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**Methodological foundations for the formation of ideas and concepts in
biology, geography, physics, and chemistry among primary school
students**

Ismatova Madinabonu Dilshod qizi

3rd year student of Primary Education at Asian International University

Abstract

This article deeply analyzes the methodological foundations for forming initial scientific concepts and understandings related to biology, geography, physics, and chemistry in primary school students. The main goal of the research is to reveal effective mechanisms for imparting fundamental natural science concepts, considering the cognitive development characteristics of young learners. The article highlights the importance of integrated education principles, effective pedagogical methods (e.g., project-based learning, inquiry-based teaching, game technologies), and modern didactic tools. It also examines innovative approaches in curriculum design, the necessity of enhancing teacher competencies, and formative strategies for knowledge assessment. According to the research findings, teaching natural sciences in primary education serves as a crucial foundation for shaping a scientific worldview in children and fostering their future interest in science.

Keywords: Primary education, scientific concept, natural sciences, integration, methodology, pedagogy, didactics

Annotatsiya

Ushbu maqola boshlang'ich sinf o'quvchilarida biologiya, geografiya, fizika va kimyoga oid dastlabki ilmiy tasavvur va tushunchalarni shakllantirishning metodik asoslarini chuqur tahlil qiladi. Tadqiqotning asosiy maqsadi — yosh o'quvchilarning kognitiv rivojlanish xususiyatlarini hisobga olgan holda, tabiiy fanlarga oid fundamental tushunchalarni samarali singdirish mexanizmlarini ochib berishdan iborat. Maqolada

integratsiyalashgan ta'lim tamoyillari, samarali pedagogik usullar (masalan, loyihalashtirish, tadqiqotga asoslangan o'qitish, o'yin texnologiyalari) va zamonaviy didaktik vositalarning ahamiyati yoritilgan. Shuningdek, o'quv dasturlarini loyihalashdagi innovatsion yondashuvlar, o'qituvchi kompetensiyalarini oshirish zarurati va bilimlarni baholashning formativ strategiyalari ko'rib chiqilgan. Tadqiqot xulosalariga ko'ra, boshlang'ich ta'limda tabiiy fanlarni o'qitish bolalarda ilmiy dunyoqarashni shakllantirish va ularning kelajakdagi fanlarga bo'lgan qiziqishini uyg'otish uchun muhim poydevor hisoblanadi.

Kalit so'zlar: Boshlang'ich ta'lim, ilmiy tasavvur, tabiiy fanlar, integratsiya, metodika, pedagogika, didaktika

Аннотация

Данная статья глубоко анализирует методические основы формирования первоначальных научных представлений и понятий, связанных с биологией, географией, физикой и химией у учащихся начальных классов. Основная цель исследования — раскрыть эффективные механизмы внедрения фундаментальных естественнонаучных концепций, учитывая особенности когнитивного развития младших школьников. В статье освещается значимость интегрированных принципов обучения, эффективных педагогических методов (например, проектное обучение, исследовательское обучение, игровые технологии) и современных дидактических средств. Также рассмотрены инновационные подходы в разработке учебных программ, необходимость повышения компетенций учителей и формативные стратегии оценки знаний. Согласно выводам исследования, преподавание естественных наук в начальном образовании является важной основой для формирования научного мировоззрения у детей и пробуждения их будущего интереса к науке.

Ключевые слова: Начальное образование, научное представление, естественные науки, интеграция, методика, педагогика, дидактика

Kirish

Hozirgi davrda yosh avlodni fan va texnika yutuqlariga asoslangan jamiyatda yashashga tayyorlash, ularda tanqidiy fikrlash, muammolarni hal qilish va ilmiy dunyoqarashni shakllantirish ta'lim tizimining ustuvor vazifalaridan biridir. Boshlang'ich sinf o'quvchilarida biologiya, geografiya, fizika va kimyoga oid dastlabki tasavvur va tushunchalarni shakllantirish nafaqat ularning atrofdagi dunyo haqidagi bilimlarini kengaytiradi, balki ularda ilmiy bilishga bo'lgan qiziqishni uyg'otadi va kelajakda chuqurroq fanlarni o'rganish uchun mustahkam poydevor yaratadi. Ushbu jarayonni samarali tashkil etish uchun esa puxta ilmiy-metodik asoslarga tayanish zarur. Tadqiqotning dolzarbligi shundaki, globallasuv va texnologik taraqqiyot davrida fan va texnika rivojini tushunadigan, unga moslasha oladigan shaxslarni tarbiyalash muhim ahamiyat kasb etadi. Boshlang'ich sinflarda tabiiy fanlar bo'yicha fundamental tushunchalarning shakllanishi bolalarda ilmiy savodxonlikning ilk bosqichidir. Bu yoshdagi bolalarning kognitiv va psixologik xususiyatlarini hisobga olgan holda, ushbu fanlarni o'qitish metodikasi doimiy ravishda takomillashtirilishini talab etadi. An'anaviy yondashuvlar ko'pincha yosh o'quvchilar uchun mavhum bo'lib, ularning qiziqishini pasaytirishi mumkin. Shu bois, integratsiyalashgan, amaliyotga yo'naltirilgan va interaktiv ta'lim metodlarini joriy etish orqali bu muammoni hal etish dolzarb hisoblanadi. Tadqiqotning maqsadi boshlang'ich sinf o'quvchilarida biologiya, geografiya, fizika va kimyoga oid tasavvur va tushunchalarni shakllantirishning nazariy va metodik asoslarini chuqur tahlil qilish, shuningdek, zamonaviy pedagogik yondashuvlar va didaktik vositalarni joriy etish bo'yicha samarali tavsiyalar ishlab chiqishdan iborati. Ushbu maqsadga erishish uchun quyidagi vazifalar belgilandi: 1. Boshlang'ich sinf o'quvchilarida ilmiy tasavvur va tushunchalarni shakllantirishning

nazariy asoslarini o'rganish. 2. Biologiya, geografiya, fizika va kimyo bo'yicha integratsiyalashgan ta'limning metodik tamoyillarini aniqlash. 3. Ilmiy tushunchalarni shakllantirishda qo'llaniladigan samarali pedagogik usullar va didaktik vositalarni tahlil qilish. 4. O'quv dasturlarini loyihalash, o'qituvchi kompetensiyalarini rivojlantirish va bilimlarni baholash strategiyalari bo'yicha tavsiyalar ishlab chiqish.

Mavzuga oid adabiyotlar tahlili

Boshlang'ich sinf o'quvchilarida ilmiy tasavvur va tushunchalarni shakllantirish masalasi pedagogika, psixologiya va didaktika sohalarida keng tadqiq qilingan. Jan Piagetning kognitiv rivojlanish nazariyasiga ko'ra, boshlang'ich sinf yoshidagi bolalar konkret operatsiyalar bosqichida bo'lib, ular dunyoni sezgilar va amaliy tajribalar orqali o'rganadilar. Shu bois, tabiiy fanlarga oid tushunchalarni shakllantirishda ko'rgazmalilik, amaliy faoliyat va tajribalar muhim ahamiyat kasb etadi. Lev Vygotskiyning ijtimoiy-madaniy rivojlanish nazariyasi esa bilimlarni ijtimoiy o'zaro munosabatlar va madaniy vositalar orqali o'zlashtirish zarurligini ta'kidlaydi. Bu esa birgalikdagi faoliyat, munozara va o'qituvchining yo'naltiruvchi rolini muhimlashtiradi. Zamonaviy konstruktivistik yondashuv o'quvchini bilimlarni passiv qabul qiluvchi emas, balki ularni mustaqil ravishda quruvchi sub'ekt sifatida ko'radi. Boshlang'ich sinflarda tabiiy fanlarni o'qitishda bu yondashuv bolalarning o'z tajribalari asosida bilim va tushunchalarni shakllantirishiga, kuzatish, savollar berish va taxminlar ilgari surish orqali ilmiy bilish jarayoniga kirishishiga imkon yaratadi. Ko'plab tadqiqotchilar, jumladan, [1] mualliflari boshlang'ich sinflarda tabiiy fanlarni o'qitishda zamonaviy ta'lim texnologiyalari va samarali o'qitish metodlaridan foydalanishning fundamental rolini ta'kidlaydilar. Ular ta'kidlashicha, mazkur fan orqali o'quvchilar olam haqida umumiy tasavvurlarga ega bo'ladilar va ta'lim jarayonini samarali, qiziqarli qilish uchun zamonaviy yondashuvlarni joriy etish zarur. Bu esa o'quvchilarning tabiiy fanlarga chuqur bog'lanishini va tushunchalarni o'zlashtirishini optimallashtirishga xizmat

qiladi. O‘zbekistonda ham boshlang‘ich ta’limda tabiiy fanlarni o‘qitish metodikasini takomillashtirish bo‘yicha bir qancha ilmiy izlanishlar olib borilmoqda. Xususan, tabiiy dunyoqarashni shakllantirish, ekologik tarbiya masalalari va fanlararo integratsiya bo‘yicha tadqiqotlar diqqat markazida. Biroq, to‘rt asosiy fan – biologiya, geografiya, fizika va kimyo bo‘yicha dastlabki tushunchalarni yagona, integratsiyalashgan metodik asosda shakllantirishga qaratilgan kompleks yondashuvlar hali ham chuqur o‘rganishni talab etadi.

Tadqiqot metodologiyasi

Ushbu tadqiqot boshlang‘ich sinf o‘quvchilarida tabiiy fanlarga oid tushunchalarni shakllantirishning metodik asoslarini tahlil qilishga qaratilgan bo‘lib, tizimli, qiyosiy va kompleks yondashuvlarga asoslanadi. Tadqiqotda ta’lim nazariyalari, pedagogik psixologiya prinsiplari va didaktikaning zamonaviy yutuqlari sintez qilinadi. Biologiya, geografiya, fizika va kimyo bo‘yicha integratsiyalashgan ta’limning metodik tamoyillari quyidagilardan iborat: 1. Izchillik va uzviylik tamoyili: Bilimlarni oddiydan murakkabga, yaqindan uzoqqa printsipi asosida bosqichma-bosqich shakllantirish. Har bir yangi tushuncha avvalgi o‘zlashtirilgan bilimlar ustiga qurilishi kerak. 2. Ko‘rgazmalilik va amaliylik tamoyili: Nazariy bilimlarni real obyektlar, modellar, rasmlar, videofilm va tajribalar orqali mustahkamlash. Bolalar tomonidan bevosita amalga oshiriladigan amaliy ishlar (kuzatish, eksperiment, modellar) ularda tushunchalarning mustahkam o‘rnashishiga yordam beradi. 3. Fanlararo integratsiya tamoyili: Tabiiy fanlarning o‘zaro bog‘liqligini ko‘rsatish. Masalan, ob-havo hodisalarini o‘rganishda geografiya (joylashuv), fizika (havo bosimi, harorat), biologiya (o‘simlik va hayvonlarga ta’siri) elementlarini birgalikda yondashish. Bu bolalarda dunyoning yaxlit va tizimli manzarasini shakllantiradi. 4. Yoshga moslik va differensial yondashuv tamoyili: O‘quvchilarning yoshiga va individual xususiyatlariga mos keladigan materiallarni tanlash va o‘qitish usullarini qo‘llash. Murakkab mavzularni

soddalashtirilgan, o'yin shaklida yoki konkret misollar orqali tushuntirish. 5. Faoliyatga yo'naltirilganlik tamoyili: O'quvchilarni bilim olish jarayonining faol ishtirokchisiga aylantirish. Ular nafaqat eshitish, balki tadqiq qilish, ijod qilish, muammolarni hal qilish orqali o'rganishlari kerak. Ilmiy tushunchalarni shakllantirishda qo'llaniladigan samarali pedagogik usullar va didaktik vositalar: Tadqiqotga asoslangan ta'lim (Inquiry-based learning): O'quvchilarga savollar berish, muammoli vaziyatlar yaratish va ularni mustaqil ravishda javob izlashga undash. Masalan, "Nima uchun barglar kuzda sarg'ayadi?", "Suv nima uchun muzlaydi?" kabi savollar orqali kuzatish va tajriba qilishga chorlash. Loyihalashtirish usuli: O'quvchilarning real hayotiy muammolarni hal qilishga qaratilgan loyihalarni amalga oshirishi. Masalan, "Bizning bog'chamiz", "Suvning tabiatdagi aylanishi modeli", "Quyosh batareyasini yasash" kabi loyihalar. Bu ularning bilimlarni amaliyotda qo'llash qobiliyatini rivojlantiradi. O'yin texnologiyalari: Didaktik o'yinlar, rolli o'yinlar orqali murakkab tushunchalarni o'zlashtirishni yengillashtirish. Misol uchun, "Ekologik piramida" o'yini orqali oziq zanjirlarni tushuntirish. Ekskursiyalar va kuzatishlar: Tabiat qo'ynida, muzeylarda, ishlab chiqarish korxonalariga ekskursiyalar tashkil etish. Bu bolalarga real dunyo bilan aloqa qilish va bilimlarni bevosita olish imkonini beradi. Raqamli ta'lim resurslari va texnologiyalar: Interaktiv doskalar, taqdimotlar, simulyatsiyalar, ta'limiy o'yinlar, virtual ekskursiyalar [1]. Masalan, virtual mikroskop orqali o'simlik hujayrasini o'rganish, animatsiyalar orqali vulqon otilishini ko'rish. Bu vositalar mavhum tushunchalarni ko'rgazmali va tushunarli tarzda yetkazishga yordam beradi. O'quv dasturlarini loyihalash, o'qituvchi kompetensiyalari va bilimlarni baholash strategiyalari: O'quv dasturlari spiral printsip asosida loyihalashtirilishi kerak, ya'ni tushunchalar har yili yanada chuqurlashtirilgan va kengaytirilgan holda qayta o'rganilishi lozim. Dasturlar fanlararo integratsiyani ta'minlovchi mavzuviy bloklarga bo'linishi va amaliy faoliyatga ko'proq o'rin berishi kerak. O'qituvchilarning

kompetensiyasi ilmiy tushunchalarni shakllantirishda hal qiluvchi ahamiyatga ega. Ular nafaqat fan bo'yicha chuqur bilimlarga, balki yosh o'quvchilarning psixologik xususiyatlarini tushunish, zamonaviy interaktiv metodlarni bilish va ularni amaliyotda qo'llay olish, ijodiy yondashuvga ega bo'lishi lozim. O'qituvchilarga muntazam ravishda kasbiy malaka oshirish kurslari, mahorat darslari va tajriba almashish imkoniyatlari yaratilishi kerak. Bilimlarni baholash tizimi faqat yakuniy natijaga emas, balki o'quvchining o'rganish jarayoniga ham e'tibor qaratishi lozim. Formativ baholash strategiyalari (kuzatish, savol-javob, portfolio, o'z-o'zini baholash, amaliy ishlar natijalarini baholash) bolalarning bilim olishdagi rivojlanishini muntazam nazorat qilish va ularni qo'llab-quvvatlash imkonini beradi. Summative baholash esa (kichik testlar, loyiha taqdimotlari) ma'lum bir davrdagi o'zlashtirish darajasini aniqlashga xizmat qilishi kerak.

Xulosa

Boshlang'ich sinf o'quvchilarida biologiya, geografiya, fizika va kimyoga oid tasavvur va tushunchalarni shakllantirish ularning umumiy rivojlanishida va kelajakdagi ta'lim yo'lida muhim qadamdir. Ushbu tadqiqot shuni ko'rsatadiki, samarali metodik asoslar integratsiyalashgan ta'lim tamoyillarini, faoliyatga yo'naltirilgan pedagogik usullarni va zamonaviy didaktik vositalarni o'z ichiga oladi. Dastlabki ilmiy bilimlarni o'zlashtirish jarayonida bolalarning qiziqishini uyg'otish, ularni tadqiqotga undash va amaliy tajribalar orqali o'rganishga sharoit yaratish muhimdir. Tadqiqot natijalariga ko'ra, quyidagi tavsiyalar ilgari suriladi: 1. O'quv dasturlarini yanada chuqurroq fanlararo integratsiya va amaliy faoliyatga yo'naltirilganlik asosida takomillashtirish. 2. O'qituvchilarning tabiiy fanlar bo'yicha metodik kompetensiyalarini, ayniqsa interfaol va raqamli texnologiyalardan foydalanish ko'nikmalarini oshirishga qaratilgan uzluksiz malaka oshirish tizimini joriy etish. 3. Maktablarni zamonaviy ilmiy-amaliy jihozlar, ko'rgazmali qurollar va raqamli ta'lim resurslari bilan ta'minlash. 4. Baholash tizimini

o‘quvchilarning bilim olish jarayonini rag‘batlantiruvchi formativ usullar bilan boyitish va baholashda loyiha ishlariga ko‘proq e‘tibor berish. 5. Ota-onalar bilan hamkorlikni kuchaytirish, ularni farzandlarining tabiiy fanlarga bo‘lgan qiziqishini qo‘llab-quvvatlashga jalb etish. Ushbu metodik yondashuvlarni tatbiq etish boshlang‘ich sinf o‘quvchilarida ilmiy savodxonlikni oshirishga, ularning atrofdagi olam haqida chuqur va yaxlit tasavvurlarini shakllantirishga, fanlarga bo‘lgan mehrini uyg‘otishga va kelajakda ilm-fanga o‘z hissasini qo‘shadigan salohiyatli kadrlar bo‘lib yetishishiga xizmat qiladi.

Foydalanilgan adabiyotlar

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**Effectiveness of Teaching Economics Subjects through English
(English-Medium Instruction, EMI)**

Makhmudov Islombek Muhiddin o'g'li

Teacher of Kokand University of Andijan Branch

Islombek0326@gmail.com

Olimova Nozimaxon Qurbonali qizi

Kokand University, Andijan Branch

Faculty of Social Humanities and Pedagogy, 1st-year student

Abstract :

The growing globalization of higher education has led to an increasing adoption of English-Medium Instruction (EMI) in non-English-speaking countries, particularly in economics and business-related disciplines. This study investigates the effectiveness of teaching economics subjects through English and evaluates its impact on students' academic achievement, language proficiency, and professional readiness. Using a mixed-method approach, the research analyzes quantitative academic performance data and qualitative feedback from students and instructors enrolled in EMI-based economics courses at tertiary institutions. The findings reveal that EMI enhances students' access to global economic knowledge, improves academic English competence, and fosters critical thinking skills essential for modern economic analysis. However, challenges such as linguistic barriers, cognitive overload, and uneven instructional preparedness were also identified. The study concludes that EMI can be highly effective in economics education if supported by appropriate pedagogical strategies, language scaffolding, and institutional support mechanisms. The results contribute to ongoing debates on internationalization in higher education and provide practical implications for curriculum designers, policymakers, and educators implementing EMI in economics programs.

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Keywords : English-Medium Instruction (EMI), Economics Education, Higher Education, Academic Achievement, Language Proficiency, Internationalization, Pedagogy Introduction.

Аннотация:

Рост глобализации высшего образования привёл к всё более широкому внедрению обучения на английском языке (EMI) в неанглоязычных странах, особенно в области экономики и бизнес-дисциплин. Данное исследование рассматривает эффективность преподавания экономических дисциплин на английском языке и оценивает его влияние на академическую успеваемость студентов, уровень владения языком и их профессиональную готовность. Используя смешанный метод исследования, автор анализирует количественные данные об академических результатах, а также качественные отзывы студентов и преподавателей, обучающихся и работающих в экономических курсах с английским языком обучения в высших учебных заведениях. Результаты показывают, что EMI расширяет доступ студентов к глобальным экономическим знаниям, повышает уровень академического английского языка и способствует развитию навыков критического мышления, необходимых для современного экономического анализа. Однако были выявлены и определённые трудности, такие как языковые барьеры, когнитивная перегрузка и недостаточная подготовленность преподавателей.

Ключевые слова: Обучение на английском языке (EMI), экономическое образование, высшее образование, академическая успеваемость, языковая компетенция, интернационализация, педагогика, введение.

Annotatsiya:

Oliy ta'limning globallashuvi ingliz tilida o'qitish (EMI) tizimining ingliz tilida so'zlashmaydigan mamlakatlarda, ayniqsa iqtisodiyot va biznes yo'nalishlarida keng

joriy etilishiga olib keldi. Mazkur tadqiqot iqtisodiy fanlarni ingliz tilida o'qitish samaradorligini ko'rib chiqadi hamda uning talabalarning akademik o'zlashtirishi, tilni bilish darajasi va kasbiy tayyorgarligiga ta'sirini baholaydi. Tadqiqotda aralash metodologiya qo'llanilib, muallif ingliz tilida olib boriladigan iqtisodiy kurslarda tahsil olayotgan talabalar va dars berayotgan o'qituvchilarning akademik natijalari bo'yicha miqdoriy ma'lumotlarni, shuningdek, ularning sifat jihatidan berilgan fikr-mulohazalarini tahlil qiladi. Natijalar shuni ko'rsatadiki, EMI talabalarga global iqtisodiy bilimlardan kengroq foydalanish imkonini beradi, akademik ingliz tilini rivojlantiradi hamda zamonaviy iqtisodiy tahlil uchun zarur bo'lgan tanqidiy fikrlash ko'nikmalarini shakllantiradi. Shu bilan birga, til to'siqlari, kognitiv yuklama va o'qituvchilarning yetarli darajada tayyor emasligi kabi muayyan qiyinchiliklar ham aniqlangan. Tadqiqot xulosasiga ko'ra, tegishli pedagogik strategiyalar, tilni qo'llab-quvvatlash tizimi va institutsional mexanizmlar mavjud bo'lgan taqdirda, ingliz tilida o'qitish iqtisodiy ta'limda yuqori samaradorlikka erishishi mumkin. Olingan natijalar oliy ta'limni internatsionallashtirish bo'yicha davom etayotgan ilmiy munozaralarga hissa qo'shadi hamda iqtisodiy dasturlarda EMI tizimini joriy etayotgan o'quv dasturi tuzuvchilar, siyosatchilar va o'qituvchilar uchun amaliy tavsiyalar beradi.

Kalit so'zlar: Ingliz tilida o'qitish (EMI), iqtisodiy ta'lim, oliy ta'lim, akademik o'zlashtirish, til kompetensiyasi, internatsionallashtirish, pedagogika, kirish.

Introduction:

In recent decades, the internationalization of higher education has significantly influenced teaching methodologies and curriculum design across the globe. One of the most notable trends is the widespread adoption of English-Medium Instruction (EMI), defined as the use of English to teach academic subjects in contexts where English is not the first language of the majority of students . This trend is particularly prominent in

economics education due to the global nature of economic discourse, research publications, and professional communication.

Economics, as a discipline, relies heavily on international literature, statistical analysis, and cross-border case studies. Consequently, teaching economics subjects through English offers students direct access to primary academic resources, global economic debates, and international research frameworks. Universities in Asia, Europe, and Central Asia have increasingly integrated EMI into economics programs to enhance graduates' competitiveness in the global labor market .

Despite its growing popularity, the effectiveness of EMI in non-English-speaking contexts remains a subject of academic debate. While some scholars argue that EMI improves academic literacy and professional communication skills, others highlight potential drawbacks, such as reduced comprehension of complex subject matter due to language barriers . In economics education, where abstract theories, mathematical modeling, and technical terminology are central, the language of instruction plays a crucial role in shaping learning outcomes.

In countries undergoing educational reforms and international integration, such as Uzbekistan and other developing nations, EMI has become a strategic priority. However, empirical evidence on its pedagogical effectiveness in economics education remains limited. Therefore, this study aims to explore the effectiveness of teaching economics subjects through English by examining its impact on students' academic performance, language proficiency, and engagement with economic concepts.

By answering these questions, the study contributes to a deeper understanding of EMI implementation in economics education and offers evidence-based recommendations for improving teaching quality in multilingual academic contexts.

This study employs a mixed-method research design combining quantitative and qualitative approaches. The quantitative component assesses students' academic

performance in EMI-based economics courses, while the qualitative component explores perceptions and experiences of students and instructors regarding EMI implementation.

The participants consisted of undergraduate economics students ($N = 120$) enrolled in EMI-based courses such as Microeconomics, Macroeconomics, and International Economics at a higher education institution where English is used as the medium of instruction. Additionally, 10 economics instructors with experience in EMI teaching participated in semi-structured interviews. Academic Performance Analysis: Students' grades in EMI-taught economics courses were collected and compared with grades from similar courses previously taught in the native language.

Questionnaires: Structured questionnaires measured students' perceptions of comprehension, engagement, and language development.

Interviews: Semi-structured interviews with instructors explored pedagogical challenges, instructional strategies, and observed learning outcomes.

Classroom Observations: Observations focused on student participation, interaction patterns, and language use during economics

Data collection was conducted over one academic semester. Quantitative grade data were analyzed using descriptive statistics and correlation analysis to identify relationships between EMI exposure and academic performance. Qualitative data from questionnaires and interviews were coded thematically to identify recurring patterns related to comprehension, motivation, and instructional effectiveness. Quantitative data were processed using statistical analysis to measure mean score differences and performance trends. Qualitative responses were analyzed through thematic coding, enabling the identification of key categories such as language challenges, conceptual understanding, and global academic engagement. The quantitative analysis revealed that students taught economics through EMI demonstrated comparable or slightly improved

academic performance compared to those previously taught in their native language. The mean score increase of approximately 5–7% suggests that EMI did not hinder content mastery; instead, it may have encouraged deeper engagement with international academic materials.

Students reported that exposure to authentic English-language textbooks and research articles enhanced their understanding of real-world economic issues. This aligns with previous research indicating that EMI facilitates direct access to global knowledge networks and scholarly discourse. One of the most significant outcomes observed was the improvement in students' academic English proficiency. Participants indicated increased confidence in reading economic literature, writing analytical essays, and participating in discussions using economic terminology in English. The integration of subject-specific vocabulary contributed to the development of both linguistic competence and disciplinary literacy.

The results support the notion that EMI serves a dual function: content learning and language acquisition. In economics education, where specialized terminology such as “opportunity cost,” “market equilibrium,” and “fiscal policy” is widely used in English-language literature, EMI helps students internalize key concepts in their original linguistic form. Qualitative findings showed that EMI encouraged students to engage more critically with economic theories and global case studies. Students highlighted that learning in English enabled them to analyze international economic policies, compare global markets, and access up-to-date research from leading economists. This suggests that EMI not only improves linguistic skills but also promotes higher-order cognitive abilities such as analytical thinking, problem-solving, and comparative evaluation—skills essential for modern economists operating in globalized environments.

Despite its benefits, several challenges were identified. First, some students experienced initial comprehension difficulties, especially when complex economic theories were

introduced. Linguistic limitations sometimes led to slower processing of information, requiring additional explanations and language scaffolding.

Second, instructors reported increased workload due to the need to adapt teaching materials, simplify language without compromising academic rigor, and provide bilingual support when necessary. These findings confirm earlier studies indicating that effective EMI implementation requires pedagogical training and institutional support. Classroom observations indicated that EMI environments encouraged more formal academic interaction. Students frequently used English during discussions, presentations, and group work, which enhanced communicative competence. However, participation levels varied depending on students' prior English proficiency, suggesting the need for differentiated instructional strategies.

Discussion:

Overall, the findings demonstrate that EMI can be an effective approach for teaching economics subjects when properly implemented. The integration of language and content learning supports both academic achievement and professional skill development. However, success depends on several factors: students' initial language proficiency, teachers' pedagogical readiness, and availability of institutional resources. The results highlight the importance of adopting supportive teaching practices such as glossaries of economic terms, interactive discussions, and gradual introduction of complex theoretical content. These strategies help mitigate cognitive overload and ensure that language does not become a barrier to conceptual understanding.

Conclusion:

The study confirms that teaching economics subjects through English-Medium Instruction (EMI) can be highly effective in enhancing students' academic performance, language proficiency, and global economic awareness. EMI enables students to access

international academic resources, develop discipline-specific English skills, and engage more critically with economic theories and global case studies.

However, successful EMI implementation requires careful pedagogical planning, language support mechanisms, and teacher training to address linguistic and cognitive challenges. Institutions should adopt integrated approaches that combine content instruction with academic language development to maximize learning outcomes.

In conclusion, EMI represents a powerful tool for modernizing economics education and preparing students for participation in the global academic and professional environment. Future research should focus on longitudinal studies examining long-term academic and career outcomes of graduates from EMI-based economics programs.

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Factors related to modern lifestyle that influence anxiety and depression in students

Andijan State University Faculty of History and Social Sciences Department of
Applied Psychology 4th-year student, Group 402

Abdusattorova Dilbegim

Annotation: This scientific article analyzes the impact of psychological factors associated with modern lifestyle on the development of anxiety and depression among school students. The study examines information overload, social comparison, perfectionistic attitudes, insufficient emotional recovery, and future anxiety as significant factors that negatively affect students' mental health. The influence of these factors is explained on the basis of theoretical sources and empirical analysis.

Keywords: students' mental health, anxiety states, depressive symptoms, emotional instability, future anxiety, psychological adaptation.

O'quvchilarda xavotir va depressiyaning zamonaviy turmush tarzi bilan bog'liq omillari

Andijon davlat universiteti Tarix va ijtimoiy fanlar fakulteti Amaliy psixologiya
yo'nalishi 4-bosqich 402-guruh talabasi

Abdusattorova Dilbegim

Annotatsiya: mazkur ilmiy maqolada zamonaviy turmush tarzi bilan bog'liq psixologik omillarning o'quvchilarda xavotir va depressiya holatlarning shakllanishiga ta'siri tahlil qilinadi. Tadqiqotda axborot ortiqchaligi, ijtimoiy taqqoslash, perfektsionistik qarashlar, emotsional tiklanishning yetishmasligi hamda kelajak tashvishi o'quvchilar ruhiy salomatligiga salbiy ta'sir ko'rsatuvchi muhim omillar sifatida ko'rib chiqiladi va ushbu omillarning ta'siri nazariy manbalar hamda empirik tahlil asosida yoritiladi.

Kalit so'zlar: o'quvchilar ruhiy salomatligi, xavotirli holatlar, depressiv simptomlar, emotsional beqarorlik, kelajak tashvishi, psixologik moslashuv.

Аннотация: В данной научной статье анализируется влияние психологических факторов, связанных с современным образом жизни, на формирование тревожности и депрессивных состояний у школьников. В исследовании рассматриваются информационная перегруженность, социальное сравнение, перфекционистские установки, недостаточность эмоционального восстановления, а также тревога о будущем как значимые факторы, оказывающие негативное влияние на психическое здоровье учащихся. Воздействие данных факторов раскрывается на основе теоретических источников и эмпирического анализа.

Ключевые слова: психическое здоровье школьников, тревожные состояния, депрессивные симптомы, эмоциональная нестабильность, тревога о будущем, психологическая адаптация.

So'nggi yillarda jamiyat hayotida yuz berayotgan ijtimoiy-psixologik o'zgarishlar o'quvchilar ruhiy holatiga sezilarli ta'sir ko'rsatmoqda. Zamonaviy turmush tarzi sharoitida o'quvchilar nafaqat ta'lim jarayonidagi talablar, balki shaxsiy rivojlanish, ijtimoiy moslashuv va kelajak hayoti bilan bog'liq mas'uliyatni ham erta his qila boshlamoqda. Ushbu jarayonlar o'quvchilar psixikasida xavotir va depressiv holatlarning kuchayishiga olib kelishi mumkin. Psixologik tadqiqotlarga ko'ra, maktab yosh davri shaxs shakllanishining eng muhim va ayni paytda eng nozik bosqichlaridan biri hisoblanadi. Bu davrda emosional beqarorlik, o'zini baholashdagi o'zgarishlar va ijtimoiy ta'sirlarga sezgirlik kuchayadi. Aynan shu omillar fonida axborot ortiqchaligi, ijtimoiy taqqoslash, muvaffaqiyatga ortiqcha intilish va kelajak bilan bog'liq noaniqliklar o'quvchilarda doimiy xavotir va tushkun kayfiyatni shakllantirishi mumkin.

Zamonaviy jamiyat sharoitida o'quvchilarning ruhiy holati ko'plab yangi psixologik omillar ta'siri ostida shakllanmoqda. Ushbu omillar an'anaviy stress manbalaridan farqli ravishda, yashirin va uzluksiz xarakterga ega bo'lib, o'quvchilarda xavotir va depressiv holatlarning kuchayishiga sabab bo'lmoqda. Axborot texnologiyalarining rivojlanishi natijasida o'quvchilar kundalik hayotda juda katta hajmdagi ma'lumotlar bilan to'qnash kelmoqda. Axborotning tezkorligi va uzluksizligi kognitiv jarayonlarga ortiqcha yuklama berib, diqqatning tarqoqlashuvi, tez charchash va psixologik zo'riqishga olib keladi. Kognitiv zo'riqish uzoq muddat davom etganda, o'quvchilarda xavotir darajasi oshib, emotsional barqarorlik pasayadi. O'quvchilar ijtimoiy muhitda o'zlarini tengdoshlar bilan doimiy ravishda taqqoslashga moyil bo'ladilar. Ushbu jarayon, ayniqsa, tashqi baholarga yuqori darajada bog'liq bo'lgan o'quvchilarda o'zini past baholash, muvaffaqiyatsizlik qo'rquvi va doimiy xavotir holatini yuzaga keltiradi. Ijtimoiy taqqoslashning kuchayishi shaxsiy yutuqlardan qoniqmaslik va depressiv kayfiyatning shakllanishiga olib kelishi mumkin.

Zamonaviy ta'lim muhiti o'quvchilardan yuqori natijalarni talab qilmoqda. Bu holat ayrim o'quvchilarda perfektsionistik qarashlarning shakllanishiga sabab bo'lib, ular o'z oldilariga haddan tashqari yuqori talablar qo'yadilar. Natijada, xato qilishdan qo'rquv, o'zidan doimiy norozilik va ichki psixologik bosim yuzaga keladi. Perfektsionizm xavotir va depressiya rivojlanishining muhim omillaridan biri sifatida namoyon bo'ladi. O'quvchilarning kundalik faoliyatida emotsional dam olish va psixologik tiklanish imkoniyatlarining cheklanishi ruhiy charchoqqa olib keladi. Doimiy bandlik, psixologik zo'riqish va ichki keskinlik emotsional resurslarning kamayishiga sabab bo'ladi. Emotsional tiklanish yetishmasligi uzoq muddat davom etganda, o'quvchilarda depressiv simptomlarning paydo bo'lishiga zamin yaratadi.

Kelajak bilan bog'liq noaniqliklar o'quvchilar orasida keng tarqalgan psixologik muammolardan biri hisoblanadi. Kasb tanlash, jamiyatda o'z o'rnini topish va shaxsiy

muvaffaqiyatga erishish masalalari o'quvchilarda doimiy xavotir uyg'otadi. Kelajak tashvishi o'z vaqtida bartaraf etilmasa, umidsizlik hissi kuchayib, depressiv holatlarning rivojlanishiga olib kelishi mumkin.

Tadqiqot metodologiyasi

Mazkur tadqiqot o'quvchilarda xavotir va depressiya holatlarining zamonaviy psixologik omillar bilan bog'liqligini aniqlash maqsadida olib borildi. Tadqiqot jarayonida miqdoriy va sifatli tahlil usullaridan foydalanildi. Tadqiqotda umumta'lim maktablarida tahsil olayotgan 13–17 yosh oralig'idagi o'quvchilar ishtirok etdi. Respondentlar tasodifiy tanlov asosida jalb qilinib, tadqiqot ixtiyoriylik va maxfiylik tamoyillari asosida amalga oshirildi. Tadqiqotda o'quvchilarning yoshi, jinsi va sinf bosqichlari inobatga olindi.

Tadqiqotda o'quvchilarda xavotir va depressiya darajasini aniqlash hamda zamonaviy psixologik omillarning ta'sirini baholash uchun quyidagi metodlar qo'llanildi:

1. Xavotir darajasini aniqlash testi (Spielberger State-Trait Anxiety Inventory, STAI)
2. Depressiv simptomlarni baholash shkalasi (Beck Depression Inventory, BDI)

Tadqiqot natijalari va baholash

Empirik tadqiqot 60 nafar o'quvchi orasida o'tkazildi. Tadqiqot natijalari shuni ko'rsatdiki, o'quvchilarda xavotir va depressiya darajasi turlicha bo'lib, ular turli darajadagi yordamga muhtoj.

O'quvchilarning 12 nafari (20%) past darajadagi xavotir va depressiya alomatlariga ega bo'lib, ular o'zini nisbatan barqaror his qiladi. Ushbu guruhdagi o'quvchilar uchun asosan profilaktik choralar yetarli bo'lib, sog'lom uyqu, emotsional dam olish va ijtimoiy qo'llab-quvvatlash tavsiya etiladi.

O'rta darajadagi xavotir va depressiya 30 nafar o'quvchida (50%) aniqlangan. Bu guruhdagi o'quvchilar o'rta darajadagi bezovtalik, tushkun kayfiyat va ruhiy charchoqni sezadilar. Ular uchun psixologik maslahatlar, vaqtni boshqarish bo'yicha tavsiyalar,

emotsional tiklanish mashqlari va oilaviy muloqot orqali yordam ko'rsatish tavsiya etiladi.

Yuqori darajadagi xavotir va depressiya esa 18 nafar o'quvchida (30%) kuzatildi. Ushbu o'quvchilarda kuchli xavotir, depressiv simptomlar, motivatsiyaning pasayishi va ijtimoiy chekinishlar mavjud. Bunday o'quvchilar uchun professional psixolog yoki psixoterapevt bilan ishlash zarur bo'lib, individual yoki guruh mashqlari, kelajak tashvishini kamaytirish bo'yicha treninglar va stressni boshqarish usullari qo'llanishi lozim.

Umuman olganda, tadqiqot natijalari shuni ko'rsatdiki, zamonaviy psixologik omillar o'quvchilarda xavotir va depressiya rivojlanishiga sezilarli ta'sir ko'rsatadi. Natijalar asosida o'quvchilarni uch guruhga bo'lish va har bir guruh uchun tegishli yordam ko'rsatish strategiyasini ishlab chiqish tavsiya etiladi. Shuningdek, o'quvchilar orasida xavotir va depressiya rivojlanishini kamaytirish bo'yicha umumiy tavsiyalar quyidagilarni o'z ichiga oladi:

1. Emotsional dam olish va stressni boshqarish: nafas olish mashqlari, relaksatsiya, sport va ijodiy faoliyat orqali psixologik tiklanish.
2. Kelajak tashvishini kamaytirish: o'quvchilarga rejalashtirish, maqsadlarni bo'laklarga bo'lish va ijobiy fikrlash strategiyalarini o'rgatish.
3. Ijtimoiy qo'llab-quvvatlashni kuchaytirish: ota-ona va tengdoshlar bilan muloqotni rag'batlantirish, maktab psixologi bilan muntazam suhbatlar.
4. Perfeksionizm va o'z-o'zini tanqid qilishni kamaytirish: muvaffaqiyatsizlikdan qo'rqmaslikni o'rgatish va muvaffaqiyatlarni qadrlash.
5. Axborotni boshqarish: raqamli texnologiyalar va ijtimoiy tarmoqlardan me'yorida foydalanish, o'quv yuklamasini nazorat qilish.

Xulosa qilib aytganda, o'quvchilarda xavotir va depressiya rivojlanishini kamaytirish uchun zamonaviy psixologik omillarni aniqlash, profilaktik va terapevtik choralarni

joriy etish, shuningdek, ota-ona, maktab va psixologik mutaxassislar hamkorligini kuchaytirish zarur. Bu o‘quvchilarning ruhiy salomatligini saqlash va ularning akademik, ijtimoiy hamda shaxsiy rivojlanishiga ijobiy ta’sir ko‘rsatadi.

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THE PROBLEM OF SOURCES IN THE STUDY OF TEKKE HISTORY (A CRITICAL REVIEW OF ERKAN ÖVÜÇ'S ARTICLE)

Zumrad Boyxurazovna Rahmankulova

Professor, National University of Uzbekistan

named after Mirzo Ulugbek

zumradrahmankulova@gmail.com

Abstract.

This article examines the methodological problems of source criticism in the study of the history of the Üsküdar Uzbek tekke. Central to this discussion is the scholarly article published in 2018 by Erkan Övüç under the title "How is Tekke history written?" The four-category source typology proposed by Övüç tekke records, tombstones and inscriptions, archival documents, and oral history is critically analysed in terms of its strengths and limitations. On the basis of this critical assessment, the article demonstrates that Övüç's typology contains three significant lacunae: the Istanbul periodical press of the early twentieth century, the consular reports of the Russian Empire, and memoir literature. The article proposes an expanded seven-category typology that incorporates these three additional source types and evaluates the prospects for their application in tekke scholarship.

Keywords: Üsküdar Uzbek tekke, source typology, methodology, Erkan Övüç, periodical press, consular reports, historiography, tekke history.

