis of the global technology market in 2024-2025, the total share of artificial intelligence and automation systems in the field of technological integration is expected to reach 35 percent. However, integration processes require coordinated technical, legal and information security approaches.

Scientific and theoretical approaches to the issues of modern technologies and their integration have been widely used in international and national research. In particular, Porter M. (2019) analyzed the impact of digital transformation and technological integration on the efficiency of industrial sectors and justified the strategic advantages of the formation of digital ecosystems. Brynjolfsson E. and McAfee A. (2021) showed the role of artificial intelligence and automated systems in economic processes, and the possibilities of creating new value through their mutual integration [2].

In local research, Ravshanov Sh. (2022) studied the integration of information and communication technologies in industry and service sectors in Uzbekistan, assessing the effectiveness of the integrated introduction of technologies and their impact on the digital economy. The report prepared by the Agency for Innovation Development of the Republic of Uzbekistan (2023) shows the legal and organizational foundations of technological integration, the development of innovative infrastructure and practical results within the framework of state policy[3].

In addition, the reports of the OECD (2023) and the World Economic Forum (2024) provide an in-depth analysis of global trends in technological integration in industry and education, the contribution of artificial intelligence and IoT to the economy.

The resolution of the President of the Republic of Uzbekistan on the “Digital Uzbekistan - 2030” strategy (2020) serves as the basis for the integrated development of technologies at the national level.

In general, the literature review shows that the integration of modern technologies is a relevant scientific direction that requires a comprehensive approach in science and practice. Research in this area is aimed at increasing the efficiency of technology integration, accelerating digital transformation, and serving national innovative development.

The study was based on systematic and comprehensive approaches to studying the processes of integration of modern technologies. The following methods were used in the process of scientific research: Systematic analysis and synthesis, comparative analysis, information analysis, expert assessment, modeling and systematization methods were widely used[3].

The integration of modern technologies is becoming an integral part of the digital transformation process today. The results of the study show that the combination of information and

communication technologies, artificial intelligence, IoT and cloud computing systems directly affects the increase in production efficiency, improvement of management systems and improvement of the quality of services.

During the discussion, it was found that the success of technological integration depends on a number of factors:

- Technical flexibility - the ability to establish seamless communication between different systems and devices;
- The availability of a legal and regulatory framework - the importance of regulatory documents ensuring the security of integrated systems and data protection;
- Human resources - the lack of qualified specialists in the implementation and management of modern technologies can slow down the process;
- Infrastructure development - the Internet network and network security infrastructure are the technical basis of integration.

According to the results of the analysis, it was noted that for the successful implementation of technological integration, it is important to ensure the operation of systems based on open platforms, the uniformity of data exchange protocols and compliance with information security requirements.

Also, the analysis of integration processes shows that these processes should be considered not only as a technical and technological issue, but also as an important component of strategic management and innovative development. The integration of modern technologies serves sustainable development by serving human resources, economic efficiency and digital transformation.

Based on scientific analysis and practical observations conducted during the research process, the following main results were achieved:

1. It was determined that the integration of modern technologies is an important strategic factor in innovative development and digital transformation, and it was proven that the integration of artificial intelligence, IoT, cloud technologies and cybersecurity systems increases efficiency in the fields of production, management and service provision.

2. Integrated technology systems create opportunities for rational use of resources, reduce operating costs and improve the quality of services, and this result has been confirmed in international and local practice.

3. It was determined that for the successful implementation of technological integration, the harmonious functioning of technical infrastructure, legal and regulatory framework, qualified personnel and information security systems is necessary.

4. The results of the analysis showed that solutions based on open systems and platforms, as well as systematic and strategic approaches to technology integration, provide high efficiency.

5. Although the “Digital Uzbekistan - 2030” strategy serves as a normative basis for the integration of modern technologies in the conditions of Uzbekistan, it was noted that for the full implementation of these processes, a scientific approach using comprehensive planning and best practices is needed.

6. It was proven that the expansion of integrated systems not only ensures economic efficiency, but also creates a favorable environment for the development of innovative approaches in social spheres and achieving sustainable development.

7. The analysis of the integration of modern technologies shows that these processes are expected to serve as the main drivers of the digital economy in the future and become an important factor ensuring global competitiveness.

These results confirm the need to develop scientifically based practical recommendations in the direction of the integration of modern technologies and expand the possibilities of their implementation in various fields.

In conclusion, the integration of modern technologies is of great strategic importance in the processes of digital transformation and innovative development of the current era. The results of the study show that the integration of information and communication technologies, artificial intelligence, IoT systems, cloud computing and cybersecurity has become an important factor not only in economic efficiency, but also in the development of social and management systems.

It was confirmed that factors related to infrastructural, organizational, legal and human resources are of great importance for the successful implementation of modern integrated technologies. In particular, the use of technologies based on an integrated approach, the use of open systems and digital platforms, and compliance with information security measures are the main conditions for sustainable and effective integration.

The analyzed international and local experiences show that technological integration has a high impact on innovative development and the digital economy. In particular, the "Digital Uzbekistan - 2030" strategy program in the Republic of Uzbekistan creates a legal and organizational basis for the integrated development of modern technologies.

In general, systematic research and implementation of the integration of modern technologies is an urgent scientific and practical task today, which serves to ensure global competitiveness, increase economic efficiency, and accelerate innovative development.

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Rezyume: *Maqolada zamonaviy texnologiyalar taraqqiyoti sharoitida integratsiya jarayonlarining nazariy asoslari va ularning amaliy jihatlari tadqiq qilingan. Axborot-kommunikatsiya texnologiyalari, sun'iy intellekt, IoT tizimlari, kiberxavfsizlik va bulutli hisoblash platformalarining o'zaro uyg'unlashuvi, innovatsion yechimlar yaratishdagi o'rni ilmiy asosda tahlil etilgan. Shuningdek, texnologik integratsiya jarayonlarining ishlab chiqarish, ta'lim, sog'liqni saqlash va boshqa sohalardagi samaradorligi, raqamli transformatsiyani jadallashtirishdagi ahamiyati ochib berilgan.*

Резюме: *В статье рассматриваются теоретические основы интеграционных процессов и их практические аспекты в контексте развития современных технологий. Научно анализируется роль информационно-коммуникационных технологий, искусственного интеллекта, систем Интернета вещей, кибербезопасности и платформ облачных вычислений в создании инновационных решений. Также раскрывается эффективность технологических интеграционных процессов в производстве, образовании, здравоохранении и других сферах, а также их значение для ускорения цифровой трансформации.*

Kalit so‘zlar: *zamonaviy texnologiyalar, integratsiya jarayonlari, sun’iy intellekt, axborot-kommunikatsiya texnologiyalari, innovatsion yechimlar, raqamli transformatsiya, integratsiyalashgan tizimlar.*

Ключевые слова: *современные технологии, интеграционные процессы, искусственный интеллект, информационно-коммуникационные технологии, инновационные решения, цифровая трансформация, интегрированные системы.*

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METHODOLOGY OF TEACHING STUDENTS ON LABOR PROTECTION AND TECHNICAL SAFETY

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Summary: *The article explores modern methodological approaches to the formation of knowledge and skills in labor protection and technical safety for students. The theoretical and practical basis for the effective organization of the educational process is considered, aimed at the development of the culture of labor protection and security, the Prevention of possible risks in the processes of production and practice. Through the use of interactive methods, practical training and innovative technologies in the educational process, the possibilities of strengthening the knowledge of students and preparing them for safe Labor activities are covered on a scientific basis. On the basis of modern pedagogical technologies, the article developed recommendations for improving the educational and methodological support system for labor protection and Technical Safety.*

Key words: *labor protection, technical safety, interactive pedagogy, electronic methodologies, practical training, safety culture.*

In addition to forming skills today, labor protection and Technical Safety Education requires an integrated approach, such as real or virtual adaptation of students to a safe Labor environment, teaching them to use new technologies.n addition to forming skills today, labor protection and Technical Safety Education requires an integrated approach, such as real or virtual adaptation of students to a safe Labor environment, teaching them to use new technologies. According to global trends in 2025, artificial intelligence, Internet of Things (IoT), smart devices, and VR/AR technologies have been noted to significantly increase the effectiveness of Occupational Safety Training . For example, the ILO (Revolutionizing Health and Safety: the Role of AI and Digitalization at Work) report argues that it is radically changing the security management process through AI and digitization.

The regulatory framework for labor protection of the Republic of Uzbekistan (resolutions No. 267, 153 and Regulations No. 286) guarantees that students undergo practical safety training and training in real conditions.he regulatory framework for labor protection of the Republic of Uzbekistan (resolutions No. 267, 153 and Regulations No. 286) guarantees that students undergo practical safety training and tr.

Today, these approaches form not only theoretical knowledge, but also the safety culture of students.oday, these approaches form not only theoretical knowledge, but also the safety culture of students. For example, VR-based simulaoday, these approaches form not only theoretical knowledge, but alson.

At the same time, it was recognized that the role of new personal protective equipment and technologies presented at the 2025 ASSP Safety conference was also important.t the same time, it was recognized that the role of new personal protective equipment and technologies presented at the 2025 ASSP Safety conference was also important. Thus.

Many scientists conducted research on the topic of training students for Technical Safety. Several scientific popular articles as well as scientific works have been done on this topic:

Rakhiakhimov O.D. t.f.d. prof. In 2024-2026, he headed the project" systematic management of labor protection in Uzbekistan on the basis of digitization and competence approach", the platform" training and knowledge digitization model of labor protection of industrial enterprises management employees and specialists " was developed, through which he introduced tests and legal-moduleelectronic format.

Yo‘ldoshev O‘.R. t.f.d. prof. Andijon Davlat Universiteti mehnat muhofazasi va texnika xavfsizligi bo‘yicha 2013 yilda nashr etilgan maqolalar asosidagi qo‘llanmalar bilan ta’minlash, o‘quv mashg‘ulotlarida sanitariya, yong‘in, elektrotexnika xavfsizligi bo‘yicha amaliy ko‘nikmalarni mustahkamlashni tajriba asosida ilgari surgan[2].

Roozikov R.S. in his scientific work, he prepared manuals that proposed the comprehensive training of safety techniques and professional sanitation in highe.

Juraev B.X. t.f.f.d. (PhD) in the dissertation” improving methods of compliance with labor protection requirements in the field of Agriculture", methods of improving the safety of agricultural technologies were analyzed with systematic approaches to meet nts[3].

Atabaev K.A. PhD in the specialty” labor protection and the safety of human activities", his dissertation dealt with issues of increasing labor productivity.

Ruggiero L. A professor at Massey University, he has promoted the safety of the digital building environment by developing fire-evacuation simulations using virtual realism and AR technologies.

Enrico R. A professor at Lund University, has done research on evacuation research and modeling of human behavior in the context of VR.

Mark Billinghurst is a professor at the University of South Australia, who has developed AR/VR interfaces and pedagogical tools.

Thomas A. Emeritus, a professor at the University of Washington, is considered the “father of VR” in the VR/AR field, having led innovations as the co-founder of HIT Lab (Human Interface Technology Laboratory).

The study is based on an experimental-pedagogical model, in which interactive methods, flipped classroom and virtual simulations (VR/serious games) are tested on a scientific basis with students of the faculty.he study is based on an experimental-pedagogical model, in which interactive methods, flipped classroom and virtual simulations (VR/serious games) are tested on a scientific basis with students of the faculty.

The results of the study show that VR/AR trainings and challenge-based learning pedagogical methodologies have a significant advantage over traditional methods: they serve as an effective tool for generalizing theoretical knowledge, strengthening practical skills, and increasing the ability to identify risks.he results of the study show that VR/AR trainings and challenge-based learning pedagogical methodologies have a significant advantage over traditional methods: they serve as an effective tool for generalizing theoretical knowledge, strengthenin.

Also, multisensory virtual environments enhance emotional involvement, which reinforces practical memory, but no significant difference has been observed in written tests.lso, multisensory virtual environments enhance emotional , which relso, multisensory virtual environments enhance emotional involvement, which reinforces practical memory, but no significant difference has been observed in written tests. This situation indicates the need to maintain balance in pedagogical planning. In an additional case, in the information obtained from the trainer interviews, educators adapt the problems to the context of real work, forming a socio-interactive environment and focusing on the monitoring processes of the results. This pedagogical approach corresponds to the basic principles of the CBL (Challenge-Based Learning) educational method (student-content compatibility, collaboration, reflection) [6].

However, the experience of Reddit users has shown that some users calculate VR-training as a waste if it is motivational but not adapted, emphasizing that load sensitivity and the level of application quality are an important factor.owever, the experience of Reddit users has shown that some users calculate VR-training as a waste if it is motivational but not adapted, emphasizing that load sensitivity and the level of application qualit.

In the end, the selected methods will not only ensure the digital formation of knowledge and skills, but will also become the basis for the development of safety culture and risk detection skills and the introduction of innovative pedagogical approaches to both labor protection and Technical Safety.n the end, the selected methods will not only ensure the digital formation of knowledge and skills, but will also become the basis for the .

Scientifically based results on the topic of training students for labor protection and technical safety are presented in Figure 1.

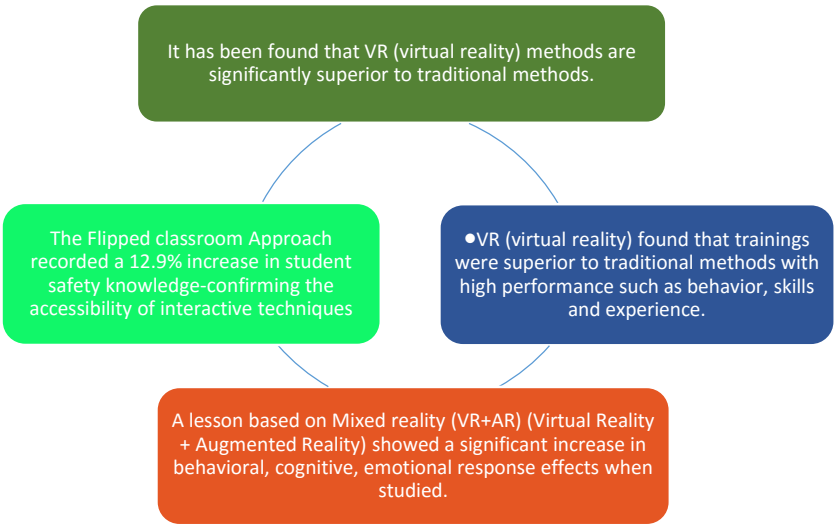


Figure 1. Results.

In conclusion, research has shown that VR / AR technologies represent a scientifically based advantage over traditional methods in labor protection and Technical Safety Education.n conclusion, research has shown that VR / AR technologies represent a scientifically based advantage over traditional methods in labor protection and Technical Safety Education. For example, trainings studied under the method of PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) allow an interactive and secure preparation for practice through a virtual environment, showing significant positive changes compared to traditional methods. In the fields of development, industry and health, VR-assisted skills were studied at a higher level than traditional training, and the results showed high efficiency in preparing for real working conditions.n the fields of development, industry and health, VR-assisted skills were studied at a higher level than traditional training, and the results showed high efficiency in preparing fn the fields of development, industry and health, VR-assisted skills were studied at a higher level than traditional training, and the results showed high efficiency in preparing for real working conditions. Mixed reality (VR+AR) techniques, on the other hand, increase cognitive, emotional and behavioral skills together, strengthening the complex effectiveness in pedagogical education. In addition, multisensory stimulus (heat, smell) and gamified virtual trainings increase motivation and increase risk perception and attention potential. These approaches will further deepen not only theoretical knowledge, but also practical skills - which will significantly increase the readiness of students for work activities in a safe working environment.hese approaches will further deepen not only theoretical knowledge, but also practical skills - which will significantly increase the readiness of students for work activities in a safe working environment. The integration of such innovative methods into the educational system of l.