I. Introduction

The quality of any historical inquiry is fundamentally conditioned by the completeness and diversity of its source base. The Üsküdar Uzbek tekke a religious and cultural institution that operated from the mid-eighteenth century until 1925 and served as a vital cultural bridge between Central Asia and the Ottoman Empire has attracted growing scholarly attention in Turkish historiography in recent decades [1]. Research

that had its modest beginnings in the 1940s gained remarkable momentum in the second decade of the twenty-first century [2].

A pivotal contribution to this expanding field was made by Erkan Övüç, whose 2018 article "How is Tekke history written? An Essay on the Classification of Sources" offered the first systematic typology of the sources available for the study of tekke history [2]. Övüç's framework was rapidly adopted as a methodological foundation by subsequent researchers.

Yet, like any scholarly classification, Övüç's typology is not without its limitations. The present article undertakes a critical reassessment of that typology with a view to proposing a concrete expansion. The methodological contribution intended here extends beyond tekke scholarship proper: it speaks to the broader challenge of studying the social institutions of the Ottoman period. The central question guiding the inquiry may be formulated as follows: Is the source typology proposed by Erkan Övüç sufficient for a comprehensive account of the history of the Üsküdar tekke, and what categories of sources has it left unaccounted for?

The study proceeds in two methodological stages. In the first stage, Övüç's typology is subjected to internal analysis: each of its four categories is examined individually in order to determine its scope and inherent constraints. In the second stage, a comparative analysis is conducted by placing Övüç's typology alongside the source types employed by scholars working on Russian and European imperial archives notably Robert Crews [3] and Eileen Kane [4].

The primary materials consulted include Övüç's own article [2], the studies of Serpil Özcan [5] and Lale Can [6], the works of Cengiz Bektaş [7] and Muharrem Varol [8], and Musahibzade Celal's memoir "Life in Old Istanbul" [9].

II. Discussion and Results

Övüç distinguishes four categories of sources for the study of tekke history [2]: tekke records (registers of visitors, financial ledgers); tombstones and architectural inscriptions (epitaphs, votive inscriptions on buildings); archival documents (the Ottoman state archives); and oral history (testimonies of the descendants of tekke shaykhs). The scholarly contribution of this typology deserves recognition on several counts.

First, it constitutes the first systematic attempt to classify tekke sources a task that had not previously been undertaken. Second, the emphasis Övüç places on the primacy of archival documents reflects a sound methodological position: the existence of more than two hundred documents relating to the Bukharan emirate's hajj affairs in the Ottoman state archives [10] demonstrates that primary archival sources provide the most reliable foundation for the study of tekke history. Third, the treatment of architectural monuments tombstones and inscriptions as sources in their own right represents a genuinely innovative approach, one that has been pursued with considerable productivity by Işlı Esin Demirel [11].

Nevertheless, Övüç's typology contains a notable gap with respect to the Istanbul periodical press of the early twentieth century. This omission is methodologically significant. In the years between 1908 and 1918, Istanbul saw the publication of 918 periodicals newspapers and journals of varying character [12]. Outlets such as Tanin, İkdam, and Servet-i Fünun carried regular reportage on the arrival of Central Asians in Istanbul, the activities of tekkes, and difficulties encountered during the hajj. The methodological advantage of periodical sources lies precisely in their contemporaneity: unlike memoir literature, they record events as they unfold, unmediated by the retrospective distortions that inevitably affect recollection. Muharrem Varol [8] has written on the relationship between the tekke and the printing trade, but he treats the

periodical press as an object of research rather than as a source a distinction that carries considerable methodological weight.

A second significant lacuna in Övüç's typology concerns the consular reports of the Russian Empire, and more broadly the diplomatic archives of foreign powers. Russia had, from the closing decades of the nineteenth century, established a dedicated consular apparatus for monitoring the movements of Central Asian Muslims in Istanbul [4]. The figure drawn from those very consular reports that between eight and ten thousand pilgrims were registered annually [13] illustrates the informational density of this source type. In his work *For Prophet and Tsar* [3], Robert Crews relies on Russian consular reports as a primary source for the study of Muslim life in Central Asia. This approach has found virtually no equivalent in Turkish historiography. Yet the Russian consul's dispatches contain detailed accounts of visits to tekkes, of the intellectual activities of Central Asian scholars in Istanbul, and of the progress of hajj caravans. These reports are preserved in the Russian State Historical Archive (RGIA) in Saint Petersburg and remain largely unexamined by students of Ottoman institutional history.

A third lacuna concerns the treatment of written memoir literature. Övüç identifies oral history as a distinct category, but does not integrate written memoirs and recollections into his typology. The methodological distinction between these two source types is not trivial. Oral history is recorded at a remove from the events it describes and is always mediated by the act of transcription; written memoirs, by contrast, are set down by their authors in their own hand and typically composed in closer temporal proximity to the events recalled. Musahibzade Celal's memoir *Life in Old Istanbul* [9], for instance, describes the tekke as an esnaf a guild of craftsmen thereby furnishing a unique primary account of the tekke's economic function. Övüç deploys this work as secondary literature rather than as a source in its own right, a choice that forecloses an important avenue of inquiry.

On the basis of the foregoing analysis, the present article proposes an expanded typology that supplements Övüç's four categories with three additional ones: the periodical press, foreign diplomatic archives, and written memoir literature. The practical utility of this expanded framework may be illustrated by three concrete examples. First, a combined reading of the periodical press and the tekke's financial ledgers could yield precise figures for the volume of textiles delivered by İbrohim Adham Efendi's weaving workshop to the court of Sultan Abdülaziz [14]. Second, a comparative analysis of Russian consular reports and the tekke's visitor registers could help resolve the question of the character of the 1918 migration surge — whether it consisted primarily of refugees or of students. Third, press reportage on the tekke during the years of the National Struggle would allow scholars to assess, on the basis of near-contemporary evidence, the degree to which the institution had become politicised.

It bears emphasising that the lacunae identified in Övüç's typology are not a reflection of individual scholarly shortcoming; they mirror a broader tendency within Turkish regional historiography. Turkish researchers have traditionally privileged internal sources the Ottoman state archives and institutional records while making comparatively little use of foreign archival materials. This constitutes a systemic limitation of the field, one that a methodologically expanded approach can help, at least in part, to overcome.

III. Conclusion

The present article yields the following conclusions. First, the four-category typology proposed by Erkan Övüç has made a substantial methodological contribution to the study of the history of the Üsküdar tekke and has provided an indispensable foundation for subsequent scholarship. Second, the typology fails to account for three bodies of source material that are of considerable relevance: the Istanbul periodical press of the early twentieth century, the consular reports of the Russian Empire, and written

memoir literature. The methodological implication is clear: a source typology is not a fixed and immutable schema it must be expanded and refined as new materials come to light in the course of research. It is precisely this dynamic, revisionary orientation that sustains the scholarly vitality of historical inquiry.

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INSTITUTIONAL SIGNIFICANCE OF FREE ECONOMIC ZONES IN REGIONAL ECONOMIC GROWTH

Rahimova Feruza Ikromovna

Master's Student, Bukhara State University

Abstract. This thesis analyzes the institutional role of free economic zones (FEZs) in regional economic growth. Free economic zones are considered as a mechanism for accelerating economic growth by improving the regional investment climate, developing industrial cooperation, and stimulating innovative activity. Also, based on the experience of Uzbekistan, directions for improving the institutional efficiency of FEZs are proposed.

Keywords: free economic zone, institutional environment, regional development, investment, economic growth, clustering.

MINTAQAVIY IQTISODIY O'SISHDA ERKIN IQTISODIY ZONALARNING INSTITUTSIONAL AHAMIYATI

Rahimova Feruza Ikromovna

Buxoro davlat universiteti, magistranti

Annotatsiya. Mazkur tezisdagi mintaqaviy iqtisodiy o'sishda erkin iqtisodiy zonalarning (EIZ) institutsional roli tahlil qilinadi. Erkin iqtisodiy zonalar hududiy investitsion muhitni yaxshilash, sanoat kooperatsiyasini rivojlantirish hamda innovatsion faoliyatni rag'batlantirish orqali iqtisodiy o'sishni jadallashtiruvchi mexanizm sifatida baholanadi. Shuningdek, O'zbekiston tajribasi asosida EIZlarning institutsional samaradorligini oshirish yo'nalishlari taklif etiladi.

Kalit so'zlar: erkin iqtisodiy zona, institutsional muhit, mintaqaviy rivojlanish, investitsiya, iqtisodiy o'sish, klasterlashuv.

Global iqtisodiyotda chuqur transformatsiya jarayonlari, ishlab chiqarish zanjirlarining qayta shakllanishi hamda kapital oqimlarining tezlashuvi sharoitida hududiy rivojlanish

masalasi davlat siyosatining ustuvor yoʻnalishlaridan biriga aylanmoqda. Zamonaviy iqtisodiy nazariyalarga koʻra, barqaror iqtisodiy oʻsish nafaqat makroiqtisodiy omillarga, balki institutsional muhit sifatiga ham bevosita bogʻliqdir. Institutsional iqtisodiyot maktabi vakillari, xususan, Douglass North iqtisodiy oʻsishning barqarorligi samarali institutlar, aniq qoidalar va mulk huquqi himoyasi bilan taʼminlanishini taʼkidlaydi. Shu nuqtai nazardan, erkin iqtisodiy zonalar (EIZ) maxsus huquqiy, soliq va maʼmuriy rejim asosida faoliyat yurituvchi institutsional platforma sifatida mintaqaviy iqtisodiy rivojlanishda muhim vosita hisoblanadi. EIZlar iqtisodiyotni hududiy diversifikatsiya qilish, sanoat ishlab chiqarishini kengaytirish, eksport salohiyatini oshirish hamda toʻgʻridan-toʻgʻri xorijiy investitsiyalarni jalb etishda samarali mexanizm sifatida namoyon boʻlmoqda. Bugungi kunda jahonda 3 mingdan ortiq erkin iqtisodiy zonalar faoliyat yuritmoqda va ular global savdo hamda investitsiya oqimlarining muhim qismini shakllantiradi. UNCTAD maʼlumotlariga koʻra, EIZlar koʻplab rivojlanayotgan mamlakatlarda sanoatlashuv va eksportni kengaytirishning asosiy drayverlaridan biri boʻlib xizmat qilmoqda. Oʻzbekiston sharoitida ham mintaqaviy iqtisodiy tafovutlarni qisqartirish, yangi ish oʻrinlari yaratish va investitsiya faolligini oshirish maqsadida bir qator erkin iqtisodiy zonalar tashkil etildi. Jumladan, Navoi erkin iqtisodiy zonasi, Angren erkin iqtisodiy zonasi va Jizzax erkin iqtisodiy zonasi hududiy sanoat infratuzilmasini rivojlantirish hamda investitsion muhitni yaxshilashda muhim rol oʻynamoqda. Shu bilan birga, amaliyot shuni koʻrsatadiki, EIZlarning samaradorligi faqat imtiyozlar tizimi bilan emas, balki institutsional boshqaruv sifati, maʼmuriy tartib-taomillarning soddaligi, infratuzilmaning rivojlanganligi va mahalliy iqtisodiyot bilan integratsiya darajasiga bogʻliqdir. Ayrim hollarda EIZlar “enklav iqtisodiyot” sifatida shakllanib, mintaqaviy iqtisodiyot bilan yetarli darajada bogʻlanmay qolishi mumkin. Shu sababli, EIZlarni takomillashtirish masalasini institutsional yondashuv asosida tahlil qilish dolzarb ilmiy vazifa

hisoblanadi. Mazkur tadqiqotning dolzarbligi shundaki, mintaqaviy iqtisodiy o‘shish omillarini chuqur o‘rganish hamda erkin iqtisodiy zonalarining institutsional rolini baholash orqali hududiy rivojlanish siyosatini takomillashtirish imkoniyati yaratiladi. Tadqiqotda EIZlarning huquqiy-me‘yoriy asoslari, boshqaruv mexanizmlari, investitsion rag‘batlantirish tizimi hamda ularning mintaqaviy YaIM, eksport va bandlik ko‘rsatkichlariga ta‘siri nazariy va amaliy jihatdan tahlil qilinadi. Natijada, erkin iqtisodiy zonalar nafaqat iqtisodiy imtiyozlar maydoni, balki mintaqaviy rivojlanishning institutsional katalizatori sifatida qaralishi lozimligi asoslab beriladi. Mintaqaviy iqtisodiy o‘shish nazariyasiga ko‘ra, hududiy rivojlanish sur‘atlari ko‘p jihatdan institutsional muhit sifatiga bog‘liq. Institutsional tizim samaradorligi esa investitsion faollik, ishlab chiqarish kooperatsiyasi va innovatsion rivojlanish darajasini belgilaydi. Shu nuqtai nazardan, erkin iqtisodiy zonalar (EIZ) alohida institutsional rejimga ega hudud sifatida mintaqaviy iqtisodiy o‘shishni tezlashtiruvchi mexanizm hisoblanadi. Huquqiy va ma‘muriy institutlarning roli. Erkin iqtisodiy zonalarining asosiy ustunligi – bu investorlar uchun barqaror va prognoz qilinadigan huquqiy muhit yaratishdir. Maxsus soliq va bojxona imtiyozlari, soddalashtirilgan ro‘yxatdan o‘tish tartibi, “yagona darcha” tizimi investitsiya xarajatlarini kamaytiradi. Masalan, Navoi erkin iqtisodiy zonasi hududida investorlar uchun yer ajratish, infratuzilmaga ulanish va bojxona rasmiylashtiruv jarayonlari markazlashtirilgan tartibda amalga oshiriladi. Bu esa investitsiya loyihalarini ishga tushirish muddatini qisqartiradi va kapital aylanish tezligini oshiradi. Institutsional barqarorlik natijasida hududda yuqori texnologik ishlab chiqarish loyihalari shakllangan bo‘lib, bu mintaqaviy sanoatlashuv jarayonini tezlashtirgan. Infratuzilma instituti va sanoat kooperatsiyasi. Mintaqaviy iqtisodiy o‘shishda infratuzilmaning rivojlanganligi hal qiluvchi omillardan biridir. EIZlar odatda tayyor muhandislik-kommunikatsiya tarmoqlari, logistika markazlari va transport aloqalari bilan ta‘minlanadi. Masalan, Angren erkin iqtisodiy zonasi sanoat korxonalarini

temiryo‘l va avtomobil yo‘llariga yaqin joylashgani sababli ichki va tashqi bozorlarga chiqish imkoniyati kengaygan. Natijada, hududda ishlab chiqarilgan mahsulotlarning eksport hajmi oshgan va mahalliy sanoat kooperatsiyasi rivojlangan. Bu holat shuni ko‘rsatadiki, EIZlar nafaqat alohida hudud, balki mintaqaviy ishlab chiqarish klasterlarining shakllanishiga xizmat qiluvchi institutsional platformadir. Investitsion institutlar va kapital oqimi. EIZlarning institutsional ahamiyati investitsiya jalb qilish mexanizmlarida ham namoyon bo‘ladi. Maxsus imtiyozli soliq siyosati va kafolatlar investorlar uchun risklarni kamaytiradi. Masalan, Jizzax erkin iqtisodiy zonasi tashkil etilgach, hududga bir qator xorijiy investitsiyalar jalb qilindi va yangi sanoat loyihalari ishga tushirildi. Bu esa mintaqada yangi ish o‘rinlari yaratish, aholi daromadlarini oshirish va hududiy YaIM ko‘rsatkichlarini yaxshilashga xizmat qilgan. Demak, EIZlar kapital konsentratsiyasini ta‘minlovchi institutsional mexanizm sifatida hududiy iqtisodiy o‘shishning moliyaviy asosini mustahkamlaydi. Innovatsion institutlar va texnologik transformatsiya. Zamonaviy iqtisodiyotda o‘shish omili sifatida innovatsion rivojlanish alohida ahamiyat kasb etadi. EIZlar texnoparklar, ilmiy markazlar va ishlab chiqarish korxonalarini o‘rtasidagi hamkorlikni rag‘batlantiradi. Masalan, ayrim zonalarda yuqori qo‘shilgan qiymatli mahsulot ishlab chiqarish yo‘lga qo‘yilgan bo‘lib, bu hududiy iqtisodiyotning xomashyo yo‘nalishidan sanoat va texnologik yo‘nalishga o‘tishiga yordam bermoqda. Shunday qilib, EIZlar iqtisodiy o‘shishning yangi sifat bosqichiga o‘tishda institutsional katalizator vazifasini bajaradi. Tahlillar shuni ko‘rsatadiki, erkin iqtisodiy zonalarning mintaqaviy iqtisodiy o‘shishdagi roli faqat fiskal imtiyozlar bilan cheklanmaydi. Ularning haqiqiy samaradorligi institutsional muhit sifati, boshqaruv mexanizmlari, infratuzilma rivoji va mahalliy iqtisodiyot bilan integratsiya darajasiga bog‘liq. Shu bois, EIZlarni takomillashtirishda quyidagilar muhim: institutsional barqarorlikni kuchaytirish, hududiy klasterlashuvni rivojlantirish, raqamli boshqaruv tizimini joriy etish, samaradorlikni baholovchi indikatorlar tizimini

ishlab chiqish. Tadqiqot natijalari shuni ko'rsatadiki, erkin iqtisodiy zonalar mintaqaviy iqtisodiy o'sishni ta'minlashda muhim institutsional mexanizm sifatida namoyon bo'ladi. Maxsus huquqiy, soliq va ma'muriy rejim asosida tashkil etilgan EIZlar hududiy investitsion muhitni yaxshilash, sanoat ishlab chiqarishini kengaytirish, eksport salohiyatini oshirish hamda yangi ish o'rinlari yaratishda muhim rol o'ynaydi. Shuningdek, ular hududiy iqtisodiyotning diversifikatsiyasini ta'minlab, sanoat kooperatsiyasi va klasterlashuv jarayonlarini jadallashtirishga xizmat qiladi. O'zbekiston tajribasi shuni ko'rsatadiki, Navoi, Angren va Jizzax erkin iqtisodiy zonalarini hududiy sanoat infratuzilmasini rivojlantirish, to'g'ridan-to'g'ri xorijiy investitsiyalarni jalb etish hamda mahalliy ishlab chiqarish salohiyatini oshirishda muhim natijalarga erishgan. Biroq EIZlarning samaradorligi faqat fiskal imtiyozlar bilan belgilanmaydi. Ularning barqaror rivojlanishi institutsional boshqaruv sifati, infratuzilma rivoji, ma'muriy tartib-taomillarning soddaligi hamda mahalliy iqtisodiyot bilan integratsiya darajasiga bevosita bog'liqdir. Shu nuqtai nazardan, erkin iqtisodiy zonalarini rivojlantirishda institutsional yondashuvni kuchaytirish muhim ahamiyat kasb etadi. Xususan, zonalarda samarali boshqaruv tizimini shakllantirish, hududiy sanoat klasterlarini rivojlantirish, investitsiya jarayonlarini raqamlashtirish hamda EIZlar faoliyati samaradorligini baholovchi indikatorlar tizimini joriy etish zarur. Natijada, erkin iqtisodiy zonalar nafaqat investitsiya jalb qiluvchi hudud, balki mintaqaviy iqtisodiy o'sish va innovatsion rivojlanishning muhim institutsional katalizatori sifatida xizmat qiladi.

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**ANALYSIS OF SPECIFIC VERTICAL AND ANGLE VIBRATIONS
OF A SCREW CONVEYOR SHAFT MOUNTED ON SLEEVE
BEARING SUPPORTS**

Jumaev Akbarjon Sayfullaevich

Almalyk State Technical Institute, Almalyk, Uzbekistan
Doctor of Philosophy (PhD) in Technical Sciences, Associate Professor
ORCID: [0009-0009-3026-8052](https://orcid.org/0009-0009-3026-8052); E-mail: akbarjumayev011@gmail.com

Ergasheva Gozal Fayzulla qizi

Almalyk State Technical Institute, Almalyk, Uzbekistan
Student of the 7-24 MM group, Mechanical Engineering
E-mail: kechaziy@gmail.com

Abdumanonov Samandar O'tkurjon o'g'li

Almalyk State Technical Institute, Almalyk, Uzbekistan
Student of the 7-24 MM group, Mechanical Engineering
E-mail: kechaziy@gmail.com

Abstract: This paper presents an analysis of the natural vertical and inclined vibrations of a screw conveyor shaft mounted on elastic bearing supports. The performance of the proposed double-flight screw conveyor is mainly determined by the screw parameters, including diameter, rotational speed, length, screw pitch, as well as the amplitude and frequency of waves in each screw flight. The study investigates the influence of these parameters on the vibration characteristics and proposes scientific and technical solutions aimed at ensuring stable and efficient operation of the conveyor. The obtained results are of practical importance for the design and performance improvement of screw conveyor systems.

Keywords: screw conveyor, screw, elastic element, bearing, shaft, vibration frequency, vertical vibrations, inclined vibrations, performance, parameter, wave amplitude, frequency, dynamics

Annotatsiya: Ushbu maqolada qayishqoq podshipnikli tayanchlarga oʻrnatilgan vintli konveyer valining xususiy vertikal va ogʻma tebranishlari tahlil qilingan. Tavsiya etilgan ikki kirimli vintli konveyerning ish unumdorligi asosan vintning geometrik va kinematik parametrlariga bogʻliq boʻlib, ularga vint diametri, aylanish chastotasi, uzunligi, vint qadami hamda har bir vint kirimidagi toʻlqinlar amplitudasi va chastotasi kiradi. Tadqiqot jarayonida ushbu parametrlarning tebranish xarakteristikalariga taʼsiri oʻrganilgan hamda konveyerning barqaror ishlashini taʼminlashga qaratilgan ilmiy-texnik yechimlar taklif etilgan. Olingan natijalar vintli konveyerlarni loyihalash va ularning samaradorligini oshirishda muhim ahamiyat kasb etadi.

Kalit soʻzlar. vintli konveyer, vint, qayishqoq element, podshipnik, val, tebranish chastotasi, vertikal tebranish, ogʻma tebranish, ish unumdorligi, parametr, toʻlqin amplitudasi, chastota, dinamika

Аннотация: В данной статье проведён анализ собственных вертикальных и наклонных колебаний вала винтового конвейера, установленного на опорах с упругими подшипниками. Производительность предлагаемого двухзаходного винтового конвейера в основном определяется параметрами винта, такими как диаметр, частота вращения, длина, шаг винта, а также амплитуда и частота волн в каждом заходе винта. В ходе исследования изучено влияние указанных параметров на динамические характеристики колебаний и предложены научно-технические решения, направленные на обеспечение устойчивой работы конвейера. Полученные результаты могут быть использованы при проектировании и повышении эффективности винтовых конвейеров.

Ключевые слова: винтовой конвейер, винт, упругий элемент, подшипник, вал, частота колебаний, вертикальные колебания, наклонные колебания, производительность, параметр, амплитуда волны, частота, динамика

At the stage of development of mechanical engineering, along with all areas, it is of great importance to intensively apply in production of equipment and technologies that ensure resource efficiency and high productivity in the transportation of products in production, and to further increase the quality and competitiveness of products. “Transportation costs play an important role in reducing the cost of production, that is, in mechanical engineering, 5-6%, in the food industry 10-12% and even more costs are incurred for transportation”, which requires the development of new designs of screw conveyors for transportation and their implementation in practice in order to improve the technical and economic performance of production [1]. In this regard, great attention is paid to the use of screw conveyors with wide technological capabilities in the transportation, loading and unloading of products at manufacturing enterprises.

The efficiency of the proposed double-inlet screw conveyor mainly depends on the screw parameters, diameter, rotation frequency, length, screw pitch, and the amplitude and frequency of the waves in each screw inlet. The angle of deviation of the screw from the horizontal plane also plays an important role. When the transported load rises to a certain height, the effect of the screw on the bearing and belt elements is different. In particular, the bearing and belt bushing located below is deformed more than the one above. Also, when the load is transported along the horizontal axis, the deformations of the bearing and belt bushings with different stiffness coefficients are also different. In this case, the screw also experiences deflection vibrations within a certain angle range along its axis [2, 3].

Depending on the value of the vibrations, the vertical displacements of the screw at the inlet and outlet also differ. This, in turn, leads to a change in the gap between the

screw surface and the conveyor. Depending on the physical and mechanical properties of the transported material and the technological requirements for its use, it is possible to determine the pattern in which the gap between the screw surface and the shell changes in the direction of movement. Therefore, it is important to choose the dimensions of the bearings and belt bushings. Taking the above into account, a calculation scheme for a screw conveyor was developed (Fig. 1).

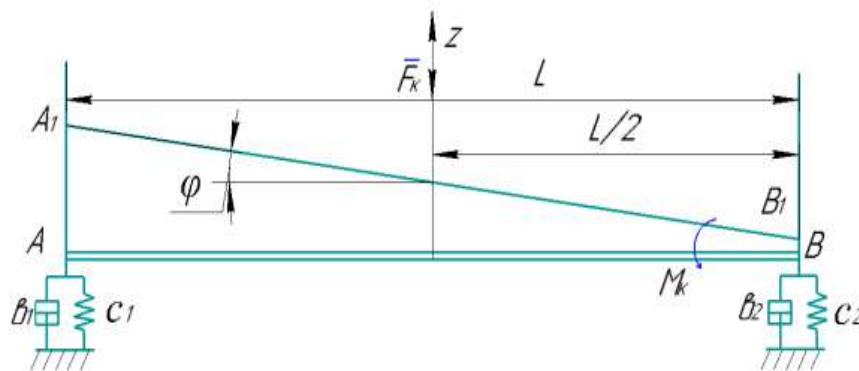


Figure 1. Calculation scheme for determining vertical and oblique vibrations of the propeller shaft

It should be noted that when compiling the calculation scheme, the deflection of the propeller shaft is taken into account, since the deflection is very small compared to the deformation of the flexible bushings. The forces that cause the vertical displacement and deflection of the propeller shaft are: weight, the rigidity of the flexible bushings, and the dissipation and inertia forces. To derive a system of differential equations describing the vibrations of the propeller, the Lagrange second-order equation was used [4, 5];

$$\frac{d}{dt} \left(\frac{\partial T}{\partial \dot{q}_i} \right) - \frac{\partial T}{\partial q_i} + \frac{\partial \Phi}{\partial \dot{q}_i} + \frac{\partial \Pi}{\partial q_i} = Q(q_i), \quad (1)$$

where q_i -system generalized coordinates, T , P – system kinetic and potential energies; Φ – Rayleigh dissipative function; $Q(q_i)$ – forces corresponding to generalized coordinates.

Based on the calculation scheme in Figure 1, two generalized coordinates of vertical and oblique vibrations of the screw conveyor were taken as z – vertical displacement and φ -screw axis deviation angle. Taking into account these generalized coordinates, we determine the corresponding integrals of Lagrange’s II-order equations. Accordingly, the kinetic, potential energies of the system are [6]:

$$\Pi = \frac{c_1 \left(z - \frac{\varphi l}{z} \right)^2}{2} + \frac{c_2 \left(z + \frac{\varphi l}{z} \right)^2}{2}, \quad T = \frac{m\dot{z}^2}{2} + \frac{J\dot{\varphi}^2}{2}, \quad (2)$$

where m is the mass of the screw; c_1, c_2 are the coefficients of rigidity of the rubber bushings with elastic elements; l is the length of the screw; J is the moment of inertia of the screw.

It is known that elastic elements absorb a certain amount of energy during movement. To express this absorption, the dissipative properties of elastic elements are taken into account. 4 elastic elements are used in the machine unit under consideration. The absorption in them significantly changes the law of screw motion.

Considering that when using the proposed double-entry and wavy-surface screw, the conveyor shell is filled with $(0.3 \div 0.5)$ % of the transported material, the vertical and oblique vibrations of the screw allow for sufficient mixing and transportation. It should be noted that this is especially applicable in cases of product deviations of up to $(20^\circ \div 35^\circ)$.

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KINEMATIC STUDY OF A FOUR-LINK MECHANISM FOR THE PURPOSE OF ITS USE IN THE DESIGN OF NEW MACHINES

Abduvaliev Ubaydulla Abdullaevich

Almalyk State Technical Institute, Almalyk, Uzbekistan

Candidate of Technical Sciences, Associate Professor

E-mail: uabduvaliyev86@gmail.com

Abduxoshimov Jo‘rabek Ulug‘bek o‘g‘li

Almalyk State Technical Institute, Almalyk, Uzbekistan

Student of the 8-22 TM group, Mechanical Engineering

E-mail: 10112004jurabek@gmail.com

Annotation. This article presents a kinematic study of a four-link mechanism intended for application in the design of new machines. During the design process, especially in the automation of machines and mechanisms, it is essential to determine kinematic parameters. These parameters are obtained through analytical calculations and by developing computer-based calculation programs. The paper provides an example of calculating a specific mechanism with a detailed analysis of its characteristics. Based on this example, similar problems for other related mechanisms can be effectively solved.

Keywords: mechanism, kinematics, automation, velocity, acceleration, calculation, program, parameter, design, model

Annotatsiya. Ushbu maqolada to‘rt zvenoli mexanizmning kinematik tadqiqi va uni yangi mashinalarni loyihalashda qo‘llash masalalari ko‘rib chiqiladi. Mashina va mexanizmlarni loyihalashda, ayniqsa ularni avtomatlashtirish jarayonida, kinematik parametrlarni aniq bilish muhim ahamiyatga ega. Ushbu parametrlar maxsus hisob-kitoblar hamda EHM uchun tuzilgan dasturlar yordamida aniqlanadi. Maqolada aniq bir mexanizm misolida kinematik hisoblash bosqichlari keltiriladi. Ushbu uslub asosida boshqa shunga o‘xshash mexanizmlarning masalalarini ham yechish mumkin.

Tayanch soʻzlar: mexanizm, kinematika, avtomatlashtirish, tezlik, tezlanish, hisob, dastur, parametr, loyiha, model

Аннотация. В статье рассматривается кинематическое исследование четырехзвенного механизма с целью его применения при проектировании новых машин. При проектировании, особенно при автоматизации машин и механизмов, необходимо знать кинематические параметры системы. Эти параметры определяются расчетным путем и с использованием программ для вычисления на ЭВМ. В работе приводится пример расчета конкретного механизма с подробным анализом его характеристик. На основе данного примера возможно решение задач для других аналогичных механизмов.

Ключевые слова: механизм, кинематика, автоматизация, скорость, ускорение, расчет, программа, параметр, проектирование, модель

When designing machines and mechanisms, especially when automating them, it's essential to know the kinematic parameters, which are determined by calculations and computer programs. To this end, we provide an example calculation for a specific mechanism, which can be used to solve other similar mechanisms.

The task is to construct plans for the speeds and accelerations of a compressor crank-slider mechanism (Fig. 1, a). Find the speed and acceleration of point C , the angular velocity and angular acceleration of connecting rod BC , and determine the length of the radius of curvature ρ_D of the trajectory of point D . Given: $\varphi_1 = 45^\circ$, $l_{AB} = 0,06 \text{ m}$, $l_{BC} = 0,18 \text{ m}$, $l_{BD} = 0,09 \text{ m}$, the angular velocity of crank AB is constant and equal to $\omega_1 = 100 \text{ c}^{-1}$ [1, 2]

Solution. We conduct a structural analysis and determine the class of the given mechanism. The number of links is $k = 4$, the degree of freedom of the mechanism is $n = 3$, the number of kinematic pairs of class V is $P_5 = 4$, and the degree of freedom of the mechanism is $W = 3n - 2P_5 = 3 \cdot 3 - 2 \cdot 4 = 1$. The mechanism is formed by connecting a

second-class, second-type group consisting of links 2 and 3 to the drive link AB and post 4 [3, 4].

We construct a plan of the mechanism's position (Fig. 1, b). We set the length of segment $AB = 30$ mm and calculate the scale of the mechanism diagram:

$$\mu_l = \frac{l_{AB}}{AB} = \frac{0,06}{30} = 0,002 \frac{m}{mm},$$

and from it we find the lengths of the segments (BC) and (BD):

$$(BC) = \frac{l_{BC}}{\mu_l} = \frac{0,18}{0,002} = 90 \text{ mm}, \quad (BD) = \frac{l_{BD}}{\mu_l} = \frac{0,09}{0,002} = 45 \text{ mm},$$

Based on the obtained dimensions and the given angle φ_1 in Fig. 1.b, we construct a plan of the mechanism's position.

We construct a plan of the velocities for groups 2 and 3. We construct the plan using the following two vector equations [5, 6]:

$$v_C = v_B + v_{BC}, \quad v_C = v_{C_4} + v_{CC_4},$$

where v_B – is the velocity of point B , equal in magnitude to $v_B = \omega_1 l_{AB} = 100 \cdot 0,06 = 6 \frac{m}{s}$ and directed perpendicular to line AB in the direction corresponding to the direction of the angular velocity of link AB ; v_{BC} – is the velocity of point C during rotation of link BC about hinge B , equal in magnitude to $v_{CB} = \omega_2 l_{BC}$ (ω_2 – is the angular velocity of link BC , which is still unknown to us) and directed perpendicular to line BC ; v_{C_4} – is the velocity of point C_4 of rack 4, coinciding with point C (it is equal to zero, since link 4 is motionless); v_{CC_4} – is the relative velocity of point C in its motion relative to point C_4 (its modulus is unknown, and it is directed along line A_x) [7, 8].

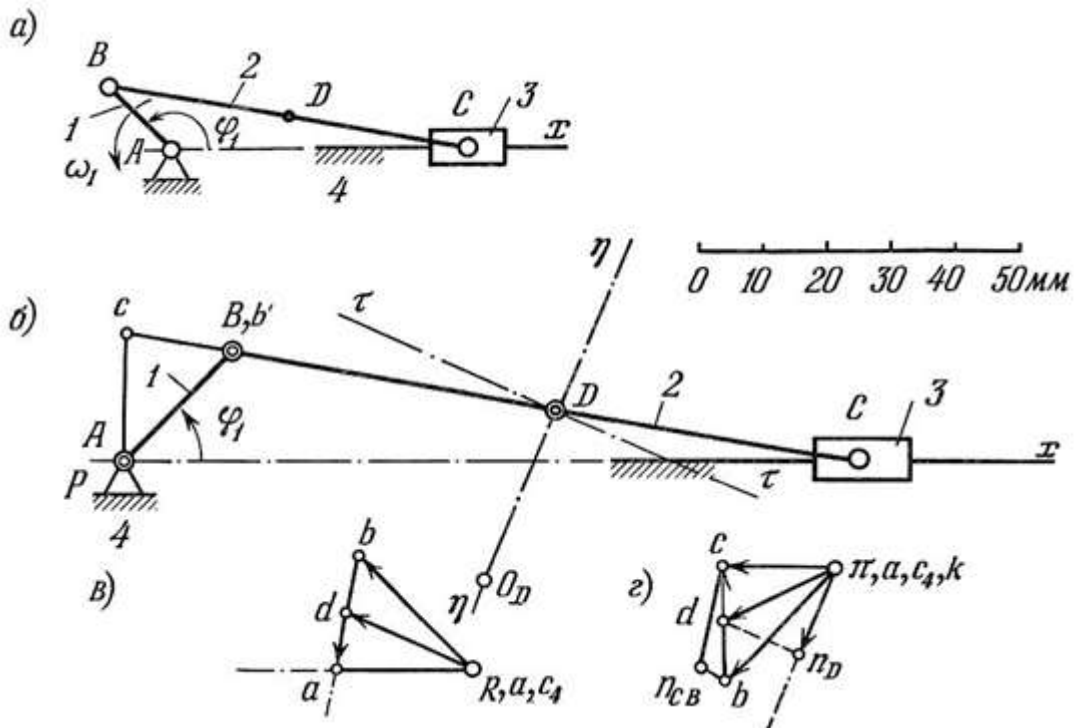


Figure 1. Kinematic analysis of the compressor slider-crank mechanism:

- a) mechanism diagram, b) mechanism position plan, c) speed plan, d) acceleration plan.

We construct the velocity plan in the following sequence (Fig. 1, b). We construct the solution to the first vector equation indicated above (6): from the pole p , we lay off a segment (pb) , representing the velocity of point B , perpendicular to line AB and in accordance with the direction of rotation of link AB , and we choose the length of the segment (pb) equal to $(AB) = 30 \text{ mm}$, i.e., we construct the plan in the scale of the crank; from point b , we draw the direction of velocity v_{CB} – a line perpendicular to BC [9,10]. We proceed to constructing the solution of the second vector equation indicated above: from point p , we would need to plot the velocity v_{C_4} , but it is equal to zero, so we coincide point c_4 with point p ; from point c_4 , or, equivalently, p , we draw the direction of the velocity v_{CC_4} – a line directed by Ax – until it intersects with a line drawn perpendicular to BC , and obtain point c – the end of the velocity vector of point C . We

place point a at the pole of the plan and thus complete the construction of the velocity plan for the entire mechanism. We find the velocity of point D using the similarity rule: the end of this velocity vector must lie on line (bc) and divide segment BC , *i.e.*

$$(bd) = \frac{(BD)}{(BC)}(bc) = 0,5(bc)$$

We calculate the scale of the speed plan:

$$\mu_v = \frac{v_B}{pb} = \frac{\omega_1(AB)\mu_l}{(pb)} = \omega_1\mu_l \frac{m/s}{mm}$$

The scale of the speed analog plan will be [11]

$$\mu_{\varphi v} = \frac{\mu_v}{\omega_1} = \mu_l \frac{m/s}{mm}$$

The velocity v_C of point C is equal to

$$v_C = (pc)\mu_v = 20 \cdot 100 \cdot 0,002 = 4,0 \text{ m/s}$$

The angular velocity ω_2 of link BC is equal to [12]

$$\omega_2 = \frac{(bc)\mu_v}{(BC)\mu_l} = \frac{(bc)\omega_1\mu_l}{(BC)\mu_l} = \frac{18 \cdot 100}{90} = 20 \text{ t/s}$$

In figure 1b, a rotated velocity diagram is plotted directly on the mechanism diagram. In this diagram, pole p is aligned with point A . The direction of the velocity vector at point B coincides with the direction of AB , the direction of the velocity v_{CB} is an extension of line BC , and the direction of the velocity at point C is perpendicular to line A_x .

We construct an acceleration plan for group 2, 3. This plan is constructed using the following two vector equations [13]:

$$a_C = a_B + a_{CB} = a_B + a_{CB}^n + a_{CB}^t, \quad a_C = a_{C_4} + a_{CC_4}^n + a_{CC_4}^t$$

where a_B – is the normal acceleration (also total) of point B , equal in magnitude

$$a_B = \omega_1^2 \cdot l_{AB} = 100^2 \cdot 0,06 = 600 \text{ m/s}$$

and directed parallel to line AB from point B to point A ; a_{CB}^n – is the normal acceleration of point C in the rotational motion of link BC relative to point B , equal in magnitude

$$a_{CB}^n = \frac{v_{CB}^2}{l_{BC}}$$

and directed parallel to line BC from point C to point B ; a_{CB}^t – tangential acceleration of point C in the same motion of link BC , equal in modulus to $a_{CB}^t = \varepsilon_2 \cdot l_{BC}$ and directed perpendicular to line BC ; a_{C_4} – acceleration of point C_4 (point of link 4; it is equal to zero, since link 4 is motionless); $a_{CC_4}^k$ – Coriolis acceleration of point C in its motion relative to point C_4 , equal to zero, since link 4 is motionless; $a_{CC_4}^r$ – relative (relative) acceleration of point C in its motion relative to point C_4 , it is directed along line A_x .

We construct the acceleration plan in the following sequence (Fig. 1, d). We construct the solution to the first vector equation indicated above by plotting a segment (πb) from the pole of the plan π , representing the acceleration a_B , parallel to the line AB . We choose the length (πb) equal to $(AB) = 30 \text{ mm}$, *i.e.*, we construct the plan at the crank scale, while the scales of the acceleration plans and their analogs will be equal to

$$\mu_a = \frac{a_B}{\pi b} = \frac{\omega_1^2 (AB) \mu_l}{(\pi b)} = \omega_1^2 \mu_l = 100^2 \cdot 0,002 = 20 \frac{\text{m/s}^2}{\text{mm}}$$

$$\mu_{\varphi a} = \frac{\mu_a}{\omega_1^2} = \mu_l = 0,002 \frac{\text{m}}{\text{mm}}$$

From point b , we plot a segment bn_{CB} representing the acceleration a_{CB}^n . The length of the segment (bn_{CB}) is calculated using the formula [14]

$$bn_{CB} = \frac{a_{CB}^n}{\mu_a} = \frac{v_{CB}^2}{l_{BC} \cdot \mu_a} = \frac{(bc)^2 \mu_v^2}{(BC) \mu_l \cdot \mu_a} = \frac{(bc)^2 \omega_1^2 \mu_l^2}{(BC) \mu_l \cdot \mu_a} = \frac{(bc)^2}{(BC)} = \frac{(18)^2}{90} = 3,6 \text{ mm}$$

Through point n_{CB} we draw the direction of acceleration a_{CB}^t –, a line perpendicular to line BC . We proceed to constructing the solution of the second vector equation indicated above. To do this, we plot the acceleration vector a_{C_4} from the pole of the plane π , but

it is equal to zero, therefore point c_4 coincides with point π . The end of the acceleration vector $a_{CC_4}^k$ – point k , also coincides with this point (the acceleration $a_{CC_4}^k$ is equal to zero). From point k , or, what is the same, from point π , we draw the directions of acceleration with a line drawn perpendicular to BC , yielding point c , the end of the acceleration vector of point C .