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Rezyume: *Maqolada talabalarga mehnat muhofazasi va texnika xavfsizligi bo‘yicha bilim va ko‘nikmalarni shakllantirishning zamonaviy metodik yondashuvlari tadqiq qilingan. Mehnat muhofazasi va xavfsizlik madaniyatini rivojlantirish, ishlab chiqarish va amaliyot jarayonlarida yuzaga kelishi mumkin bo‘lgan xavf-xatarlarni oldini olishga qaratilgan o‘quv jarayonini samarali tashkil etishning nazariy va amaliy asoslari ko‘rib chiqilgan. Ta’lim jarayonida interaktiv metodlar, amaliy mashg‘ulotlar va innovatsion texnologiyalardan foydalanish orqali talabalar bilimlarini mustahkamlash va xavfsiz mehnat faoliyatiga tayyorlash imkoniyatlari ilmiy asosda yoritilgan. Maqolada zamonaviy pedagogik texnologiyalar asosida mehnat muhofazasi va texnika xavfsizligiga oid o‘quv-metodik ta’minot tizimini takomillashtirishga doir tavsiyalar ishlab chiqilgan.*

Резюме: *В статье исследованы современные методические подходы к формированию у студентов знаний и умений по охране труда и технике безопасности. Рассмотрены теоретические и практические основы эффективной организации образовательного процесса, направленные на развитие культуры охраны труда и техники безопасности, предупреждение возможных опасностей в производственных и практических процессах. Научно обоснованы возможности закрепления знаний учащихся и подготовки их к безопасной трудовой деятельности посредством использования интерактивных методов, практических занятий и инновационных технологий в образовательном процессе. В статье разработаны рекомендации по совершенствованию системы учебно-методического обеспечения по охране труда и технике безопасности на основе современных педагогических технологий.*

Kalit so‘zlar: *Mehnat muhofazasi, texnika xavfsizligi, interfaol pedagogika, elektron metodikalar, amaliy mashg‘ulotlar, xavfsizlik madaniyati.*

Ключевые слова: *Охрана труда, безопасность техники, Интерактивная педагогика, электронные методики, практические занятия, культура безопасности.*

INFORMATION ABOUT KARAKALPAK HOUSING

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Summary: *This article presents information and perspectives on the dwellings of the Karakalpaks who inhabited the Khorezm oasis in the 19th century, as well as their architectural styles.*

Key words: *Karakalpaks, oasis, expedition, Khorezm, korauy, kerege*

The dwellings of the Karakalpaks in the Khorezm oasis during the 19th century were characterized by a diversity of forms, influenced by historical and environmental conditions, as well as the unique nature of building materials, construction techniques, types of residential and economic structures, and their layout.

Information about the dwellings of the Karakalpaks in the Khorezm oasis can be found in the works and materials of Russian research expeditions, including those of Butakov (1858–1859), Kaulbars (1873), the Amu Darya expedition (1874–1875), and others. According to these written sources, the dwellings of the Karakalpaks in the mid-to-late 19th century primarily consisted of yurts. It can be considered that the expedition led by S.P. Tolstov in 1937 studied the ancient period of this region thoroughly and comprehensively [1].

This study also highlights how, even during the most challenging periods of their history, the Karakalpak people consistently demonstrated a creative desire to decorate their domestic spaces. Furthermore, it reveals the value and significance of Karakalpak folk ornamentation as a historical and ethnographic source, through which many features can be traced that illuminate the history of the Karakalpaks' origin, their ethnic and cultural connections with ancient and medieval tribes and peoples, as well as with some contemporary peoples of Central Asia, Eastern Europe, and Siberia [2].

Archaeological excavations conducted by A.Yu. Yakubovsky at the complexes of *«Nazlimkhan Suliu»* and "*Gauir Kala"* near the city of Khodjeyli, and by S.P. Tolstov at "*Topyrak Kala"*, "*Zhomart Kassap"*, and "*Ay Buyir"*, indicate that architecture and residential construction in these areas were highly developed.

According to S.P. Tolstov: "The history of the Karakalpaks cannot be considered separately from the history of Khorezm." For instance, at the monument "*Baraktam"*, discovered in the Takhtakupyr district, ancient Khorezmian architecture merged with the yurt-making traditions of semi-nomadic people. Archaeologists suggest that the second floor (tier) of the house was covered with felt [3].

These findings indicate that the craft of house construction among the Karakalpaks was well-developed even in ancient times. Under pressure from external enemies, the Karakalpaks were forced to adopt a nomadic lifestyle around their ancient settlement in Khorezm. In such conditions, dwellings needed to be easily and quickly erected and dismantled. The first examples of such dwellings were huts and tents. Over time, they were gradually improved and adapted to the conditions of nomadic life. One of these types of dwellings appears to have been the yurt, or "*kara uy"*, which has survived to the present day [4].

The Karakalpak yurt had certain distinctions from the yurts of neighboring nomadic peoples, visible in specific construction details as well as in its interior and exterior decoration.

The "*tam"* was a large rectangular house with a flat roof. It consisted of one or two living rooms. The walls contained a hearth, storage rooms, a barn, and a covered courtyard (*uyjay*), where a yurt could be erected. Its entrance was secured with massive wooden gates. The "*tam"* primarily served as a winter dwelling, while in summer, people preferred to live in the yurt outside the house [5]. The Karakalpak yurt has been studied in many respects by numerous ethnographers.



Figure 1. Karakalpak Yurt

In this article, we will discuss the architectural and artistic features of the yurt, its simplicity and durability, the safety of the materials used, and the decoration of its interior and exterior.

The construction of the yurt contains no unnecessary elements. Every component, whether small or large, has its function. The wooden parts of the yurt are divided into four groups: "*kerege"*, *"uyk"*, "*shanyrak"*, and "*ergenek"*. The "*ergenek"* (double-leaf door) includes "*zhaklau*" (side posts), "*manlaisha"* (lintel), and "*tabaldryk"* (threshold), which together form the framed structure of the door. They are made from the wood of white willow and "*janeuit"* (a type of turang tree). The wood of these trees is strong and lightweight. A yurt can last for hundreds of years. It is convenient and easy to transport during relocations.

The "*kerege"* and "*uyk"* are made from selected willow poles. They are uniform in length and thickness.



Figure 2. Kerege

The "*kerege"* consists of approximately forty or more poles, which are arranged in two rows and bound together with a thick leather strap in such a way that they can be tightened or stretched lengthwise. This forms one "rope" (section) of the "*kerege"*. A yurt can have four (the smallest), six, and up to twelve "ropes" (sections), with the largest size reaching twelve. The height of the "*kerege"* is approximately 1.28–1.40 m, and the width is 2.10–2.40 m.

The "*kerege"* sections are installed starting from the right side. The sections are tied together with "*dizbe"* (rope). Once assembled and tied in a circular shape, the first and last sections are attached to the doorposts. The door is positioned according to the lintel (*manlaisha*) and threshold (*bosaga*). All "*kerege"* sections are connected in the middle on the inside with an inner belt (*beldeu*), a flat rope around the circumference. The "*beldeu"* or belt rope (*beljip*) is woven from cotton threads, 30–40 cm wide, with smooth or textured patterns made of thick brown or red woolen threads. The "*beljip"* firmly secures the entire yurt framework and also serves a decorative function.

The "*shanyrak"* consists of two wooden circles (*taban*). The outer circle is slightly wider than the inner circle, and the holes (or "eyes") on it are used to insert the ends of the "*uyk"* poles. The number of holes in the "*shanyrak"* must correspond to the number of "*uyk"*, which are attached to the top of the "*kerege"* and the lintel (*manlaisha*). At the center, the "*shanyrak"* is reinforced with

two sets of five curved sticks arranged in a cross. These provide structural strength and give the "*shanyrak"* a dome-like shape, while also serving a decorative purpose.

Figure 3. Dome-shaped form of the Shanyrak.

The dome-shaped form of the Karakalpak yurt is one of its distinguishing features compared to the yurts of other peoples. The dome shape of the "*shanyrak"* facilitates the opening and closing of the "*tunlik*" (cover for the yurt dome). The "*shanyrak"* performs several functions: light enters the yurt through it, and smoke exits through it.

Nine curved poles forming the dome of the "*shanyrak"* are attached to the inner wooden circle of the "*shanyrak"* in a radiating pattern, creating an aesthetically pleasing appearance. The inner wooden circle, with its curved poles, is connected to the outer wooden circle by three small wooden sticks in four locations. The ends protruding on the inside of the "*shanyrak"* serve as decorative elements, to which long ropes with tassels are attached.

The diameter of the "*shanyrak"* is approximately 1.35–1.70 m, and the height is about 0.5 m. The curved poles, arranged in a cross pattern, are aligned with the four cardinal directions. The length of the "*uyk"* poles must be at least 2.5 m, resulting in a yurt height of around 4 meters. To ensure the "*uyk"* poles are evenly spaced and do not tilt sideways, they are tied with a narrow patterned woven rope (*dizbe*), placed slightly above the "*iyneu"*.

Before covering with the "*uzik"* (dome cover), two horizontal ropes (*baskur*) are stretched at the lower part of the "*uyk"*: one "*kara* (black) *baskur"* and one "*ak* (white) *baskur"*. These provide structural strength and decoration. A third, "*kyzyl* (red) *baskur"*, 50–70 cm wide, firmly connects the upper and lower parts of the yurt. It is called "red" because large black diamond-shaped patterns are set against a red background. The length of the "*ak baskur"* is 12–13 m, width 40–50 cm, displaying the finest examples of Karakalpak women's weaving. The "*ak baskurs"* preserve traditional national patterns such as "*kos muyiz"*, *"tai tuyak"*, *"gaz moyyn"*, *"gauasha gul"*, *"tarak"*, *"arys"*, and others. The ends of the *ak baskur* are attached to the "*uyk"* at the lintel (*manlaisha*).