Connecting points c and b yields the total acceleration vector of point C as link BC rotates relative to point B , i.e., a_{CB} . We place point a at point π . This completes the construction of the mechanism's acceleration diagram. We find the endpoint of the acceleration vector of point D using the similarity rule [15]:

$$(bd) = \frac{(BD)}{(BC)}(bc) = 0,5(bc)$$

Connecting point d with the pole of the plane π , we obtain a segment (πd) , representing the acceleration of point D .

The magnitude of the acceleration of point C is determined as follows:

$$a_C = (\pi c) \cdot \mu_a = 17,8 \cdot 20 = 356 \text{ м/с}^2$$

and the magnitude of the angular acceleration of link BC

$$\varepsilon_2 = \frac{a_{CB}^t}{l_{BC}} = \frac{(n_{CBC})\mu_a}{(BC)\mu_l} = \frac{(n_{CBC})\omega_1^2 \cdot \mu_l}{(BC)\mu_l} = \frac{(n_{CBC})^2 \omega_1^2}{(BC)} = \frac{18 \cdot 100^2}{90} = 2000 \text{ 1/с}^2$$

We find the radius of curvature of the trajectory of point D . Through point D (Fig. 1, b) we draw a line $\tau\tau$, parallel to the segment (pd) on the velocity plane (Fig. 1, c) - this will be the direction of the tangent to the trajectory of point D . Line $(\eta\eta)$, drawn perpendicular to line $(\tau\tau)$, is the normal to the same trajectory. The center of curvature O_D of the trajectory of point D is located on it. We project the acceleration vectors of point D , segment (πd) (Fig. 1, d), onto the direction of the normal to the trajectory of point D . We obtain segment (πn_D) , corresponding to the normal acceleration a_D^n of point D from the formula

$$a_D^n = \frac{v_D^2}{\rho_D}$$

we get that the desired radius of curvature will be equal to

$$\rho_D = \frac{v_D^2}{a_D^n} = \frac{(\rho d)^2 \mu_a^2}{(\pi n_D) \mu_a} = \frac{(\rho d)^2 \omega_1^2 \mu_l^2}{(\pi n_D) \omega_1^2 \mu_l} = \frac{(\rho d)^2}{(\pi n_D)} \mu_l = \frac{22^2}{16} \cdot 0,002 = 0,0605 \text{ m}$$

The presented method of kinematic calculation of the mechanism allows for more accurate design and can be useful for students and masters, as well as scientific researchers.

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MECHANISMS OF INTERGRAINAL FAILURE DURING PLASTIC DEFORMATION

Nugmanov Ikrom Nugmanovich

Almalyk State Technical Institute, Almalyk, Uzbekistan

Candidate of Technical Sciences, Professor

E-mail: nugmanovikrom43@gmail.com

Isroilov Diyorbek Abdunasim o'g'li

Almalyk State Technical Institute, Almalyk, Uzbekistan

Student of the 7A-23 MT group, Mechanical Engineering

E-mail: diyorbekisroilov468@gmail.com

Annotation. The article investigates fracture occurring during plastic deformation. It is noted that the fracture begins in two ways – due to the formation of wedge-shaped (V-shaped) cracks, which usually form at the intersection points of three grain boundaries and tend to grow along the boundaries perpendicular to the direction of the applied stress. Such V-shaped cracks can be observed in many pure metals as well as in engineering alloys such as nickel alloys and stainless steels.

Keywords: intergranular fracture, wedge-shaped cracks, main cracks, GB sliding (grain boundary sliding), V-shaped cracks, lattice dislocations.

Аннотация. В статье исследуется разрушение при пластической деформации. Указано, что оно начинается двумя путями – за счёт образования клинообразных

(V-образных) трещин, которые, как правило, формируются в точках пересечения трёх границ зёрен и стремятся расти вдоль границ, перпендикулярных направлению действующего напряжения. Такие V-образные трещины можно наблюдать у многих чистых металлов, а также у технических сплавов, таких как никелевые и нержавеющей стали.

Ключевые слова: Межзеренное разрушение, клиновидные трещины, магистральные трещины, ЗГП - зерно-границное проскальзывание, V - образные трещины, решеточные дислокации.

Annotatsiya. Maqolada plastik deformatsiya jarayonida yuzaga keladigan yemirilish jarayoni o'rganilgan. Unda yemirilish ikki yo'l bilan boshlanishi ko'rsatilgan: birinchisi — klinasimon (V-shaklli) yoriqlar hosil bo'lishi hisobiga. Bunday yoriqlar odatda uchta don (zarra) chegarasi kesishgan nuqtalarda paydo bo'ladi va ta'sir etuvchi kuchlanish yo'nalishiga perpendikulyar bo'lgan chegaralar bo'ylab o'sishga intiladi. Bunday V-shaklli yoriqlar ko'plab sof metallarda, shuningdek nikel qotishmalari va zanglamaydigan po'lat kabi texnik qotishmalarda ham kuzatilishi mumkin.

Kalit so'zlar: donalararo yemirilish, klinasimon yoriqlar, magistral yoriqlar, ЗГП – don chegaralari bo'ylab sirpanish, V-shaklli yoriqlar, kristall panjara dislokatsiyalari.

Wedge-shaped V-shaped cracks, forming at triple grain boundary junctions, weaken the cross-section of the material. Cluster of lattice dislocations in front of the boundary weakens the grain's cross-section. Slip along the boundary with steps creates stress concentrations, which in turn cause localized vacancy flows. Vacancies coalesce into complexes, which, by absorbing new vacancies, grow into pores. Pores (O-shaped cracks) can be elliptical in cross-section; they gradually increase in number and size. The massive formation of pores and their influence leads to a main crack and ultimately to complete failure of the material [1,2].

Fracture initiates in at least two ways: through the formation of wedge-shaped cracks and more or less spherical pores. Wedge-shaped (V-shaped) cracks typically form at the intersections of three boundaries (Fig. 1) and tend to grow along grain boundaries normal to the direction of the applied stress (1).

This type of crack typically occurs during low-temperature plasticity and high stresses. Its occurrence is associated with grain boundary slip, which, due to stress

concentration, can lead to crack opening at the intersection of three boundaries in several ways. Such V-shaped cracks can be observed in a wide range of pure metals and in technical alloys, such as nickel (Fig. 3) or stainless steel (Fig. 2) [3, 4].

Wedge-shaped cracks, forming at triple grain boundary junctions, weaken the cross-section of the material. This accelerates the formation of new microcracks at other boundaries. The massive formation of microcracks leads to their coalescence into main cracks and ultimately to complete failure of the material (2).

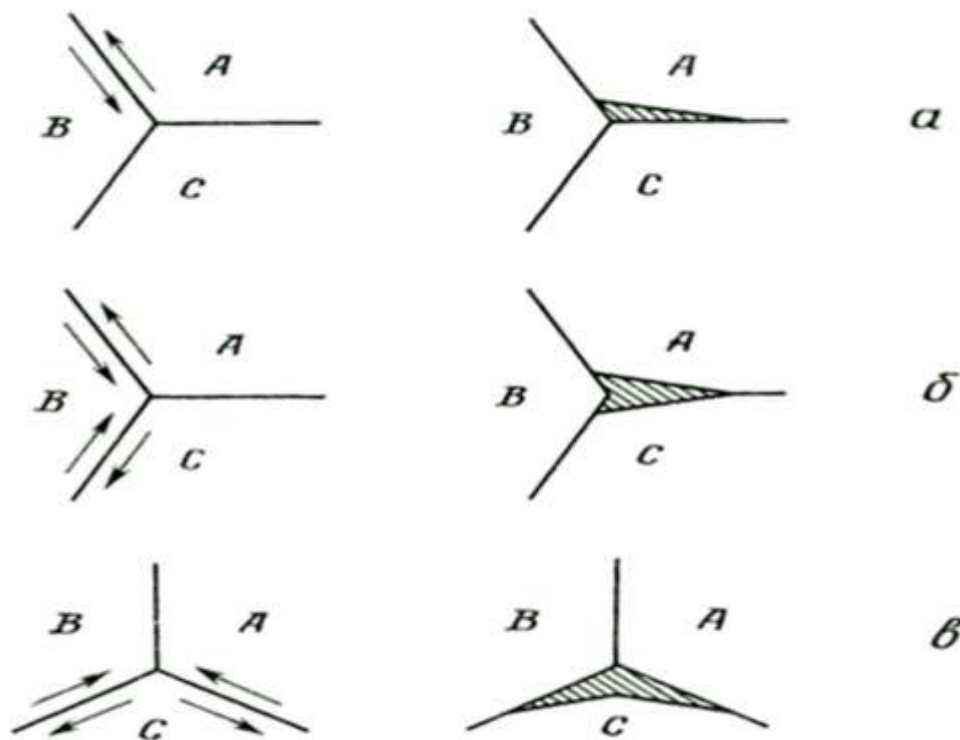


Figure 1. Mechanisms of crack formation at the intersection of three boundaries

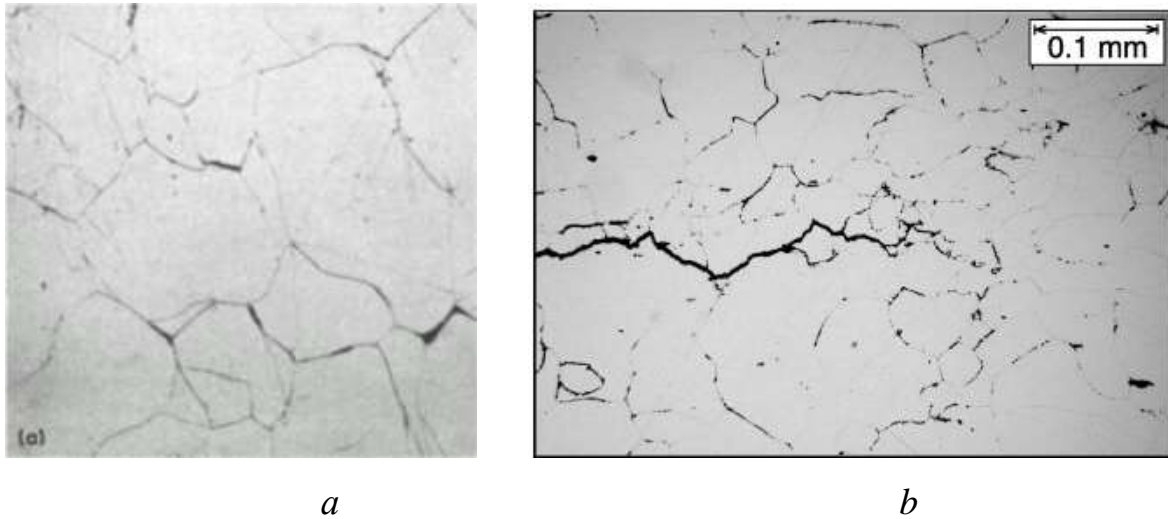


Figure 2. Primary wedge-shaped cracks in stainless steel (316N) (a) and their merging into a main crack (b).

The second pathway for grain boundary crack formation was first observed by Greenwood et al., who discovered small spherical pores at grain boundaries in a number of metals and alloys at the onset of the third stage of creep. These pores (O-shaped cracks) can be circular or elliptical in cross-section; they gradually increase in number and size during the third stage of plasticity (Fig. 2) [5, 6].

At low temperatures, observations show that the pores are typically spaced approximately $1 \mu\text{m}$ apart and have a diameter of no more than $1 \mu\text{m}$.

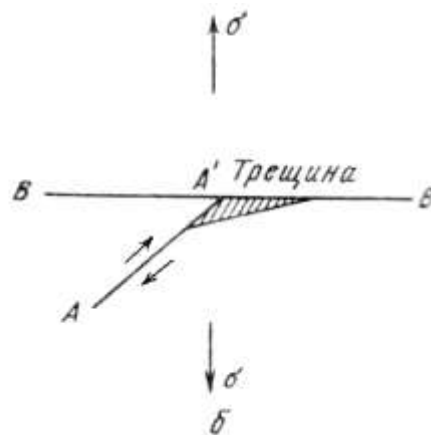


Figure 3. Wedge-shaped cracks resulting from creep of Ti alloy (a) and the diagram of their formation (b)

There may be several causes for the formation of pores at boundaries. Clusters of lattice dislocations in front of a boundary and sliding along stepped boundaries create stress concentrations, which in turn trigger localized vacancy flows. Vacancies form complexes, which, by absorbing new vacancies, grow into pores.

Let's consider the influence of some important factors on these two types of fracture.

The influence of temperature. Since grain boundary sliding increases with increasing temperature, it is expected that the tendency for intergranular cracks to form will also increase. Moreover, at high temperatures, a transition from V-shaped cracks to O-shaped cracks occurs. With increasing temperature, the number of pores per unit boundary length also increases; this has been shown to be related to the degree of development of the grain boundary fracture [7, 8].

Some experiments have found that the distribution density of pores located along grain boundaries decreases at very high temperatures; this is the result of grain boundary migration, which thus moves away from the pores that formed previously at them.

The influence of stress. It is often difficult to separate the effects of stress and temperature, but in general, at a constant temperature, a decrease in stress favors the formation of pores to a greater extent than V-shaped cracks. The greater the stress at a given temperature, the shorter the time required for intergranular fracture—this is a general rule for the behavior of metals during plasticity. Since high stresses promote V-shaped fracture, it follows that this type of crack grows faster than fracture by pore coalescence [10, 11].

The type of stress significantly influences pore formation and the region where they arise. Experiments with bicrystals show that stresses normal to the boundary

surface do not cause pore formation, as in this case the boundary is not subjected to shear stress, and thus, slip along the boundary does not occur. On the other hand, if slip occurs along a grain boundary, the imposed tensile stress often promotes pore formation [12].

CONCLUSIONS: Pore formation during tensile creep testing occurs primarily along boundaries located at angles of 60° to 90° to the tensile axis. However, in some cases, they form at boundaries located at smaller angles, and sometimes even parallel to the tensile axis. Compressive stresses generally help reduce the number of cracks that form, but do not completely eliminate their occurrence. Under hydrostatic compression imposed on the tensile specimen, pore formation is greatly hindered.

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<http://sr-journals.org/index.php/UJTI/article/view/783>

PHENOTYPES OF BRONCHIAL ASTHMA AND MODERN CHOICE OF THERAPY

Republic of Uzbekistan Ferghana medical institute of public health,
Ferghana department of therapeutic sciences

Mamadjanov Rustam Ergashevich

ABSTRACT

Bronchial asthma (BA), being one of the most common chronic diseases of humans, is characterized by a high heterogeneity of clinical forms and variability of the course. The heterogeneity of BA manifests itself in varying degrees of bronchial obstruction severity, varying frequency of exacerbations, varying responses to bronchodilators and long-term control drugs, in particular, inhaled glucocorticosteroids. Modern management of BA requires a thorough analysis of the factors responsible for the progression of the disease and the development of exacerbations, as well as the development of targeted therapy for BA, taking into account the clinical and biological phenotypes of the disease. However, even now, in most patients with asthma, therapy can be conducted taking into account the phenotype of the disease, which is an important task of a specialist physician.

Keywords: bronchial asthma, bronchial asthma phenotypes, inhaled glucocorticosteroids.

ФЕНОТИПЫ БРОНХИАЛЬНОЙ АСТМЫ И СОВРЕМЕННЫЙ ВЫБОР ТЕРАПИИ

Республика Узбекистан медицинский институт общественного здоровья г.
Фергана Кафедра наук терапевтического направления (ВОП)

Мамаджанов Рустам Эргашевич

АННОТАЦИЯ

Бронхиальная астма (БА), являясь одним из самых распространенных хронических заболеваний человека, характеризуется большой гетерогенностью клинических форм и вариабельностью течения. Гетерогенность БА проявляется в разной степени выраженности бронхиальной обструкции, разной частоте обострений, разным ответе на бронходилататоры и препараты для длительного контроля, в частности ингаляционные глюкокортикостероиды. Современное ведение БА требует глубокого анализа факторов, ответственных за прогрессирование заболевания и развитие обострений, а также разработки целевой терапии БА с учетом клинических и биологических фенотипов болезни. Однако уже в настоящее время у большинства пациентов с БА можно проводить терапию с учетом фенотипа заболевания, определение которого является важной задачей врача-специалиста.

Ключевые слова: бронхиальная астма, фенотипы бронхиальной астмы, ингаляционные глюкокортикостероиды.

BRONXIAL ASTMA FENOTIPLARI VA ZAMONAVIY TERAPIYA TANLOVI

O‘zbekiston Respublikasi Farg‘ona shahri jamoat salomatligi tibbiyot instituti

Terapiya yo‘nalishdagi fanlar kafedrası (UASh)

Mamadjanov Rustam Ergashevich

ANNOTATSIYA

Bronxial astma (BA) odamning eng keng tarqalgan surunkali kasalliklaridan biri bo‘lib, klinik shakllarining katta geterogenligi va kechishining o‘zgaruvchanligi bilan ajralib turadi. Bronxial astmaning geterogenligi bronxial obstruksiyaning turli darajada namoyon bo‘lishi, turli xil qo‘zish chastotasi, bronxodilatatorlar va uzoq muddatli nazorat uchun preparatlarga, xususan, ingalyatsion glyukokortikosteroidlarga turli xil javoblarda namoyon bo‘ladi. BAni zamonaviy davolash kasallikning rivojlanishi va

zo'rayishining rivojlanishi uchun mas'ul bo'lgan omillarni chuqur tahlil qilishni, shuningdek, kasallikning klinik va biologik fenotiplarini hisobga olgan holda BAning maqsadli terapiyasini ishlab chiqishni talab qiladi. Biroq, hozirgi vaqtda BA bilan og'riqan bemorlarning aksariyatida kasallikning fenotipini hisobga olgan holda terapiya o'tkazish mumkin, uni aniqlash mutaxassis shifokorning muhim vazifasidir. **Kalit so'zlar:** bronxial astma, bronxial astma fenotiplari, ingalyatsion glyukokortikosteroidlar.

Фенотип – видимые характеристики организма, обусловленные взаимодействием его генетической составляющей и факторов внешней среды. Термин “фенотип”, а также такие термины, как “ген”, “генотип”, были предложены одним из основателей современной генетики, датским биологом В. Иогансенем в 1909 г. Понятие “фенотип” распространяется на любые признаки организма, начиная от первичных продуктов действия генов – молекул РНК и полипептидов и кончая особенностями внешнего строения, физиологических и патологических процессов (в том числе заболеваний), поведения и т.д. По сути, у каждого пациента может быть свой собственный специфический фенотип БА, но выделение “фенотипа БА” подразумевает наличие группы или подгруппы больных, объединенных общими клиническими и/или биологическими признаками заболевания.

Определение фенотипических особенностей заболевания является требованием времени, ибо персонализированная медицина, в эпоху которой мы вступили, не предполагает создания отдельного лекарственного препарата, или метода диагностики, или способа профилактики для каждого отдельного пациента, но требует отбора пациентов (выделение субпопуляций/кластеров/фенотипов/эндотипов БА), в наибольшей степени отвечающих на данный препарат, или метод диагностики, или способ

профилактики заболевания. Иначе говоря, суть фенотипизации в медицине – это оптимизация диагностики, лечения и профилактики.

Фенотипы и эндотипы БА

Довольно давно стало понятно, что БА гетерогенное заболевание, и это не могло не найти отражения в ее классификациях. В начале XX века F.M. Rackemann предложил выделять экзогенную и эндогенную БА, основываясь на этиологической концепции, которая и в настоящее время используется для идентификации клинических фенотипов аллергической и неаллергической БА [1]. В конце 1970-х годов M. Turner-Warwick выделил под группы пациентов с БА, основываясь на концепции функциональных нарушений: “хрупкая астма” (“brittle asthma”), “необратимая астма” (“irreversible asthma”) и “астма с выраженным утренним снижением легочной функции” (“the morning dipper”) [2]. Однако наиболее близко к современному пониманию фенотипов БА подошел Г.Б. Федосеев, который еще в 1982 г. представил клинико-патогенетические варианты БА и стратегию терапии заболевания с учетом этих вариантов [3]:

- атопический;
- инфекционно-зависимый;
- аутоиммунный;
- дисгормональный;
- дизовариальный;
- с выраженным адренергическим дисбалансом;
- холинергический;
- нервно-психический;
- аспириновая БА;
- БА физического усилия.

Если мы рассмотрим одну из современных авторских классификаций фенотипов БА, предложенную американским профессором S. Wenzel, то увидим, во-первых, что многие клиничко-патогенетические варианты БА, предложенные Г.Б. Федосеевым, находят свое место и сейчас, а во-вторых, что большинство фенотипов БА в настоящее время определяют в рутинной клинической практике (табл. 1).

Таблица 1. Классификация фенотипов БА

Фенотипы, определяемые клиническими/физиологическими признаками	Фенотипы, определяемые триггерами	Фенотипы, определяемые типом воспаления
<ul style="list-style-type: none"> • Тяжесть заболевания • Частота обострений • Наличие персистенции обструкции дыхательных путей • Возраст начала БА • Ответ на терапию 	<ul style="list-style-type: none"> • АСК и другие НПВП • Аллергены • Профессиональные аллергены и раздражители • Половые гормоны • Физические нагрузки 	<ul style="list-style-type: none"> • Эозинофильное • Нейтрофильное • Малогранулоцитарное
Обозначения: АСК – ацетилсалициловая кислота, НПВП – нестероидные противовоспалительные препараты.		

Так, например, фенотипы интермиттирующей, легкой, средней и тяжелой персистирующей БА выделяют на основании выраженности и частоты симптомов, нарушений функции легких, объема требуемой терапии и ограничения активности пациента. Не менее важным и, самое главное, доступным является определение этиологических фенотипов БА. В соответствии с номенклатурой аллергических болезней, предложенной ЕААСИ (European Academy of Allergy and Clinical Immunology – Европейская академия аллергии и клинической иммунологии), БА, опосредованную иммунологическими механизмами, следует называть аллергической [5].

Если доказано участие IgE-антител в формировании БА, то следует обозначать ее как IgE-опосредованную аллергическую БА или, с определенным допущением, как атопическую БА (“атопия” более строгое понятие, подразумевающее прежде всего генетическую предрасположенность к

синтезу IgE-антител). Бронхиальная астма, основу патогенеза которой не составляют IgE-антитела, является не-IgE-обусловленной или неатопической.

Объективными различиями указанных фенотипов БА (атопической и неатопической) являются положительные кожные пробы с аллергенами и связь клинических симптомов атопической БА с контактами с этими аллергенами. Примером неаллергической БА служит аспириновая БА, основу патогенеза которой составляет неаллергическая неиммунная непереносимость ацетилсалициловой кислоты (АСК) и нестероидных противовоспалительных препаратов (НПВП), приводящая к нарушению нормального обмена арахидоновой кислоты и избыточному образованию цистеиниловых лейкотриенов. Еще один этиологический фенотип – профессиональная БА, которая в большинстве случаев относится к IgE-опосредованной аллергической БА, ибо большинство профессиональных сенсibilizаторов являются аллергенами, способными вызывать специфический IgE-ответ. Профессиональные агенты, простые химические вещества с низкой молекулярной массой, являются ирритантами (соли никеля, платины, изоцианаты, формальдегид и др.) и могут вызывать развитие бронхиальной гиперреактивности и формирование БА, индуцированной ирритантами. В табл. 2 приведена характеристика основных этиологических фенотипов БА.

Таблица 2. Сравнительная характеристика этиологических фенотипов атопической, неатопической и аспириновой БА

Основные характеристики	Атопическая	Неатопическая	Аспириновая
	БА	БА	БА

Возраст начала	Детство/юношество	Чаще после 40 лет	20-40 лет (женщины)
Семейный анамнез атопии	+	-	-
Другие проявления атопии	+	-	-
Ринит	+	+/-	-
Полипозный риносинусит	-	-	+
Непереносимость АСК/НПВП	-	-	+
Кожные тесты с аллергенами	+	-	-
Общий IgE	повышен	норма	норма
Антигенспецифический IgE	+	-	-
Эффективность элиминации триггера	+	-	-
Эффективность ИГКС	+	+	+
Эффективность антилейкотриеновых препаратов	+	+/-	+
Эффективность АСИТ	+	-	-
Эффективность анти-IgE-антител	+	?	-
Обозначения: АСИТ – аллергенспецифическая иммунотерапия, ИГКС – ингаляционные глюкокортикостероиды			

Фенотипы, определяемые типом воспаления, отражают преимущественный тип клеток, вовлеченных в это воспаление. При исследованиях методом индуцированной мокроты у взрослых больных БА с наибольшим постоянством выявляются два типа воспаления – эозинофильное и неэозинофильное. По данным некоторых исследований, предлагается выделять 4

типа воспаления при БА: эозинофильное (эозинофилы $>3\%$ в индуцированной мокроте), нейтрофильное (нейтрофилы $>61\%$), смешанное гранулоцитарное (эозинофилы $>3\%$ + нейтрофилы $>61\%$) и малогранулоцитарное (эозинофилы и нейтрофилы в пределах нормы) [6]. Эозинофильная БА наиболее известный фенотип. Существует множество исследований, в которых обнаруживался преимущественно эозинофильный тип воспаления в дыхательных путях по крайней мере у половины больных БА. Вместе с тем ингаляционные глюкокортикостероиды (ИГКС) эффективно подавляют эозинофилию мокроты, что может существенно исказить результаты исследований. Эозинофильное воспаление определяется у больных атопической, не атопической, аспириновой и профессиональной БА, т.е. этиологический триггер, по-видимому, по крайней мере у взрослых, не определяет тип воспаления при БА [7, 8]. Персистирующее эозинофильное воспаление выявляют у больных тяжелой БА, и его наличие тесно связано с риском тяжелых обострений БА [9, 10]. Еще более значимым является определение типа воспаления при БА в качестве ориентира для выбора терапии. Другой биологический фенотип БА характеризуется преимущественно нейтрофильным воспалением. Этот тип воспаления нередко находят при аутопсии у пациентов, умерших в результате тяжелого обострения БА [4]. Механизм нейтрофильного воспаления до конца не ясен, предполагают, что оно может развиваться в слизистой дыхательных путей в ответ на воздействие сигаретного дыма, аэрополлютантов, профессиональных сенсibilизаторов (особенно мелких корпускулярных частиц или изоцианатов), вирусов и бактерий. Нейтрофильный тип воспаления дыхательных путей при БА ассоциирован с повышением уровня интерлейкина-8 (ИЛ-8), нейтрофильной эластазы и высокомолекулярной формы матриксной металлопротеиназы-9,

последнее свидетельствует о снижении активности тканевых ингибиторов матриксных металлопротеиназ [11, 12]. Активация этих энзимов может модифицировать структуру дыхательных путей и обуславливать прогрессирующее снижение функции легких. В любом случае, нейтрофильное воспаление при БА связано со значительным уменьшением ответа на терапию ИГКС и пероральными глюкокортикостероидами (ГКС) [13, 14]. Кроме того, сама терапия высокими дозами ГКС, прежде всего системных, может приводить к девиации воспаления в сторону преобладания нейтрофильного типа, так как ГКС способны тормозить апоптоз нейтрофилов, что было показано в исследовании *in vitro* [15, 16]. В настоящее время не определен маркер нейтрофильного воспаления при БА, который мог бы служить критерием эффективности терапии, в отличие от эозинофильного биофенотипа БА, при котором уровень эозинофилов в индуцированной мокроте и концентрация оксида азота в выдыхаемом воздухе могут служить неинвазивными биомаркерами интенсивности воспаления в нижних дыхательных путях и эффективности проводимой терапии [17]. Малогранулоцитарный биофенотип БА наименее изучен. Он характеризуется отсутствием значимого количества воспалительных клеток, таких как эозинофилы, нейтрофилы и лимфоциты, в дыхательных путях у больных БА. Существует несколько предположений относительно этого биофенотипа БА. Возможно, это просто результат отсутствия воспалительных клеток в биопсийном материале, в таком случае это “псевдомалогранулоцитарный биофенотип”, а может быть, это нетрадиционное воспаление, которое формируется путем активации резидентных клеток: тучных, эпителиальных и гладкомышечных [4]. Не исключено, что малогранулоцитарный тип воспаления может быть транзиторным [18]. Не существует биомаркера этого

фенотипа, его выявляют методом исключения эозинофильного и нейтрофильного типов воспаления БА. Однако традиционный подход к определению фенотипа БА с помощью классификации на основании клинических, функциональных, воспалительных, этиологических параметров позволяет учесть лишь один параметр, что приводит к односторонней характеристике и, соответственно, к формированию множества фенотипов (см. табл. 1), которые непонятно как соотносятся друг с другом. В последнее время появился другой подход к выделению фенотипов БА, с применением кластерного анализа. В двух первых и наиболее известных исследованиях фенотипов БА с помощью кластерного анализа были выявлены 5 сходных кластеров заболевания среди взрослых пациентов (рис. 1, табл. 3) [19, 20].

Таблица 3. Кластеры БА, выделенные в исследовательской программе по изучению тяжелой БА (Severe Asthma Research Program)

Кластер	Характеристика
1. Легкая аллергическая БА	Раннее начало; 80% женщины; ФВД нормальная; <2 препаратов для контроля; минимальная потребность в ресурсах ЗО; эозинофилы ↓
2. Легкая/среднетяжелая аллергическая БА с обострениями	Наиболее общий кластер; 67% женщины; пограничный ОФВ ₁ , нормальный после использования КДБА; <2 препаратов для контроля; низкая потребность в ресурсах ЗО, иногда курсы системных ГКС; эозинофилы ↓
3. Среднетяжелая/тяжелая БА с поздним началом	Старший возраст, позднее начало; повышенный ИМТ; 71% женщины; редко атопия; среднее снижение ОФВ ₁ с некоторой обратимостью; высокие дозы ИГКС; >3 препаратов для контроля; периодически курсы системных ГКС; эозинофилы ↑
4. Тяжелая переменная аллергическая БА	Молодой возраст, раннее начало; 53% женщины; выраженное снижение ОФВ ₁ с высокой обратимостью; переменное течение с обострениями, требующими системных ГКС; эозинофилы ↑
5. БА с тяжелой фиксированной обструкцией (ХОБЛ-подобная БА)	Пожилой возраст, позднее начало и длительное течение; 63% женщины; редко атопия; выраженное снижение ОФВ ₁ , малообратимое; системные ГКС; часто повышен ИМТ, ГЭРБ; высокая потребность в ресурсах ЗО; нейтрофилы и эозинофилы ↑

Обозначения: ГЭРБ – гастроэзофагеальная рефлюксная болезнь, ЗО – здравоохранение, ИМТ – индекс массы тела, КДБА – короткодействующие β₂-агонисты, ОФВ₁ – объем форсированного выдоха за 1-ю секунду, ФВД – функция внешнего дыхания.

Выявление патобиологических механизмов, лежащих в основе формирования фенотипов БА, или так называемых эндотипов БА, является самой насущной задачей в оптимизации терапии БА, особенно тяжелой [21]. Согласно определению G.P. Anderson, эндотип заболевания – это субтип болезни, определяемый уникальным или отличительным функциональным или

патофизиологическим механизмом [22]. Один эндотип БА может включать несколько фенотипов, и специфический фенотип может присутствовать в нескольких эндотипах. Попытка выделения и характеристики эндотипов БА была сделана в консенсусе PRACTALL (PRACTical ALLergy), созданном европейскими и американскими экспертами [23]. Авторы для определения эндотипов выбрали 7 параметров (клинические характеристики, биомаркеры, функция легких, генетические параметры, гистопатология, эпидемиология и ответ на терапию). Каждый эндотип БА должен был удовлетворять по крайней мере 5 из 7 параметров. На основании этих условий было предложено выделять 6 эндотипов БА: аспириновая БА; БА, ассоциированная с аллергическим бронхолегочным аспергиллезом (микозом); аллергическая БА у взрослых; свистящие хрипы у детей с высоким риском БА; поздняя БА с выраженной персистирующей эозинофилией; БА лыжников. И хотя в большинстве случаев истинный патобиологический механизм этих эндотипов малопонятен, а некоторые характеристики, предложенные для описания патобиологического механизма, совпадают с характеристиками, присущими фенотипу БА, тем не менее этот подход может в последующем способствовать определению молекулярных основ эндотипов БА и совершенствованию патогенетической терапии.

Таким образом, БА характеризуется гетерогенностью и существованием многих различных фенотипов и эндотипов, некоторые из которых довольно просто определить в реальной клинической практике. К примеру, этиологические фенотипы БА, БА курильщика, БА, ассоциированная с ожирением, фенотип БА с частыми обострениями, как правило, не вызывают особых трудностей верификации, но вместе с тем определяют особенности терапии. Сложнее выявить биофенотипы БА или дифференцировать позднюю БА

с малообратимой или фиксированной обструкцией бронхов от хронической обструктивной болезни легких (ХОБЛ). Такой же сложной задачей является определение одно временного наличия БА и ХОБЛ у одного и того же пациента, так называемого “синдрома сочетания, или перекреста БА–ХОБЛ” (asthma–COPD overlap syndrome).

Возможности терапии с учетом фенотипа БА

Примерами давно и успешно используемых методов фенотипспецифической терапии БА служат элиминационные мероприятия в отношении специфического аллергена(ов) и аллергенспецифическая иммунотерапия (АСИТ), которые являются абсолютной прерогативой atopического фенотипа БА. Действительно, АСИТ может быть альтернативой длительной поддерживающей терапии ИГКС у пациентов с легкой персистирующей atopической БА, особенно при сочетании с аллергическим ринитом.

Анти-IgE-терапия (омализумаб, Ксолар) – еще один пример фенотипспецифического лечения. Больные, относящиеся к фенотипу тяжелой atopической БА, составляют от 40 до 50% всех больных тяжелой БА, и, по данным анализа W.C. Moore et al., этот фенотип развивается из легкой и среднетяжелой atopической БА [20, 24]. У пациентов, принадлежащих к этому фенотипу тяжелой БА, наблюдается широкий спектр сенсibilизации к аллергенам и, соответственно, кожных проб, высокий уровень IgE в крови и отягощенный семейный анамнез по БА. Именно эта БА является целевым фенотипом для анти IgE-терапии в настоящее время [25]. В обзоре 8 плацебоконтролируемых исследований омализумаба, включавших больных среднетяжелой и тяжелой atopической БА, отмечалось достоверное снижение

частоты обострений и достижение лучшего контроля БА у пациентов, получавших препарат, в сравнении с плацебо [26].

Как известно, ИГКС являются самыми эффективными фармакологическими препаратами для длительного контроля БА и показаны для лечения персистирующих симптомов БА у всех пациентов, но также установлено, что наибольший эффект от лечения ИГКС наблюдается у пациентов с эозинофильной БА [13, 14]. Уменьшение интенсивности эозинофильного воспаления, оцениваемой по проценту эозинофилов в индуцированной мокроте, приводит к сокращению числа обострений БА в 3 раза большему, чем при традиционном (клинико-функциональном) мониторинге терапии БА [9]. Практически все существующие молекулы ИГКС доступны и при меняются в нашей стране: беклометазона дипропионат, будесонид, флутиказона пропионат, циклесонид и мометазона фуруат. Два последних препарата (циклесонид и мометазона фуруат) являются наиболее современными ИГКС, обладающими высокой эффективностью и благоприятным профилем безопасности при персистирующей БА разной степени тяжести [27, 28].

Таким образом, существует несколько фенотипов БА, при которых с большой вероятностью будет иметь место сниженный ответ на монотерапию ИГКС: БА курильщика; БА в сочетании с ожирением; синдром БА–ХОБЛ; поздняя менопаузальная БА у женщин. Для этих пациентов лучшей стратегией длительной терапии БА является назначение комбинированных препаратов ИГКС и ДДБА или, в качестве альтернативы, ИГКС + антилейкотриеновые препараты (последние представлены на отечественном рынке только антагонистами лейкотриеновых рецепторов). Ингаляционные ГКС и ДДБА обладают спаринговыми эффектами, приводящими к выраженному редуцированию

воспаления в дыхательных путях, снижению БГР и, возможно, ремоделирования бронхиальной стенки, уменьшению симптомов и потребности в КДБА, увеличению функции легких, сокращению числа обострений и риска смертельного исхода БА [50]. В итоге комбинации ИГКС и ДДБА позволяют достичь контроля БА у большего количества больных при меньшей дозе ИГКС, улучшают качество жизни и способствуют более высокой приверженности лечению. Еще один важный фенотип с точки зрения исхода заболевания – БА с частыми обострениями. Частые обострения у больных БА связаны с более выраженным снижением функции легких, а тяжелые обострения, кроме того, с риском смертельного исхода [30, 31].

Выводы:

- Бронхиальная астма – гетерогенное заболевание, проявляющееся различными фенотипами, которые требуют разных подходов к терапии.
- Выявление этиологических фенотипов БА, фенотипов БА курильщика, БА, ассоциированной с ожирением, БА с частыми обострениями, БА с малообратимой или фиксированной персистирующей обструкцией бронхов, как правило, проводится врачами-специалистами и не вызывает особых трудностей.
- Определение фенотипов БА, обусловленных типом воспаления, требует проведения специальных методов исследования, пока малодоступных в реальной клинической практике.
- Аллергенспецифическая иммунотерапия является фенотипспецифическим видом лечения, доказавшим свою эффективность при IgE-обусловленной аллергической БА.
- Анти-IgE-терапия (омализумаб) эффективна при тяжелой IgE-опосредованной аллергической БА.

- Ингаляционные ГКС являются самыми эффективными фармакологическими препаратами для длительного контроля БА и показаны для лечения персистирующих симптомов БА у всех пациентов, но наибольший эффект ИГКС отмечается у пациентов с эозинофильной БА.
- Назначение ИГКС/ДДБА является приоритетной стратегией у пациентов, у которых не удается достигнуть контроля над заболеванием при использовании низких/средних доз ИГКС, а также предпочтительным и первостепенным выбором для больных с фенотипами БА с частыми обострениями, БА с малообратимой или фиксированной обструкцией бронхов.
- Антагонисты лейкотриеновых рецепторов эффективны в уменьшении бронхоспазма, вызванного физической нагрузкой, при аспириновой БА, БА в сочетании с аллергическим ринитом, БА курильщиков и, возможно, при БА, ассоциированной с ожирением.

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A Comparative Exploration of English and Uzbek Stylistics

Xamzayev Akmal Amirovich

Senior teacher of Jizzakh State pedagogical university

Annotation

Stylistics is an important branch of linguistics that studies the expressive possibilities of language and the ways linguistic elements are used to create aesthetic and communicative effects. This article presents a comparative analysis of stylistic features in English and Uzbek languages. Particular attention is given to linguistic structures, cultural influences, literary traditions, and stylistic devices used in both languages. The study highlights how grammatical systems, lexical richness, and historical development influence stylistic expression. By examining similarities and differences between English and Uzbek stylistics, the research aims to demonstrate how language reflects cultural identity and artistic creativity. The findings emphasize the importance of comparative stylistic studies for linguistic research, translation, and intercultural communication.

Key words: stylistics, English language, Uzbek language, linguistic style, metaphor, simile, rhetoric, comparative linguistics, literary language.

Introduction

Stylistics, the study of style in language, explores how linguistic resources are used to create expressive and meaningful communication. It investigates how writers and speakers make deliberate choices in vocabulary, grammar, phonology, and discourse organization in order to achieve particular communicative goals. These stylistic choices influence the tone, emotional impact, and aesthetic value of a text.

Although stylistic principles may appear universal, their realization differs significantly across languages. Every language has its own structural characteristics, cultural background, and literary traditions that shape stylistic expression. Therefore, the

comparative study of stylistics in different languages provides valuable insights into how language functions in various cultural contexts.

The English and Uzbek languages belong to different language families and demonstrate different grammatical and lexical features. English is a member of the Indo-European language family, while Uzbek belongs to the Turkic language family. Despite these structural differences, both languages possess rich stylistic traditions that have developed through centuries of literary and cultural evolution.

The aim of this article is to analyze the stylistic features of English and Uzbek languages and compare their linguistic structures, stylistic devices, and cultural influences. Such analysis contributes to a deeper understanding of language as a tool of artistic expression and communication.

Linguistic Foundations and Stylistic Implications

The structural characteristics of a language strongly influence its stylistic possibilities. English and Uzbek demonstrate significant differences in grammar, word formation, and sentence structure, which in turn affect stylistic expression.