A small mat, 1.30 m long and 40 cm wide, covering the ends of the "*ak baskur"*, is called "*esikkas"*. The ends of the "*esikkas"* are also attached to the "*uyk"*, and its lower edge is decorated with woolen cords with tassels. The "*esikkas"* is decorated with yellow patterns, including "*bauyrsak"* (diamond) and "*kos muyiz"*. The two ends of the "*esikkas"* continue inward as "*jambau"*. This is not a wide :*akkur"* with multiple colored patterns. It is attached to the "*kerege"* and slightly diagonally downward, giving it another name: "*iykembas"*.

From reed stalks stripped of leaves, a mat (*shiy*) is made. Making the "*shiy"* requires skill. Tying the "*shiy"* tightly is an important feature of the Karakalpak yurt. Over the "*shiy"*, a covering mat (*shiy onir*), 40–50 cm wide and equal in length to the "*shiy"*, is stretched. In the middle of the "*shiy"*, a cord called "*beldeu"* or "*kur"*, woven in the form of "*ak baskur"*, is tied to hold the "*shiy"* and "*kerege"* firmly in place.

A fully assembled and properly furnished yurt protected people from the cold in winter and from heat in summer, serving as a universal dwelling for living and resting. The "karauy" yurt represents the finest example of Karakalpak residential construction and plays a significant role in the modern organization of urban planning and landscape design in settlements with extreme climatic conditions in Karakalpakstan.

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DEVELOPMENT OF VISUAL-MOTOR THINKING IN PRIMARY SCHOOL PUPILS

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Summary: *Thinking operates according to general laws common to all people, yet it also manifests age-related characteristics and individual peculiarities. This article discusses observations and reflections on the development of visual-motor thinking in primary school pupils.*

Keywords: *thinking, visual-motor thinking, visual-imagery thinking, abstract thinking, visual representations, internal cognitive operations, object-directed activities.*

Thinking's individual peculiarities appear differently in different people. Constant relations arise among the complementary forms and manifestations of thinking activity (visual-motor, visual-imagery, and abstract thinking).

According to the genealogy of thinking, it can be distinguished into the following forms: visual-motor; visual-imagery; logical-verbal; and abstract-logical.

Visual-motor thinking is genetically the earliest level. At this level, relations are revealed through direct manipulation of concrete objects. For example, if a child discovers that striking one ball against another can set it in motion, the child is using visual-motor thinking. Although this level primarily characterizes thinking in early childhood, it also appears in adults during the development of conceptual thinking. Visual-motor thinking involves perceptual situations that can bring a person to perform real practical actions.

Visual-motor thinking is "…a mode of thought in which the learner uses visual representations and concrete actions to understand and solve problems. Instead of abstract concepts and theories, it relies on concrete examples and experiences to comprehend information and make decisions. Visual-motor thinking is particularly useful in learning and practical activity because it enables rapid and effective application of knowledge in practice."

In this form, internal cognitive operations are minimized, and problems are mainly solved through external practical actions with real material objects. This manifestation of thinking can be observed from early infancy (around 6–8 months) and continues into primary school age.

When discussing the single structure of the cognitive process, it should be noted that visual-motor thinking, though genetically an initial form, is not the "lowest" stage in the development of thinking. Its defining quality is that it reflects indirectly and in generalized form the relations and connections in surrounding reality that are not immediately perceivable. Visual-motor thinking not only has two-way relations with other forms of cognitive activity — visual-imagery and verbal-logical forms — but qualitative changes in visual-motor thinking can also be identified during the general process of intellectual development.

The psychological and pedagogical characteristics of developing pupils' visual-motor thinking may vary depending on each pupil's age, individual traits, and level of education. At the same time, the general features of developing this type of thinking include the following aspects:

1. Awareness of spatial knowledge**.** Pupils can develop reasoning by understanding spatial relations. This includes the ability to act in space and to understand geometric shapes and their relative positions.
2. Development of motor skills and coordination**.** To foster visual-motor thinking, it is important to develop instrumental skills and coordination that allow pupils to control movements in space. This is because activities such as sports, dance, drawing, and other physical tasks require such capabilities.
3. Visual perception and information analysis**.** Pupils can develop visual-motor thinking through visual perception and analysis of information, for example by working with graphs, diagrams, maps, and other visual materials.

4. Play and creative tasks. Using play and creative assignments helps develop pupils' visual-motor thinking because these activities require active movement as well as visual perception and processing.

5. Individual developmental characteristics**.** It is important to consider each pupil's individual developmental features, since "the level of visual-motor thinking may differ from one person to another. Pedagogical work should be oriented toward pupils' individual needs and abilities."

Thus, developing pupils' visual-motor (visual-action) thinking requires a comprehensive approach that includes varied activities, play and creative tasks, and attention to each pupil's individual characteristics.

A. N. Leontyev described the interactions among different forms of thinking and noted that the study of complex intellectual activity "…has created the basis for accepting various highly developed forms of thinking that are often tightly interconnected and transform into one another." In adults, higher levels of practical intelligence are particularly significant.

Undoubtedly, adult practical thinking, unlike a small child's thinking, is not always directly linked to perceptible changes in the object. However, there are many cognitive and practical tasks whose solutions cannot be achieved without direct perception of the object and the situation — that is, without materially transforming the object. Frequently, "higher developed forms of thinking operate in close connection with practical actions under certain conditions."

In ontogenesis, the development of visual-motor thinking proceeds together with the development of object activity and the child's acquisition of speech. As E. G'oziyev emphasized, the empirical observation of the sequential complication of object activity shows that later and more complex object-related skills are formed after simpler ones have been mastered.

Several important stages can be distinguished in the evolution of object-directed actions: the child's direct interaction with objects; initial effective actions performed by hand; then the performance of actions indirectly using another object; as a result, the first object begins to emerge as the object of activity. The use of auxiliary objects — the transition between object-directed and tool-mediated activity — is a key direction in the development of object activity. The use of auxiliary items and the formation of tool-mediated activity create necessary conditions for the child's selective orientation to different parts and properties of objects and become instruments for achieving results.

Thus, the emergence and development of visual-motor thinking in children are associated with the transition from manipulative to object-directed and then to elementary forms of effective activity; with the complication of relationships with adults and peers; and with the increase in the volume of acquired knowledge and speech. These changes are manifested in the child's activity directed at mastering objects and at acquiring socially developed ways of using them.

Pedagogical psychologists have amassed extensive empirical evidence on the importance of the development of children's actions (motor activity) for perception, memory, attention, and the formation of thinking — specifically in relation to object activity. "The role of object activity has been studied in connection with children's mastery of the generalizing function of words, the development of speech, and initial concept formation. The influence of direct practical experience on children's thinking and the content of emerging generalizations is evident; the understanding of cause-and-effect relations depends on the child's practical acquaintance with objects."

S.S. G'ulomov noted that "any practical action includes both directive and executive, operational components." Research by M. Saidov on the development of pupils' thinking ability showed that "…the effectiveness of performing various tasks in a visual-motor manner is directly related to the nature of children's investigatory activity."

Studies of methods for initially introducing primary school children to new objects have shown that, with age, the nature of directive-investigatory activity changes: directive-investigatory reactions separate from executive reactions, and methods of investigation appropriate to the objects' properties are formed. Children transition from tactile-action orientations to observational orientations; as a result, different types of orientations become more coordinated and complementary, which affects the nature of children's concepts of objects.

However, not only the directive-investigatory component but also the executive component of action requires careful study: "…just as it is impossible to understand the executive component without analyzing the directive part of action, it is also impossible to understand the directive-investigatory component without analyzing the executive part."

Under the leadership of N. N. Podd'yakov, a number of experimental studies demonstrated success in using practical changes of objects to form ideas about mechanical relations occurring during objects' rotational movements and in using models and diagrams to guide children's conceptualizations of soil properties (loose, dense, viscous, etc.). These studies confirmed that guiding children in object reality through models and schemes contributes to the formation of relevant concepts.

Therefore, the defining feature of the form of thinking under discussion is its direct, effective relation to the surrounding object world. Visual-motor thinking "is always directly tied to a specific practical situation in which actions are performed," and this situation should present itself to the child as a problematic task — that is, as a challenge to be solved.

In visual-motor thinking, the decision-making process can be introduced directly during a particular practical action when the decision-making situation is realized by actually changing the situation. In doing so, the child sequentially implements each step of the practical task solution and obtains the opportunity to visually perceive the consequences of changing the situation; as a result, a direct basis for subsequent steps of the thinking process is created. In such a case, thinking acquires a step-by-step character that gradually brings the individual closer to the goal (problem solving, discovering the unknown). "Practical action itself partially replaces the operations of thought by allowing the anticipation and timely accounting for all changes arising from previous stages of problem solving in the problematic situation."

This advantage of visual-motor thinking — the provision of continuous control over the course of thought — creates "highly favorable conditions for immediate checking and self-checking of each stage of the cognitive process."

Thus, practical methods of changing objects play a special role in visual-motor thinking, during which a child can identify their hidden, important properties and relations. These methods represent the most important components of visual-motor thinking.

The changes used to single out internal properties and relations of objects are diverse (for example, morphological and functional transformations).

Practical actions are sometimes distinguished by authors into executive and experimental actions; their specific feature is the child's readiness to obtain both matching and non-matching outcomes relative to the intended result. Experimental actions are crucial for identifying hidden, internal relations of the objects under study and for analyzing obtained results. These actions form the basis of investigative activity. In investigative activity, "…a child's particular aspect of perceiving reality emerges as the content of their thinking activity: a domain of specific objects and relations appears. Such objects may include the child's own actions and their results (both object-related and cognitive), the results themselves, and the relations between these results and the given outcome."

For primary school children, teaching generalized methods of using practical experimental actions to identify hidden properties and relations of objects, "extended experiment" methods, and the ability to extract useful information from mistakes appears very promising. All of the above justifies considering visual-motor thinking as a more complex form of investigative activity.

Based on numerous experimental research results and theoretical analysis, N. N. Poddyakov proposed distinguishing two types of visual-motor thinking. He emphasized that this differentiation "is somewhat theoretically abstract" and that in reality both types interact and transform into each other; he defined them as follows.

"The first type of visual-motor thinking is characterized by being directed toward learning about the object without aiming to achieve a particular practical result. This type of thinking is revealed as a disinterested cognitive activity and is primarily defined by the properties of the object under study. The main aspect of this type is that all practical actions are subordinated to the cognitive task."

"The second type of visual-motor thinking is characterized by being oriented toward solving a specific practical task that involves transforming the object from its current state to a prescribed state. Knowledge of the object here is necessary only in the relations directly linked to the solution of the practical task. Cognitive actions… are integrated into and serve the practical activity." Hence, the child isolates and records only those relations and connections in the object that ensure the solution of the assigned practical task.

The basis for distinguishing the two types of visual-motor thinking is also the nature of the external material actions that bring about transformation of the situation. Analysis of the direction of investigative activity allows distinguishing two groups of practical actions that implement one or the other type of visual-motor thinking: the first group includes actions aimed at changing the object in order to obtain cognitive results, and the second group includes actions aimed at changing the object to achieve a specific practical outcome.

The first group of actions is further subdivided into two subgroups:

a) actions associated with changing the object in order to learn about object properties that are necessary for achieving a specified practical result (serving the second type of visual-motor thinking); and

b) actions associated with changing the object in order to learn about its properties without aiming to achieve any specified practical result (serving the first type of visual-motor thinking).

Although Podd'yakov's idea of distinguishing two specific types within visual-motor thinking offers a promising avenue for deeper study, it still lacks extensive experimental elaboration. Therefore, targeted study of the two types of visual-motor thinking in preschool children — their structural properties and the possibilities for transitioning to higher levels of thinking development (for example, to visual-imagery thinking and beyond) — remains an urgent research task.

Poddyakov's criterion for distinguishing the two types — the directionality of the child's investigative activity —, in our view, can be supplemented by another principle that marks the characteristics of the internal structure of a certain type of thinking: the mechanism of goal formation.

Indeed, the first type of visual-motor thinking develops as an autonomous ("disinterested") cognitive activity in which the cognitive goal is independently determined by the child. The nature of goal formation in this type of thinking may serve as an analogue to incidental goal formation in incidental learning.

The second type of visual-motor thinking develops within the context of a specific practical task; in this case the cognitive process is determined by a goal externally set for the child. Accordingly, goal formation here may serve as a model of deliberately organized instruction (acceptance and retention of goals) in special teaching.

Thus, experimental investigation of the two types of visual-motor thinking in primary school pupils enables us to combine analysis of the genesis of the initial form of thinking with analysis of goal-formation processes.

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Rezyume: *Tafakkur barcha insonlar uchun umumiy bo'lgan qonuniyatlar orqali amalga oshadi, lekin shu bilan birga tafakkurda insonning yosh jihatlari va individual o'ziga xosligi namoyon bo'ladi. Ushbu maqolada kichik maktab o'quvchilarida ko'rgazmali-harakatli tafakkurini rivojlantirish borasida fikr-mulohazalar bayon etilgan.*

Резюме: *Мышление осуществляется на основе общих для всех людей закономерностей, однако при этом в мышлении проявляются возрастные особенности и индивидуальная*

специфика человека. В данной статье изложены мнения и рассуждения о развитии наглядно-действенного мышления у младших школьников.

Kalit so'zlar. *Tafakkur, ko'rgazmali-harakatli, ko'rgazmali-obrazli, abstrakt tafakkur, vizual tasvirlar, ichki aqliy harakatlar, predmetli harakatlar.*

Ключевые слова: *мышление, наглядно-действенное, наглядно-образное, абстрактное мышление, визуальные образы, внутренние умственные действия, предметные действия.*

TRADITIONAL ARCHITECTURAL METHODS IN EASTERN BUILDING DESIGN

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Summary: *This article examines traditional architectural methods in Eastern architecture, their significance and role, and the various forms they have assumed over time.*

Keywords: *Eastern architecture, Greek and Roman civilization, architectural ensembles, architecture of the Independence period.*

In Ancient Greece, the word "architecture" originally referred to the chief builder, which laid the foundation for the development of this great profession. The emergence of architecture dates back to the Paleolithic era.

In Greek and Roman civilizations, the period from the 12th–13th centuries BCE to the 4th–5th centuries CE is referred to as the "Ancient World." The Gothic architectural style in Rome spans the 13th–15th centuries.

In architecture, the method of expressing both the function of a structure and its artistic aspect is called "tectonics." From history, we know that the Acropolis of Athens was constructed in the 5th century BCE, and Vitruvius wrote the treatise "Ten Books on Architecture."

The combination of architecture with painting and its connection to sculpture is called the "synthesis of the arts." For example, in architecture, the term "ensemble" is also used. It refers to the highest form of architectural composition—the unity of architectural structures and the coherence of a specific artistic design, interconnected with one another, which gave rise to the concept of an architectural "ensemble." A striking example in our country is Registan Square in Samarkand, where the Sher-Dor, Ulughbek, and Tilla-Kori madrasahs are located.

At the beginning of the 18th–19th centuries, the style of "Classicism" emerged in architecture. By the functional aspect of architecture, we mean its practical and useful side. In architecture, there is also the concept of "eclecticism," which in modern architecture is realized through the combination and use of elements from several earlier architectural styles. The concept of "eclecticism" is fully reflected in the mosques, madrasahs, and mausoleums of our time.

In the book by academician Akmal Saidov, "Hazreti Zangi Ata," the following ideas are expressed: "The origins of the development of courtyard architectural traditions, characteristic of Uzbek architecture, can be clearly traced in the example of buildings in the territory of Tashkent, in particular, the historical and architectural ensemble of Zangi Ata. An example of traditional architecture in Tashkent is the sequential arrangement of a series of rooms and 'ayvan' with columns" [1].

According to D. Salahiddinov, "There were methods such as constructing buildings on one or several sides surrounding a territory, creating squares and courtyards that formed a microclimate in the space, which occupied such an important place in Uzbek architecture that even residential houses in the local language were called 'khovli'" [2].

"In mosques and madrasahs, the courtyards are surrounded on all four sides by buildings, and the rooms are ventilated through the courtyards. Considering the dry, hot climate of Central Asia, architectural techniques typical of traditional Eastern courtyards were used to create a microclimate, such as arranging 'ayvan' and canopies, laying out gardens and alleys, and constructing 'khauz' (water basins). These elements can be observed in the buildings that are part of the historical and architectural monument of Zangi Ata" [3].