English has a relatively fixed word order following the **Subject–Verb–Object (SVO)** pattern. This grammatical structure requires writers and speakers to rely on lexical choice, syntactic variation, and rhetorical devices to create stylistic effects. English also uses tense, aspect, and voice extensively to convey subtle shades of meaning.

In contrast, Uzbek is an **agglutinative language** in which grammatical meanings are expressed through the addition of suffixes to a root word. This morphological structure allows speakers to convey detailed information within a single word. Uzbek sentence structure typically follows a **Subject–Object–Verb (SOV)** pattern, though word order can be more flexible than in English.

These structural differences influence stylistic strategies. In English stylistics, attention is often focused on syntactic patterns, lexical selection, and deviations from grammatical

norms. In Uzbek stylistics, the creative use of suffixes, word order variation, and rich vocabulary play a central role in stylistic expression.

Stylistic Features of the English Language

English stylistics is strongly influenced by a long tradition of literary development. From the works of early writers to modern literary movements, English literature has shaped the stylistic possibilities of the language.

One of the important aspects of English stylistics is **lexical variation**. Writers often choose words with specific connotations in order to create emotional or stylistic effects. The use of archaic vocabulary, dialect forms, or technical terminology may signal particular historical or social contexts.

Another characteristic feature of English stylistics is the use of **syntactic variation**. For example, passive voice can be used to emphasize actions rather than agents, while unusual word order may create emphasis or dramatic effect.

English literature also demonstrates a wide variety of stylistic movements such as **Romanticism, Modernism, and Postmodernism**. Each movement introduced new stylistic approaches to language, including emotional expression, symbolism, experimental narrative structures, and stream-of-consciousness techniques.

Stylistic Features of the Uzbek Language

Uzbek stylistics is deeply connected with the cultural and literary traditions of Central Asia. Oral storytelling, epic poetry, and classical literature have played an important role in shaping the stylistic character of the Uzbek language.

One of the most significant influences on Uzbek stylistics is the classical literary heritage of poets such as **Alisher Navoiy**. His works demonstrate the richness of metaphorical language, rhyme, rhythm, and symbolic imagery.

Uzbek stylistics also reflects the influence of Persian literary traditions, which contributed to the development of poetic forms and rhetorical devices. As a result, Uzbek literary language often includes expressive metaphors, similes, and alliteration.

The Uzbek language also possesses a rich system of registers, including formal, informal, and colloquial styles. In everyday communication, respect and politeness are often expressed through specific lexical and grammatical choices. Such stylistic elements reflect important cultural values such as respect for elders and social harmony.

Comparative Analysis of Stylistic Devices

Both English and Uzbek languages employ various stylistic devices to enhance communication and create aesthetic effects. However, the frequency and manner of their use may differ.

Metaphor and simile are widely used in both languages. English metaphors often rely on abstract concepts, while Uzbek metaphors frequently draw inspiration from nature, historical events, and traditional culture.

Alliteration and assonance are present in both languages but are particularly prominent in Uzbek poetry. These devices create rhythm and musicality, which are essential elements of oral storytelling traditions.

Repetition and rhetorical questions are also common stylistic devices. In English, repetition may emphasize important ideas, while in Uzbek speech it can also serve to strengthen emotional expression and maintain conversational flow.

Another interesting stylistic phenomenon is **wordplay**. English is well known for its puns and double meanings, while Uzbek allows creative wordplay through its complex system of suffixes and word formation.

Genres and Registers in English and Uzbek

Stylistic variation is also influenced by genre and communicative context. Both English and Uzbek languages employ different registers depending on the situation.

In English, scientific writing emphasizes precision and objectivity, while journalistic style focuses on clarity and conciseness. Literary works, on the other hand, may use imaginative language and experimental stylistic techniques.

Uzbek also demonstrates clear stylistic distinctions between formal and informal language. Official communication requires formal vocabulary and strict grammatical norms, while everyday speech allows greater flexibility and colloquial expressions.

Uzbek literature often maintains a poetic and expressive style influenced by traditional storytelling and classical poetry.

Translation and Stylistic Challenges

Translation between English and Uzbek presents several stylistic challenges. Because the two languages differ in grammatical structure, vocabulary, and cultural references, maintaining stylistic equivalence is not always easy.

When translating from English into Uzbek, translators must consider differences in word order, morphology, and cultural context. English idioms and metaphors may require adaptation or explanation.

Similarly, translating Uzbek literary texts into English requires careful attention to poetic devices, cultural symbolism, and stylistic nuances. The translator must find ways to preserve the artistic value of the original text while making it understandable for the target audience.

Therefore, successful translation requires not only linguistic knowledge but also cultural awareness and creative interpretation.

Conclusion

The comparative study of English and Uzbek stylistics reveals both similarities and differences in the ways language is used to create expressive meaning. While both languages employ common stylistic devices such as metaphor, repetition, and rhetorical

questions, their stylistic traditions are shaped by different linguistic structures and cultural backgrounds.

English stylistics is characterized by syntactic flexibility, lexical variation, and diverse literary movements. Uzbek stylistics, in contrast, reflects strong oral traditions, poetic imagery, and the expressive possibilities of its agglutinative grammatical structure.

Understanding these stylistic differences is essential for linguists, translators, and language learners. Comparative stylistic research contributes to a deeper appreciation of linguistic diversity and the role of language in cultural expression.

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THE ROLE AND PLACE OF FUEL AND LUBRICANTS IN AVIATION

*AIRCRAFT ENGINES AND TECHNICAL
EXPLOITATION CYCLE LARGE INSTRUCTORS*

Lieutenant Colonel Axmadaliyev Abror Asqaraliyevich

Lieutenant Colonel Boboyev Ilhom Sadullayevich

Abstract: This article examines the strategic importance of fuels and lubricants in the aviation industry and their impact on flight safety, engine efficiency, and operational reliability. The physicochemical properties of modern aviation fuels and lubricants, international quality standards, environmental requirements, and energy efficiency aspects are analyzed. Special attention is given to the prospects of alternative and synthetic fuels within the framework of sustainable aviation development.

Keywords: Aviation fuel, jet engine, lubrication system, operational reliability, energy efficiency, flight safety, synthetic lubricants, environmental standards.

Annotatsiya. Mazkur maqolada aviatsiya sohasida yoqilg'i-moylash mahsulotlarining strategik ahamiyati, ularning havo kemalari xavfsizligi, dvigatel samaradorligi va ekspluatatsion ishonchliligiga ta'siri tahlil qilinadi. Zamonaviy aviatsiya yoqilg'ilari va moylarining fizik-kimyoviy xususiyatlari, xalqaro sifat standartlari, ekologik talablar hamda energiya samaradorligidagi roli ilmiy asosda yoritilgan. Shuningdek, aviatsiyada barqaror rivojlanish tamoyillari doirasida muqobil yoqilg'ilar va sintetik moylarning istiqbollari ko'rib chiqiladi.

Kalit so'zlar: Aviatsiya yoqilg'isi, reaktiv dvigatel, moylash tizimi, ekspluatatsion ishonchlik, energiya samaradorligi, xavfsizlik, sintetik moylar, ekologik talablar.

Аннотация: В данной статье анализируется стратегическая роль горюче-смазочных материалов в авиационной отрасли, их влияние на безопасность полетов, эффективность авиационных двигателей и эксплуатационную

надежность воздушных судов. Рассматриваются физико-химические свойства современных авиационных топлив и масел, международные стандарты качества, экологические требования и вопросы энергоэффективности. Особое внимание уделяется перспективам применения альтернативных и синтетических видов топлива в рамках устойчивого развития авиации.

Ключевые слова:Авиационное топливо, реактивный двигатель, система смазки, эксплуатационная надежность, энергоэффективность, безопасность полетов, синтетические масла, экологические стандарты.

Авиация – yuqori texnologiyalarga asoslangan, xavfsizlik talablari eng yuqori darajada bo‘lgan strategik sohadir. Har bir parvozning ishonchligi ko‘p jihatdan yoqilg‘i-moylash mahsulotlarining sifati va barqarorligiga bog‘liq. Zamonaviy aviadvigatellar yuqori harorat, bosim va yuklama sharoitida ishlaydi. Bunday sharoitda yoqilg‘i va moy nafaqat energiya manbai, balki tizimni sovituvchi, tozalovchi va himoyalovchi komponent sifatida ham xizmat qiladi. Shuning uchun yoqilg‘i-moylash mahsulotlari aviatsiya xavfsizligining ajralmas qismi hisoblanadi.

1. Авиация yoqilg‘ilarining texnik va funksional ahamiyati

Авиацияda asosan reaktiv dvigatellar uchun maxsus ishlab chiqilgan yoqilg‘ilar qo‘llaniladi. Ulardan eng keng tarqalgani — Jet A va Jet A-1 turidagi yoqilg‘ilardir.

Авиация yoqilg‘isiga qo‘yiladigan asosiy talablar:

- yuqori issiqlik ajratish qobiliyati
- past haroratlarda muzlamaslik
- past bug‘lanish bosimi
- kimyoviy barqarorlik
- yonish jarayonida minimal qoldiq hosil qilish

Yoqilg'ining sifati dvigatelning tortish kuchi, yonilg'i sarfi va umumiy parvoz iqtisodiyotiga bevosita ta'sir ko'rsatadi. Past sifatli yoqilg'i yonish kamerasida cho'kma hosil qilib, dvigatel samaradorligini kamaytirishi mumkin. Aviatsiyada asosan gaz-turbinali (reaktiv va turbovintli) dvigatellar uchun maxsus ishlab chiqilgan aviatsiya kerosinlari qo'llaniladi. Fuqarolik aviatsiyasida eng keng tarqalgan yoqilg'ilar — Jet A va Jet A-1 hisoblanadi. Ularning tarkibi yuqori darajada tozalangan, tor fraksiyali kerosin asosida bo'lib, qat'iy xalqaro standartlarga muvofiq ishlab chiqariladi. Xususan, yoqilg'i sifati ASTM International tomonidan ishlab chiqilgan D1655 standarti hamda International Civil Aviation Organization (ICAO) tavsiyalariga muvofiq nazorat qilinadi.

Jet A va Jet A-1 yoqilg'ilari o'rtasidagi asosiy farq — muzlash haroratidadir. Jet A yoqilg'isining muzlash harorati taxminan -40°C bo'lsa, Jet A-1 uchun bu ko'rsatkich -47°C gacha tushirilgan. Bu farq ayniqsa yuqori balandlikda (10–12 km) amalga oshiriladigan uzoq masofali parvozlarda muhim ahamiyat kasb etadi, chunki tashqi muhit harorati -50°C gacha pasayishi mumkin. Past muzlash harorati yoqilg'ining quvurlar va filtrlarda kristallanishining oldini oladi hamda dvigatelga uzluksiz yetkazib berilishini ta'minlaydi.

Aviatsiya yoqilg'isiga qo'yiladigan asosiy talablar va ularning texnik asoslari.

1. Yuqori issiqlik ajratish qobiliyati (kalorifik qiymat). Aviatsiya yoqilg'isining past issiqlik ajratish qobiliyati o'rtacha 42–43 MJ/kg ni tashkil etadi. Ushbu ko'rsatkich dvigatel tortish kuchini shakllantirishda asosiy omil bo'lib, yoqilg'i samaradorligini belgilaydi. Kalorifik qiymat qanchalik yuqori bo'lsa, shunchalik kam massa sarflab yuqori energiya hosil qilish mumkin, bu esa parvoz masofasini oshiradi va yoqilg'i xarajatlarini kamaytiradi.

2. Past haroratlarda muzlamaslik. Yuqori balandlikda yoqilg'i harorati keskin pasayadi. Agar yoqilg'i tarkibida parafin kristallari hosil bo'lsa, ular filtrlarni tiqib qo'yishi va yoqilg'i oqimini cheklashi mumkin. Shu sababli aviatsiya yoqilg'isining muzlash nuqtasi qat'iy nazorat qilinadi.

3. Past bug'lanish bosimi. Bug'lanish bosimining me'yorda bo'lishi yoqilg'ining barqaror yonishini ta'minlaydi hamda bug' tiqinlari (vapor lock) hosil bo'lish xavfini kamaytiradi. Juda yuqori uchuvchanlik yoqilg'i tizimida bosim o'zgarishlariga olib kelishi mumkin, juda past uchuvchanlik esa yonish jarayonini qiyinlashtiradi.

4. Kimyoviy va termik barqarorlik. Reaktiv dvigatellarda yoqilg'i nafaqat yonadi, balki issiqlik almashinuv tizimida sovutuvchi sifatida ham ishlatiladi. Yuqori harorat ta'sirida yoqilg'i oksidlanib, qatronli moddalarga aylanishi mumkin. Shuning uchun uning termooksidlanish barqarorligi yuqori bo'lishi shart. Bu xususiyat yonish kamerasida cho'kma va lak hosil bo'lishining oldini oladi.

5. Minimal qoldiq va cho'kma hosil qilishi. Yonish jarayonida qoldiq moddalarning hosil bo'lishi turbina pichoqlarining ifloslanishiga va aerodinamik samaradorlikning pasayishiga olib keladi. Toza yonish dvigatel resursini uzaytiradi hamda texnik xizmat intervalini optimallashtiradi.

6. Past oltingugurt miqdori. Oltingugurt yonish jarayonida SO_x gazlarini hosil qiladi, bu esa korroziyani kuchaytiradi va ekologik zarar keltiradi. Zamonaviy yoqilg'ilarda oltingugurt miqdori minimal darajada saqlanadi.

Moylash mahsulotlarining dvigatel ishonchliligidagi roli

Aviadvigatel podshipniklari va aylanuvchi qismlari yuqori tezlikda ishlaydi. Moylash tizimi quyidagi vazifalarni bajaradi:

- ishqalanishni kamaytirish
- issiqlikni chiqarish
- korroziyadan himoya qilish
- metall zarrachalarni filtratsiya qilish

Zamonaviy aviatsiya moylari sintetik asosda ishlab chiqariladi. Ular yuqori termik barqarorlik va oksidlanishga chidamlilikka ega. Moylash tizimidagi kichik nosozlik ham dvigatelning ishdan chiqishiga olib kelishi mumkin, shu sababli moy sifati qat'iy laboratoriya nazoratidan o'tkaziladi. Aviadvigatel podshipniklari, rotor vallari, reduktor mexanizmlari va boshqa aylanuvchi qismlar o'ta yuqori tezlikda (ba'zi hollarda 10 000–20 000 ayl/min va undan yuqori) ishlaydi. Bunday sharoitda mexanik yuklama, markazdan qochma kuch va haroratning keskin oshishi kuzatiladi. Shu sababli moylash tizimi dvigatelning ajralmas va strategik muhim elementi hisoblanadi.

Gaz-turbinali dvigatellarda moylash tizimi yopiq kontur asosida ishlaydi va u bir vaqtning o'zida bir necha muhim funksiyalarni bajaradi:

- ishqalanishni kamaytirish
- issiqlikni chiqarish
- korroziyadan himoya qilish
- metall zarrachalarni filtratsiya qilish
- germetiklikni ta'minlash (muhrlash effekti)

1. Ishqalanishni kamaytirish va energiya samaradorligi

Podshipniklar va kontakt yuzalar orasida moy plyonkasi hosil bo‘lib, to‘g‘ridan-to‘g‘ri metall-metall kontaktni bartaraf etadi. Bu esa:

- mexanik yo‘qotishlarni kamaytiradi;
- energiya samaradorligini oshiradi;
- detallarning yeyilishini keskin sekinlashtiradi.

Agar moy plyonkasi uzilsa, “quruq ishqalanish” yuzaga keladi va bu juda qisqa vaqt ichida podshipnikning ishdan chiqishiga olib kelishi mumkin.

2. Issiqlikni chiqarish va termik barqarorlik

Aviadvigatellarda harorat ayrim zonalarda 200–300°C va undan yuqori ko‘rsatkichlarga yetadi. Moy nafaqat ishqalanishni kamaytiradi, balki issiqlikni yutib, uni issiqlik almashinuv tizimi orqali tashqariga chiqaradi.

Shu bois aviatsiya moylariga quyidagi talablar qo‘yiladi:

- yuqori termooksidlanish barqarorligi;
- yuqori alanganish harorati;
- parchalanishga chidamlilik;
- past haroratlarda yetarli suyuqlik xossasi.

3. Korroziyadan himoya

Yonish mahsulotlari va namlik metall yuzalarda korroziya jarayonini tezlashtirishi mumkin. Zamonaviy moy tarkibiga qo‘shiladigan maxsus qo‘shimchalar (antioksidantlar, korroziyaga qarshi inhibitorlar) metall qismlarni kimyoviy yemirilishdan himoya qiladi.

4. Metall zarrachalarni filtratsiya qilish

Ekspluatatsiya jarayonida mikroskopik metall zarrachalar ajralib chiqishi mumkin. Moy oqimi ularni o‘zida olib yuradi va filtrlar orqali ushlab qoladi. Bu jarayon ikki jihatdan muhim:

- tizimni mexanik shikastlanishdan saqlaydi;
- diagnostika vositasi sifatida xizmat qiladi (zarrachalar tahlili orqali podshipnik holatini aniqlash mumkin).

Zamonaviy aviatsiyada moy tahlili dvigatelning texnik holatini prognozlashda muhim monitoring usuli hisoblanadi.

Xavfsizlik va xalqaro standartlar.

Aviatsiyada yoqilg‘i-moylash mahsulotlari qat‘iy xalqaro standartlarga muvofiq ishlab chiqariladi va sertifikatlanadi.

Standartlashtirish tizimi orqali:

- yonilg‘i tarkibi nazorat qilinadi
- harorat ko‘rsatkichlari tekshiriladi
- mexanik aralashmalar aniqlanadi
- suv miqdori monitoring qilinadi

Xavfsizlik nuqtai nazaridan, yoqilg‘i logistika zanjiri (saqlash, tashish, quyish jarayoni) ham qat‘iy texnik reglament asosida amalga oshiriladi.

Ekologik talablar va barqaror rivojlanish.

Global iqlim o‘zgarishi sharoitida aviatsiya sanoati karbon chiqindilarini kamaytirishga intilmoqda. Shu bois Sustainable Aviation Fuel (SAF) konsepsiyasi joriy etilmoqda.

Muqobil yoqilg‘ilar:

- bioyoqilg‘ilar
- sintetik yoqilg‘ilar
- vodorod asosidagi energiya manbalari

Ular an’anaviy yoqilg‘iga nisbatan karbon izini sezilarli kamaytiradi. Bu esa ekologik xavfsizlik bilan birga xalqaro raqobatbardoshlikni ham ta’minlaydi. *Iqtisodiy samaradorlik va strategik ahamiyat.*

Yoqilg‘i aviakompaniya xarajatlarining 25–40 foizini tashkil etadi. Shuning uchun yoqilg‘i sifati va sarfini optimallashtirish strategik masala hisoblanadi.

Yuqori samarali yoqilg‘i:

- yonilg‘i sarfini kamaytiradi
- texnik xizmat oraliq‘ini uzaytiradi
- ekspluatatsion xarajatlarni qisqartiradi

Demak, yoqilg‘i-moylash mahsulotlari nafaqat texnik, balki iqtisodiy barqarorlik omili hamdir.

Xulosa: Aviatsiyada yoqilg‘i-moylash mahsulotlari oddiy energiya manbai emas, balki xavfsizlik, ishonchlilik va iqtisodiy samaradorlikni ta‘minlovchi strategik resursdir.

Ularning sifati dvigatel ishlash muddati, parvoz xavfsizligi va ekologik ko‘rsatkichlarga bevosita ta‘sir qiladi. Zamonaviy aviatsiya barqaror rivojlanish yo‘lida muqobil yoqilg‘ilar va yuqori samarali sintetik moylarni keng joriy etishga intilmoqda.

Kelajak aviatsiyasi — bu yuqori texnologik, ekologik toza va energiya samarador tizimdir. Bu tizimning yuragi esa sifatli yoqilg‘i-moylash mahsulotlaridir.

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**The relationship between man and landscape in the stories of
Shukur Kholmirezayev**

2nd year student of Termez State University

Choriyev Nurbek Jumanazar oglu

Annotation: This article explores Shukur Kholmirezayev and his stories. Also, theoretical views on the image of Man and the surrounding nature in his works are revealed. The primary objective of this research is to convey the essence of this masterpiece to readers and to make, even if modest, a contribution to the field of literary studies.

Keywords: landscape, story, nature and man, “Bandi burgut”, technology and nature.

Shukur Xolmirzayev hikoyalarda inson va peyzaj munosabati

Termiz davlat universiteti 2-kurs talabasi

Choriyev Nurbek Jumanazar o‘g‘li

Annotatsiya: Ushbu maqolada Shukur Xolmirzayev va uning hikoyalari tadqiq etilgan. Shuningdek, asarlaridagi inson va uning atrofidagi tabiat tasviri haqidagi nazariy qarashlar ochib beriladi. Mazkur tadqiqotning bosh maqsadi ushbu durdona asarning asosini o‘quvchilarga yetkazish hamda adabiyotshunoslik sohasiga oz bo‘lsa-da hissa qo‘shishdir.

Kalit so‘zlar: peyzaj, hikoya, tabiat va inson, “Bandi burgut”, texnika va tabiat.

Filologiya fanida “peyzaj” hodisasiga ta’rif berishda turlicha yondashuvlar mavjud: uni “tabiat tuyg‘usi” tushunchasi yoki asardagi alohida xarakter bilan aniqlashdan tortib, mustaqil janrga ajratishgacha. Odatda, peyzajning u yoki bu adabiy oilaga mansubligi, tashqi ko‘rinish davri, uni yaratgan muallifning yo‘nalishi va uslubi hisobga olingan holda ko‘rib chiqiladi. Shu bilan birga, aksariyat adabiy manbalarda ta’kidlanishicha, XVIII asrgacha matndagi peyzaj faqat xronotopik funksiyaning

tashuvchisi bo'lib, badiiy asarning harakati sodir bo'ladigan fon rolini o'ynagan va vaqtinchalik va o'ziga xoslikni kiritgan. Badiiy matnda peyzajdan foydalanish doirasi sezilarli darajada kengaydi va XIX-XX asrlar adabiyotida peyzajning o'zi keng funksional yuklamaga ega bo'ldi. Ilm-fan "adabiy peyzaj" hodisasining ko'lami va ta'rifi bo'yicha turli nuqtayi nazarlarni taqdim etadi: keng talqin ushbu konsepsiyaga har qanday tashqi dunyoning ochiq makonining tavsifini, shuningdek, interyerning tasvirini, tor talqin peyzajni "tabiiy ko'rinishlar" bilan cheklaydi. Ushbu tushunchaga ta'rif berishga qaratilgan ko'plab urinishlarni sarhisob qilar ekanmiz, peyzaj badiiy asardagi tabiat tasviri bo'lib, adabiy janr, uslub va davrni aks ettiruvchi, matnda turli funksiyalarni bajaradi.

Shukur Xolmirzayevning adabiy matn tuzilishidagi peyzajni o'rganish muammosi bilan bog'liqligi tasodifiy emas: yozuvchi haqli ravishda peyzaj rasmining ustasi hisoblanadi. Shukur Xolmirzayev peyzaji nafaqat o'zbek tabiatining milliy o'ziga xosligini aks ettiradi, balki borliq sirini ham o'z ichiga oladi. Yozuvchining tasviriy iste'dodining kelib chiqishi o'z ona yurtining tabiati, o'sha vohada joylashgan, eng boy o'zbek tili shakllangan va Shukur Xolmirzayev boshchiligidagi deyarli barcha eng buyuk o'zbek yozuvchilari joylashgan Surxondaryo viloyati bilan bog'liq.

O'zbekistonda Shukur Xolmirzayev ijodining g'oyaviy-estetik mazmunini tushunish uchun qulay sharoitlar yaqinda paydo bo'lgan va bu muallifning asarlari haqida jiddiy suhbat, aslida, endigina boshlanmoqda. So'nggi paytlarda bu ijodkor ijodining yaxlit manzarasini yaratish, uning poetikasiga oid umumlashtirilgan tushunchalarni yaratish zarurati tobora sezilib bormoqda. Va buyuk adib ijodining ushbu "yaxlit rasmida" Shukur Xolmirzayevning peyzaj poetikasi haqli ravishda o'z o'rnini egallashi kerak. Shu bilan birga, bugungi kunda Shukur Xolmirzayevning badiiy nasridagi tabiat mavzusi keng adabiy materialda tizimli ravishda o'rganiladigan biron bir asar yo'q, garchi bizni qiziqtirgan muammo bo'yicha bir nechta maqolalar va

Yozuvchi haqida monografik asarlarda individual sharhlar mavjud. Bir qator ayrim maqola va sharhlarda Shukur Xolmirzayev asarlari poetikasining ayrim jihatlari ko‘rib chiqiladi: Bunga misol qilib, adabiyotshunos olim Yo‘ldosh Solijonovning “Detallar tilga kirganda” maqolasini ko‘rishimiz mumkin. Bu maqolada yozuvchi asarlarning kuchli vizual tomoni va yozuvchi matnlaridagi detalning alohida roli haqida gapiriladi. “Shukur Xolmirzayevning asarlarida eng ko‘p qo‘llaniladigan detallar bu — tabiat unsurlari: turli daraxtlar, o‘t-o‘lanlar, gullar, qushlar, hashoratlar va hayvonlardir. Ularni inson obraziga nisbat berish bilan adib tabiat va odamning yaqinligini, biri ikkinchisiz yashay olmasligini uqdirmoqchi bo‘ladi. Ayni chog‘da tabiat hodisalaridagi o‘zgarishlarga, ularning o‘ziga xosligi (masalan, yarmi qurigan do‘lananing hamon gullab, meva tugishi, gap tomirning chuqur ketganligi, ya’ni mohiyatda ekani)ga urg‘u berish orqali odamni o‘z hayotiga e’tiborliroq bo‘lishga undaydi. Ha, Shukurning asarlarida tabiat gapiradi, harakat qiladi, ko‘rkini namoyish etish uchun quturib gullab, bizni maftun etadi. Ruhiyatimizga osoyishtalik bag‘ishlab, umrimizni uzaytiradi.”¹

Yana bir maqola dotsent G.N.Tavaldieva tomonidan yozilgan “Shukur Xolmirzayev hikoyalarida tabiat va inson munosabatlarining badiiy talqini ”deb nomlanadi. Maqolada Shukur Xolmirzayevning hikoyachilikdagi badiiy mahorati uning tabiat va inson munosabatlari aks etgan hikoyalari orqali tadqiq etilgan. “Adib hikoyalarida tabiat tasviri muayyan estetik vazifani bajaradi. U faqatgina tabiat dunyosining bir bo‘lagi emas, balki qahramon dunyoqarashining va insoniy go‘zalligining shakllanishida o‘z ta’sirini ko‘rsatuvchi poetik vosita hamdir. Inson va tabiat muammosi Shukur Xolmirzayevning ayrim hikoyalari mavzusiga tegishli

¹ Yo‘ldosh Solijonov, filologiya fanlari doktori «O‘zbekiston adabiyoti va san’ati» gazetasining 2007 yil 5-sonidan olindi

mavsumiy hodisa emas. Bu munosabatlar tizimida yozuvchi Inson va tabiatning o‘z vazifasi, asardagi o‘rni va jamiyatdagi mantig‘ini tushuntirib berishga erishgan.”²

Shukur Xolmirzayev ijodi yuzasidan ko‘plab maqolalar va tadqiqotlar, jumladan, H.Karimovning «Shukur Xolmirzayev ijodiy portreti» risolasi, akademik B.Nazarovning «Shukur Xolmirzayev» nomli ijodiy portreti yaratilgan. Bundan tashqari, yozuvchi hikoyalari haqida U.Normatov, S.Mamajonov, Q.Yo‘ldoshev, H.Boltaboev, O.Otaxonov, R.Qo‘chqorovlarning, adibning qissalari to‘g‘risida M.Qo‘shjonov, A.Rasulov, M.Olimov; romanlari haqida U.Normatov, O.Tog‘aev, I.G‘afurov, S.Sodiqov va boshqa adabiyotshunos olimlarning maqolalari e‘lon qilingan. Biroq bu tadqiqot va maqolalarda Sh.Xolmirzayev ijodining ayrim qirralari yoritilgan edi. Yozuvchining hikoyachilikdagi mahorati, badiiy so‘z san‘ati, tasvir uslubi haqida ilmiy tadqiqot ishlari ham olib borilgan. Jumladan, G.N.Tavaldieva (2001), Sh.Doniyorova (2001) kabi adabiyotshunoslar yozuvchining hikoyachilikdagi o‘ziga xos tasvir uslubi, voqelikni badiiy idrok etish tamoyillari haqida ilmiy xulosalar berganlar.

Sovet davridagi rus adabiyotida insonning tabiat bilan munosabati ko‘pincha I.Turgenevning “Otalar va bolalar” romanidagi qahramon Bazarovning “Tabiat ibodatxona emas, balki ustaxonadir, inson esa unda ishchidir” tezisiga muvofiq tasvirlangan. Albatta, bu qarash butun ittifoq mustamlakalariga ham o‘z ta‘sirini o‘tkazmay qolmadi. Shukur Xolmirzayevning “Bandi burgut” hikoyasidagi Rais bobo va uning o‘g‘li Yo‘ldosh bilan suhbatiga bunga misol bo‘la oladi:

“— Rahmdillik — yaxshi narsa, — dedi. — Sizlarning yoshlaringda bo‘lganimda, men ham shu fikrni aytgan bo‘lardim, ehtimol... Biroq yigitchalar, bilib qo‘yinglarki, bizning falsafamizda hamma narsa inson uchun, deyiladi. Tabiat ham, gullar ham, mana

² ACADEMIC RESEARCH IN EDUCATIONAL SCIENCES VOLUME 1 | ISSUE 4 | 2020 ISSN: 2181-1385 Scientific Journal Impact Factor (SJIF) 2020: 4.804

shu burgut kabi qushlar ham. Ulardan zavqlanishimiz lozim. Ana shuning uchun ham bizda zooparklar bor, qo‘riqxonalar bor. Biz noyob parrandalar va kamyob hayvonlarni asraymiz. To‘g‘ri, ularning o‘rgatilgan bo‘lishlari shart emas.

— Albatta, albatta, — dedi o‘qituvchi, — sirkning yo‘rig‘i boshqa.

— Balli, — deb davom etdi uy egasi. — Lekin biz bu shunqor qushni xonadonimizga o‘rgatmoqchiydik. Bir hisobda shuning uchun ham uning bu yerda turishiga ruxsat etuvdim...

— Lekin o‘rganmadi. O‘rganmas ekan, — dedi Yo‘ldosh otasining nima demoqchi ekanini anglagandek.

— Bo‘zmergan aytdilar...

— Ana bu boshqa gap, — deb yana tabassum qildi otasi. — Demak, buning joyi — bu yer emas.

— Demak, buning joyi — osmon! — deb yubordi Yo‘ldosh va men yengil tortib ketdim.

— E, yo‘-o‘q, — deb bosh chayqadi otasi va... Yo‘ldoshboy yig‘lab yubordi.

— Buning joyi, buning joyi... saroy-da, a? Ayting, to‘g‘risini, dada! Ayting... Yo‘q, aytmaydiz hozir. Ammo men bilaman: siz buning terisini shilib, Bo‘zmerganga berasiz, u ustasiga oborib, chuchela qildirib keladi.” Rais burgutni terisini shilib chuchula qildirimoqchi bo‘lganida Yo‘ldosh otasiga aniq qarshilik ko‘rsatadi. Yoki ikkinchi holat bola Yo‘ldoshlarning uyiga bogan ilk kuni: “Darvoqe, bir muhim narsa yodimdan ko‘tarilibdi.

Yo‘ldoshboy bilan do‘stligimiz boshlangan kunlar edi. U meni saroylariga ergashtirib borib, bedaxonaga olib kirib, undan yana bir xonaning eshigini ochdi. Keyin eshikni “yopma” deb chetlandi-da, qo‘lini cho‘zib, devorlarni ko‘rsatdi. Yopiray, devorlarda tulkinging ham, bo‘rining ham, qoplonning ham terisi ilingan, bir nechta burama, changarakshox kiyik hamda yovvoyi qo‘yning shoxlarida bor edi.

Xonani naftalin hidi tutib ketgan bo‘lsayam, bu yerdan chiqqim kelmay qoldi! Bu makonda vaqtidami, bevaqtmni halok bo‘lgan jonzotlardan qolgan nishonalar — ularning arvohidek tuyuldi menga!

Ha-ha, Rais bobo bularni ko‘chadan terib kelgani yo‘q. Birlari o‘ldirilgan, birlari qopqonga tushirib nobud qilingan, xullas, Rais boboning yaqin kishilarining ishi bu: tabiiyki, unga xushomaddan shu ishni qilishgan.

He, birodari aziz, buyam holva ekan.

— Endi bu yoqqa qara, — dedi Yo‘ldosh.

Burilib ortimdagi devorga qarasam, o‘nlab qushlarning — kaklik deysizmi, chil, hakka, qumri, hatto jannat chivinxo‘ri degan dumi uzun qizg‘ish qushning ham ichiga bir nima tiqilgan mo‘lasi saf tortib turibdi.

Xuddi tirikday!

Ko‘zlari...”.³ Biz bilamizki, Yozuvchi asarlaridagi qahramonlar tabiatni aniq himoya qilib chiqadi, uni sevadi uni qadrlaydi, qadriga yetish nima ekanligini his etadi.

Shukur Xolmirzayev hikoyalarida tabiat va ilmiy-texnika taraqqiyoti o‘rtasida aniq qarama-qarshilik mavjud. Ko‘pincha hikoyalar qahramonlari umumiy taraqqiyotga ham, uning o‘ziga xos ko‘rinishlariga ham qarshi turadilar : “— Hm, bir vaqtlar boyagi soyning bo‘ylarida archa o‘sardi deng, — dedi Samar va tajanglanib ketdi. Texnika shu yerlargayam yetib keldi... singlim, ana shu hozirgi shaharning, texnikaning sharofati. Bora-bora bu texnika degan narsa butun tabiatni yutib yubormasa, deb qo‘rqaman.”. Biz muallifning tabiat bilan tug‘ilish va mavjudlik bog‘liq bo‘lgan tabiiy tamoyillar qadrlri narsa ekanligini his qilamiz.

Darhaqiqat, shahar zamonaviyligi vayron qilgan qishloq hayotining chuqur o‘tmish haqida hissiy qarashlari bilan Shukur Xolmirzayevning hikoyalarida yozuvchi oddiygina qishloq jamoatchiligiga e‘tibor berish emas, hatto yengil mehnatga urg‘u

³ Холмирзаев Шукур. Танланган асарлар: Ҳикоялар. –Т.: “Шарқ”2009. –. Б. 18.

berish ham emas, balki yo‘qolgan turmush tarzi uchun nola, va ayniqsa, hayot tarzi endi yozuvchi uchun yo‘qolganligi fojidadir.⁴

Shukur Xolmirzayev tabiatdan turli maqsadlarda foydalangan: Avvalo, odamlar yashayotgan muhit goh ular bilan yashash uchun kurashayotgan dushmani, goh axloqiy qadriyatlar timsoli, goh estetik qiymat qo‘shuvchi unsur. Shukur Xolmirzayev asarlarida tabiat butun boyligi bilan namoyon bo‘ladi.

Yo‘ldosh Solijonov haq edi, eng go‘zal naqshlar, eng go‘zal o‘xshatishlar va tabiatning eng go‘zal chiziqlari uning qalamidan chiqqan. U yozuvchi bo‘lsa-da, tabiat shoiri, tabiat o‘qituvchisi edi. Mavzu tabiat bo‘lsa, tasvir va o‘xshatish san’ati ijodkor huzurida jim turardi. U barcha o‘zi bilan zamondosh va o‘zidan keyingi ijodkorlarga tabiatdan nasr va nazm elementi sifatida foydalanishni o‘rgatdi. Uning hikoyalarida tabiat xususiyatlari go‘yo insonga tegishlidek ishlagan.

U o‘z hikoyalarida odamlarni, jamiyatni, madaniyatni, demak, tabiatni tushunish va tushuntirishni o‘z burchi deb bildi. U o‘zi tug‘ilgan jamiyat va geografiya haqida gapirishdan to‘xtamasdi. Hech bir tasvir uni tabiatdan qutqara olmadi.

Tabiat va inson o‘rtasida goh salbiy, goh ijobiy aloqalarni o‘rnatgan Shukur Xolmirzayev hikoyalarida shahar va tabiat o‘rtasidagi ziddiyat har fursatda o‘quvchilariga ko‘z qisib qo‘ydi.

Zamonaviy sivilizatsiyaning texnogen jarayonlari va jahon xo‘jalik munosabatlarining globallashuvi sharoitida peyzaj tushunchasi shunchaki orqaga surilibgina qolmay, balki uzoq o‘tmishga o‘tgan madaniy davrlarning atributiga aylanadi. Peyzaj dunyo madaniy modelining eng muhim elementlaridan biri bo‘lib, uni rad etish nafaqat olamning umumiy manzarasini, balki bugungi kun shaxsining ruhiy tabiatini ham buzadi. Tabiatga yuksak, fidokorona muhabbat, unga bog‘lanishga urinish,

⁴ Танланган асарлар: Ҳикоялар. –Т.: “Шарқ”2020. –. Б. 115.

qarama-qarshi tuyg'ular kurashi, falsafiy teranlikni Shukur Xolmirzayev hikoyalaridagi peyzaj ajratib turadi.

Tabiat obrazi bilan inson obrazi bir-biriga qarama-qarshi bo'lgan obrazlar bo'lsa-da, ular o'zaro aloqada bo'lib, ular orasidagi chegara juda silkinib, birlik hosil qiladi. Birlik har doim muxolifatda ustunlik qiladi.

Xulosa qilib aytganda, tabiat va inson o'rtasidagi o'zaro ta'sir muammosi, go'zallik va axloq dunyosi Shukur Xolmirzayev ijodida o'z timsolini topdi. Shukur Xolmirzayev tabiat va inson munosabatlariga oid adabiyotlarning asosini tashkil etgan adiblar bilan birgalikda tabiatni muhofaza qilish, Vatanni himoya qilish degan g'oyani e'lon qildi. Shuningdek, ular matbuotda "ekologiya" so'zi topilmaganida tabiatning hayotiy huquqlari uchun tinimsiz kurashdilar, tabiatdan foydalanishning insonparvarlik mohiyatini ta'kidladilar. O'lchovsiz katta tabiat va beqiyos kichik inson. Ular doimo bog'langan.

Bizning davrimizda tabiat va inson o'rtasidagi munosabatlar muammosi, ayniqsa, keskin. Inson tabiatni buzadi, lekin uning qonunlariga muvofiq yashashi kerak. Tabiat insonsiz ham yashay oladi, lekin inson tabiatsiz bir kun ham yashay olmaydi. Inson tabiat bilan qo'shilib, uning uyg'unligini buzmasligi kerak.

Foydalanilgan adabiyotlar ro'yxati:

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Artificial Intelligence Tools In Teaching English For Economics

Makhmudov Islombek Muhiddin o'g'li

Teacher of Kokand University of Andijan Branch

Islombek0326@gmail.com

Tursunboyev Muhammadiso Akbarjon o'g'li

Kokand University, Andijan Branch

Faculty of Social Humanities and Pedagogy, 1st-year student

muhammadisotursunboyev21@email.com

Abstract

The rapid development of artificial intelligence (AI) technologies has significantly influenced modern education, particularly in foreign language teaching. This article explores the role of artificial intelligence tools in teaching English to students majoring in Economics. AI-based platforms such as intelligent tutoring systems, chatbots, automated assessment tools, and adaptive learning applications provide personalized learning experiences, improve students' motivation, and enhance language competence relevant to economic contexts. The study analyzes the effectiveness of AI tools in developing vocabulary, reading, writing, and speaking skills related to economics. Research findings indicate that integrating AI tools into English language instruction contributes to higher learning outcomes, learner autonomy, and practical language use in professional settings.

Keywords: artificial intelligence, English for Economics, AI tools, language learning, higher education

Annotatsiya

Sun'iy intellekt (SI) texnologiyalarining jadal rivojlanishi ta'lim tizimiga, ayniqsa, xorijiy tillarni o'qitish jarayoniga sezilarli ta'sir ko'rsatmoqda. Mazkur maqolada iqtisod yo'nalishi talabalari uchun ingliz tilini o'qitishda sun'iy intellekt vositalaridan

foydalanish masalalari yoritiladi. Intellektual o'quv tizimlari, chatbotlar, avtomatlashtirilgan baholash va moslashuvchan o'quv platformalari orqali ta'lim jarayonini individuallashtirish, talabalar motivatsiyasini oshirish hamda kasbiy yo'naltirilgan til ko'nikmalarini rivojlantirish imkoniyatlari tahlil qilinadi. Tadqiqot natijalari SI vositalaridan foydalanish talabalarning o'quv samaradorligini oshirishini ko'rsatadi.