Academician Akmal Saidov, in his book "Hazreti Zangi Ata," expresses the following ideas on this matter: "Questions of harmony in architecture and the proportionality of forms were sufficiently studied by the first researchers of Central Asia, such as L.I. Rempel, Sh.E. Ratia, and V.L. Voronin, using monuments related to the Tashkent architectural school as examples. After them, research in this field was conducted by M.S. Bulatov, P.Sh. Zahidov, K.S. Kryukov, G.A. Pugachenkova, I.E. Pletnev, V.M. Filimonov, G.I. Gaganov, M.K. Akhmedov, and A.S. Uralov.

Notably, these scholars described the presence of geometric harmonization and consistency of forms in architecture" [4].

The "exterior" refers to the outward appearance of a building, while the "interior" refers to its internal appearance. In design, it is necessary to consider key aspects of architecture: aesthetics, durability, and convenience. In a composition, a barely noticeable difference in form, volume, plasticity, texture, or color is called a "nuance."

It is also important to highlight the opinion of Doctor of Architectural Sciences, Professor A. Uralov: "Mirzo Ulughbek in his lifetime engaged extensively in activities such as urban planning, architecture, the founding of observatories, restoration and repair, visual arts, and stone carving. Notably, he carried out these works not only in the capital Samarkand but also in cities such as Shakhrisabz, Bukhara, Gijduvan, Yassy, Merv, Zangi Ata, and other places. At the same time, he devoted his efforts to the prosperity and governance of the country" [5].

In the architecture of the Independence period, the historical and architectural ensemble of "Zangi Ata" occupies an important place and plays a significant role among the architectural monuments created and restored by Amir Temur and Mirzo Ulughbek [6].

It is a source of pride that during the years of independence, historical buildings are being restored and reconstructed, returning to their historical appearance. In particular, extensive restoration and reconstruction work has been carried out in the historical and architectural ensemble of "Zangi Ata," located in the Tashkent region [7].

We reflect on architecture and its role in human life, as well as its historical significance. Examining the historical architectural monuments of Karakalpakstan, we see that architectural solutions, "nuances," and the "exterior" have been fully preserved. These historical architectural monuments, once built by our ancestors and used for everyday life, have now become an invaluable heritage of the past.

Historical, archaeological, and architectural monuments in Karakalpakstan were studied by the world-renowned scholar S.P. Tolstov and several other researchers, including internationally recognized architects. For example, the settlement of "Bolshoy Kyrk-Kyz" was studied in 1938 by S.P. Tolstov: a schematic plan was created, numerous materials were collected, and irrigation works were examined. In 1947 and 1948, additional materials were gathered, and photographs of the general view of the fortress were taken. The fortress was surveyed by B.I. Vaynberg and architect M.S. Lapirov-Skoblo [8].

The archaeological complex of "Mizdahkan" was named the "ancient city of Mizdahkan" after it was mapped by academician V.V. Bartold. In 1928-1929, the monument was studied by the Russian scholar A.Yu. Yakubovsky. In 1959 and 1966, during restoration work at the "Nazlymkan Suluv" mausoleum, architect V.M. Filimonov conducted a study of this structure [9].

In 1939, under the direction of S.P. Tolstov, excavations were carried out on the walls of a large building on the northeast and southeast sides of the fortress "Zhanbas Kala," dating to the period of the 4th–1st centuries BCE. In addition, architects V.I. Pilyavsky and G. Ali-Zada developed the general plan of the fortress and conducted architectural cleaning works. The total area of the excavations amounted to about 485 m², of which 75 m² were walls [10].

Undoubtedly, our ancestors built their structures with comprehensive conveniences. This means that they met architectural requirements. However, people with the profession of "architect" began their work in our society only in the 20th century. The first professional architects in Karakalpakstan were K. Molutov, O. Tureniyazov, and K. Nurmagambetov. With the country gaining independence, the demand for this specialty increased.

At one period, when construction was carried out according to a unified standard project developed centrally, housing in Moscow was identical to housing in Leningrad, down to the same "keys" for apartments. Today, in an era that emphasizes the uniqueness of each country and nation, architects are also held to high standards. An example of this is the National Museum of Berdakh, erected in our capital at the end of the 20th century, designed by the honored architect of Karakalpakstan, O. Tureniyazov.

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THE SCIENTIFIC AND PRACTICAL IMPORTANCE OF MODERN METHODOLOGY IN DEVELOPING STUDENTS' THINKING

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Summary. *This article analyzes the scientific and practical significance of using modern methods in developing students' thinking. It is shown that innovative pedagogical approaches and interactive methods serve to increase the effectiveness of the educational process and develop critical thinking.*

Key words: *students, thinking, modern methods, pedagogical technologies, critical thinking, educational process, innovative approach.*

In the educational process, one of the important tasks is not only to provide students with knowledge, but also to develop their thinking. Today, the rapid development of information technologies and innovative pedagogical methods requires the use of new approaches in the educational process. Modern methods play a major role in the formation of students' critical thinking, creative approach and problem-solving skills. Therefore, this topic is relevant and helps to identify effective teaching methods in pedagogical practice, implement them and solve the problems of improving the quality of education.

The problematic method is usually contrasted with the explanatory-demonstrative method. Such a contrast is relative and makes sense only if we consider these methods idealized from the point of view of the leading tendency that characterizes this or that method. The explanatory-demonstrative method transfers the activity in principle from the student to the teacher, using the teacher's language as if the subject of study itself were speaking. Scientific (including philosophical) knowledge appears before the subject of this knowledge either as a completed system of concepts, a ready-made result, in which the thought process that led to the development of this system of concepts is dialectically eliminated, and the system of exercises thus acquires its own objective logic independent of the subject.[1] When the student encounters the ready-made logic of knowledge, he is forced to subordinate himself to it, and therefore to play the role of an object receiving knowledge, rather than a subject creating it. Of course, in this case, a certain, often very high cognitive activity is required of him, as well as interest in the subject of education. Nevertheless, the student's activity here only follows the objective process of knowledge dissemination and resembles the activity of the observer.

The concept of "problem" cannot be applied to the object itself, since the object does not contain anything other than real things and the connections between them, there is no problem in them. The problem does not arise in the passive attitude of the subject to the object either. It is the result of the active interaction of the subject and the object of the cognitive process. The problem-based method assumes independent efforts of thought by learners, but the efforts are organized purposefully, meaningfully, objectively in accordance with the logic of the subject. The activity and independence of students are thus directed to the goal in the most rational way.

The problem-based method involves the creation of such teaching conditions that allow the objective logic of the subject to be connected with the subjective process of thinking. This process continues until it becomes a ready-made result in the consciousness of the individual. The problem-based method represents, as it were, a dialectical return back - from the ready-made result to the subjective conditions of its obtaining.[2] Therefore, the development of a problematic method requires an appeal to psychology, the verification of recommendations using a science that studies not only the results of thinking, but also its process, its course in the human mind. One of the important achievements of modern psychology is the definition of the nature of thinking as a process.

How can this process be imagined? According to psychologists, the most convenient model of the thinking process is problem solving. The problem is manifested as a determining factor in mental activity, as a method of involving the subject in the dialectical process of changing something (the conditions of the problem). This is done in order to find the thing being sought (the solution to

the problem). The solution involves reformulating the conditions that determine the next step. Each step in solving the problem (successful or unsuccessful), in turn, leads to reformulating the conditions taking into account the step taken. Such an approach to thinking directly leads us to the dialectical category of contradiction underlying any object, phenomenon, including the thinking process. Because in solving tasks, the conflict between the achieved level of knowledge and a certain specific ignorance (task requirement) is manifested as a motivating factor in the thinking process.

It is impossible not to notice the similarity of the process of mastering a subject of study with scientific research. The goal of these two processes is one - the acquisition of new knowledge. The essence of both is the transition from ignorance to knowledge, from incomplete knowledge to more perfect knowledge. The internal source of both processes is the contradiction between the task that has arisen and the existing level of knowledge. Based on this understanding of knowledge, it is necessary to more boldly introduce the basic concepts of dialectics into didactics: contradiction, problem, hypothesis, etc. The object of study should be presented not in a static state (as a set of ready-made conclusions), but in dynamics, that is, as a process of the emergence and resolution of contradictions, posing and solving problems, putting forward and testing hypotheses. However, this is not enough. The problematic method can only turn into formal problems if it does not affect the person himself, his interests, and life directions. Modern psychology believes that thinking cannot be separated from the person. It is necessary to add the study of the personal aspect of thinking to the mechanism of the thinking process itself. When viewed in this way, thinking appears as an activity. It is impossible to talk about thinking in isolation from human activity, in which the whole person comes into play as the subject of thinking.