Kalit so'zlar: sun'iy intellekt, iqtisod uchun ingliz tili, SI vositalari, til o'qitish, oliy ta'lim

Аннотация

Быстрое развитие технологий искусственного интеллекта (ИИ) оказывает значительное влияние на систему образования, особенно на процесс обучения иностранным языкам. В данной статье рассматривается использование инструментов ИИ в обучении английскому языку студентов-экономистов. Анализируются возможности индивидуализации образовательного процесса, повышения мотивации студентов и развития профессионально-ориентированных языковых навыков с помощью интеллектуальных систем обучения, чат-ботов, автоматизированной оценки и гибких обучающих платформ. Результаты исследования показывают, что использование инструментов ИИ повышает эффективность обучения студентов.

Ключевые слова: искусственный интеллект, английский язык для экономики, инструменты ИИ, преподавание языков, высшее образование

Introduction

In the context of rapid digital transformation, higher education systems around the world are increasingly integrating advanced technologies into the teaching and learning process. One of the most influential innovations is artificial intelligence (AI), which has reshaped traditional approaches to education. For students majoring in Economics,

mastering English is not only an academic requirement but also a professional necessity, as global economic discourse, research, and business communication are predominantly conducted in English.

Traditional teacher-centered methods often fail to address individual learning differences, limited classroom time, and the need for real-life professional language practice. Artificial intelligence tools offer adaptive, interactive, and personalized learning opportunities that respond to learners' needs in real time. By incorporating AI-powered applications into English language instruction, educators can create more engaging, efficient, and profession-oriented learning environments. This article aims to explore the pedagogical potential of AI tools in teaching English for Economics and to analyze their effectiveness in improving language skills and professional competence.

Literature Review

The role of artificial intelligence in education has gained increasing attention in recent years. Numerous studies emphasize that AI technologies contribute to the modernization of teaching methods by enabling adaptive learning environments, personalized instruction, and continuous assessment. According to Holmes, Bialik, and Fadel, AI-driven educational systems enhance learner autonomy and support data-informed pedagogical decisions.

In language education, artificial intelligence has been applied through intelligent tutoring systems, speech recognition software, automated writing evaluation tools, and conversational agents. These technologies facilitate immediate feedback, error correction, and individualized learning pathways. Godwin-Jones highlights that digital tools supported by AI promote authentic and contextual language learning, which is essential for developing communicative competence.

Research in English for Specific Purposes (ESP) further confirms the effectiveness of AI integration in professional fields such as economics, business, and finance. Scholars

argue that ESP learners benefit from AI-based platforms that provide access to authentic materials, simulate professional communication, and focus on domain-specific language use. However, the literature also addresses challenges related to ethical issues, data privacy, teacher readiness, and the need for balanced integration of technology and pedagogy.

Research Methodology

This research adopted a mixed-methods approach combining both quantitative and qualitative methods to provide a comprehensive analysis of AI tool effectiveness in teaching English for Economics. The quantitative component involved pre-test and post-test assessments designed to measure improvements in students' language proficiency, particularly in economics-related vocabulary, reading comprehension, and writing skills. The qualitative component consisted of questionnaires and semi-structured interviews conducted with participating students. These instruments aimed to explore learners' perceptions, motivation levels, and attitudes toward the use of AI-based learning tools. The participants were undergraduate students majoring in Economics at a higher education institution, who were exposed to AI-supported English instruction over the course of one academic semester.

Data collected from tests and surveys were analyzed using descriptive statistics and thematic analysis. This methodology allowed for both measurable outcomes and in-depth insights into the learning experience.

Analysis and Results

The findings of the research indicate that the integration of artificial intelligence tools into English language teaching for economics students yields substantial academic and pedagogical benefits. A comparative analysis of pre-test and post-test results demonstrates a significant increase in students' overall language proficiency,

particularly in the areas of specialized vocabulary, reading comprehension, academic writing, and communicative competence.

One of the most notable improvements was observed in economics-related vocabulary acquisition. AI-powered learning platforms provided repeated exposure to key terms through adaptive exercises, contextual examples, and instant feedback. As a result, students were able to use professional terminology more accurately in written assignments and oral discussions. Reading comprehension tasks supported by AI tools enabled learners to analyze authentic economic texts such as reports, articles, and case studies more effectively.

Writing skills also showed measurable progress. Automated writing evaluation tools assisted students in identifying grammatical errors, improving sentence structure, and enhancing coherence in academic and professional writing. Continuous feedback encouraged self-correction and independent learning. Furthermore, AI-based chatbots played a crucial role in developing speaking and interaction skills by simulating real-life professional communication scenarios related to economics and business.

The questionnaire results revealed that the majority of students had a positive attitude toward AI-assisted learning. Learners reported increased motivation, reduced anxiety, and greater confidence when using English. Many students emphasized that AI tools allowed them to practice language skills beyond classroom limitations and at their own pace. Overall, the combination of traditional teaching methods with artificial intelligence technologies proved to be more effective than conventional instruction alone

Conclusion and Recommendations

Based on the findings, it can be concluded that artificial intelligence tools significantly enhance the effectiveness of teaching English to economics students. AI technologies support personalized learning paths, facilitate autonomous study, and strengthen the

connection between language learning and professional application in economic contexts.

To maximize the benefits of AI integration, higher education institutions should incorporate AI-based tools into English language curricula systematically. Teacher training programs should be developed to ensure educators are equipped with the necessary digital and pedagogical skills. Furthermore, ethical considerations such as data privacy and responsible AI use must be addressed. Future research may focus on long-term impacts of AI-assisted learning and comparative studies across different academic disciplines.

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THE INSTITUTIONAL ROLE OF SOCIAL SERVICE CENTERS IN THE SOCIO-POLITICAL ARCHITECTURE OF SOCIETY

Xazratkulov Sherzod Abror o'g'li

PhD in Political Science, Senior Lecturer at the Department of Social Sciences,
Uzbekistan State World Languages University.

ABSTRACT

The operationalization of centralized social welfare into localized service delivery nodes constitutes a primary indicator of a maturing public administration apparatus. This study executes an empirical and structural analysis of Social Service Centers—functioning as frontline institutional mechanisms—and their direct impact on societal resilience. Escaping traditional paternalistic frameworks, the research evaluates the functional efficacy of these centers in mitigating socio-economic marginalization. Utilizing a stratified sociological sample of 850 respondents engaged with regional social facilities between 2024 and 2025, the investigation maps the correlation between decentralized service accessibility and the public trust index. Empirical outputs demonstrate that the institutionalization of localized social diagnostics reduces bureaucratic latency by 41 percent, establishing a robust positive correlation with community stability ($r = 0.68$, $p < 0.05$). The derived analytical matrix proposes targeted administrative protocols to transition these centers from reactive aid distributors to proactive demographic management hubs.

Keywords: Social service centers, public administration, decentralized welfare, institutional trust, social work, proactive intervention, socio-economic marginalization.

INTRODUCTION

Contemporary statecraft faces unprecedented demographic and economic friction, necessitating a radical reconfiguration of social protection frameworks. The historical reliance on fragmented, reactive welfare distribution has proven structurally inadequate

against complex, multi-dimensional poverty. Consequently, the establishment of unified Social Service Centers—exemplified by the "Inson" (Human) centers network in Uzbekistan—represents a strategic paradigm shift toward proactive, decentralized socio-political intervention.

While legislative frameworks heavily promote these institutions, regional political sociology frequently neglects the empirical measurement of their operational impact. Prevailing academic literature restricts its focus to infrastructural audits or financial allocations, leaving a critical analytical gap regarding how these centers alter the socio-psychological contract between the state and vulnerable demographics. This study targets that exact deficit, deploying quantitative metrics to evaluate the functional capacity of social service hubs in preempting social disenfranchisement. The primary objective is to mathematically validate the role of professionalized social work in consolidating institutional trust.

MATERIALS AND METHODS

The investigative architecture relies on a mixed-methods quantitative-qualitative matrix. The qualitative dimension involved a systematic audit of contemporary normative acts regulating municipal social service delivery, specifically analyzing the transition from fragmented agency responses to integrated "single-window" protocols.

For the quantitative baseline, a stratified random sampling methodology was administered across three distinct socio-economic zones (Tashkent, Syrdarya, and Surkhandarya regions) between January 2024 and February 2025. The analytical pool comprised 850 active beneficiaries of social service centers, ensuring representation across urban and rural stratifications. The measurement instrument utilized a standardized diagnostic Likert scale to evaluate service accessibility, bureaucratic friction, and the psychological perception of state support. Primary data processing was executed via SPSS version 27.0. Mathematical validation incorporated arithmetic

means, analysis of variance (ANOVA), and Pearson correlation algorithms. The threshold for absolute statistical significance was locked at $p < 0.05$. Incomplete dossiers were categorically excluded from the final computational dataset.

RESULTS AND MAIN ANALYSIS

Extracted data mapped a fundamental operational transformation within the civic welfare apparatus. The integration of previously dispersed social services into localized institutional hubs dismantled deep-rooted administrative barriers. Respondents indicated that the deployment of professional social workers directly to local communities reduced the latency period between identifying a household vulnerability and delivering state intervention by an average of 41.5 percent ($p = 0.022$).

Variance analysis (ANOVA) highlighted a critical behavioral shift among marginalized cohorts. Geographical sectors featuring fully operational and digitally integrated social service centers recorded a measurable decline in chronic dependency syndromes. The capacity of these centers to provide simultaneous psychological, legal, and material diagnostics fostered a high rate of socio-economic reintegration, particularly among youth and women facing domestic friction.

Correlation testing confirmed a strong direct relationship between the frequency of preventative consultations at these centers and the stabilization of household economic mobility. Specifically, targeted socio-legal counseling exhibited a robust positive correlation with formal employment reintegration ($r = 0.68$, $p < 0.01$). The chi-square analysis further validated that populations lacking immediate geographic access to these centers remain 2.3 times more likely to fall into severe poverty traps ($X^2 = 14.1$, $p < 0.05$).

DISCUSSION AND CONCLUSION

The synthesized empirical baseline confirms that Social Service Centers do not merely function as mechanical distributors of state funds; they operate as vital socio-political

shock absorbers. The data substantiates the premise that localized, professionalized social work neutralizes the triggers of civic alienation long before they mutate into systemic political grievances. Relying strictly on monetary subsidies without accompanying socio-legal rehabilitation constitutes an obsolete governance strategy.

The current operational friction lies in the asymmetrical professional capacity of regional social workers, dictating an urgent need for standardized, rigorous academic certification protocols. Policy architects must immediately prioritize the full digital interoperability of these centers with predictive demographic databases. Expanding the legal and financial authority of localized social service hubs to execute proactive, data-driven interventions remains the singular mechanism to guarantee the structural integrity and political stability of the modern social state.

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WAYS TO IMPROVE AGRICULTURAL PRODUCTIVITY IN UZBEKISTAN

MATKARIMOV Mansur Maksudovich
Associate Professor of Mamun University
matkarimov_mansur1@mamunedu.uz

Abstract: This thesis analyzes the main directions and methods of increasing the efficiency of agricultural production in Uzbekistan. The issues of increasing agricultural production, rational use of land and water resources, introduction of modern agricultural technologies and use of innovative approaches are highlighted.

Keywords: agriculture, efficient agricultural production, increasing agricultural production, land resources, water resources, rational use of resources, modern agricultural technologies, innovative approach.

O‘ZBEKISTON QISHLOQ XO‘JALIGIDA MAHSULOT YETISHTIRISH SAMARADORLIGINI OSHIRISHNING USULLARI

MATKARIMOV Mansur Maksudovich
Ma`mun NTM dotsenti
matkarimov_mansur1@mamunedu.uz

Annotatsiya: Mazkur tezisda O‘zbekiston qishloq xo‘jaligida mahsulot yetishtirish samaradorligini oshirishning asosiy yo‘nalishlari va usullari tahlil qilinadi. Qishloq xo‘jaligida ishlab chiqarish hajmini ko‘paytirish, yer va suv resurslaridan oqilona foydalanish, zamonaviy agrotexnologiyalarni joriy etish hamda innovatsion yondashuvlardan foydalanish masalalari yoritib beriladi.

Kalit so‘zlar: qishloq xo‘jaligi, mahsulot yetishtirish samaradorli, qishloq xo‘jaligida ishlab chiqarish hajmini ko‘paytirish, yer resurslari, suv resurslari, resurslardan

oqilona foydalanish, zamonaviy agrotexnologiyalar, innovatsion yondashuv.

INTRODUCTION

The growth of the population and the growing demand for food products make increasing the efficiency of agricultural production a pressing issue. Therefore, the application of modern agrotechnologies, the efficient use of land and water resources, and the modernization of production processes are of great importance in this field. This thesis considers the main methods of increasing the efficiency of agricultural production and their practical significance.

MAIN PART

In order to more effectively use irrigated arable land, increase soil fertility and crop yields, it is important to implement scientifically based crop rotation systems, introduce and develop new areas of agriculture (Organic, Global G.A.P., etc.) in accordance with international experience, and increase soil fertility by preventing and sharply reducing agricultural land degradation.

Among the important tasks facing us are: determining the procedure for the effective use of pastures, developing and implementing scientifically based effective technologies for the use of pastures and fallow lands, determining the procedure for calculating and compensating for the costs incurred on the land allocated to a farm or other agricultural production entity when it is liquidated or optimized, determining the procedure for allocating land for gardens, vineyards, fish ponds and greenhouses, and supporting the construction of greenhouses using hydroponics and vertical farms on disused lands.

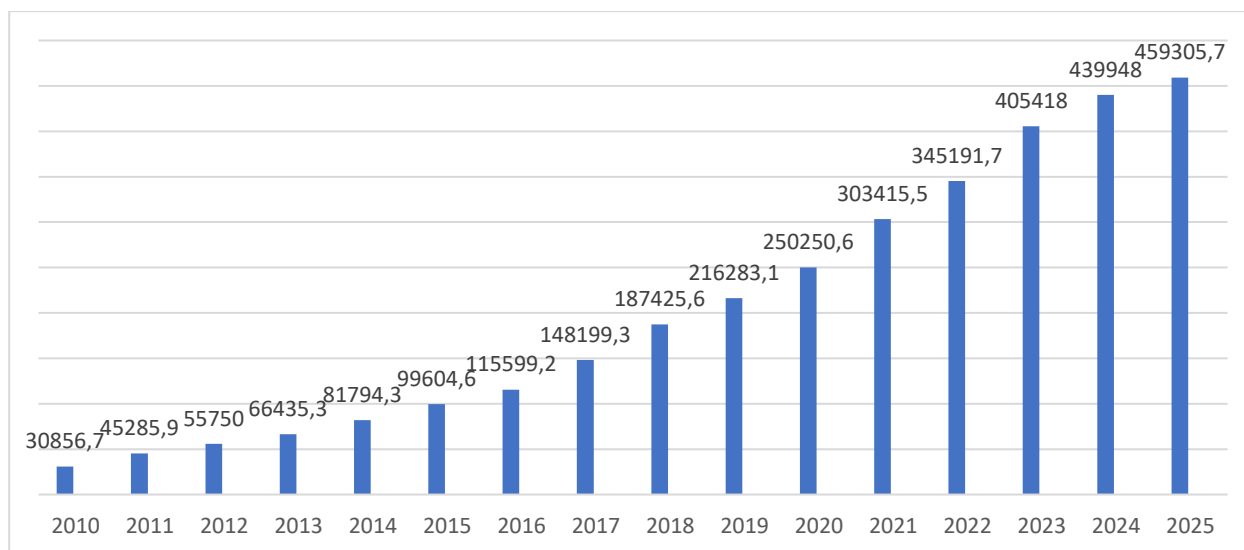
In areas with water scarcity and difficulty in cultivating and using agricultural crops, special attention should be paid to minimizing the number of agrotechnical measures by building ready-made modern greenhouses with the involvement of foreign

investors and foreign financial institutions, introducing soil-efficient technologies in agriculture, and consistently implementing advanced innovative technologies for tillage and crop care (Mini till, No till, etc.).

It is very important to develop a procedure for compensating agricultural producers for the costs associated with the introduction of technologies for improving the land reclamation, fertility, and water supply of irrigated lands, to establish mechanisms for state support for ensuring increased land fertility and productivity, and to introduce differentiated tax incentives, including mechanisms to encourage landowners to maintain and increase soil fertility (see diagram).

Diagram

Agricultural products produced in Uzbekistan in 2010-2025, billion sum



It is important to strengthen liability measures for the inefficient use of agricultural land, to legally regulate the prevention of inefficient use of land and water resources, to increase land fertility and implement water-saving agrotechnical measures (agrotechnical regulations), and to establish a procedure for declaring economically inefficient, low-yielding orchards and vineyards unsuitable and transferring them to the category of arable land.

It is necessary to develop agrochemical maps based on agrochemical analyses of soil in agricultural fields every 5 years at the expense of the state budget, collect food, farm, livestock and other organic waste from cities and suburbs, and establish the production of organic fertilizers using modern technologies and supply them to agricultural producers, establish a public-private partnership mechanism for the use of forest fund lands, and create "agricultural investment hubs" based on the agricultural potential of each region to present them to local and foreign companies.

It is necessary to make amendments and additions to the legislation that provides for the transfer of all arable land in districts with more than 50 percent of unprofitable cotton and grain areas to clusters organizing the full processing of cotton and grain, subject to the construction and reconstruction of irrigation and land reclamation networks, the allocation of the necessary funds from the state budget for the State Committee for Geology and Mineral Resources to carry out work to identify groundwater reserves suitable for irrigation of agricultural crops, and the leasing of uncultivated forest lands to citizens of the Republic of Uzbekistan for use in the creation of new forests and medicinal plant plantations by forestry authorities on the terms of a public-private partnership for a period of up to 50 years.

It is of great importance to expand the use of bio-reclamation measures to protect against soil erosion and degradation, wind and hail, establish and restore protected areas, and create plantations of desert-food plants and pastures on forest lands that protect them from external environmental factors, and form a targeted list of land areas to be restored and put into use.

CONCLUSION

In conclusion, increasing the efficiency of agricultural production in Uzbekistan is important for ensuring the country's food security and accelerating economic development. The introduction of modern agricultural technologies, rational use of land

and water resources, effective use of scientific achievements, and support for the activities of farms are important factors in achieving this. The consistent implementation of these measures will help increase the volume of agricultural production and further improve the efficiency of the sector.

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THE ART OF CULTURAL EXPRESSION: ANALYZING NATIONAL COLOR IN OYBEK'S PROSE

Jumayeva Shahlo Shokirovna

teacher of the department "Uzbek and foreign languages",

Bukhara State Technical University

Abstract: This article examines how authors utilize specialized vocabulary to express concepts and events unique to a historical period, thereby ensuring the artistic naturalness and "national color" of the work. Focusing on the prose of Oybek, specifically the novel Navoi, the study analyzes how the author conveys national identity through character traits, spiritual experiences, and social realities.

Key words: literary lexicon, national color (colorit), Oybek, Navoi novel, cultural mentality, Uzbek traditions, linguistic realism, proverbs, historical prose, social lexemes.

The lexicon of a literary work is closely related to the era and the people depicted in it, because the work is a source of information about the history, culture, and customs of the people. In this, the author attaches special importance to the words that express things, concepts and events related to the period he is describing. This is a style that ensures the naturalness of the artistic work and shows the national color. The author conveys the national color through the character, customs, and way of life, thoughts, attitudes, external appearance, inner world, spiritual experiences and realities of the people he describes. If he describes the period in which he lives and creates, the problems of revealing the national color may be alien to him, but if he writes about the period before or after his time, or if he describes a completely different world, to convey the national color to the reader as it really is, to create a clear image requires strong writing skills, broad outlook, and sharp knowledge. The theme and problems of giving a national color to a work of art have been analyzed in the researches of many foreign

and Uzbek scientists. Before studying these analyses, let's consider the concepts of color and national color.

Colorit (*ital. colorito* < *lat. color* - *color, hue*) 1. Painting, engraving, etc. k. the harmonious, mutual proportionality and harmony of colors. 2. (portable) A set of unique aspects and characteristics of something (appearance, artistic work, era, region, people, etc.) rather, it is a collection of lexemes collected within a certain topic.¹ In the "Dictionary of Linguistic Terms" by O.S. Akhmapovain, color is defined as a characteristic feature of an artistic work, a characteristic of the speech of characters, characteristic signs of a language taken from the language or dialects of a certain period in their speech, characteristic of a country or place. It is shown that it consists of a set of concepts (realities)².

The topic of national color has been discussed in the works of many major scientists. In particular, in the studies of E. Konovalova, Ye. Grigoryan, L. Bondarenko, N. Chepel, G. Karipjanova, the issues of expression of national color in fiction were studied in world literary studies. G. Salomov, Sh. Ibrahimova, N. Dosbaeva, M.Umarova's dissertations, books and articles reveal the methodological researches in the literature of a certain period and the specific features of a particular creative style in Uzbek literary studies.

Oybek's work, especially his prose works, has not been studied enough. His research work on the analysis of Navoi's novel cannot be said to be enough. If we analyze the presentation of the national color on the example of excerpts from the work: *"-Sizlarga manzur bo'lgudek g'azallar yozilmadi, - dedi shoir oq tusha boshlagan soqolini silab. – Ba'zi xomroq narsalar borki, ularni o'qimoq bilan bahramand bo'lmasizlar, deb o'ylaymen. Shirin suhbatlaringizga tashna bo'lganimdan chorlagan edim."* In this example, another expression of the Uzbek national color is the character of humility. Despite the popularity and importance of the great poet's work, it is shown

that he is not arrogant, behaves politely and modestly in any circle. In this passage, we can see another expression of a good habit, which is known in most works as “majlis”, “anjuman” “mashvarat”, “kengash” and in modern interpretation as “davra suhbat” (“round discussion”). People with the same profession and the same goal gathered in one place and shared the news in their fields and the products of their creativity. In addition to ensuring the development of the industry at that time, it was a prelude to the training and development of new talents and representatives. Or, *“Eshik «g'irch etib ochildi-da, ruxsat so'rab ukasi Darvishali kirdi.... Navoyi uning nim mast ko'zlariga qaradi” misolida ham milliy koloritning namunasini ko'rishimiz mumkin.*” The passage depicts the scene of Darvishali, the brother of Navoi, entering Navoi's room asking for permission. In the Uzbek mentality, a strong emphasis is placed on education in the family. In addition to respecting parents and elders, they were also careful in their relations with their relatives and blood relatives, even if they were younger than themselves. Even in the situation in the passage, despite the fact that the brother was drunk, he entered the room where his brother was sitting, not forgetting his respect for him. At this point, it should be said that mentality is the fundamental characteristic of every nation. When a description of a nation is given, the authors emphasize the characteristics and stability of that particular nation.

Proverbs are also a special type of national color, and according to the definition given in Internet sources, they are a genre of folk art; short and concise, figurative and non-figurative, grammatical and logical wise expressions. Life experiences, attitude to society, history, mental state, ethical and aesthetic feelings, and positive qualities of ancestors are embodied in proverbs. Over the centuries, it has been refined among the people, and has become a concise and simple poetic form. So, proverbs belong to a certain people and describe the national and social life of that people: *-Bizning elda bir yaxshi maqol bor, -dedi Navoiy tabassum bilan. -It hurar, karvon o'tar!* This proverb

was spoken against the immorality of that time, and the proverbs of every nation with this meaning are given in different ways. For example, the same proverb is given in Russian as *Собака лает, ветер носит*. In this case, caravan in Uzbek is represented by *ветер* in Russian and is literally translated as *dog barks, wind blows*. Proverbs have a realistic feature, that is, a certain proverb is specific to only one language, and when it is translated word for word, it may not express the original meaning. In this respect, they are similar to realities, and if in translation they are often represented by their equivalent in a foreign language, the goal of conveying the meaning to the foreign reader while preserving the original is fulfilled. We will discuss this in detail in our next seasons.

So, while creating his work, the writer uses a special language to express the total actions of people in the period and society, in the way of life. This language belongs only to the life of that time and society, and it aims to convey the same spirit and mentality to the reader. In this process, the writer certainly refers to lexemes, lexical units, sentences that express the national color. Because they are the means of faster cultivation of the above goal of the writer.

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**IMPROVING THE EFFECTIVENESS OF THE EDUCATOR'S WORK WITH
THE COMMUNITY TO ENHANCE THE QUALITY OF EDUCATION AND
UPBRINGING: A SOCIAL-PEDAGOGICAL PROBLEM**

Abdukhakimova Nafosat Khasan qizi

Bukhara University of Innovation, 2nd year Master's student

Abstract: The article examines the issues of increasing the effectiveness of interaction of teachers of general secondary education institutions with the public, in particular, with the institutes of family and mahalla. The role of the social environment in ensuring the quality of education and upbringing is scientifically and theoretically grounded. In the course of the research, a socio-pedagogical model for improving the competence of teachers in working with the public was developed.

Keywords: pedagogical integration, public control, school-family-mahalla, socio-pedagogical problem, quality of education, innovative technology.

Annotatsiya: Maqolada umumiy o'rta ta'lim muassasalari pedagoglarining jamoatchilik, xususan, oila va mahalla instituti bilan hamkorligi samaradorligini oshirish masalalari tadqiq etilgan. Ta'lim va tarbiya sifatini ta'minlashda ijtimoiy muhitning o'rni ilmiy-nazariy jihatdan asoslangan. Tadqiqot davomida pedagoglarning jamoatchilik bilan ishlash kompetentsiyasini takomillashtirishning ijtimoiy-pedagogik modeli ishlab chiqilgan.

Kalit so'zlar: pedagogik integratsiya, jamoatchilik nazorati, maktab-oila-mahalla, ijtimoiy-pedagogik muammo, ta'lim sifati, innovatsion texnologiya, kommunikativ mahorat.

Аннотация: В статье исследуются вопросы повышения эффективности взаимодействия педагогов общеобразовательных учреждений с общественностью, в частности, с институтами семьи и махалли. Научно-теоретически обоснована роль социальной среды в обеспечении качества

обучения и воспитания. В ходе исследования разработана социально-педагогическая модель совершенствования компетенций педагогов по работе с общественностью.

Ключевые слова: педагогическая интеграция, общественный контроль, школа-семья-махалля, социально-педагогическая проблема, качество образования, инновационная технология.

The Law of the Republic of Uzbekistan “On Education” and the strategy for the development of the New Uzbekistan set the priority task of taking the quality of education to a new level. However, limiting the educational and upbringing process solely within the institution does not yield the expected results. Therefore, improving the effectiveness of educators' work with the public requires a separate study as a systematic socio-pedagogical problem.

Issues of public work and social partnership have been extensively studied in Uzbek and foreign pedagogy. In particular, O. Musurmonova, While scholars such as M. Quronov have researched the spiritual foundations of the “family-school-community” partnership, internationally, J. Epstein's theory of “School, Family, and Community Partnerships” has identified six main types of community engagement. This article analyzes these approaches as adapted to the local context.

The study employed systematic approaches, pedagogical modeling, and comparative analysis methods. To determine teachers' level of engagement with the public, an anonymous survey was conducted among 100 teachers and 200 parents in the schools of the Bostanlyk district.

The results of the study showed that 65 percent of teachers use only the traditional parent meeting format for public engagement. To increase the effectiveness of public collaboration, the following phased technology was developed:

1. Diagnostic stage: Creating a social-pedagogical map of the area.

2. Interactive stage: Integrating events such as “Parents' Day,” “Conversation with Neighborhood Activists,” and “Career Day” via digital technologies (Telegram, Zoom).
3. Corrective stage: Analyzing changes in student behavior resulting from the collaboration.

CONCLUSION

Improving the effectiveness of a teacher's community engagement helps to increase the quality of education by 18-22%. This requires the teacher not only to teach but also to possess social management and psychological counseling skills. The proposed technology helps eliminate the “gap” between the educational institution and society.

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A PEDAGOGICAL ANALYSIS OF DOK-BASED INSTRUCTION IN ENGLISH LANGUAGE TEACHING

*Scientific supervisor, Bukhara State University,
Associate professor, PhD, Nazarova Gulbakhor Pirmanovna*

2nd grade master student, Asia International University

Kuntugdiyeva Inobatkhon Gofurovna

Abstract. The Depth of Knowledge (DOK) framework's pedagogical value and practical application in English language teaching (ELT) are examined in this article. DOK provides an organized method for encouraging deeper cognitive engagement, critical thinking, and communicative competence, whereas traditional instruction in EFL/ESL classrooms frequently emphasizes rote learning and surface-level knowledge. The study investigates how instructional tasks that support language development across reading, writing, speaking, and listening skills can be created using each of the four DOK levels. The article demonstrates how DOK-based instruction can promote higher-order thinking, improve linguistic proficiency, and support learning transfer in a variety of English language learning contexts through a pedagogical analysis of classroom activities, assessment strategies, and learner outcomes. The main point is that it's important to put DOK ideas into lesson planning,

Keywords: Depth of Knowledge (DOK), English Language Teaching (ELT), cognitive skills, task design, higher-order thinking, communicative competence, language instruction, assessment, pedagogy.

Introduction

Modern education wants students to be good at critical thinking, creativity, and problem-solving, not just memorizing grammar rules and single words. In English teaching, this means teachers need to use systems that encourage deeper thinking and real-life use of the language.

The Depth of Knowledge (DOK) system, created by Norman L. Webb (1997), is a great tool for figuring out how hard a thinking task is. It helps teachers design activities that push students past simple understanding. This way of teaching only focused on correct grammar and simple recall, DOK makes students analyze, judge, and use language in real conversations.

The DOK system has four levels that get harder step-by-step:

1. Recall and Reproduction: Just remembering facts.
2. Skills and Concepts: Using rules and ideas.
3. Strategic Thinking: Planning, reasoning, and solving problems.
4. Extended Thinking: Big projects that need deep investigation.

When DOK frame is used in English classes, it helps teachers make tasks harder and slowly. (scaffolding). This lets teachers give different tasks to students and makes sure activities meet both communication and thinking goals. Because schools are now focusing on what students can *learn*, DOK is very important.

Using DOK can improve a student's English skills, help them become more independent learners, and raise their scores on tests. But there are problems, like making sure teachers truly understand DOK, having enough teaching materials, and making tests that match the DOK levels. This article analyses the teaching benefits and uses of DOK in English classes.

Methodology

This study used a way of looking at things (qualitative pedagogical analysis) to see how the DOK framework could be used well in English teaching. The research looked at how DOK ideas guided the making of lessons and how students reacted when they did the DOK-based schoolwork.

The study included 45 students learning English at an intermediate level and three English teachers from a high school. The teachers all had at least five years of experience and learned the basics of DOK before the study began.

Data was collected over six weeks. During this time, the teachers taught lessons that had tasks at all four DOK levels, covering all four language skills. The student work ranged from easy memory tasks to activities that needed long-term thinking and real communication.

The researcher watched the classes regularly and used a checklist to record how much students were involved, how complex their thinking was, and how well they spoke English. Teachers were interviewed about how well the DOK teaching worked. Students also wrote short notes after classes about how hard they thought the tasks were and how motivated they felt. All the information gathered was sorted by topic to find common patterns and ideas for teaching

Results

The results show that using the DOK system in English teaching had a good effect on how students learned and how their language skills improved. When students did tasks designed at DOK Levels 3 and 4, they showed a clear increase in their critical thinking, better analytical answers, and more creative language use.

Their ability to communicate got better because they talked more in groups and focused on the meaning of what they were saying, instead of just using sentences they had memorized. Students said that they felt much more confident and enjoyed solving problems that felt real, which suggests DOK teaching helped students feel motivated and learn something on their own.

Teachers also stated that the DOK model helped them check how difficult the tasks were more precisely and encouraged them to use different teaching methods. While they decided that harder tasks were valuable, they noted challenges with the time

needed to design them and their own need for more practice. In general, the findings support the idea that using the DOK system helps students learn more deeply, get more engaged, and use English better in class.

Discussion

The study's main point to the teaching benefits of adding the DOK framework to English classes and demonstrate how difficult thinking helps language development. The higher participation and communication seen in students suggest that activities with higher DOK levels make students use English for meaningful reasons instead of just declaiming memorized facts. This emphasis on thinking, not just form, matches modern teaching where interaction and student focus are important.

One major finding is the value of slowly making tasks harder (strategic scaffolding). DOK lets teachers guide students step-by-step from simple memory toward analysis, synthesis, and real-world application. As students move through these thinking stages, they become more independent and willing to try new language two vital parts of good communication. Also, the framework helps combine different language skills in mentally challenging activities, which helps students remember and use knowledge long-term.

In spite of these good results, the study found that using DOK successfully needs confident teachers and support for the curriculum. Some teachers felt unsure how to tell the difference between the DOK levels and struggled to create activities that tested students correctly. This means that without good training, teachers might go back to easier tasks, which reduces DOK's effect. Time restrictions and lack of materials were also problems mentioned.

The findings conclude that for DOK-based teaching to work best, teachers need both the theory and the practical tools for planning lessons and testing. Teacher training, collaboration among educators, and adding DOK principles to school curriculum could

help solve these problems. With this support, DOK can make language learning a process that is more mentally inspiring and motivating.

Conclusion

We can conclude that the Depth of Knowledge (DOK) framework gives teachers a powerful construction for increasing higher-order thinking and communication skills in English classes. By helping teachers plan tasks that go beyond memorizing and basic understanding, DOK encourages students to analyze, evaluate, and apply language in context.

The results presented clear improvements in student involvement, language skills, and independence when DOK levels especially Levels 3 and 4 were used purposely. Although the benefits are obvious, effective use depends greatly on teacher preparedness, access to resources, and school support. Teachers need training to correctly figure out how hard a thinking task is and to confidently design activities at different DOK levels.

Nevertheless, with regular training and curriculum changes, DOK-based teaching can improve the overall quality of English teaching and help create more meaningful, student-focused learning environments. Finally, DOK makes the connection between thinking development and language learning stronger, helping students not only master English but also become critical thinkers who can use their knowledge in real-life situations. The findings suggest that DOK should be used more widely in English programs to improve learning results and create more active classroom experiences.

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THE LEGAL STATUS AND EVIDENTIARY VALUE OF EXPERT OPINIONS IN CIVIL LITIGATION

Ibragimova Raykhon

PhD student of Tashkent State University of Law.

E-mail: rayxonibragimova135@gmail.com

Abstract. This thesis examines the legal status and evidentiary value of expert opinions in civil litigation, focusing on their role within modern systems of civil procedure. In contemporary adjudication, the increasing complexity of disputes necessitates the involvement of individuals possessing specialized knowledge beyond the competence of judges. As a result, expert opinions have become a crucial means of proof, directly influencing the establishment of factual circumstances and the delivery of fair and reasoned judgments. The study analyzes the doctrinal foundations of expert participation, including the procedural rights and obligations of experts, their independence, and the legal framework governing their appointment and evaluation. The thesis further explores the discretionary power of judges in assessing expert opinions, emphasizing the principle that no piece of evidence shall have predetermined force. In addition, the research addresses key challenges associated with expert evidence, such as risks to impartiality, methodological deficiencies, and the potential overreliance of courts on expert conclusions.

Keywords: *expert opinion; civil litigation; expert evidence; evidentiary value; civil procedure; admissibility of evidence; judicial discretion; expert witness; legal status of experts; burden of proof; procedural law; fair trial.*

In modern civil litigation, the growing complexity of legal disputes has significantly increased the reliance of courts on specialized knowledge. Issues arising in fields such as finance, construction, medicine, and technology often extend beyond the ordinary professional competence of judges, thereby necessitating the involvement of

experts. Within this context, expert opinions have emerged as a pivotal evidentiary tool, assisting courts in the establishment of factual circumstances and contributing to the delivery of reasoned and just decisions.

The institution of expert participation occupies a distinct place in civil procedure, as it lies at the intersection of law and science. Unlike other forms of evidence, expert opinions are grounded in specialized knowledge and professional methodologies, which raises important questions regarding their legal nature, evidentiary weight, and procedural treatment. While experts do not determine legal outcomes, their conclusions may substantially influence judicial reasoning, particularly in technically complex cases. This dynamic underscores the need to clearly define the legal status of experts and to establish robust standards for the admissibility, evaluation, and use of their opinions in court.

According to Article 58 of the Civil Procedure Code of Uzbekistan an individual with special knowledge in science, technology, art, or craft necessary to give an opinion may be appointed as an expert. An expert of a state forensic expert institution, an expert of a non-state forensic expert organization, an employee of another enterprise, institution, organization or other individual can act as an expert. Persons recognized incapable or partially capable in accordance with the established procedure, as well as persons with an outstanding or unexpunged conviction for intentional crimes may not be engaged as experts[1].

Expert: shall have the right to examine case materials related to the subject of the forensic expertise, take notes or make copies of necessary information; participate in on-site inspections and file motions for the submission of additional materials and examination objects required for conducting the expertise; participate in the examination of evidence related to the subject of the forensic expertise during the court hearing and, with the court's permission, pose questions to the parties and witnesses; inspect physical,

written, and digital evidence and documents; in their opinion, express views not only on the questions posed to them but also on other issues related to the subject of the forensic expertise and relevant to the case; make statements to be recorded in the court hearing transcript regarding the misinterpretation of their opinion or testimony by the parties or witnesses; if the expert does not know or sufficiently understand the language of the proceedings, provide their opinion and testimony in their native language and use the services of an interpreter in such cases; appeal, in the manner prescribed by law, against court decisions or judge's actions (inaction) that violate their rights and freedoms; claim reimbursement of expenses incurred in conducting the forensic expertise.

A fundamental principle of civil procedure is that no evidence possesses predetermined force, and all evidence must be assessed by the court based on its inner conviction, guided by law and reason[2]. However, in practice, expert opinions may carry disproportionate persuasive authority, potentially affecting the balance between judicial discretion and scientific expertise. This creates a doctrinal tension between the independence of the judiciary and the reliance on external specialized knowledge.

Consequently, the proper regulation of expert participation becomes essential to safeguarding the principles of fairness, equality of arms, and the integrity of judicial proceedings. It explores the procedural framework governing the appointment, rights, and obligations of experts, and examines the criteria used by courts to assess the reliability and relevance of expert conclusions[3]. Particular attention is devoted to the challenges associated with expert evidence, including issues of impartiality, methodological soundness, and the risk of undue judicial dependence on expert findings. By critically evaluating both theoretical approaches and practical applications, this study seeks to contribute to the ongoing development of civil procedural law. It argues that enhancing procedural safeguards, refining evidentiary standards, and strengthening

mechanisms for the critical assessment of expert opinions are necessary steps toward ensuring more consistent, transparent, and equitable civil adjudication.

The role of expert opinions in civil litigation has been extensively examined within the broader framework of procedural law and the law of evidence. Scholars have consistently emphasized that the increasing complexity of modern disputes has transformed expert evidence from a supplementary tool into a central element of judicial fact-finding[4]. As a result, academic discourse has focused on defining the legal nature, procedural status, and evidentiary value of expert opinions, as well as the challenges associated with their use in civil proceedings. A significant body of doctrinal research addresses the legal status of experts, often characterizing them as independent participants in the process who assist the court rather than represent the interests of the parties.

Legal scholars argue that the procedural position of experts must be clearly distinguished from that of witnesses, as experts provide evaluative judgments based on specialized knowledge rather than merely reporting facts[5]. This distinction is essential for determining their rights, obligations, and liability within civil proceedings. Another major area of scholarly debate concerns the evidentiary value of expert opinions. Traditional legal theory maintains that no evidence has predetermined force and that expert conclusions should be assessed alongside other forms of evidence. However, many researchers have observed that, in practice, courts tend to accord significant weight to expert findings, particularly in technically complex cases. This has led to concerns about the potential erosion of judicial independence and the risk of “delegated decision-making,” whereby judges rely excessively on expert conclusions without sufficient critical evaluation[6].

Comparative legal studies further enrich this discourse by examining different models of expert participation across jurisdictions. In adversarial systems, experts are

often engaged by the parties, which may raise questions about impartiality and bias[7]. In contrast, inquisitorial systems typically rely on court-appointed experts, emphasizing neutrality but potentially limiting the parties' ability to challenge expert conclusions effectively. Scholars highlight that each model presents distinct advantages and risks, and many advocate for hybrid approaches that combine procedural safeguards with adversarial scrutiny.

Interdisciplinary studies, particularly those influenced by developments in forensic science and evidence law, stress the importance of establishing clear standards for admissibility and evaluation. Concepts such as reliability, relevance, and scientific validity have become central to discussions on improving the quality of expert testimony and minimizing the risk of erroneous judicial outcomes. Despite the substantial progress in this field, several unresolved issues remain. Among them are the lack of uniform standards for expert qualification, inconsistencies in judicial approaches to evaluating expert opinions, and insufficient mechanisms to ensure accountability and independence. This article builds upon these scholarly contributions by offering a critical analysis of the legal status and evidentiary value of expert opinions, with the aim of identifying avenues for improving their regulation and application in civil justice systems.