Thinking as an activity has the following main structural elements: goal, motive, conditions, means, result. Without going into the details of psychological theory, it is worth noting that the direction of the thinking process does not arise from this process itself, but from the motives and goals of human activity in general. Therefore, it is impossible to develop thinking without simultaneously developing the personality itself. The formation of a personality is, first of all, the development of goal-setting and, accordingly, the expansion of the circle of its practical relations. The wider the connections with the world, the more complex the internal structure of the personality becomes, the more diverse and deep the mechanism of motivation and goal-setting of the personality becomes.

Education can and should be considered not as pure thinking separated from the personality, but as a human activity with its own interests, needs and goals. These interests, needs and goals affect both the thinking process and its result. Education achieves its goal only when the content to be mastered has personal significance for the learner - knowledge becomes deeper and more complete, becoming a means of individual belief and further activity. This is especially true of philosophy. Due to the worldview nature of philosophical knowledge, the process of teaching philosophy has a profound impact on the inner world of a person, affects the individual himself, his life goals, relationships and interests. This process places the individual in a social context, expands it to the general social scale, to the main issues of human existence, and leads a person into the world of the deepest problems of science and culture.[3]

The process of mastering philosophy as an academic discipline is simultaneously a process of transformation of the individual. During the mastering of philosophical knowledge, the "expansion" of the subject, or rather, the expansion of the subject's consciousness, takes place. In this process, he begins to understand his essence, what was previously imagined only as a set of external conditions of existence, more deeply. Developing in this way, going from an ordinary individual to a person with developed forms of attitude towards reality, the subject mastering philosophy also improves, clarifies and regulates his relations with the world, society as a whole, its main institutions and other people. What has become his personality in the knowledge of an individual to a certain extent changes his attitude to the world. The manifestation of a particular individual in various social spheres of human life, the degree to which he has achieved high achievements in various aspects of social consciousness characterizes him as a person. The more the individual expresses the commonality in him through his individual characteristics, the more significant he is.

Of course, the acquisition of philosophical knowledge is not always equivalent to transforming it into an internal belief and life position of the individual. The formation of faith is a complex process, which is solved more by life itself, and not only by studying worldview sciences. Well-organized education can only bring a person closer to understanding and mastering the correct worldview. However, education can become a means of forming faith only if it is based on intellectual activity arising from life itself, which is personally relevant to a person.

In the process of teaching philosophy, the development of the individual can be achieved by overcoming the limitations of everyday consciousness. Education aimed at solving this task allows you to create problem situations with a deeply personal content. Due to the specificity of philosophical language, which also uses everyday speech, it becomes difficult to determine and understand the purely philosophical meaning of categories. The transition of consciousness from the everyday level to the scientific level is difficult, since it is necessary to reconstruct the thinking of the subject of knowledge.

However, this reconstruction is one of the main tasks of teaching philosophy and an important condition for mastering the discipline of philosophy in general. It is necessary to emphasize another important aspect of overcoming everyday consciousness in the process of teaching philosophy. There is a certain connection between the various stages of the development of everyday consciousness and past, historically outdated philosophical systems. Philosophy, as a form of social consciousness, is also manifested at the everyday level. At the same time, elements of past philosophical systems and old views are preserved in everyday consciousness for a longer time. A person who embodies these views may not realize it, and only a special philosophical analysis allows us to identify a specific philosophical system that has been preserved by inertia from the past in a person's everyday imagination.

The study of the history of philosophy can be inextricably linked with issues of personality development by presenting it as a system of problematic tasks that are set before the student and perceived as his personal problems.

In the example of the assimilation of the category of contradiction by students, it was found that the student goes through a number of stages from the vital level to scientific thinking, in which various elements of the scientific theoretical understanding of this category are consistently mastered. These stages are: 1) misunderstanding, determined as a result of the collision of two opposing signs, tendencies; 2) absolutization of one of the sides (variability, continuity, infinity, relativity), which is misunderstood by students as dialectics; 3) mechanical addition of contradictions, the mutual transition of contradictions is not noticed due to the lack of mastery of the idea of development - the contradictions freeze at their poles and remain motionless; 4) dialectical scientific understanding.

In general, the use of modern methods in the development of students' thinking is of great scientific and practical importance. It has been found that innovative pedagogical approaches and interactive methods make the learning process effective and interesting, and help develop critical thinking and creative approaches. Therefore, the application of modern methods in the educational process is an important tool in pedagogical practice for increasing the intellectual potential of students.

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Rezyume: *Ushbu Maqolada talabalarning tafakkurini rivojlantirishda zamonaviy metodikalarni qo‘llashning ilmiy va amaliy ahamiyati tahlil qilinadi. Innovatsion pedagogik yondashuvlar va interaktiv metodlar o‘quv jarayonining samaradorligini oshirish va tanqidiy fikrlashni rivojlantirishga xizmat qilishi ko‘rsatildi.*

Резюме*: В данной статье анализируется научное и практическое значение использования современных методов в развитии мышления учащихся. Показано, что инновационные педагогические подходы и интерактивные методы способствуют повышению эффективности образовательного процесса и развитию критического мышления.*

Kalit so‘zlar: *talabalar, tafakkur, zamonaviy metodika, pedagogik texnologiyalar, tanqidiy fikrlash, ta’lim jarayoni, innovatsion yondashuv.*

Ключевые слова: *учащиеся, мышление, современные методы, педагогические технологии, критическое мышление, образовательный процесс, инновационный подход.*

PRIORITY AREAS FOR THE DEVELOPMENT OF THE EDUCATION SYSTEM IN THE REPUBLIC OF UZBEKISTAN

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Summary. *This article examines the essence and content of the new paradigm of the education system, its basic principles, as well as the features of human-centered education. The content of the concept of the system-activity method is revealed in its interrelation with the innovative strategy of education.*

Key words. *education, paradigm, innovative education, system-activity approach, civilization approach, human development.*

The current stage of societal development is characterized by the increasing complexity of social processes. The contradictions between the characteristics of the information civilization, which is forming in humanity in the 21st century, the industrial civilization, which has not yet lost its significance, and, at the same time, local civilizations, reflecting the uniqueness of regions, create difficulties in explaining social processes. The transition from one stage of system development to another is marked by an increase in chaotic conditions, or, in the words of synergetics, an interdisciplinary doctrine, an increase in entropy. The technological revolution caused by the development of production literally led to the choice between humanity living as a unified system or declining. The preservation of humanity as a unified, sustainably developing system requires the development of new mechanisms, and it is becoming clear that this mechanism should be based on human resources, their spiritual capabilities.

The participation of the Republic of Uzbekistan as an element of the global community in this process also presents certain difficulties. In our country, general civilizational processes are combined with the restoration of national statehood, the construction of a democratic state in our state, and the development of a national model of civil society. At the same time, a "new development strategy" has been developed - a way to achieve sustainable evolutionary development of Uzbekistan, the harmonization of universal principles with our national identity. [1] The correctness of our chosen path and goals is confirmed by the peaceful and sustainable development in our country in the current digital age. This development considers the expansion of human freedoms as a criterion for societal progress. The concept of human development, widely promoted today by the entire world community, considers the development of education in direct connection with the fulfillment of its tasks.

Currently, the changes taking place in the Republic of Uzbekistan also promote the creation of socio-pedagogical conditions corresponding to these processes and require the implementation of a new model of education, including thoughtful reforms, creative design. For this, a corps of teachers with a new analytical, project-constructive nature of thinking, aimed at improving the pedagogical paradigm, will be necessary. In other words, solving the problems of higher education is impossible without raising pedagogical intellectual culture, actively influencing public opinion, and conditionally eliminating stereotypes and conservatism in pedagogical science and practice. The solution to these issues is directly related to the development of innovative educational technologies for teaching. Therefore, the logic of a human-oriented innovative model should be directed from predicting learning objectives (why and why?) to selecting and designing content (what?), organizing the learning process (how?), selecting teaching methods and tools (with the help of what?), taking into account the teacher's qualification level (who is teaching?) and diagnosing the achieved learning outcomes (what have we obtained?). From this point of view, the goal of teaching is realized with the help of a pedagogical system, which is considered as an element of a "large system" called education, and it should be presented in a way based on the "general law of balance." This method necessitates thinking about the inclusion of educational institutions in a "highly responsible educational environment." Recognition of education by the economic, social, and cultural spheres allows for a transition from sloganeering and theoretical thinking to the construction of new effective education

systems that meet the needs of both the individual and society, as well as its economy. A healthy society is formed on the basis of citizens who receive education worthy of it.