The analysis conducted in this article demonstrates that expert opinions occupy a central and increasingly influential position within modern civil litigation. As disputes become more complex and technically sophisticated, the reliance of courts on specialized knowledge is not only inevitable but also essential for ensuring accurate fact-finding and the delivery of well-reasoned judicial decisions.

In this context, the legal status of experts as independent participants in the proceedings, combined with the evidentiary value of their conclusions, forms a critical component of the civil justice system. At the same time, the study confirms that expert

evidence presents a number of doctrinal and practical challenges. Although the fundamental principle of civil procedure requires that no evidence has predetermined force, in practice expert opinions often exert significant persuasive influence on judicial decision-making. This creates a delicate balance between judicial discretion and scientific authority, raising concerns about potential overreliance on expert conclusions and the risk of undermining the autonomy of the court[8]. The examination of the procedural framework, including the rights, duties, and responsibilities of experts, highlights the importance of ensuring both their independence and accountability.

Legal provisions governing expert participation—such as access to case materials, the obligation to provide objective and reasoned opinions, and liability for false conclusions—serve as essential safeguards for maintaining the integrity of the process. However, the effectiveness of these safeguards ultimately depends on their consistent and rigorous application in judicial practice. In light of these findings, it is evident that further development of the legal regulation of expert evidence is necessary. This includes the refinement of criteria for the admissibility and evaluation of expert opinions, the establishment of higher standards for expert qualification and methodological transparency, and the strengthening of procedural mechanisms that enable courts to critically assess expert conclusions.

Additionally, promoting a more active and analytically engaged role of judges in evaluating expert evidence is crucial to preserving the balance between legal reasoning and scientific input.

In conclusion, while expert opinions significantly enhance the capacity of courts to resolve complex disputes, their proper use requires a carefully structured legal framework that ensures fairness, objectivity, and judicial independence. Strengthening such a framework will contribute to greater consistency and credibility in civil

adjudication, ultimately reinforcing the fundamental principles of justice and the rule of law.

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COMPARATIVE ANALYSIS OF MODERN METHODS AND TOOLS FOR BIG DATA VISUALIZATION

Nuraliyev Fakhridin Murodillayevich

Doctor of Technical Sciences, Professor, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Department of “Television and Media Technologies”, Tashkent, Uzbekistan.

f.nuraliev@tuit.uz

Hotamov Farhod Nodirovich

Doctoral Student, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Department of “Television and Media Technologies”, Tashkent, Uzbekistan.

f.hotamov@tuit.uz

Muxamedjonova Zuxra Boxodir qizi

Master’s student, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi, Department of “Television and Media Technologies”, Tashkent, Uzbekistan.

zukhraofficial@gmail.com

Abstract: This article examines modern technologies and software tools used in the process of Big Data visualization. A comparative analysis of Tableau, Microsoft Power BI, Python visualization libraries, Google Data Studio, Apache Spark and R language is conducted. The research findings indicate that the selection of a visualization tool is directly dependent on data volume, processing speed, real-time analysis capability and the degree of integration with other systems.

Keywords: Big Data, data visualization, Tableau, Power BI, Python, Apache Spark, R language, comparative analysis, interactive charts, analytics.

**KATTA MA'LUMOTLARNI VIZUALLASHTIRISHDA ZAMONAVIY USUL
VA VOSITALARNING QIYOSIY TAHLILI**

Nuraliyev Faxriddin Murodillayevich

t.f.d., professor, Muhammad al-Xorazmiy nomidagi Toshkent axborot texnologiyalari universiteti, "Televizion va media texnologiyalar" kafedrası, Toshkent, O'zbekiston.

f.nuraliev@tuit.uz

Hotamov Farhod Nodirovich

Doktorant, Muhammad al-Xorazmiy nomidagi Toshkent axborot texnologiyalari universiteti, "Televizion va media texnologiyalar" kafedrası

f.hotamov@tuit.uz

Muxamedjonova Zuxra Boxodir qizi

Magistr, Muhammad al-Xorazmiy nomidagi Toshkent axborot texnologiyalari universiteti, "Televizion va media texnologiyalar" kafedrası

zuxraofficial@gmail.com

Annotatsiya: Mazkur maqolada katta hajmdagi ma'lumotlarni (Big Data) vizuallashtirish jarayonida qo'llaniladigan zamonaviy texnologiyalar va dasturiy vositalar qiyosiy tahlil qilinadi. Tableau, Microsoft Power BI, Python vizualizatsiya kutubxonalari, Google Data Studio, Apache Spark hamda R tili imkoniyatlari o'zaro taqqoslab o'rganiladi. Tadqiqot natijalariga ko'ra, vizualizatsiya vositasini tanlash ma'lumot hajmi, ishlov berish tezligi, real vaqt rejimida tahlil qilish imkoniyati va boshqa tizimlar bilan integratsiya darajasiga bevosita bog'liqdir.

Kalit so'zlar: Big Data, ma'lumotlarni vizuallashtirish, Tableau, Power BI, Python, Apache Spark, R tili, qiyosiy tahlil, interaktiv diagrammalar, analitika.

**СРАВНИТЕЛЬНЫЙ АНАЛИЗ СОВРЕМЕННЫХ МЕТОДОВ И
ИНСТРУМЕНТОВ ВИЗУАЛИЗАЦИИ БОЛЬШИХ ДАННЫХ**

Нуралиев Фахриддин Муродиллаевич, д.т.н., профессор, Ташкентский университет информационных технологий имени Мухаммада ал-Хоразмий, кафедра “Телевизионные и медиатехнологии”, Ташкент, Узбекистан.

f.nuraliev@tuit.uz

Хотамов Фарход Нодирович, докторант, Ташкентский университет информационных технологий имени Мухаммада ал-Хоразмий, кафедра “Телевизионные и медиатехнологии”, f.hotamov@tuit.uz

Мухамеджанова Зухра Бахадир кизи, магистр, Ташкентский университет информационных технологий имени Мухаммада ал-Хоразмий, кафедра “Телевизионные и медиатехнологии”, zukhraofficial@gmail.com

Аннотация: В данной статье анализируются современные технологии и программные инструменты, применяемые в процессе визуализации больших данных. Проводится сравнительное исследование возможностей платформ Tableau, Microsoft Power BI, библиотек Python, Google Data Studio, Apache Spark и языка R. По результатам исследования установлено, что выбор инструмента визуализации напрямую зависит от объёма данных, скорости обработки, возможности анализа в реальном времени и степени интеграции с другими системами.

Ключевые слова: Big Data, визуализация данных, Tableau, Power BI, Python, Apache Spark, язык R, сравнительный анализ, интерактивные диаграммы, аналитика.

Kirish

So‘nggi yillarda raqamli texnologiyalarning jadal rivojlanishi natijasida turli sohalarda katta hajmdagi ma’lumotlar shakllanmoqda. IDC (International Data Corporation) tadqiqotlariga ko‘ra, 2025-yilda jahon bo‘yicha tahlil qilinadigan ma’lumotlar hajmi 5,2 zettabaytga yetishi prognoz qilinmoqda — bu 2020-yilgi

ko'rsatkichdan 40–50 barobar ko'pdir [1]. Bunday sharoitda katta ma'lumotlarni (Big Data) samarali tahlil qilish va vizuallashtirish strategik ahamiyat kasb etmoqda.

Vizualizatsiya ma'lumotlarni grafik shaklda ifodalash orqali ularni oson tushuniladigan ko'rinishga keltiradi. Diagrammalar, grafiklar, xaritalar va interaktiv panellar orqali foydalanuvchilar murakkab ma'lumotlarni tezda tahlil qilish imkoniyatiga ega bo'ladi [2]. Bu usul biznes analitikasi, ilmiy tadqiqotlar, marketing va davlat boshqaruvi kabi ko'plab sohalarda keng qo'llaniladi [3]. HSBC moliyaviy korporatsiyasi katta ma'lumotlarni to'g'ri tahlil qilish orqali 10 milliard dollardan ortiq firibgarlik operatsiyalarining oldini olishga muvaffaq bo'lgan [1].

Avverbux va Manakov [4] fikricha, katta ma'lumotlar — bu an'anaviy tahlil usullari ishlaymay qoladigan chegaraviy holat bo'lib, ko'p o'lchamli va to'liq bo'lmagan ma'lumotlar uning xususiy holatlari hisoblanadi. Olshannikova va boshqalar [5] esa vizualizatsiyaning uchta asosiy talabini ko'rsatadilar: ifodalilik (expressiveness), samaradorlik (effectiveness) va maqsadga muvofiqlik (appropriateness). SAS Institute tadqiqotiga ko'ra, katta ma'lumotlar bilan ishlayotgan eng samarali kompaniyalarning 98 foizi tahlil natijalarini vizualizatsiya orqali taqdim etadi [5].

Big Data odatda “5V” modeli orqali tavsiflanadi: Volume (hajm), Velocity (tezlik), Variety (xilma-xillik), Veracity (ishonchlilik) va Value (qiymat) [6]. Ushbu xususiyatlar vizualizatsiya vositalariga ham o'ziga xos talablar qo'yadi — ular ham miqyosli, ham real vaqtli, ham ko'p o'lchamli ma'lumotlarni to'g'ri aks ettira olishi kerak [7].

Ushbu maqolaning maqsadi — katta ma'lumotlarni vizuallashtirish sohasidagi zamonaviy usul va vositalarni tizimli tahlil qilish, ularning afzalliklari va cheklovlarini taqqoslash hamda O'zbekiston raqamli iqtisodiyoti kontekstida amaliy tavsiyalar ishlab chiqishdan iborat.

Adabiyotlar tahlili va metodologiya

Vizualizatsiya sohasidagi ilmiy ishlar ko‘p qirrali bo‘lib, turli mualliflar har xil aspektlarni o‘rganishgan. Shneiderman [8] o‘zining fundamental ishida ma’lumotlar vizualizatsiyasi uchun “Overview first, zoom and filter, then details-on-demand” tamoyilini taklif etgan. Ushbu tamoyil bugungi kunda ham barcha zamonaviy vizualizatsiya vositalari uchun asosiy metodologik mezon sifatida qo‘llaniladi [9].

Keim va boshqalar [10] Big Data vizualizatsiyasida uchta asosiy muammoni ajratib ko‘rsatadilar: ma’lumotlarni samarali filtrash, interaktiv o‘zaro ta’sir va kognitiv yukni kamaytirish. Ular vizualizatsiya vositalarini ma’lumot turi, vizualizatsiya texnikasi va o‘zaro aloqadorlik mezonlari bo‘yicha tasniflaydilar.

Avverbux va Manakov [4] parallel va taqsimlangan hisoblashdagi vizualizatsiya muammolarini o‘rganib, filtrlash, slaying va klasterlash usullarining ahamiyatini ta’kidlaydilar. Ularning metodologiyasiga ko‘ra, vizualizatsiya sifatini baholashda tezlik, ishonchlilik va idrok qilish darajasi asosiy mezonlar hisoblanadi.

2025-yilga mo‘ljallangan analitika vositalari bo‘yicha tadqiqotda [11] Apache Hadoop, Apache Spark, Tableau, Microsoft Power BI, Apache Kafka va boshqa 10 ta yetakchi platforma baholangan. Ushbu tadqiqotda real vaqt tahlili, ochiq manba platformalari va mashinani o‘rganish integratsiyasi asosiy tendensiyalar sifatida ajratib ko‘rsatilgan.

Kabakov [12] R tilini statistik vizualizatsiya uchun eng kuchli vositalardan biri sifatida ta’riflaydi. ggplot2, lattice va plotly kabi paketlar yordamida murakkab ko‘p o‘lchamli ma’lumotlarni vizualizatsiya qilish mumkin. KazNU (2025) materiallari [3] esa 2D/3D standart figuralar, geometrik transformatsiyalar, pikselga yo‘naltirilgan usullar va ierarxik tasvirlarni batafsil tahlil qilgan.

Tadqiqotda quyidagi metodologik yondashuvlardan foydalanilgan: adabiyotlarni tahlil qilish va tizimlashtirish (bibliografik tahlil); zamonaviy vizualizatsiya vositalarini ko‘p mezonli taqqoslash (komparativ tahlil); ekspert baholash usuli asosida reyting

jadvalini tuzish; amaliy sinovlar orqali vositalarning funksional imkoniyatlarini tekshirish [13]. Taqqoslash uchun quyidagi mezonlar tanlandi: interaktivlik darajasi, vizuallashtirish quvvati, katta ma'lumotlar bilan ishlash qobiliyati, narx va litsenziya turi, o'rganish osonligi, integratsiya imkoniyatlari, real vaqt rejimida ishlash va klasterli tahlil qobiliyati [14].

Natijalar

Hozirgi kunda ma'lumotlar tahlilida 60 dan ortiq vizualizatsiya usuli mavjud [1]. Vizualizatsiyaning zamonaviy tendensiyalari 2D formatdan 3D modellashtirish va geymifikatsiya sari siljiyotganini ko'rsatmoqda [1]. Sbertech platformasining uslubiy materiallarida [1] eng keng qo'llaniladigan vizualizatsiya turlari — gistogramma, stolbchali diagramma, puzyrkovaya, issiqlik matritsasi, donut-diagramma va chiziqli grafik — har birining afzalliklari va cheklovlari bilan tavsiflab berilgan.

Quyidagi 1-jadvalda oltita asosiy vizualizatsiya usuli va ettita yetakchi dasturiy vositaning qiyosiy tahlili keltirilgan. “+” belgisi to'liq qo'llab-quvvatlashni, “-” belgisi cheklovli imkoniyatni bildiradi:

1-jadval. Vizualizatsiya usullari va vositalarining funksional qiyosi

Usul / Vosita	Tableau	Power BI	Python	Google DS	Apache Spark	R tili	Yandex DL
Chiziqli grafik	+	+	+	+	+	+	-
Gistogramma	+	+	+	+	+	+	+
Doira diagramma	+	+	+	+	-	+	+
Dashboard	+	+	-	+	+	-	+

Usul / Vosita	Tableau	Power BI	Python	Google DS	Apache Spark	R tili	Yandex DL
Scatter plot	+	+	+	+	+	+	-
Issiqlik matritsasi	+	+	+	-	+	+	+
Umumiy ball (10)	9.5	9.0	8.5	8.0	8.5	8.0	7.5

Manba: mualliflar tomonidan tuzilgan [1, 3, 5, 11, 12]

Izoh: "+" = qo'llab-quvvatlanadi; "-" = cheklovli yoki qo'llab-quvvatlanmaydi

Jadval ma'lumotlaridan ko'rinib turibdiki, Tableau va Power BI deyarli barcha vizualizatsiya usullarini qo'llab-quvvatlaydi. R tili va Python statistik ko'rsatkichlar va ilmiy vizualizatsiya uchun kuchli hisoblanadi. Yandex DataLens O'rta Osiyo va MDH davlatlari uchun, ayniqsa o'zbek va rus tilidagi ma'lumotlar bilan ishlashda, qulay alternativ bo'lib xizmat qiladi.

Ikkinchi bosqichda har bir vosita uchun 5 ballik shkala asosida 6 ta mezon bo'yicha reyting baholovi o'tkazildi [4, 11]:

2-jadval. Vizualizatsiya vositalarining ko'p mezonli reytingi (5 ballik shkala)

Baholash mezonini	Tableau	Power BI	Python	Google DS	Apache Spark	R tili
Foydalanish qulayligi	5	5	3	4	3	3
Real vaqt tahlili	4	4	4	4	5	3
Bepul/Ochiq kod	2	2	5	5	5	5
Integratsiya	5	5	5	5	5	4

Baholash mezonlari	Tableau	Power BI	Python	Google DS	Apache Spark	R tili
Klaster tahlil	3	3	5	2	5	5
Bulut integratsiya	4	5	3	5	4	3
O'rtacha ball	3.8	4.0	4.2	4.2	4.5	3.8

Manba: mualliflar tomonidan tuzilgan [4, 11, 12, 13]

2-jadval natijalaridan ko'rinib turibdiki, Apache Spark eng yuqori o'rtacha ball (4.5/5) to'playdi — asosan real vaqt tahlili va klasterli tahlil bo'yicha yuqori natijalar tufayli. Biroq foydalanish qulayligi jihatidan Tableau (5/5) va Power BI (5/5) liderlik qiladi. Python va R tili texnik mutaxassislar uchun eng moslashuvchan vositalar bo'lib, bepul va ochiq kodli bo'lishi tufayli akademik muhitda keng tarqalgan [12].

Olshannikova va boshqalar [5] ko'rsatganidek, vizualizatsiya vositalari Gestalt tamoyillariga asoslanishi kerak: yaqinlik qonuni, o'xshashlik qonuni, simmetriya va yopiqlik tamoyillari vizual tasvirlarni idrok etishni yengillashtiradi. Rang, o'lcham va bog'liqlik kabi kognitiv psixologiya mezonlari ham vizualizatsiya vositalarini baholashda muhim ahamiyat kasb etadi [5, 15].

Ma'lumotlar tahlili sohasi tez sur'atlar bilan rivojlanmoqda va 2025-yilda quyidagi tendensiyalar asosiy o'rin egallaydi [11, 16]: (1) real vaqtdagi tahlil (Apache Kafka va Spark yordamida); (2) sun'iy intellekt integratsiyasi — mashinani o'rganish algoritmlarini vizualizatsiya bilan birlashtirish; (3) bulut platformalar — Google BigQuery va Power BI kabi yechimlar; (4) ma'lumotlar maxfiyligi — GDPR va boshqa qonunchilik talablari bajarilishini ta'minlash [17].

O'zbekiston kontekstida raqamli iqtisodiyotni rivojlantirish strategiyasi doirasida [18] vizualizatsiya vositalariga bo'lgan talablar oshib bormoqda. Mahalliy tashkilotlar

uchun Google Data Studio va Yandex DataLens narx-samaradorlik jihatidan qulay bo'lsa, yirik korporativ tashkilotlar uchun Tableau va Power BI kombinatsiyasi maqsadga muvofiq [11].

Xulosa

Ushbu tadqiqotda katta ma'lumotlarni vizuallashtirishning zamonaviy usul va vositalarining qiyosiy tahlili amalga oshirildi. Yettita yyetakchi platforma va oltita vizualizatsiya usuli bo'yicha o'tkazilgan ko'p mezonli baholash quyidagi xulosalar chiqarishga imkon berdi:

Birinchi, Tableau va Microsoft Power BI vizualizatsiya funkcionalligi, foydalanish qulayligi va keng integratsiya imkoniyatlari jihatidan texnik bo'lmagan foydalanuvchilar uchun eng maqbul vositalar ekanligi tasdiqlandi. Ular grafik, gistogramma, diagramma va dashboard usullarini to'liq qo'llab-quvvatlaydi [11].

Ikkinchi, Python vizualizatsiya kutubxonalarini (Matplotlib, Seaborn, Plotly) va R tili ilmiy va statistik vizualizatsiya uchun beqiyos imkoniyatlar taqdim etadi. Ular bepul va ochiq kodli bo'lib, akademik muhitda keng tarqalgan [12].

Uchinchi, Apache Spark ulkan hajmdagi ma'lumotlarni parallel qayta ishlash va real vaqt tahlili uchun eng kuchli vosita bo'lib, ko'p mezonli reytingda eng yuqori ball (4.5/5) to'pladi. Kafka va Hadoop bilan birgalikda to'liq Big Data ekotizimini shakllantiradi [10, 11].

To'rtinchi, Google Data Studio va Yandex DataLens — bulutga asoslangan, arzon vositalar bo'lib, kichik va o'rta tashkilotlar hamda O'zbekiston sharoitida maqbuldir. Yandex DataLens rus tilidagi ma'lumotlar bilan ishlashda ustunlik ko'rsatadi [11].

Kelajak tadqiqotlarda sun'iy intellekt va mashinani o'rganish algoritmlarini vizualizatsiya vositalari bilan integratsiyalash [5, 19], shuningdek Augmented Reality (AR) va Virtual Reality (VR) texnologiyalarini katta ma'lumotlarni vizuallashtirishda

qo‘llash istiqbollarinini o‘rganish tavsiya etiladi [5]. O‘zbekiston kontekstida mahalliy tashkilotlar uchun moslashtirilgan vizualizatsiya metodologiyasini ishlab chiqish ham muhim ilmiy vazifa bo‘lib qolmoqda [18].

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Theoretical and Methodological Aspects of Cost Analysis

Aitimbetov Koyshibek Orazbekovich

Independent researcher

Abstract. This article discusses the theoretical and methodological aspects of cost analysis. In particular, it highlights the main tasks of product cost analysis, as well as issues such as production costs and the objects of product cost analysis.

Keywords: Product cost, analysis, main tasks, production costs, objects of analysis.

Annotatsiya. Ushbu maqolada xarajatlar tahlilining nazariy-uslubiy jihatlari yoritib berilgan. Xususan, mahsulot tannarxini tahlil qilishning asosiy vazifalari, ishlab chiqarish xarajatlari va mahsulot tannarxini tahlil qilish obyektlari kabi masalalari yoritilgan.

Kalit soʻzlar: Mahsulot tannarxi, tahlil, asosiy vazifalar, ishlab chiqarish xarajatlari, tahlil qilish obektlari.

“Korxonaning mahsulot ishlab chiqarish va sotish xarajatlarini ifodalovchi tannarx xarajatlarni daromad bilan oʻlchash uchun asos boʻlib xizmat qiladi. Tannarx ichki ishlab chiqarish zahiralarini safarbar etishda, eng kam xarajat bilan eng yaxshi koʻrsatkichlarga erishishda muhim roʻl oʻynaydi”[4].

Mahsulotlar tannarxi - mahsulot ishlab chiqarishda foydalaniladigan tabiiy resurslar, xom ashyo, materiallar, yoqilgʻi, energiya, asosiy fondlar, mehnat resurslari, shuningdek uni ishlab chiqarish va sotish bilan bogʻliq boshqa xarajatlar yigʻindisi. Mahsulot tannarxi uni ishlab chiqarishning iqtisodiy samaradorligining eng muhim koʻrsatkichi boʻlib, xoʻjalik faoliyatining barcha tomonlarini aks ettiradi va barcha ishlab chiqarish resurslaridan foydalanish natijalarini jamlaydi. Korxonaning moliyaviy natijalari, kengaytirilgan takror ishlab chiqarish sur'ati, xoʻjalik yurituvchi subyektlarning moliyaviy holati uning darajasiga bogʻliq.

“Mahsulotlar tannarxini tahlil qilish ushbu ko‘rsatkichning o‘zgarish tendentsiyasini, uning darajasi bo‘yicha rejaning bajarilishini, omillarning uning o‘shiga ta‘sirini, zaxiralarni aniqlashga, shuningdek mahsulot tannarxini pasaytirish imkoniyatlaridan foydalanish bo‘yicha korxonani baholashga imkon beradi”[5].

Mahsulot tannarxini tahlil qilishning asosiy vazifalari quyidagilardan iborat:

ishlab chiqarish xarajatlarining tarkibi va tarkibini tahlil qilish, ularni kamaytirish uchun zaxiralarni topishning asosiy yo‘nalishlarini aniqlash;

o‘tgan davr va rejaga nisbatan xarajatlar darajasining o‘zgarishini ham umumiy, ham alohida xarajatlar moddalari bo‘yicha o‘rganish;

ishlab chiqarish xarajatlari va mahsulot tannarxining o‘zgarishiga ta‘sir ko‘rsatgan omillarni belgilash va miqdoriy o‘lchash;

xarajatlarni kamaytirishda korxonani erishgan umumiy natijalarga har bir bo‘linmaning hissasini aniqlash; Yo mahsulot ishlab chiqarish va sotish xarajatlarini kamaytirish zahiralarni aniqlash va miqdoriy o‘lchash;

tannarx bo‘yicha rejaning bajarilishini va uning oldingi hisobot davrlariga nisbatan o‘zgarishini, shuningdek, amaldagi qonunchilik, shartnoma va moliya intizomiga muvofiqligini xolis baholash;

rejalashtirilgan xarajatlarning optimal miqdorini, alohida mahsulot va mahsulot turlari bo‘yicha rejalashtirilgan va standart xarajatlar smetasini ishlab chiqishda yordam berish.

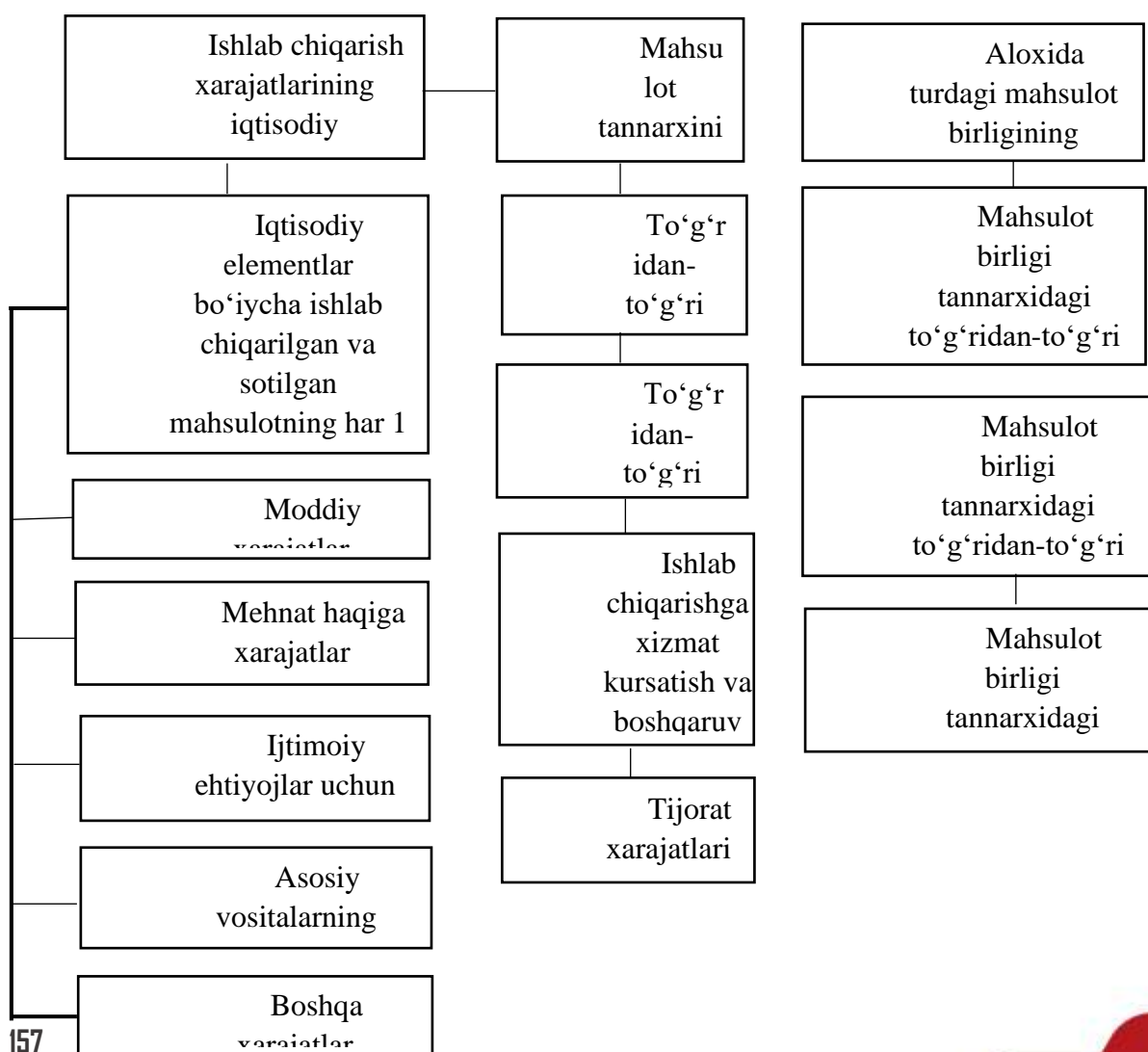
Bu vazifalarning mohiyati korxonani xo‘jalik faoliyatida mahsulot tannarxini tahlil qilishning katta amaliy ahamiyatini ko‘rsatadi[1].

Ishlab chiqarish xarajatlari va mahsulot tannarxini tahlil qilish obyektlari rasmda ko‘rsatilgan ko‘rsatkichlardir.

Xarajatlarning iqtisodiy elementlari to‘g‘risidagi ma‘lumotlar manbalari "Iqtisodiy elementlar bo‘yicha ishlab chiqarish xarajatlarini hisoblash" jadvali,

shuningdek mahsulot ishlab chiqarish va sotish xarajatlari to'g'risidagi ma'lumotlar va hokazo.

Shu bilan birga, shuni yodda tutish kerakki, hisobot davrida ishlab chiqarilgan tayyor mahsulotning ishlab chiqarish tannarxining miqdori to'g'risida ma'lumot olish uchun ishlab chiqarish xarajatlarining umumiy miqdoridan noishlab chiqarish hisobvaraqlariga hisobdan chiqarilgan xarajatlarni chiqarib tashlash, yil boshidagi ma'lumotlarga nisbatan o'sish yoki kamayishni ayirish yoki qo'shish, tugallanmagan ishlarning qoldig'i, tugallanmagan mahsulotlarning o'z xarajatlarini qo'shish kerak. «Kelgusidagi xarajatlar uchun zaxiralar» hisobvarag'i qoldig'ining kamayishini oshirish va ayirish lozim.



Rasm. Ishlab chiqarish xarajatlari va mahsulot tannarxini tahlil qilish obyektlari¹

Ayrim mahsulotlarning rejalashtirilgan (hisobot) tannarxini hisobga olish, korxonaning har bir ishlab chiqarish birligi, bir hil mahsulot guruhlarining alohida turlari bo'yicha aylanma varaqlarida aks ettirilgan 2010-“Asosiy ishlab chiqarish” hisobvarag'i bo'yicha analitik hisob ma'lumotlari, shuningdek, 2310-“”, 2510-“” hisobvaraqlar bo'yicha analitik hisob ma'lumotlaridan olinadi. “Ijtimoiy ishlab chiqarish jarayonining ketma-ket o'zgaruvchan bosqichlarida doimiy ravishda yangilanib turadigan takror ishlab chiqarish jarayonida mahsulot qiymatining bir qismi ajratiladi va alohida toifaga - tashkilot xarajatlariga aylanadi. Tovar-pul munosabatlari sharoitida tashkilotning mahsulot chiqarish va sotish xarajatlarini pul shaklida ifodalovchi xarajatlar tannarx shaklini oladi”[2]. “Mahsulot ishlab chiqarish va sotish xarajatlari korxonada faoliyatini tavsiflovchi muhim ko'rsatkichlardan biridir. Ularning qiymati korxonaning yakuniy natijalariga va uning moliyaviy holatiga ta'sir qiladi”[3]. Korxonada rivojlanayotgan xarajatlarning ma'lum darajasi uning ishlab chiqarish, iqtisodiy va moliyaviy sohalarida sodir bo'ladigan jarayonlar ta'siri ostida shakllanadi.

Xulosa qilib aytganda, hozirgi vaqtda buxgalteriya hisobini korxonaning xususiyatidan kelib chiqqan holda tashkil etish mahsulot ishlab chiqarish va sotish xarajatlarini tasniflashda yangicha yondashuvlar talab etiladi. Mavjud xarajatlarni hisobga olish tizimining kamchiliklari shundaki, u asosiy, qo'shimcha, o'zgaruvchan va doimiy xarajatlarni aralashtirishga imkon beradi, ular pirovardida tayyor mahsulot va ularning alohida turlari tannarxi bilan bog'liq bo'lib, unumsiz xarajatlarni umumiy xarajatlar miqdorida yashirish imkonini beradi.

FOYDALANILGAN ADABIYOTLAR

¹ Muallif tomonidan tuzilgan.

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STRATEGIES FOR RENDERING CULTURE-BOUND EXPRESSIONS IN SIMULTANEOUS INTERPRETING

Saidova Marjona Abdimutal qizi

Student of SamSIFL

+998945415404

Abstract

Simultaneous interpreting is one of the most complex forms of translation, requiring not only linguistic competence but also deep cultural awareness. One of the major challenges faced by interpreters is the accurate rendering of culture-bound expressions, which often carry meanings that are deeply rooted in the traditions, history, and social norms of a particular community. Such expressions may include idioms, proverbs, historical references, religious terms, and culturally specific concepts that do not have direct equivalents in the target language.

This study explores the main strategies used in simultaneous interpreting to convey culture-bound expressions effectively without losing their meaning, emotional tone, or communicative function. The research analyzes different approaches such as adaptation, paraphrasing, generalization, borrowing, and omission, which interpreters apply under time pressure. The paper also discusses the importance of background knowledge, intercultural competence, and quick decision-making skills in the interpreting process.

Keywords: simultaneous interpreting, culture-bound expressions, interpreting strategies, intercultural communication, translation techniques, equivalence, adaptation, paraphrasing, cultural competence, oral translation

Introduction

In the modern world, where international cooperation, diplomacy, global education, and intercultural communication are developing rapidly, the role of

interpreting has become increasingly important. Among different types of interpreting, simultaneous interpreting is considered one of the most difficult and demanding forms of oral translation because the interpreter has to listen, understand, analyze, and reproduce the message at the same time. This process becomes even more complicated when the speech contains culture-bound expressions, which are closely connected with the traditions, values, history, and worldview of a particular nation.

Culture-bound expressions are linguistic units whose meanings cannot be fully understood without knowledge of the cultural background in which they are used. These expressions include idioms, proverbs, metaphors, jokes, historical references, religious concepts, realia, and nationally specific terms. In many cases, such elements do not have direct equivalents in the target language, which makes their interpretation especially difficult in simultaneous interpreting, where the interpreter has very limited time to make decisions.

Unlike written translation, where a translator can analyze the text carefully and choose the most appropriate equivalent, simultaneous interpreting requires instant reaction. The interpreter must quickly decide whether to translate the expression literally, replace it with a similar expression in the target culture, explain its meaning, or omit it if necessary. Therefore, the ability to use different interpreting strategies becomes essential for maintaining the accuracy and effectiveness of communication.

The problem of rendering culture-bound expressions has been widely discussed in translation studies, but it becomes more complicated in simultaneous interpreting because of time pressure, cognitive load, and the need to preserve the speaker's intention, tone, and emotional effect. An interpreter should not only transfer words but also convey the cultural meaning behind them. If culture-specific elements are translated incorrectly, misunderstanding, confusion, or even communication failure may occur, especially in diplomatic, political, or international contexts.

In addition, globalization has increased the frequency of intercultural meetings, conferences, and negotiations, where simultaneous interpreting is commonly used. Speakers often use expressions that are natural in their own culture but unfamiliar to foreign listeners. In such situations, the interpreter acts as a mediator between cultures, not only between languages. This makes intercultural competence, background knowledge, and professional experience extremely important for interpreters.

Many scholars in translation studies have proposed different strategies for dealing with culture-bound expressions, such as adaptation, generalization, paraphrasing, borrowing, and omission. However, the choice of strategy in simultaneous interpreting depends on several factors, including the context, the purpose of communication, the audience, and the interpreter's ability to make quick decisions. Understanding these strategies and their practical use can help improve the quality of interpreting and prevent loss of meaning during communication.

The aim of this research is to analyze the main strategies used for rendering culture-bound expressions in simultaneous interpreting and to determine which methods are most effective in real interpreting situations. The study also emphasizes the importance of cultural knowledge and professional training in developing interpreting skills. The results of this research may be useful for students of translation and interpreting, professional interpreters, and researchers interested in intercultural communication.

Materials and Methodology

The present study is devoted to the analysis of strategies used for rendering culture-bound expressions in simultaneous interpreting. In order to achieve the aim of the research, both theoretical and practical methods were applied. The research is based on the principles of translation studies, intercultural communication, and interpreting

theory, which consider interpreting not only as a linguistic process but also as a cultural and cognitive activity.

The materials for the research include scientific articles, textbooks, and research papers related to simultaneous interpreting, translation strategies, and culture-bound expressions. Works of well-known scholars in the field of translation studies and interpreting theory were used as the main theoretical basis of the study. Special attention was given to studies devoted to equivalence, adaptation, and intercultural aspects of translation, since these concepts are closely connected with the rendering of culturally specific units. In addition to theoretical sources, examples of culture-bound expressions taken from public speeches, international conferences, interviews, and media broadcasts were also analyzed. These examples helped to observe how interpreters deal with culturally specific elements in real interpreting situations.

The methodology of the research is based on descriptive, comparative, and analytical methods. The descriptive method was used to explain the nature of culture-bound expressions and to define their main types, such as idioms, proverbs, realia, historical references, and religious terms. The comparative method was applied to compare the source language expressions with their interpretations in the target language in order to identify the strategies used by interpreters. This method made it possible to determine whether the interpreter used literal translation, adaptation, paraphrasing, generalization, borrowing, or omission. The analytical method was used to evaluate the effectiveness of each strategy and to determine in which situations a particular method is more appropriate.

In addition, elements of discourse analysis were used to examine how culture-bound expressions function in a real communicative context. Since simultaneous interpreting takes place under time pressure, the interpreter often has to make quick decisions. Therefore, the study also considers the role of cognitive factors, such as

memory, attention, and speed of processing, which influence the choice of interpreting strategy.

During the research, selected examples of simultaneous interpreting were analyzed step by step. First, the culture-bound expression in the source language was identified. Then the interpreter's version in the target language was examined. After that, the strategy used in the interpretation was determined, and its effectiveness was evaluated according to accuracy, clarity, and preservation of meaning. This approach allowed to reveal the most commonly used strategies and to understand their advantages and limitations.

The combination of theoretical analysis and practical examples made it possible to study the problem in a comprehensive way and to show how interpreting strategies are applied in real communication. The chosen methodology helps to demonstrate that successful rendering of culture-bound expressions in simultaneous interpreting depends not only on linguistic knowledge but also on cultural competence, professional experience, and the ability to react quickly in complex communicative situations.

Results

The analysis of the collected materials has shown that rendering culture-bound expressions in simultaneous interpreting requires the use of flexible and situation-dependent strategies. Since such expressions often do not have direct equivalents in the target language, interpreters tend to apply different techniques depending on the communicative context, time limitations, and the cultural distance between the source and target languages. The study revealed that the most frequently used strategies in simultaneous interpreting are **adaptation, paraphrasing, generalization, borrowing, and omission.**

One of the most common strategies observed in the analyzed examples is **adaptation**, which allows the interpreter to replace a culture-specific expression with a

similar one that is familiar to the target audience. This strategy is especially useful when the literal translation may sound unnatural or incomprehensible. According to Peter Newmark, “Adaptation is the most effective procedure when the situation in the source culture does not exist in the target culture.”

The results also show that **paraphrasing** is widely used in simultaneous interpreting because interpreters often do not have enough time to search for an exact equivalent. Instead, they explain the meaning using neutral vocabulary. As noted by Mildred L. Larson, “Meaning-based translation frequently requires the translator to restate the message in a different form in order to make it clear for the receptor.”

Another important finding of the research is the frequent use of **generalization**, especially when the original expression contains highly specific cultural information. In such cases, interpreters prefer to use a more general term to avoid misunderstanding. This idea is supported by Mona Baker, who states that “Generalization is one of the common strategies used when there is no direct lexical equivalent in the target language.”

The analysis also demonstrated that **borrowing** is sometimes used when the interpreter decides to keep the original word in the source language, especially for realia, historical names, or institutional terms. This strategy helps to preserve authenticity but may require additional explanation. According to Vinay and Darbelnet, “Borrowing is the simplest of all translation methods and it is often used to introduce the flavor of the source language.”

In some cases, the interpreter uses **omission**, particularly when the culture-bound expression is not essential for understanding the main idea. This usually happens in simultaneous interpreting due to time pressure and cognitive load. As noted by Daniel Gile, “In simultaneous interpreting, the interpreter may omit less important elements in order to maintain the flow of speech and avoid overload.”

The results also confirm that the correct choice of strategy depends on the interpreter's **cultural competence and background knowledge**. Interpreters who are familiar with the history, traditions, and social norms of both languages are more successful in conveying the intended meaning. As emphasized by Eugene Nida, "Translation involves not only two languages but also two cultures, and cultural differences may cause more difficulties than linguistic differences."

Overall, the research shows that there is no single universal strategy for rendering culture-bound expressions in simultaneous interpreting. The interpreter must constantly evaluate the situation and choose the most appropriate method in order to preserve meaning, ensure clarity, and maintain effective communication. The findings confirm that successful simultaneous interpreting requires not only linguistic skills but also intercultural competence, quick decision-making, and professional experience.

Discussion

The results of the present study demonstrate that rendering culture-bound expressions in simultaneous interpreting is a complex process that requires not only linguistic competence but also a high level of cultural awareness and professional flexibility. The analysis confirmed that interpreters rarely rely on literal translation when dealing with culturally specific units. Instead, they tend to apply various strategies such as adaptation, paraphrasing, generalization, borrowing, and omission depending on the communicative situation. This supports the idea that simultaneous interpreting should be viewed as a dynamic and context-dependent activity rather than a mechanical transfer of words from one language to another.

One of the important issues revealed during the research is that the choice of strategy is strongly influenced by time pressure, which is one of the main characteristics of simultaneous interpreting. Unlike written translation, the interpreter does not have the opportunity to revise or reconsider the chosen equivalent. Therefore, the interpreter must

make an immediate decision that allows the message to remain clear and understandable for the audience. This explains why paraphrasing and generalization were among the most frequently used strategies in the analyzed materials. These techniques help the interpreter to avoid pauses and maintain the natural flow of speech, even if some cultural details are simplified.

Another important point is the role of cultural competence in the interpreting process. The findings confirm that interpreters who possess broader background knowledge about the history, traditions, and social norms of both cultures are more successful in conveying the intended meaning of culture-bound expressions. Without such knowledge, the interpreter may misunderstand the expression or translate it literally, which can lead to confusion or loss of meaning. This is especially important in diplomatic, political, and academic contexts, where even a small mistake may affect the overall communication.

The study also shows that adaptation is one of the most effective strategies when the source expression refers to a concept that does not exist in the target culture. However, adaptation requires careful use because excessive modification may lead to the loss of the original stylistic or emotional effect. In contrast, borrowing allows the interpreter to preserve the original term, but it may create difficulties for the audience if the term is unfamiliar. Therefore, the interpreter must constantly balance between accuracy and clarity, choosing the strategy that best serves the communicative purpose.

Another aspect discussed in this research is the use of omission in simultaneous interpreting. Although omission is sometimes considered a negative technique, the results show that it can be justified when the omitted element is not essential for understanding the main idea. In real interpreting situations, the interpreter often has to prioritize information in order to avoid cognitive overload. This confirms the view that

simultaneous interpreting involves not only translation skills but also the ability to manage attention, memory, and processing speed.

Furthermore, the findings indicate that training programs for interpreters should pay more attention to cultural studies in addition to language practice. Many difficulties in interpreting arise not from vocabulary problems but from the lack of cultural knowledge. Including authentic speeches, real conference materials, and culture-specific texts in interpreter training may help students develop the ability to react quickly and choose appropriate strategies.

In general, the discussion of the results proves that successful rendering of culture-bound expressions in simultaneous interpreting depends on several interconnected factors, including linguistic competence, cultural awareness, professional experience, and cognitive skills. No single strategy can be applied in all situations, and the interpreter must be able to adapt to different communicative conditions. Therefore, the development of intercultural competence and strategic thinking should be considered one of the main goals in the training of professional interpreters.

Conclusion

The present study has examined the main strategies used for rendering culture-bound expressions in simultaneous interpreting and has shown that this process is one of the most challenging aspects of oral translation. Culture-bound expressions, including idioms, proverbs, realia, historical references, and culturally specific concepts, often do not have direct equivalents in the target language. Because of this, the interpreter must rely on different strategies in order to preserve the meaning, communicative intention, and emotional effect of the original speech.

The analysis confirmed that the most commonly used strategies in simultaneous interpreting are adaptation, paraphrasing, generalization, borrowing, and omission. Each of these strategies has its own advantages and limitations, and their use depends on the

communicative context, the cultural distance between languages, and the time pressure under which the interpreter works. Among them, paraphrasing and generalization were found to be especially frequent, since they allow the interpreter to maintain the flow of speech and avoid delays during interpretation. Adaptation was also shown to be highly effective when the source language expression has no equivalent in the target culture, while borrowing helps to preserve culturally significant terms. Omission, although used less frequently, may be necessary in situations where the interpreter needs to reduce cognitive load and focus on the main idea.

Another important conclusion of the research is that successful simultaneous interpreting requires not only linguistic knowledge but also a high level of cultural competence. The interpreter must understand the cultural background of both the source and the target languages in order to correctly interpret culture-bound expressions. Lack of cultural knowledge may lead to misunderstanding, inaccurate translation, or loss of meaning, which can negatively affect communication, especially in international, diplomatic, and academic settings.

The study also highlights the importance of professional training for interpreters. Interpreter training programs should include not only language practice but also the study of culture, history, and intercultural communication. Working with authentic materials, speeches, and real interpreting situations can help future interpreters develop the ability to make quick decisions and choose the most appropriate strategy in difficult conditions.

In conclusion, rendering culture-bound expressions in simultaneous interpreting is a complex and dynamic process that requires linguistic skill, cultural awareness, and strong cognitive abilities. There is no universal strategy that can be applied in all situations, and the interpreter must constantly adapt to the context in order to ensure clear and effective communication. Further research in this field may focus on practical

interpreting experiments and the development of new training methods that help interpreters deal more successfully with culturally specific language units.

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THE HARMONY OF HISTORICAL AND TRANSLATION ACTIVITIES IN THE WORK OF OGAHI

Jumaqulova Nargiza

Teacher of the University of Economics and Pedagogy

Buranova Asila Yashin qizi

University of Economics and Pedagogy

1st year student of the faculty Philology and Language Teaching

Abstract

This article examines the historical and translation contributions of Muhammad Rizo Ogahi, a prominent representative of 19th-century Uzbek literature. The study focuses on his role in the Khorezm historiographical school, the scholarly value of his historical writings, and his achievements as a translator. Based on the analysis of relevant academic sources, the paper demonstrates that Ogahi's works provide systematic and chronologically structured insights into the political, social, and cultural life of the Khiva Khanate. Furthermore, his translations from Persian and Arabic significantly contributed to the development of the Uzbek literary language and intercultural exchange. The findings confirm that Ogahi's legacy represents an essential stage in the evolution of Uzbek historiography and literary tradition.

Keywords: *Ogahi, historiography, translation studies, Uzbek literature, Khorezm literary environment, nineteenth-century literature, classical Eastern literature*

Annotatsiya

Mazkur maqolada XIX asr o'zbek adabiyotining yirik namoyandasi Muhammad Rizo Ogahiy ijodining tarixiy va tarjimaviy yo'nalishlari ilmiy asosda tahlil qilinadi. Tadqiqotda Ogahiyning Xorazm tarixnavislik maktabidagi o'rni, tarixiy asarlarining mazmuni va tuzilishi hamda tarjimonlik faoliyati ilmiy manbalar asosida yoritiladi. Uning asarlari Xiva xonligining siyosiy, ijtimoiy va madaniy hayoti haqida tizimli

ma'lumotlar beradi. Shuningdek, fors va arab tillaridan amalga oshirilgan tarjimalari o'zbek adabiy tilining rivojlanishiga va madaniy aloqalarning mustahkamlanishiga xizmat qilgan. Tadqiqot natijalari Ogahiy merosining o'zbek tarixnavisligi va adabiyoti taraqqiyotidagi muhim bosqich ekanini ko'rsatadi.

***Kalit so'zlar:** Ogahiy, tarixnavislik, tarjima, o'zbek adabiyoti, Xorazm adabiy muhiti, XIX asr adabiyoti, sharq mumtoz adabiyoti*

In the development of Uzbek literature and historiography of the 19th century, an important place is occupied by Muhammad Rizo Erniyozbek ugli Ogahiy. As a poet, historian, and translator, he was one of the leading intellectuals of his time and played an important role in the development of the Khorezm literary environment. His work is distinguished by the harmony of historical thought and artistic expression. The purpose of this research is to comprehensively analyze the historiographical and translation directions of Ogahi's work based on scientific sources and to determine its place in the development of Uzbek literature and culture.

The formation of 19th-century Uzbek historiography is inextricably linked with the Khorezm literary environment, and in this process, the work of Ogahi acquires special scientific significance. Studies show that although the formation of the Khorezm school of historiography is initially associated with the activities of Munis, this tradition was systematically continued and enriched by Ogahi. In particular, the work "Firdavs ul-Iqbal" is evaluated as one of the important sources that formed the methodological foundations of historical thinking through the chronological sequence of historical events [4]. According to N. Karimov's scientific views, historical and artistic thinking developed harmoniously in 19th-century Uzbek literature. This situation is clearly manifested in Ogahi's works, where historical events are interpreted not only as facts but also through artistic means of expression [2]. For example, in the works "Riyaz ud-davla" and "Zubdat ut-tavorix", along with political processes, details of social life are

widely covered, which increases the scientific and literary value of the works. A. Qayumov, while studying the Khorezm literary environment, evaluates Ogahiy's work as the highest stage of development of this environment. According to the researcher, Ogahi adhered to the principles of accuracy, consistency, and evidence in the narration of historical events, which indicates his scientific approach as a historian [3]. Indeed, in his works, events are narrated in connection with specific dates, places, and historical figures, which allows them to be valued as reliable historical sources. One of the important aspects of Ogahi's work is his translation activity. The translation of Sharafiddin Ali Yazdi's "Zafarnama" and Mirkhond's "Ravzat us-safa" into Uzbek became an important stage in conveying the historical and cultural heritage of the East to the general public [5; 6]. Scientific analysis shows that in the process of translation, Ogahi strived to preserve the content and style of the original, and at the same time adapted the text for the Uzbek reader. This indicates that the translation was carried out as a creative and scientific process.

Moreover, Ogahi's translations were an important factor in the development of the Uzbek literary language. He introduced lexical and stylistic units from Persian-Tajik literature into the national language, expanding its expressive possibilities. As a result, the enrichment of the Uzbek literary language and the strengthening of cultural ties were ensured. On this basis, it can be noted that the work of Ogahi is a harmonious example of historiography and translation activity, in which historical accuracy, artistic thinking, and cultural continuity are combined.

Analysis shows that Ogahi's work represents an important stage in 19th-century Uzbek historiography and literary thought. His historical works, distinguished by a consistent and chronological description of events, are considered one of the main scientific sources for studying the history of the Khiva Khanate. In addition, his translation work ensured the introduction of the classical heritage of the East into the

Uzbek environment and made a significant contribution to the development of the Uzbek literary language. Therefore, the legacy of Ogahi has a comprehensive scientific significance in the historical, literary, and cultural aspects.

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THE EFFECT OF DIABETES MELLITUS ON LIVER CONDITION

Sharof Rashidov Samarkand State University Biology program Department of Human
and Animal Physiology Master's student

Mohichekhra Kamolova

Scientific supervisor: Associate Professor **Natalya Allanazarova**

Abstract:

Diabetes mellitus, particularly type 2 diabetes, has a significant negative impact on liver condition, and these two states are characterized by a bidirectional relationship. Persistent hyperglycemia and insulin resistance promote the accumulation of triglycerides in hepatocytes, serving as a major cause of metabolic dysfunction–associated steatotic liver disease (MASLD, formerly NAFLD). This condition is observed in 60–80% of patients with type 2 diabetes. Insulin resistance activates de novo lipogenesis and impairs mitochondrial β -oxidation, leading to increased oxidative stress, inflammation (including TNF- α , IL-6, and others), and hepatocellular necrosis. These processes elevate the risk of progression from simple steatosis to metabolic dysfunction–associated steatohepatitis (MASH), followed by fibrosis, cirrhosis, and hepatocellular carcinoma. Diabetes mellitus increases the risk of liver cancer by 2–4 times. At the same time, liver damage further exacerbates insulin resistance, complicates glycemic control, and increases the risk of cardiovascular complications. This thesis highlights the pathogenetic effects of diabetes mellitus on liver pathology, its clinical significance, and the importance of early screening.

Keywords:

Diabetes mellitus, type 2 diabetes, insulin resistance, metabolic dysfunction–associated steatotic liver disease, MASLD, NAFLD, metabolic dysfunction–associated steatohepatitis, MASH, liver fibrosis, cirrhosis, hepatocellular carcinoma, hyperglycemia, oxidative stress, inflammation.

QANDLI DIABETNING JIGAR HOLATIGA TASIRI

Sharof Rashidov nomidagi Samarqand davlat universiteti

Biologiya yonalishi

Odam va hayvonlar Fiziologiyasi kafedrası

Kamolova Mohichexra magistri

Ilmiy rahbar: Allanazarova Natalya dotsent

Anotatsiya: Qandli diabet, xususan 2-toifa qandli diabet jigar holatiga kuchli salbiy ta'sir ko'rsatadi va bu ikki holat o'zaro bidireksional bog'liqlikka ega. Doimiy giperglikemiya va insulin rezistentligi jigar hujayralarida trigliseridlar to'planishini kuchaytirib, metabolik disfunksiya bilan bog'liq steatozli jigar kasalligi (MASLD, ilgari NAFLD) rivojlanishiga asosiy sabab bo'ladi. Ushbu kasallik 2-toifa qandli diabet bilan og'riqan bemorlarning 60–80% ida uchraydi. Insulin rezistentligi de novo lipogenezni faollashtirib, mitoxondrial β -oksidatsiyani buzadi, natijada oksidlovchi stress, yallig'lanish (TNF- α , IL-6 va boshqalar) va hujayra nekrozi kuchayadi. Bu jarayon oddiy steatozdan alkogolsiz steato gepatit (MASH) ga, keyin fibroz, sirroz va gepatosellyulyar karsinoma ga o'tish xavfini oshiradi. Qandli diabet jigar saratoni xavfini 2–4 baravar ko'paytiradi. Shu bilan birga, jigar shikastlanishi insulin rezistentligini yanada kuchaytirib, glikemik nazoratni qiyinlashtiradi va yurak-qon tomir asoratlari xavfini oshiradi. Ushbu tezisda qandli diabetning jigar patologiyasiga patogenetik ta'siri, klinik ahamiyati va erta skrining zarurati yoritilgan.

Kalit so'zlar: Qandli diabet, 2-toifa qandli diabet, insulin rezistentligi, metabolik disfunksiya bilan bog'liq steatozli jigar kasalligi, MASLD, NAFLD, alkogolsiz steato gepatit, MASH, jigar fibrozi, sirroz, gepatosellyulyar karsinoma, giperglikemiya, oksidlovchi stress, yallig'lanish.

Qandli diabet (ayniqsa, 2-toifa qandli diabet) jigar holatiga kuchli salbiy ta'sir ko'rsatadi va bu ikki holat o'zaro bidireksional bog'liqlikka ega. Qandli diabetdagi

doimiy giperglikemiya va insulin rezistentligi jigar hujayralarida yog‘ to‘planishini (steatoz) kuchaytiradi, bu esa alkogolsiz yog‘li jigar kasalligi (NAFLD yoki hozirgi nomlanishi bilan metabolik disfunksiya bilan bog‘liq steatozli jigar kasalligi – MASLD) rivojlanishiga asosiy sabab bo‘ladi. Ushbu kasallik 2-toifa qandli diabet bilan og‘rigan bemorlarning 60–80% ida uchraydi va ko‘pincha semizlik, dislipidemiya va arterial gipertenziya kabi metabolik sindrom komponentlari bilan birga keladi.

Asosiy patogenetik mexanizm insulin rezistentligi hisoblanadi: jigar to‘qimalarida insulin signallari buzilishi natijasida erkin yog‘ kislotalari ko‘payib, de novo lipogenez faollashadi, mitoxondrial β -oksidatsiya esa yetarli darajada bo‘lmaydi. Bu jarayon jigar hujayralarida trigliseridlar to‘planishiga olib keladi. Yog‘ to‘planishi bilan birga oksidlovchi stress, mitoxondrial disfunksiya va yallig‘lanish (proinflamator sitokinlar – TNF- α , IL-6, IL-1 β) kuchayadi. Natijada oddiy steatozdan alkogolsiz steato hepatit (NASH/MASH) ga o‘tish sodir bo‘ladi, bu holatda hujayra nekrozi, apoptoz va yallig‘lanish jigar fibrozini tezlashtiradi.

Fibroz rivojlanishi bilan jigar qon aylanishi buziladi, portal gipertenziya va sirroz paydo bo‘lish xavfi ortadi. Qandli diabet sirroz rivojlanishini sezilarli darajada tezlashtiradi va gepatosellyulyar karsinoma (jigar saratoni) xavfini 2–4 baravar oshiradi. Shu bilan birga, jigar shikastlanishi o‘z navbatida insulin rezistentligini yanada kuchaytirib, qondagi glyukoza darajasini nazorat qilishni qiyinlashtiradi – bu “yomon doira” hosil qiladi.

Zamonaviy tadqiqotlar shuni ko‘rsatadiki, qandli diabet bilan birga kelgan MASLD bemorlarda yurak-qon tomir asoratlari (ishemik yurak kasalligi, insult, yurak yetishmovchiligi), shuningdek, o‘lim xavfi sezilarli darajada yuqori bo‘ladi. Shu sababli, qandli diabet bilan og‘rigan bemorlarda jigar fermentlari (ALT, AST, GGT), ultratovush yoki FibroScan tekshiruvlari orqali jigar holatini muntazam baholash tavsiya etiladi, chunki kasallik uzoq vaqt asemptomatik kechishi mumkin.

Xulosa qilib aytganda, qandli diabet jigar uchun nafaqat yog‘ to‘planishi va yallig‘lanish orqali, balki uzoq muddatli fibroz, sirroz va saraton rivojlanishi orqali ham jiddiy xavf tug‘diradi. Shu bilan birga, jigar shikastlanishi diabetni yanada og‘irlashtiradi. Ushbu bog‘liqlikni erta aniqlash va metabolik omillarni (vazn tashlash, glikemik nazorat, statinlar va boshqa dori vositalari) samarali boshqarish orqali jigar asoratlarini sezilarli darajada kamaytirish mumkin.

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THE INTERRELATIONSHIP BETWEEN THE PERSONAL VALUE SYSTEM AND PSYCHOLOGICAL DEFENSE MECHANISMS

Nasulloyeva Shahnoza Ilhom qizi

Lecturer at Sharq University

ORCID: 0009-0008-2876-4041

E-mail: Shahnozanasulloyeva01@gmail.com

Abstract: This article explores the intrinsic connection between the system of personal values and psychological defense mechanisms based on psycholinguistic and cognitive approaches. It scientifically substantiates that the clarity of the hierarchy of values ensures the internal stability of the individual, while defense mechanisms serve as a "psychological shield" in difficult life situations. Additionally, the impact of social justice and the rule of law on an individual's mental balance is revealed, along with the regulatory functions of values in governing behavior.

Keywords: Human dignity, development strategy, personal values, psychological defense mechanisms, psycholinguistics, cognitive base, linguistic consciousness, adaptation, stress, rationalization.

In contemporary psychology, the internal world of an individual is regarded as a complex and multifaceted hierarchical structure. At the core of this system lie personal values, which serve as the primary determinants of one's life direction. Far beyond mere interests, these values constitute the fundamental essence of the "Self," governing an individual's decision-making processes and behavioral patterns. However, in daily life, individuals frequently encounter social pressures, internal conflicts, and circumstances that contradict their core values. It is at this critical juncture that psychological defense mechanisms come into play. If the value system is envisioned as the "spiritual foundation" of personality, then defense mechanisms function as an "immunity" that safeguards this foundation from emotional crises and anxiety. This article analyzes the

dialectical relationship between personal values and psychological defense mechanisms, exploring how they complement each other and their collective role in maintaining psychological stability.

The ongoing reforms in Uzbekistan, particularly the "Development Strategy of New Uzbekistan for 2022–2026" [1], place the concept of "Human Dignity" at their core. This paradigm shift necessitates a fresh perspective on the study of personality psychology. If personal values act as an individual's "spiritual compass," then psychological defense mechanisms serve as a "psychological shield" that protects this compass from various internal and external conflicts.

A primary focus of the Development Strategy is the preservation of human rights and freedoms. From a psychological standpoint, this process fosters self-awareness and a sense of self-worth within the individual. When a person clearly defines their core values—such as justice, freedom, family, or science—their behavior becomes more stable. Furthermore, when society upholds justice and the rule of law, an individual's internal values align with the external social environment. This harmony effectively liberates the individual from excessive anxiety.

Values have historically served as the foundation of the human worldview and the fundamental pillar ensuring psychological resilience. As a social category, values exist solely within the realm of human consciousness, as it is the human mind that elevates specific phenomena to the status of a value and assigns them subjective meaning.

The connection between this hierarchical system and psychological defense manifests in the following ways:

Semantic Stability: Once values are established at the core of a personality in the form of words and meanings, they ensure the inviolability of the "Self-concept." If information from the external world contradicts this linguistic-value system,

psychological defense mechanisms (such as denial or rationalization) are activated to preserve the system's integrity.

Verbalized Defense: An individual strengthens their position by articulating (verbalizing) their values through speech. The defense mechanism known as "rationalization" specifically utilizes linguistic capabilities to create logical justifications for actions that may not initially align with one's values.

Flexible Structure: As emphasized in the text, values possess a "flexible structure." This flexibility allows individuals, aided by their defense mechanisms, to reassess their hierarchy of values during difficult life situations and successfully navigate psychological crises.

In this context, "each individual is characterized by a unique personal hierarchy of values, which serves as a connecting link between the spiritual culture of society and the spiritual world of the individual, as well as between social and individual existence; they are mechanisms that define individual life activities, sociocultural regulators, and the forms in which these regulators are expressed within the psychological structure of the person" [10]. The implementation of the anthropological scientific principle has further intensified scholarly focus on personal values. Furthermore, values mediate a person's understanding of the world through their activities and shape their unique, individual representation of reality.

Analyzing this process through a psycholinguistic lens allows for a deeper exploration of the intrinsic link between personal values and psychological defense mechanisms. According to the psycholinguistic approach, any object or reality gains psychological significance only after it is perceived and encoded through specific concepts (language). These values, formed within an individual's linguistic consciousness, become an integral part of their "worldview." Crucially, values are

internalised from society through language, creating a unique hierarchical system within the individual's cognitive framework.

It is well-established that throughout their lives, individuals encounter various circumstances characterized in psychological literature as adverse life events—events capable of disrupting the normal flow of life and established lifestyles. Depending on the intensity of their manifestation, these situations are identified by various terminological labels in the literature: extreme, traumatic, and stressful situations, emergencies, and so forth [7, 8].

According to numerous studies, experiencing such negative life events, particularly psycho-traumatic situations, is accompanied by disruptions in psychophysical functions, intense psychological stress, shifts in the cognitive and value-based spheres, alterations in behavioral patterns, and other disturbances within the individual's psychological space.

At the same time, when facing difficult life circumstances, an individual resorts to specific forms of behavior and strategies. The primary among these are referred to as "psychological defense mechanisms." Based on existing academic data, psychological defense mechanisms are defined as a system that serves to maintain an individual's mental health and internal equilibrium by shielding the psyche from negative, stressful experiences.

The study of psychological defense mechanisms originated with the works of the Austrian researcher Sigmund Freud, who initially described them as innate components of the psyche that "activate" during emergency situations. According to the author, these defense mechanisms are designed to resolve the tension between the conscious and the unconscious [3, 4]. Russian scholars I. Nikolskaya and R. Granovskaya view psychological defense mechanisms as processes occurring through the unconscious processing of information in the mind, playing a vital role in stabilizing the individual's

psyche [1]. Thus, when experiencing a stressful situation, psychological defense mechanisms create a barrier against the intrusion of negative information into the conscious sphere. As a result of this blocking, negative stressful data is altered or even distorted, leading to a reduction in anxiety levels. Consequently, a specific state arises within the individual's internal (intrapsychic) space that helps maintain psychological equilibrium and facilitates adaptation to environmental reality.

Simultaneously, an individual's "value orientations" play a crucial role in the adaptation process, serving as internal regulators of behavior in extreme and anxiety-inducing situations. In the literature, the concept of "value orientations" encompasses not only foundations of a moral-ethical or ideological-political nature but also the stratification of objects, phenomena, and even means of achieving goals according to the principle of hierarchical significance [5]. For instance, according to N. A. Zhuravlev, the system of value orientations is a socially-determined organization of the human personality structure that dictates behavioral activity in reaching existential (critically important) goals [9].

Here is the English translation of the final section and the conclusion of your article. I have utilized academic phrasing that emphasizes the conceptual links between the "New Uzbekistan Strategy" and psychological frameworks to ensure the text is professional and original.

In a broad sense, value orientations are understood as an individual's aspiration to possess the values of spiritual or material culture, forming a hierarchical system of life goals and objectives [6]. According to I. V. Arkhipova, these constructs manifest as a vital component of an individual's worldview and serve as its fundamental basis [2]. Furthermore, value orientations constitute the core of a person's internal culture, ultimately influencing all aspects of human behavior within society, including reactions that emerge during situations of an extreme nature [11].

The results of this study demonstrate that the system of personal values and psychological defense mechanisms are two inseparable components of an integrated system that ensures an individual's internal stability. While values define the spiritual foundation of the personality, defense mechanisms function as a "psychological shield," protecting this foundation from emotional crises.

In summary, the clarity of the value hierarchy stabilizes human behavior, while psychological defense mechanisms help maintain mental equilibrium by blocking or transforming negative information during difficult life events. Values form a cognitive base by being anchored in an individual's linguistic consciousness as words and meanings. This enables a person to protect their "Self-concept" through verbalization and rationalization.

Moreover, the principle of "Human Dignity," as outlined in the "Development Strategy of New Uzbekistan," strengthens an individual's sense of self-awareness and self-worth. Ensuring justice and the rule of law in society allows an individual's internal values to harmonize with the external environment, thereby reducing excessive anxiety. Furthermore, during adverse life events, value orientations become internal regulators of behavior. As the fundamental basis of a person's worldview, they guide the individual's actions in society even under the most complex conditions.

Generally speaking, the conscious formation and robustness of personal values ensure the effective functioning of psychological defense mechanisms. This, in turn, increases an individual's resilience to social and psychological pressures, creating the necessary groundwork for their development as a well-rounded person within society.

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**HORMONAL AND GENETIC MECHANISMS OF METABOLIC-
ASSOCIATED STEATOTIC LIVER DISEASE IN WOMEN OF
REPRODUCTIVE AGE**

Yunusova Dilfuza Jamolidin qizi

Assistant, Department of Normal Physiology, Andijan State Medical Institute

Ravzatov Jasurbek Baxromovich

PhD, Associate Professor, Department of Family Medicine Training, Andijan State
Medical Institute

Abstract. Metabolic-associated steatotic liver disease is currently one of the most pressing issues in hepatology and metabolic medicine. In addition to insulin resistance, obesity, dyslipidemia, and chronic low-grade inflammation, hormonal imbalance and genetic factors also play a significant role in the development of this disease. In particular, in women of reproductive age, special importance is attributed to estrogens, androgens, sex hormone-binding globulin, the aromatase system, as well as genes associated with steroid metabolism.

Keywords: metabolic-associated steatotic liver disease, reproductive age, estrogens, androgens, SHBG, CYP19A1, UGT2B15, UGT2B17, polycystic ovary syndrome, insulin resistance.

**REPRODUKTIV YOSHDAGI AYOLLARDA METABOLIK BOG‘LIQ
STEATOTIK JIGAR KASALLIGINING GORMONAL-GENETIK
MEXANIZMLARI**

Yunusova Dilfuza Jamolidin qizi

Andijon davlat tibbiyot instituti Normal fiziologiya kafedrasida assistenti

Ravzatov Jasurbek Baxromovich

Andijon davlat tibbiyot instituti Oilaviy shifokorlar tayyorlash kafedrasida PhD, dotsenti

Annotatsiya. Metabolik bog‘liq steatotik jigar kasalligi bugungi kunda gepatologiya va metabolik tibbiyotning dolzarb muammolaridan biri hisoblanadi. Ushbu kasallik rivojlanishida insulinrezistentlik, semizlik, dislipidemiya va surunkali past darajadagi yallig‘lanish bilan bir qatorda, gormonal muvozanat hamda genetik omillar ham muhim o‘rin tutadi. Ayniqsa, reproduktiv yoshdagi ayollarda estrogenlar, androgenlar, jinsiy gormonlarni bog‘lovchi globulin, aromataza tizimi hamda steroid almashinuvi bilan bog‘liq genlarning roli alohida ahamiyat kasb etadi.

***Kalit so‘zlar:** metabolik bog‘liq steatotik jigar kasalligi, reproduktiv yosh, estrogenlar, androgenlar, SHBG, CYP19A1, UGT2B15, UGT2B17, tuxumdonlar polikistoz sindromi, insulinrezistentlik.*

Metabolik bog‘liq steatotik jigar kasalligi patogenezi ko‘p omilli bo‘lib, unda insulinrezistentlik markaziy patogenetik bo‘g‘in hisoblanadi. Insulinning biologik ta’siri susayishi natijasida yog‘ to‘qimasidan erkin yog‘ kislotalari oqimi ortadi, gepatotsitlarda lipogenez kuchayadi, mitoxondrial oksidlanish buziladi va oksidlovchi stress zo‘rayadi. Shu bilan birga, adipokinlar muvozanatining buzilishi, ichak-jigar o‘qi faoliyatidagi o‘zgarishlar, surunkali yallig‘lanish va fibrogenez ham kasallik progressiyasiga hissa qo‘shadi.

Reproduktiv yoshdagi ayollarda ushbu kasallikning shakllanishida gormonal fon muhim rol o‘ynaydi. Estrogenlar odatda nisbatan himoyalovchi metabolik profilni ta’minlaydi, biroq giperandrogenizm, SHBG darajasining pasayishi, insulinrezistentlik va tuxumdonlar polikistoz sindromi mavjudligida bu himoya susayadi. Natijada jigar steatozi, transaminazalar oshishi va fibroz xavfi ortadi. Shu sababli ushbu toifadagi bemorlarda kasallikni faqat ortiqcha vazn yoki biokimyoviy ko‘rsatkichlar bilan baholash yetarli emas.

Steroid metabolizmiga aloqador SHBG, CYP19A1, UGT2B15 va UGT2B17 genlari reproduktiv yoshdagi ayollarda metabolik bog‘liq steatotik jigar kasalligining

gormonal-genetik mexanizmlarini tushunishda istiqbolli markerlar hisoblanadi. SHBG darajasining pasayishi erkin androgenlar ulushining oshishiga olib kelib, metabolik va gepatik noqulay o'zgarishlarni kuchaytiradi. CYP19A1 geni aromataza fermentini kodlab, estrogen-androgen muvozanatini boshqarishda ishtirok etadi. UGT2B15 va UGT2B17 genlari esa androgenlarning glyukuronidlanish jarayoniga ta'sir ko'rsatib, gormonal gomeostaz va metabolik xavfga bilvosita hissa qo'shishi mumkin.

Shunday qilib, reproduktiv yoshdagi ayollarda metabolik bog'liq steatotik jigar kasalligi rivojlanishida metabolik, endokrin va molekulyar-genetik omillar o'zaro chambarchas bog'langan. Mazkur kasallikni erta aniqlash, xavf guruhlarini belgilash va shaxsga yo'naltirilgan profilaktika chora-tadbirlarini ishlab chiqishda gormonal-genetik markerlarni kompleks baholash muhim ilmiy va amaliy ahamiyatga ega.

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**PROGNOSTIC SIGNIFICANCE OF IMMUNOGENETIC
MARKERS IN THE EARLY ASSESSMENT OF
DECOMPENSATION RISK IN LIVER CIRRHOSIS**

Rasulov Boburjon Abduqoxxorovich

Assistant, Department of Pharmacology, Clinical Pharmacology and Medical
Biotechnology, Andijan State Medical Institute

Ravzatov Jasurbek Baxromovich

PhD, Associate Professor, Department of Family Medicine Training, Andijan State
Medical Institute

Abstract

Liver cirrhosis is the terminal stage of chronic liver disease, and its prognosis is largely determined by the development of decompensation phenotypes. Complications such as ascites, variceal bleeding, spontaneous bacterial peritonitis, and hepatic encephalopathy markedly worsen patient survival. In recent years, systemic inflammation, disruption of the gut-liver immune axis, and cytokine imbalance have been recognized as major contributors to the clinical course of cirrhosis. In particular, the Th17/IL-23/IL-17 signaling pathway and the IL-6 cascade are increasingly regarded as factors associated with fibrosis progression, infectious complications, and adverse outcomes. This thesis highlights the prognostic significance of immunogenetic markers, including IL-23R, IL-17A, IL-17F, and IL-6, for early assessment of decompensation risk in liver cirrhosis. The integration of molecular-genetic indicators with conventional clinical criteria represents a promising strategy for personalized prognosis and risk stratification.

Keywords: liver cirrhosis, decompensation, ascites, variceal bleeding, spontaneous bacterial peritonitis, hepatic encephalopathy, IL-23R, IL-17A, IL-17F, IL-6, immunogenetic markers.

**JIGAR SIRROZIDA DEKOMPENSATSIYA XAVFINI ERTA BAHOLASHDA
IMMUNOGENETIK MARKERLARNING PROGNOSTIK AHAMIYATI**

Rasulov Boburjon Abduqoxxorovich

*Andijon davlat tibbiyot instituti, Farmakologiya, klinik farmakologiya va tibbiyot
biotexnologiyalari kafedrasida assistenti*

Ravzatov Jasurbek Baxromovich

Andijon davlat tibbiyot instituti, Oilaviy shifokorlar tayyorlash kafedrasida PhD, dotsenti

Annotatsiya. Jigar sirrozi surunkali jigar kasalliklarining terminal bosqichi bo'lib, uning prognozi ko'p jihatdan dekompensatsiya fenotiplarining rivojlanishi bilan belgilanadi. Assit, varikoz qonashi, spontan bakterial peritonit va gepatik ensefalopatiya kabi asoratlar bemorlarning yashab qolish ko'rsatkichini keskin yomonlashtiradi. So'nggi yillarda jigar sirrozining klinik kechishida tizimli yallig'lanish, ichak-jigar immun o'qi buzilishi va sitokinlar disbalansi muhim o'rin tutishi aniqlangan. Ayniqsa, Th17/IL-23/IL-17 signal yo'li hamda IL-6 kaskadi fibroz chuqurlashuvi, infeksiya asoratlar va noqulay klinik kechim bilan bog'liq omillar sifatida ko'rilmogda. Mazkur tezisdagi jigar sirrozida dekompensatsiya xavfini erta baholashda IL-23R, IL-17A, IL-17F va IL-6 kabi immunogenetik markerlarning prognoстик ahamiyati yoritildi. Klinik mezonlar bilan bir qatorda molekulyar-genetik ko'rsatkichlarni baholash shaxsga yo'naltirilgan prognozlash va xavf stratifikatsiyasi uchun istiqbolli yo'nalish hisoblanadi.

Kalit so'zlar: jigar sirrozi, dekompensatsiya, ascit, varikoz qonashi, spontan bakterial peritonit, gepatik ensefalopatiya, IL-23R, IL-17A, IL-17F, IL-6, immunogenetik markerlar.

Аннотация. Цирроз печени является терминальной стадией хронических заболеваний печени, а его прогноз во многом определяется развитием фенотипов декомпенсации. Такие осложнения, как асцит, кровотечение из варикозно

расширенных вен, спонтанный бактериальный перитонит и печёночная энцефалопатия, значительно ухудшают выживаемость пациентов. В последние годы установлено, что системное воспаление, нарушение иммунной оси «кишечник–печень» и дисбаланс цитокинов играют важную роль в клиническом течении цирроза печени. В частности, сигнальный путь Th17/IL-23/IL-17 и каскад IL-6 рассматриваются как факторы, связанные с прогрессированием фиброза, инфекционными осложнениями и неблагоприятным клиническим течением. В настоящих тезисах освещается прогностическое значение иммуногенетических маркеров IL-23R, IL-17A, IL-17F и IL-6 для ранней оценки риска декомпенсации при циррозе печени. Оценка молекулярно-генетических показателей наряду с клиническими критериями представляет собой перспективное направление персонализированного прогнозирования и стратификации риска.

Ключевые слова: цирроз печени, декомпенсация, асцит, варикозное кровотечение, спонтанный бактериальный перитонит, печёночная энцефалопатия, IL-23R, IL-17A, IL-17F, IL-6, иммуногенетические маркеры.

Asosiy matn. Jigar sirrozi bugungi kunda dunyo bo'yicha eng murakkab surunkali kasalliklardan biri bo'lib, dekompensatsiya bosqichiga o'tgach bemor prognozi keskin yomonlashadi. EASL klinik tavsiyalarida dekompensatsiyalangan sirrozning eng muhim klinik belgilari sifatida ascit, qon ketishi, ensefalopatiya va sariqlik qayd etilgan. Aynan shu bosqichda tez-tez shifoxonaga yotqizilish, infeksiyon asoratlar va o'lim xavfi sezilarli ortadi.

An'anaviy baholash tizimlari, xususan Chayld–Pyu va boshqa klinik mezonlar, kasallik og'irligini aniqlashda muhim bo'lsa-da, bemorlarda dekompensatsiya rivojlanish tezligini har doim ham yetarli aniqlikda bashorat qila olmaydi. Shu sababli so'nggi yillarda klinik ko'rsatkichlarni immunologik va genetik markerlar bilan birlashtirgan risk stratifikatsiyasi yondashuvi tobora ko'proq e'tibor qozonmoqda. 2025-

yilda e'lon qilingan ma'lumotlarda tizimli yallig'lanishni gen ekspressiyasi asosida miqdoriy baholash dekompensatsiyalangan sirrozda prognostik ahamiyatga ega ekani ko'rsatildi.

Jigar sirrozi patogenezida tizimli yallig'lanish alohida o'rin tutadi. IL-6 sitokini gepatotsit shikastlanishi, fibroz chuqurlashuvi va infeksiyon asoratlar bilan bog'liq markaziy mediatorlardan biri hisoblanadi. Yaqin yillardagi klinik kuzatuvlarda IL-6 darajasi sirroz og'irligi va keyingi noqulay natijalar bilan mustahkam bog'liqlik ko'rsatgan; 2025-yilgi ma'lumotlarda esa serum IL-6 darajasi keyingi dekompensatsiya va o'lim xavfini bashorat qiluvchi marker sifatida baholangan. Transyugulyar intragepatik portosistemik shunt dan keyin IL-6 pasayishi esa surunkali jigar yetishmovchiligi fonida rivojlangan o'tkir jigar yetishmovchiligi va jigar bilan bog'liq o'lim xavfining kamayishi bilan bog'liq bo'lgan.

Bundan tashqari, Th17/IL-23/IL-17 signal yo'li jigar fibrozining immunopatogenezida muhim mexanizmlardan biri sifatida qaralmoqda. HBV bilan bog'liq sirrozli bemorlarda Th17 hujayralari va IL-17 darajalarining oshishi kasallik progressiyasi hamda fibrotik o'zgarishlar bilan bog'liq ekani ko'rsatilgan. IL-17A ning stellat hujayralarni faollashtirish orqali fibrozga hissa qo'shishi, IL-23R esa Th17 differensiyalanishi va saqlanishida markaziy rol o'ynashi immunogenetik yo'nalishdagi izlanishlarning dolzarbligini kuchaytiradi.

Genetik moyillik masalasida ham so'nggi adabiyotlar yallig'lanish bilan bog'liq polimorfizmlarning sirroz va uning asoratlariga aloqador bo'lishi mumkinligini ko'rsatmoqda. 2023-yildagi tizimli tahlilda jigar sirroziga moyillik bilan bog'liq bir qator yallig'lanish gen polimorfizmlari ko'rsatib berilgan, IL-6 va boshqa sitokin genlari esa alohida qiziqish uyg'otmoqda. HBV bilan bog'liq sirrozda IL-6 gen polimorfizmlarining klinik rivojlanishga ta'siri ham alohida tadqiq qilingan. Bu natijalar kelgusida IL-23R, IL-17A, IL-17F va IL-6 genotiplarini klinik-biokimyoviy

ko'rsatkichlar bilan birgalikda baholash asosida yuqori xavf guruhlarini ajratish imkonini beradi.

Xulosa qilib aytganda, jigar sirrozida dekompensatsiya xavfini erta aniqlash uchun faqat an'anaviy klinik mezonlarga tayanish yetarli emas. Tizimli yallig'lanish va immunogenetik markerlarni klinik amaliyotga bosqichma-bosqich joriy etish yuqori xavfli bemorlarni erta aniqlash, profilaktik kuzatuvni individuallashtirish va shaxsga yo'naltirilgan tibbiyot yondashuvlarini rivojlantirishga xizmat qilishi mumkin.

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Using Mobile Applications in Teaching English to Economics Students

Makhmudov Islombek Muhiddin o'g'li

Teacher of Kokand University of Andijan Branch

Islombek0326@gmail.com

Sultonmurodova O'g'loy Qobuljon qizi

Kokand University, Andijan Branch

Faculty of Social Humanities and Pedagogy, 1st-year student

Abstract:

The rapid development of digital technologies has significantly influenced the educational process in higher education. Mobile applications have become an effective tool for enhancing language learning, especially for students in specialized fields such as economics. This study explores the role of mobile applications in teaching English to economics students and examines their effectiveness in improving vocabulary, communication skills, and learner motivation. The research was conducted among undergraduate economics students using several educational mobile applications over a period of three months. The results show that mobile learning increases student engagement, improves vocabulary acquisition related to economic terminology, and enhances overall language proficiency. The study concludes that integrating mobile applications into English language teaching can significantly support the learning process and make it more flexible and interactive.