Human-oriented education, first of all, means a change in the educational paradigm. If earlier, during the time of Herbert and Pestalozzi, and later at the stage of the Industrial Revolution, teaching activity was given priority in the teaching system, now at the post-industrial stage, in its information age, priority is given to learning activity. Therefore, the old paradigm: teacher-textbook-student is being replaced by a new paradigm: student-textbook-teacher. The teacher is receiving a new status, which remains as important as before, but we think it will look different. Now the teacher's task is to organize the independent cognitive activity of the student, to teach him to independently acquire knowledge and apply it in practice. To achieve these goals, the teacher should choose teaching methods that not only allow students to acquire ready-made knowledge but also help them independently acquire knowledge from various sources, form their own views, justify them, and use previously acquired knowledge as a method for acquiring new knowledge.

A priority political aspect of the development of education in the Republic of Uzbekistan is the need to preserve the heritage and integrity of the education sector. Its relevance is especially realized in the aspect of continuous education.

Continuous education is considered as an alternative to the previously existing discrete system, its humanistically oriented constitution, and a leading method of educational reform. That is, we must move from the principle of "lifelong learning" to the principle of "lifelong learning."

In the new edition of the Law "On Education," adopted in 2000, continuous education is considered as a pedagogical system, which explains the expansion, deepening of general knowledge, social maturity, and professional competence, as a whole complex of forms, methods, means, and ways to achieve it.

An important task of the education system in the process of developing human qualities is the transition of students from unclear paths to clear concepts, the cultivation of reflection, the creation of the ability to creatively and independently organize the flow of feelings, memories, and ideas. Education should give students taste for truth, the art of searching for it, and positive experience. Therefore, the goal of education is to consider truth as a necessary and achievable foundation, requiring labor, courage, and perseverance, and knowledge not as radiation, but as the result of "continuous thinking."

Education is the process of directing teachers and students towards a specific goal based on subjective-objective actions. The educational process is characterized by the achievements of goal-oriented steps and stages determined by learning objectives. Education as a qualitative characteristic is the result of the assimilation of values by the state, society, and the individual in the process of educational activity, which are significant for the economic, moral, and intellectual state of all consumers of the product of the educational sphere - the state, society, and each person.

From a procedural point of view, education means the activity of a person growing up in a specially organized environment, which leads him to motivated cognitive activity, which is constantly enriched with new complex educational material. The content of higher professional education is based on the concept of the system-activity method. [3] "System-activity method" includes two meanings: "systemic method" and "activity method." "Systematic method" is a collective term that refers to methodological directions that have emerged from various specific sciences and consider the study of their objects as systems united by a single tendency. This method is based on the rejection of one-sided analytical, linear-causal research methods, with the main focus on the integrity of the object's integrated qualities and their origin. Therefore, attention is focused on identifying the relationship and connections of the object itself with the environment. Definitions close to the term "system" are related to "structure," "environment." If the term "system" denotes the integrity of an object, then "structure" indicates its internal discreteness, its assembly from parts, their interconnection and interrelationship. Based on this, they constitute the whole. The term "structure" is revealed through "element," "connections," and "relations."

Based on the term "method of activity," it is necessary to plan the content of academic subjects and practice based on a comprehensive consideration of the future socio-productive activity of the

graduate of the educational institution. From a psychological point of view, an active method of the learning process can be considered as a manifestation in the identification of the specific features of the process of human assimilation of the culture accumulated by humanity, conveying to a person the general historical experience developed by social practice: knowledge, skills, abilities, types and methods of activity. This process is carried out in the form of cooperation, joint activity of the teacher and the learner. The teacher organizes the learner's cognitive activity in accordance with the learning objectives using didactic tools. Collaborative activity can take various forms: from direct contact with each person to "communication with humanity": its experience, tools of labor, scientific achievements, works of art, etc. In the process of cognitive activity, the learner acquires knowledge, skills, intellectual abilities, and accumulates a certain experience of socio-psychological competence.

Consequently, the intended content of training, as an element of the pedagogical system, requires the following: the selection of educational material should be carried out by the measure of completeness and systematicity of types of activity, which is necessary for the development of a person's intellectual skills, for the acquisition of professionally qualified skills necessary for performing the main types of activities at different levels of difficulty. When planning the content of any academic subject, we must take into account that each of the subjects mastered by students should have its fundamental impact on their general professional knowledge. That is, we must not forget that the principle of teaching a specialty, not a subject, should be preserved. As a strategic goal, we must direct all sciences towards the study of phenomena and processes as a whole. Such integrity forms the human and professional qualities of a specialist.

The content of higher education, in addition to professionally oriented knowledge, should provide a healthy, rational meaning - life, practical wisdom, the ability to see the consequences of actions, to distinguish significant randomness in behavior, to choose a solution that brings real benefit from possible options. Education is both in science and in art. It teaches people of different ages to understand the difficulties and problems encountered in life, provides means to overcome and solve them. We cannot achieve a high level of professional education - creative skills - without general humanitarian knowledge and innovative methods for solving any problems (socio-economic, production-technological, economic, etc.). Orientation towards these strategic directions has been adopted, but it can be said that conservatism related to higher education has not yet been completely eliminated.

The implementation of these methods required, first of all, the development of a new educational paradigm aimed at the development of spirituality and the creative basis of man. At the same time, the most important task of educational practice is not only to teach the laws of nature and society, but also to equip with a humanistic methodology for the harmonization of relations in the "human-nature-society" system and the creative transformation of the world.

The main content of the new educational paradigm is considered to be the preservation and development of human creative potential as the main goal of innovative education. But today, creativity and planning alone are not enough. Education must be imbued with universal values. For him, first of all, it is necessary to develop balanced thinking based on the unity of a person's inner freedom and their social responsibility, tolerance for different thinking.

The innovative educational strategy ensures the systematic organization of management of the educational process. Its first characteristic feature is that the teacher or the person organizing the teaching remains the leading element, but their position towards the student and themselves changes. The teacher is considered not only as a keeper and supplier of subject-specific knowledge, norms, and programs as a source of information, but also as an assistant in the formation and development of the student's personality (independent of the student's level of knowledge acquisition, understanding, and misunderstanding). The nature of management and influence on the student changes. The authoritarian position of power, the right of the strong, disappears, replaced by a position of democratic interaction of cooperation, assistance, inspiration, increased attention to the student's side, formation, and development of a person. From the assimilation of the result, from the received grade, the student's position on active interaction with the teacher and his fellow students changes. [5]

As a second characteristic feature, we can consider changes in the functions of knowledge acquired in higher educational institutions and in the methods of organizing the process of their acquisition. In our time, knowledge and wealth have become the "third social force" after power, allowing a person to take their place in modern culture and civilization. However, it must be presented only at the assessment of the modern information society, that is, in a systematic, interdisciplinary, and generalized form. The nature of knowledge acquisition begins to lose its reproductive, purely memorization character and is organized in various forms of cognitive activity as a productive creative process.

As a third characteristic feature, we can consider the social nature of any education and the prioritization of human development. In this regard, teaching is not individual, but is directed towards group forms of teaching, collaborative activity, various forms of interaction, interpersonal relationships, the emergence of individuality from the "collective subject," and constant joint creation, rich in joy.

As educational issues related to the content of this priority innovation strategy, the task of training, first of all, organizers, technologists of the educational process, and teachers is considered. Teacher training (qualification, retraining) should pursue three main goals:

1) formation of a new meaning of the organization of the educational process, a new human position, a new management style;

2) the formation of project-constructive thinking and a new type of analytical thinking, contributing to the construction of the learning environment in all its dynamics;

3) the formation of new methods of interpersonal and social interaction, a new dialogic style of communicative and intellectual activity, ensuring the interaction and existence of all components of the educational environment and aimed at the joint construction of projects, programs.

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Rezyume: *Ushbu Maqolada talabalarning tafakkurini rivojlantirishda zamonaviy metodikalarni qo‘llashning ilmiy va amaliy ahamiyati tahlil qilinadi. Innovatsion pedagogik yondashuvlar va interaktiv metodlar o‘quv jarayonining samaradorligini oshirish va tanqidiy fikrlashni rivojlantirishga xizmat qilishi ko‘rsatildi.*

Резюме: *В данной статье анализируется научное и практическое значение использования современных методов в развитии мышления учащихся. Показано, что инновационные педагогические подходы и интерактивные методы способствуют повышению эффективности образовательного процесса и развитию критического мышления.*

Kalit so‘zlar: *talabalar, tafakkur, zamonaviy metodika, pedagogik texnologiyalar, tanqidiy fikrlash, ta’lim jarayoni, innovatsion yondashuv.*

Ключевые слова: *учащиеся, мышление, современные методы, педагогические технологии, критическое мышление, образовательный процесс, инновационный подход.*