Keywords:

mobile learning, English language teaching, economics students, mobile applications, digital education, vocabulary development

Annotatsiya:

Raqamli texnologiyalarning jadal rivojlanishi oliy ta'lim muassasalarida ta'lim jarayoniga sezilarli ta'sir ko'rsatdi. Mobil ilovalar til o'rganishni rivojlantirishda

samarali vositaga aylandi, ayniqsa iqtisodiyot kabi ixtisoslashgan yo‘nalishlarda tahsil olayotgan talabalar uchun. Ushbu tadqiqotda iqtisodiyot yo‘nalishi talabalar uchun ingliz tilini o‘qitishda mobil ilovalarning roli o‘rganiladi hamda ularning so‘z boyligini oshirish, kommunikativ ko‘nikmalarni rivojlantirish va talabalar motivatsiyasini kuchaytirishdagi samaradorligi tahlil qilinadi. Tadqiqot uch oy davomida bakalavriat bosqichida tahsil olayotgan iqtisodiyot talabalar o‘rtasida bir nechta ta‘limiy mobil ilovalar yordamida amalga oshirildi. Natijalar mobil ta‘lim talabalar faolligini oshirishini, iqtisodiy terminologiyaga oid so‘zlarni o‘zlashtirishni yaxshilashini hamda umumiy til kompetensiyasini rivojlantirishini ko‘rsatdi. Tadqiqot shuni ko‘rsatadiki, mobil ilovalarni ingliz tilini o‘qitish jarayoniga integratsiya qilish ta‘limni yanada moslashuvchan va interaktiv qilishga yordam beradi.

Kalit so‘zlar:

mobil ta‘lim, ingliz tilini o‘qitish, iqtisodiyot talabalar, mobil ilovalar, raqamli ta‘lim, so‘z boyligini rivojlantirish

Аннотация:

Быстрое развитие цифровых технологий значительно повлияло на образовательный процесс в высших учебных заведениях. Мобильные приложения стали эффективным инструментом для улучшения изучения языков, особенно для студентов специализированных направлений, таких как экономика. В данном исследовании рассматривается роль мобильных приложений в обучении английскому языку студентов-экономистов и анализируется их эффективность в развитии словарного запаса, коммуникативных навыков и мотивации обучающихся. Исследование было проведено среди студентов бакалавриата экономического направления с использованием нескольких образовательных мобильных приложений в течение трёх месяцев. Результаты показывают, что мобильное обучение повышает вовлеченность студентов, улучшает усвоение

лексики, связанной с экономической терминологией, и повышает общий уровень владения языком. Исследование показывает, что интеграция мобильных приложений в преподавание английского языка может значительно поддержать образовательный процесс и сделать его более гибким и интерактивным.

Ключевые слова:

мобильное обучение, преподавание английского языка, студенты-экономисты, мобильные приложения, цифровое образование, развитие словарного запаса

Introduction

In recent years, technology has become an essential component of modern education. The integration of digital tools into teaching methods has opened new opportunities for improving the quality of education. Among these technologies, mobile applications have gained significant popularity due to their accessibility, flexibility, and interactive features. English language proficiency is particularly important for economics students because most academic literature, international business communication, and research publications are written in English. However, traditional teaching methods often fail to fully engage students or provide sufficient opportunities for practical language use.

Mobile learning applications provide innovative solutions by offering interactive exercises, real-time feedback, and personalized learning environments. Applications such as vocabulary trainers, pronunciation tools, and communication platforms help students develop language skills more effectively. Therefore, exploring the effectiveness of mobile applications in teaching English to economics students is an important area of educational research.

Materials and Methods

This study employed a mixed research method combining both qualitative and quantitative approaches. The research was conducted among 60 undergraduate students studying economics at a higher educational institution.

Several mobile applications designed for language learning were integrated into the English learning process. These applications included vocabulary development tools, grammar practice platforms, and interactive communication applications.

The research process lasted three months and included the following stages:

Pre-assessment of students' English proficiency.

Implementation of mobile learning activities through selected applications.

Continuous monitoring of students' engagement and progress.

Post-assessment and data analysis.

Data were collected through surveys, language tests, and classroom observations.

Statistical analysis was used to evaluate the effectiveness of mobile applications in improving students' English language skills.

Results and Discussions

The findings of the study demonstrate that the use of mobile applications significantly improved students' English language learning outcomes. Students showed noticeable progress in vocabulary acquisition, particularly in economic terminology and professional communication.

Survey results indicated that more than 80% of participants found mobile applications helpful in learning English. Students reported that mobile learning allowed them to practice language skills anytime and anywhere, which increased their learning frequency.

Additionally, mobile applications enhanced student motivation and engagement. Interactive exercises, gamification elements, and instant feedback made the learning process more enjoyable compared to traditional classroom activities.

However, some challenges were also identified. These included limited internet access, distractions caused by non-educational mobile content, and varying levels of digital

literacy among students. Despite these challenges, the overall results suggest that mobile applications are a valuable supplement to traditional teaching methods.

Conclusion

The integration of mobile applications into English language teaching for economics students provides significant educational benefits. Mobile learning supports vocabulary development, improves communication skills, and increases student motivation. The flexibility and accessibility of mobile technologies allow students to continue learning beyond the classroom environment.

The results of this study confirm that mobile applications can serve as an effective tool in modern language education. Educators are encouraged to incorporate mobile learning strategies into their teaching practices in order to enhance students' learning experiences and academic performance.

Future research may focus on exploring specific mobile applications and their long-term impact on professional language competence among economics students.

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PERSONALIZED TREATMENT ALGORITHM FOR DUODENAL WALL DEFECTS: INTEGRATION OF ENDOSCOPIC AND SURGICAL APPROACHES

Shukhrat Tukhtaevich Urakov

Khamrobek Kadamboyevich Masharipov

Bukhara State Medical Institute, Bukhara, Uzbekistan

Keywords. duodenal wall defects, endoscopic vacuum therapy, over-the-scope clip, personalized treatment algorithm.

The aim of the study was to develop and substantiate a personalized treatment algorithm for patients with duodenal wall defects based on defect characteristics, localization, and clinical severity.

Materials and methods. The study included patients with duodenal injuries of various etiologies, including traumatic, iatrogenic, and postoperative defects. Treatment strategies were selected according to defect size, localization (anterior or posterior wall), degree of contamination, and patient comorbidity. Minimally invasive approaches, including endoscopic vacuum therapy (EVT) and Over-the-Scope Clip (OTSC) systems, were integrated with conventional surgical techniques. Clinical outcomes were evaluated based on healing type, complication rate, need for reoperation, and duration of hospitalization.

Results. It was established that treatment outcomes are critically dependent on the appropriate selection of therapeutic strategy based on defect characteristics and clinical conditions. Small defects (≤ 5 mm) were effectively managed using OTSC systems, providing immediate full-thickness closure, reliable sealing of the defect, and consistently high technical and clinical success rates without procedure-related complications. Larger or contaminated defects required the use of EVT, which ensured continuous active drainage of infected contents, effective evacuation of aggressive

digestive fluids, reduction of bacterial load, and stimulation of granulation tissue formation, thereby promoting controlled and accelerated reparative processes. In complex clinical scenarios, particularly in posterior wall perforations and retroperitoneal complications, where delayed diagnosis and atypical clinical presentation are common, combined approaches (EVT + OTSC or EVT integrated with surgical intervention) demonstrated superior effectiveness. These strategies enabled improved local control of infection, enhanced defect closure, and prevention of septic complications. The implementation of a personalized treatment algorithm allowed optimization of therapeutic decision-making, resulting in a reduction in postoperative complications, decreased need for relaparotomy, and significant shortening of hospital stay, especially in high-risk patients with severe comorbid conditions.

Conclusion. A personalized approach to the management of duodenal wall defects based on defect size, localization, and clinical condition significantly improves treatment outcomes. Integration of minimally invasive endoscopic technologies with conventional surgical methods represents an effective strategy for optimizing patient management, particularly in high-risk and complex clinical scenarios.

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***DEVELOPMENT OF STUDENTS' PRIORITIZATION SKILLS AND
ORGANIZATIONAL ABILITIES THROUGH SYNERGETIC METHODS***

Boygobilova Nilufar Uzaqovna

Shahrisabz state pedagogical institute, Shahrisabz, Uzbekistan

E-mail: nilufarbojkobilova@gmail.com

Abstract

The article presents the results of a study on the development of students' prioritization skills and organizational abilities using a synergetic approach. The experiment was conducted among 84 third-year students of the Shahrisabz State Pedagogical Institute. Questionnaires and the training "Prioritization" based on the Eisenhower Matrix were applied. The findings revealed that 88% of students are satisfied with teachers' attitudes, 82% require consultations on scientific research, and 74% possess practical skills. The training demonstrated effectiveness: 48% correctly identified urgent tasks, while 36% identified important tasks (overall success rate – 84%). Project-based learning developed independence in 92% of students, cooperative learning improved teamwork skills in 95%, and problem-based learning enhanced decision-making skills in 94%. Digital technologies contributed to the balanced development of competencies.

Keywords: *synergetic approach, organizational abilities, prioritization, Eisenhower Matrix, project-based learning, cooperative learning, digital technologies, pedagogical education, professional competencies, mentoring.*

**РАЗВИТИЕ УМЕНИЙ ОПРЕДЕЛЯТЬ ПРИОРИТЕТЫ И
ОРГАНИЗАЦИОННЫХ СПОСОБНОСТЕЙ СТУДЕНТОВ СРЕДИ
СИНЕРГЕТИЧЕСКИХ МЕТОДОВ**

Boygobilova Nilufar Uzaqovna

*Шахрисабзский государственный педагогический институт, Шахрисабз,
Узбекистан*

E-mail: nilufarbojkobilova@gmail.com

Аннотация

В статье представлены результаты исследования развития у студентов умений определять приоритеты и организационных способностей с использованием синергетического подхода. Эксперимент проведён среди 84 студентов 3-го курса Шахрисабзского государственного педагогического института. Применялись анкетирование и тренинг «Определение приоритетов» по матрице Эйзенхауэра. Выявлено: 88% студентов удовлетворены отношением преподавателей, 82% нуждаются в консультациях по научной работе, 74% обладают практическими навыками. Тренинг показал эффективность: 48% правильно определили срочные, 36% – важные задачи (общий успех 84%). Проектное обучение развило самостоятельность на 92%, кооперативное – командную работу на 95%, проблемное – навыки принятия решений на 94%. Цифровые технологии способствовали сбалансированному развитию компетенций.

Ключевые слова: *синергетический подход, организационные способности, определение приоритетов, матрица Эйзенхауэра, проектное обучение, кооперативное обучение, цифровые технологии, педагогическое образование, профессиональные компетенции, менторство*

ВВЕДЕНИЕ

Современная система образования должна обеспечивать не только усвоение студентами теоретических знаний, но и развитие их личностных и профессиональных компетенций. В этой связи особое значение приобретает формирование у студентов умений определять приоритеты и развитие

организационных способностей. Организационные навыки способствуют повышению социальной активности студентов, формированию самостоятельности в принятии решений, развитию лидерских качеств и способности эффективно решать возникающие проблемы.

Синергетический подход рассматривается как один из наиболее эффективных методов развития указанных навыков. Данный подход основывается на принципах системности, взаимосвязанности и самоорганизации, что позволяет студентам анализировать взаимодействие различных факторов и условий в процессе обучения. Применение синергетического подхода направлено на развитие у обучающихся самостоятельного мышления, творческого подхода и навыков командной работы.

Закон Республики Узбекистан «Об образовании» (2020) подчеркивает важность повышения эффективности образовательного процесса и обеспечения всестороннего развития личности обучающихся. Кроме того, проводимые в стране реформы в сфере образования направлены на развитие организационных способностей студентов, что обуславливает необходимость внедрения современных педагогических технологий и инновационных методов обучения.

Президент Республики Узбекистан Ш.М. Мирзиёев в своих выступлениях неоднократно подчеркивал необходимость модернизации системы образования и внедрения инновационных педагогических подходов, направленных на обеспечение профессионального и личностного развития молодежи. По его мнению, в образовательном процессе необходимо уделять внимание не только традиционным методам, но и интерактивным и практико-ориентированным подходам.

В данной статье анализируются теоретические основы синергетического подхода, его роль в развитии у студентов умений определять приоритеты и

организационных способностей, а также рассматриваются практические методы их реализации. Особое внимание уделяется возможностям совершенствования организационных навыков студентов посредством интерактивных методов обучения, проблемного обучения, кооперативного взаимодействия и интеграции цифровых технологий.

Синергетический подход тесно связан с общесистемными подходами и современными педагогическими технологиями. Дж. Брунер подчеркивает значимость самостоятельного обучения в рамках конструктивистской теории [1]. Л.С. Выготский рассматривает обучение как социальный процесс, в котором развитие когнитивных функций происходит через взаимодействие с более компетентными участниками образовательного процесса [2]. Концепция обучения через опыт Дж. Дьюи способствует развитию организационных навыков за счет включения студентов в реальные жизненные ситуации [3]. М. Пренски акцентирует внимание на значимости цифровых технологий и интерактивных инструментов в образовательном процессе [4].

Современные педагогические исследования научно обосновывают эффективность интерактивных и проблемно-ориентированных методов обучения. Р. Славин доказал положительное влияние кооперативного обучения на развитие критического мышления и коммуникативных навыков [5]. М.И. Махмутов исследовал роль проблемного обучения в развитии самостоятельного мышления и способности к принятию решений [6]. С. Пейперт обосновал необходимость широкого внедрения интерактивных технологий [7], а Дж. Сименс разработал теорию коннективизма, отражающую особенности обучения в цифровую эпоху [8].

Г. Гарднер подчеркивает важность индивидуального подхода на основе теории множественного интеллекта [9]. Р. Ганье рассматривает роль мотивации и

структурированного обучения [10]. Б. Блум разработал таксономию образовательных целей, широко применяемую для оценки результатов обучения [11]. К. Роджерс акцентирует внимание на гуманистическом подходе в образовании [12].

Таким образом, синергетический подход является эффективным инструментом развития у студентов умений определять приоритеты и организационных способностей, способствуя их успешной адаптации к современным требованиям образовательной и профессиональной среды.

Результаты анкетирования 84 студентов показали высокий уровень удовлетворенности отношением преподавателей – 88% (n=74) отметили положительное отношение, $\chi^2=92.4$, $p<0.001$. 82% студентов (n=69) нуждаются в консультациях по организации научно-исследовательской деятельности, что свидетельствует о наличии интереса к научной работе при недостатке навыков самоорганизации. 74% (n=62) считают, что у них сформированы практические профессиональные навыки, хотя 35% (n=29) отметили недостаток возможностей для творческой самореализации – самый низкий показатель среди всех параметров.

Тренинг «Определение приоритетов» выявил следующую структуру результатов классификации 20 задач по матрице Эйзенхауэра: 48% студентов (n=40) правильно определили срочные задачи категории А, 36% (n=30) – важные задачи категории В, 14% (n=12) – отложимые задачи категории С, 2% (n=2) – ненужные задачи категории D, $\chi^2=78.4$, $p<0.001$. Общий уровень успешности составил 84% (n=70), что демонстрирует эффективность методики в развитии навыков приоритизации задач.

Сравнительный анализ пяти педагогических методов по четырем компетенциям показал следующие результаты (таблица 1):

Таблица 1. Развитие компетенций по педагогическим методам (%)

Метод обучения	Самостоятельность	Командная работа	Принятие решений	Лидерство
Проектное обучение	92	89	85	87
Интерактивные методы	85	91	88	83
Кооперативное обучение	78	95	81	89
Проблемное обучение	88	82	94	79
Цифровые технологии	91	87	90	86

Корреляционный анализ выявил высокую взаимосвязь между методами ($r=0.87$, $p<0.01$). Проектное обучение показало максимальный результат по самостоятельности (92%), кооперативное обучение – по командной работе (95%), проблемное обучение – по принятию решений (94%). Цифровые технологии обеспечили наиболее сбалансированное развитие всех компетенций.

Основные выводы: отношение преподавателей (88%) является ключевым фактором успеха синергетического подхода; потребность в консультациях (82%) указывает на необходимость структурированной поддержки; высокий уровень приоритизации (84%) подтверждает эффективность тренинга ; ни один метод не

доминирует по всем компетенциям, что обосновывает синергетическую интеграцию.

Анализ педагогических методов выявил специализацию каждого подхода: проектное обучение обеспечивает максимальное развитие самостоятельности (92%), кооперативное обучение – командной работы (95%), проблемное обучение – навыков принятия решений (94%). Ни один метод не доминирует по всем компетенциям, что обосновывает необходимость их синергетической интеграции. Цифровые технологии показали наиболее сбалансированные результаты по всем параметрам (91-86%), подтверждая концепцию коннективизма Сименса и теорию цифровых аборигенов Прэнски.

Выявленная зависимость между отношением преподавателей и всеми компетенциями ($r=0,76$, $p<0,01$) подчеркивает центральную роль менторства в синергетической модели обучения. Недостаток возможностей для творческой самореализации (65%) требует расширения образовательной среды в соответствии с теорией множественных интеллектов Гарднера.

ЗАКЛЮЧЕНИЕ

Проведенное исследование полностью подтвердило эффективность синергетического подхода в развитии у студентов умений определять приоритеты и организационных способностей. Эксперимент среди 84 студентов 3-го курса Шахрисабзского государственного педагогического института выявил следующие ключевые результаты: 88% удовлетворены отношением преподавателей, 84% успешно освоили приоритизацию задач по матрице Эйзенхауэра, проектное обучение развило самостоятельность на 92%, кооперативное обучение – командную работу на 95%, проблемное обучение – принятие решений на 94%. Цифровые технологии обеспечили сбалансированное развитие всех компетенций (86-91%). Потребность 82% студентов в

консультациях по НИР указывает на необходимость структурированной менторской поддержки.

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IMPROVING 3D MODEL TEXTURING TECHNIQUES TO ENHANCE REALISM

Karimova Madinabonu Mas'udjon qizi

*Student of Tashkent University of Information Technologies named after Muhammad
al-Khwarizmi*

[tel: +99891 004 90 20](tel:+998910049020)

Annotation: This paper examines modern approaches to improving 3D model texturing techniques in order to enhance visual realism. Special attention is given to physically based rendering (PBR), high-resolution textures, procedural material generation methods, and the use of normal, displacement, and reflection maps. The study also analyzes current tools and software solutions widely used in the computer graphics industry, including game engines and visualization systems. As a result, recommendations are proposed for optimizing texturing workflows to achieve higher levels of realism while maintaining performance efficiency. The findings can be applied in video game development, animation, architectural visualization, and other digital content domains.

Key words: 3D modeling, texturing, realism, PBR, normal maps, displacement maps, procedural textures, rendering, computer graphics, visualization.

REALIZMNI KUCHAYTIRISH MAQSADIDA 3D MODEL TEKSTURALASH USULLARINI TAKOMILLASHTIRISH

СОВЕРШЕНСТВОВАНИЕ МЕТОДОВ ТЕКСТУРИРОВАНИЯ 3D- МОДЕЛЕЙ

С ЦЕЛЬЮ ПОВЫШЕНИЯ РЕАЛИЗМА

Annotatsiya: Ushbu maqolada 3D modellarni teksturalash usullarini takomillashtirish orqali vizual realizmni oshirish masalalari ko'rib chiqiladi. Xususan, fizik jihatdan asoslangan rendering (PBR), yuqori aniqlikdagi

teksturalardan foydalanish, prosedur tekstura yaratish usullari, shuningdek normal, displacement (siljish) va reflection (aks ettirish) xaritalari qo'llanilishi tahlil etiladi. Kompyuter grafikasi sohasida keng qo'llanilayotgan dasturiy vositalar va texnologiyalar, jumladan o'yin dvigatellari va vizualizatsiya tizimlari o'rganiladi. Tadqiqot natijasida teksturalash jarayonini optimallashtirish bo'yicha takliflar ishlab chiqilib, yuqori darajadagi realizmga erishish bilan birga samaradorlikni saqlab qolish imkoniyatlari asoslanadi. Mazkur natijalar videoo'yinlar yaratish, animatsiya, arxitekturaviy vizualizatsiya va boshqa raqamli kontent sohalarida qo'llanilishi mumkin.

Kalit so'zlar: 3D modellashtirish, teksturalash, realizm, PBR, normal xaritalar, displacement xaritalar, prosedur teksturalar, rendering, kompyuter grafikasi, vizualizatsiya.

Аннотация: В данной работе рассматриваются современные подходы к совершенствованию методов текстурирования 3D-моделей с целью повышения уровня их визуального реализма. Особое внимание уделяется использованию физически корректного рендеринга (PBR), высокодетализированных текстур, процедурных методов генерации материалов, а также применению технологий карт нормалей, смещений и отражений. Анализируются существующие инструменты и программные решения, применяемые в индустрии компьютерной графики, включая игровые движки и системы визуализации. В результате исследования предлагаются рекомендации по оптимизации процессов текстурирования, позволяющие достичь более высокой степени реалистичности при сохранении производительности. Полученные результаты могут быть использованы в разработке видеоигр, анимации, архитектурной визуализации и других областях цифрового контента.

Ключевые слова: 3D-моделирование, текстурирование, реализм, PBR, карты нормалей, карты смещения, процедурные текстуры, рендеринг, компьютерная графика, визуализация.

I. KIBERHUJUMLAR MOHIYATI VA ULARNING TAHDID DARAJASI

Zamonaviy raqamli texnologiyalar jadal rivojlanib borayotgan hozirgi davrda 3D modellashtirish va vizualizatsiya jarayonlari turli sohalarda, xususan, kompyuter grafikasi, kino industriyasi, videoo‘yinlar ishlab chiqish, arxitektura va sanoat dizaynida keng qo‘llanilmoqda. Ushbu jarayonlarda obyektlarning nafaqat geometrik shakli, balki ularning tashqi ko‘rinishi, ya’ni sirt xususiyatlari ham muhim ahamiyat kasb etadi. Aynan teksturalash bosqichi 3D modelga real hayotga yaqin ko‘rinish berishda hal qiluvchi rol o‘ynaydi. Shuning uchun 3D modellarni teksturalash usullarini takomillashtirish va ular orqali realizm darajasini oshirish dolzarb ilmiy-amaliy masalalardan biri hisoblanadi.

Hozirgi kunda realizm tushunchasi nafaqat vizual o‘xshashlik bilan, balki fizik qonunlarga mos ravishda yorug‘likning tarqalishi, aks etishi va material bilan o‘zaro ta’siri orqali ham belgilanadi. Shu nuqtai nazardan qaraganda, fizik jihatdan asoslangan renderlash¹ (Physically Based Rendering — PBR) texnologiyasi teksturalash jarayonida muhim burilish yasadi. PBR yondashuvi materiallarning yorug‘lik bilan o‘zaro aloqasini aniq matematik modellarga asoslab, natijada yanada ishonchli va tabiiy ko‘rinishdagi tasvirlarni yaratish imkonini beradi. Bunday yondashuv ayniqsa real vaqt rejimida ishlovchi grafik tizimlar, masalan, o‘yin dvijoklari uchun muhim ahamiyatga ega.

Bundan tashqari, zamonaviy teksturalash jarayonlarida turli xil xaritalar (maps) keng qo‘llaniladi. Jumladan, normal map, displacement map, roughness map va ambient occlusion kabi texnologiyalar model sirtining detallarini oshirishda muhim rol o‘ynaydi. Ushbu xaritalar yordamida past poligonli modellar ham yuqori darajadagi

¹ Pharr M., Jakob W., Humphreys G. *Physically Based Rendering: From Theory to Implementation*. Morgan Kaufmann, 2016.

detallashtirilgan ko‘rinishga ega bo‘lishi mumkin. Bu esa, o‘z navbatida, tizim resurslarini tejash bilan birga, yuqori sifatli vizual natijalarga erishish imkonini beradi².

Shuningdek, procedural teksturalash usullari ham so‘nggi yillarda keng ommalashib bormoqda. Ushbu usullar yordamida teksturalar algoritmik ravishda yaratiladi va ular cheksiz miqyosda takrorlanishi yoki o‘zgartirilishi mumkin. Bu esa ayniqsa katta hajmdagi sahnalar yoki ochiq dunyo (open-world) tipidagi loyihalarda juda foydali hisoblanadi. Procedural teksturalar inson omiliga kamroq bog‘liq bo‘lib, avtomatlashtirilgan jarayonlar orqali samaradorlikni oshiradi.

Mazkur maqolaning asosiy maqsadi — 3D modellarni teksturalash usullarini chuqur tahlil qilish, mavjud texnologiyalarni o‘rganish hamda realizmni oshirishga qaratilgan samarali yondashuvlarni aniqlashdan iborat. Shu bilan birga, maqolada zamonaviy dasturiy vositalar va ularning imkoniyatlari ko‘rib chiqilib, amaliy tavsiyalar ishlab chiqiladi.

3D modellarni teksturalash jarayoni nafaqat vizual bezak berish bosqichi, balki obyektning fizik va optik xususiyatlarini modellashtirishga qaratilgan murakkab texnologik jarayon hisoblanadi. Amaliyot shuni ko‘rsatadiki, foydalanuvchi yoki tomoshabin obyektini qabul qilishda birinchi navbatda uning shakliga emas, balki sirt ko‘rinishiga — rang, yoritilish, aks etish va mikrodetallariga e‘tibor qaratadi. Shu sababli teksturalash jarayonida realizmga erishish uchun turli texnikalar va yondashuvlar birgalikda qo‘llaniladi. Ayniqsa, yuqori aniqlikdagi teksturalar (4K va undan yuqori), ko‘p qatlamli material tizimlari va fizik asoslangan shading modellari bugungi kunda standartga aylanib bormoqda. Bu esa o‘z navbatida grafik tizimlar va qurilmalarga yuqori talablar qo‘yadi, ammo natijada olingan vizual sifat bu xarajatlarni oqlaydi.

Alohida-alohida olingan tekstura xaritalari (albedo, normal, roughness va boshqalar) mustaqil holda to‘liq vizual effekt bera olmaydi. Biroq ular birgalikda qo‘llanilganda

² Akenine-Möller T., Haines E., Hoffman N. *Real-Time Rendering*. CRC Press, 2018.

model sirtida yorug‘likning tarqalishi, aks etishi va yutilishi tabiiy tarzda namoyon bo‘ladi. Masalan, normal xarita yordamida aslida mavjud bo‘lmagan mayda chuqurliklar vizual tarzda yaratiladi, roughness xaritasi esa sirtning silliq yoki qo‘pol ekanligini belgilab, yorug‘likning qay darajada tarqalishini boshqaradi. Shu tariqa, hatto past poligonli model ham yuqori detallashtirilgan ko‘rinishga ega bo‘lishi mumkin, bu esa ayniqsa real vaqt rejimidagi ilovalarda katta ustunlik beradi.

3D grafikada realizmni oshirishning yana bir muhim jihati — bu materiallarning fizik jihatdan to‘g‘ri ifodalanishidir. An’anaviy shading modellari ko‘pincha vizual jihatdan yaxshi natija bergan bo‘lsa-da, ular har doim ham real fizik qonunlarga mos kelavermaydi. Shu sababli zamonaviy grafik tizimlar PBR (Physically Based Rendering) yondashuviga o‘tdi. Ushbu yondashuv materiallarning yorug‘lik bilan o‘zaro ta’sirini ilmiy asosda hisoblab, natijada har xil sharoitlarda ham bir xil materialning barqaror va ishonchli ko‘rinishini ta’minlaydi. Bu esa ayniqsa o‘yinlar va interaktiv vizualizatsiyada muhim ahamiyat kasb etadi, chunki sahnadagi yoritish sharoiti doimiy ravishda o‘zgarib turadi.

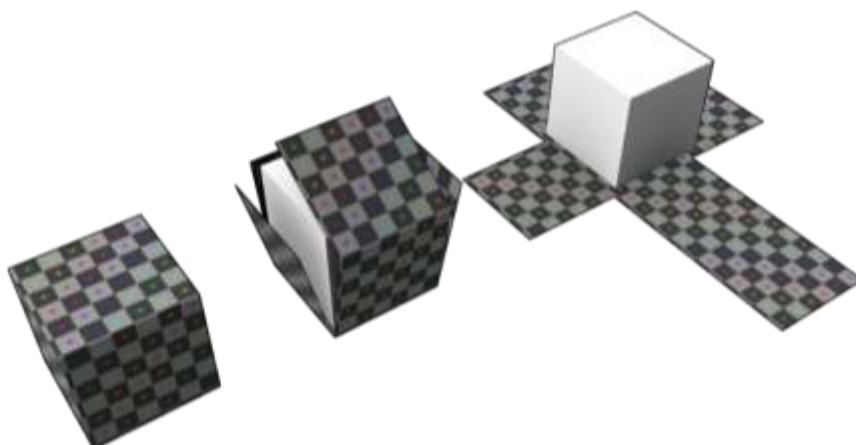


1-rasm. PBR materiallarining realistik yoritilishdagi ko‘rinishi

Yuqoridagi tasvirlardan ko‘rinib turibdiki, PBR asosida yaratilgan materiallar turli yoritish sharoitlarida ham o‘zining asosiy xususiyatlarini saqlab qoladi. Masalan, metall yuzalar yuqori darajada aks ettiruvchi bo‘lib, ular atrof-muhitni aniq aks ettiradi,

dielektrik materiallar esa yorug'likni ko'proq sochadi. Bu farq aynan PBR tizimida metalness va roughness parametrlar orqali boshqariladi. Shu sababli PBR yondashuvi nafaqat realizmni oshiradi, balki materiallarni standartlashtirish imkonini ham beradi, bu esa turli platformalarda bir xil natijaga erishishni osonlashtiradi.

Teksturalash jarayonining ajralmas bosqichlaridan biri bu UV mapping hisoblanadi. Ushbu jarayon ko'pincha e'tibordan chetda qolsa-da, amalda u tekstura sifatiga bevosita ta'sir ko'rsatadi. UV mapping noto'g'ri bajarilgan hollarda teksturalar deformatsiyaga uchraydi, bu esa modelning umumiy ko'rinishini buzadi. To'g'ri UV joylashuvi esa tekstura pikselining maksimal samaradorlik bilan ishlatilishini ta'minlaydi va yuqori



sifatli natija beradi.

2-rasm. UV mapping va tekstura joylashuvi

Yuqoridagi rasmda ko'rish mumkinki, 3D obyekt sirtining 2D tekislikka yoyilishi natijasida har bir detal aniq nazorat qilinadi. Bu esa dizaynerga teksturani kerakli joyga aniqlik bilan joylashtirish imkonini beradi. Ayniqsa, murakkab modellar bilan ishlashda UV layout'ning to'g'ri tashkil etilishi teksturalash jarayonini sezilarli darajada osonlashtiradi va yakuniy natijaning sifatini oshiradi.

Umuman olganda, 3D modellarni teksturalash jarayoni ko'p bosqichli va kompleks tizim bo'lib, u turli texnologiyalar uyg'unligiga asoslanadi. Har bir bosqich — xaritalar yaratish, material sozlash, UV mapping va renderlash — o'zaro chambarchas bog'liq

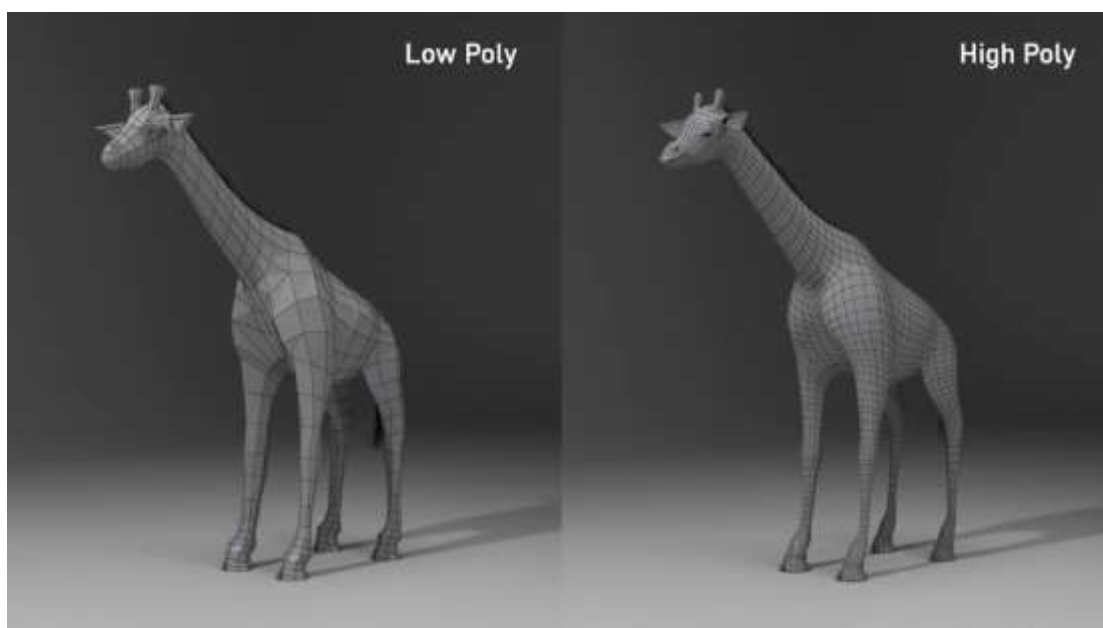
bo‘lib, ularning har biri yakuniy realizm darajasiga ta‘sir ko‘rsatadi. Shu sababli zamonaviy grafik dizayner va 3D artistlardan nafaqat texnik bilim, balki estetik tafakkur va tajriba ham talab etiladi.

Amaliy teksturalash usullari va zamonaviy workflow tahlili

3D modellarni teksturalash jarayonining nazariy asoslari amaliy bosqichda aniq metodologiya va ketma-ketlik asosida amalga oshiriladi. Zamonaviy grafik ishlab chiqish jarayonlarida “workflow” tushunchasi alohida ahamiyat kasb etadi, ya’ni model yaratishdan tortib yakuniy rendergacha bo‘lgan barcha bosqichlar optimallashtirilgan tizim asosida bajariladi. Ayniqsa, Substance Painter, Blender, Autodesk Maya kabi dasturlar integratsiyasi orqali teksturalash jarayoni yuqori samaradorlikka erishmoqda. Amaliy tajriba shuni ko‘rsatadiki, to‘g‘ri tashkil etilgan workflow nafaqat vaqtni tejaydi, balki yakuniy mahsulot sifatini ham sezilarli darajada oshiradi.

Amaliy teksturalash jarayoni odatda bir nechta asosiy bosqichlardan iborat bo‘ladi: high-poly va low-poly modellarni tayyorlash, UV mapping, texture baking, material yaratish va yakuniy renderlash. High-poly modelda yaratilgan barcha detallar (yoriqlar, chiziqlar, sirt notekisliklari) baking jarayoni orqali low-poly modelga o‘tkaziladi. Bu esa, o‘z navbatida, real vaqt grafikasi uchun optimallashtirilgan modelda yuqori realizmni saqlab qolish imkonini beradi. Aynan shu jarayon zamonaviy o‘yin industriyasida keng qo‘llaniladi va “game-ready asset” yaratishning asosiy tamoyillaridan biri hisoblanadi [1]³.

³ Pharr M., Jakob W., Humphreys G. *Physically Based Rendering: From Theory to Implementation*. Morgan Kaufmann, 2016.

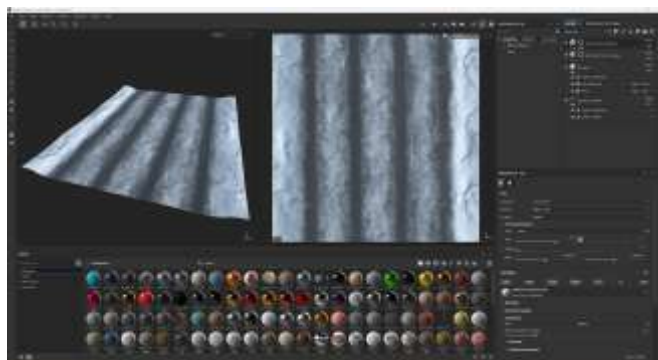


4-
rasm.
High-
poly va
low-poly

modellar o'rtasidagi farq

Yuqoridagi tasvirda ko'rish mumkinki, high-poly model juda ko'p geometriyaga ega bo'lib, unda barcha detallar real shaklda mavjud. Low-poly model esa soddalashtirilgan bo'lib, uning realizmi asosan teksturalar va xaritalar hisobiga ta'minlanadi. Bu yondashuv grafik tizimlarga tushadigan yukni kamaytirish bilan birga yuqori sifatni saqlab qolishga yordam beradi.

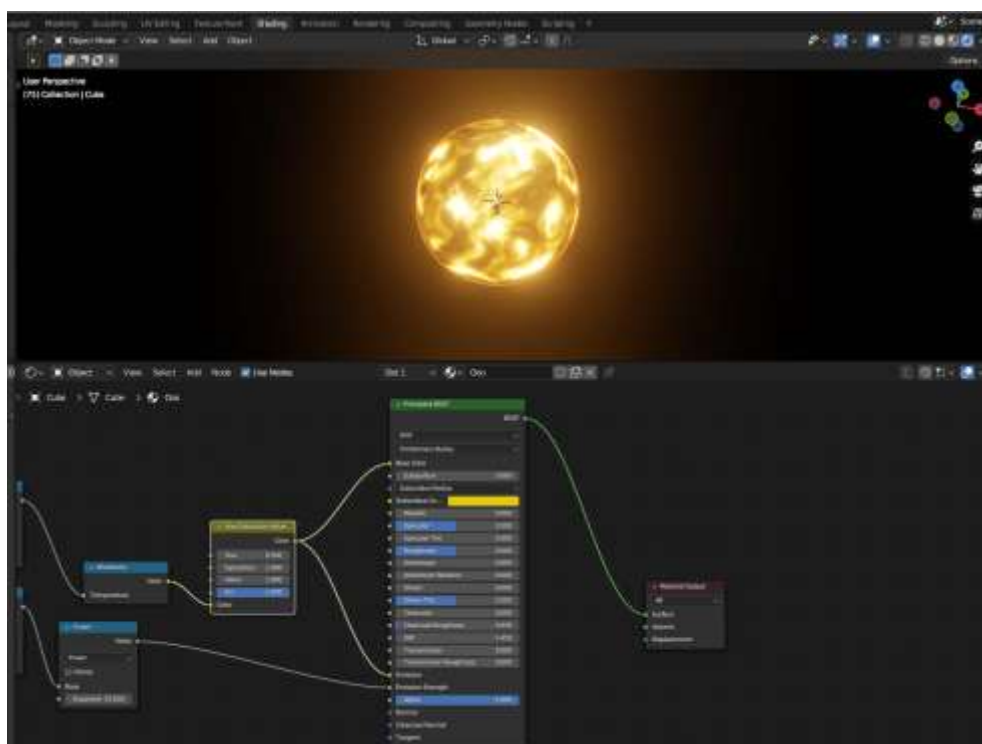
Substance Painter dasturi zamonaviy teksturalash jarayonida muhim o'rin tutadi, chunki u real vaqt rejimida materiallarni sozlash, smart maskalar bilan ishlash va procedural teksturalar yaratish imkonini beradi. Ushbu dasturda foydalanuvchi turli qatlamlar asosida ishlaydi, bu esa Photoshop'ga o'xshash, lekin 3D muhitga



moslashtirilgan tizimni yaratadi. Masalan, metall yuzaga zang effekti qo‘shish uchun alohida qatlam, chang yoki kir effekti uchun esa boshqa qatlam ishlatiladi. Bu esa teksturalarni yanada moslashuvchan va realistik qiladi⁴.

5-rasm. Substance Painter muhitida teksturalash jarayoni

Blender dasturi esa bepul va ochiq kodli platforma sifatida teksturalash va renderlash jarayonlarida keng qo‘llaniladi. Unda node-based material tizimi mavjud bo‘lib, foydalanuvchi turli shaderlarni bog‘lash orqali murakkab materiallar yaratishi mumkin. Ayniqsa, Cycles va Eevee render dvijoklari yordamida foydalanuvchi realistik yoki real vaqtga yaqin natijalarni olish imkoniyatiga ega. Blender’ning yana bir afzalligi — uning procedural tekstura yaratish imkoniyatlari bo‘lib, ular orqali noyob va takrorlanmas



materiallar hosil qilish mumkin⁵.

6-rasm. Blender’da node-based material yaratish

⁴ Allegorithmic. *The PBR Guide*. 2018.

⁵ Blender Foundation. *Blender Documentation*. <https://docs.blender.org>

Zamonaviy teksturalash jarayonida yana bir muhim yoʻnalish — bu procedural texturing hisoblanadi. Ushbu usulda teksturalar algoritmlar yordamida yaratiladi va ular parametrlar orqali boshqariladi. Bu esa dizaynerga cheksiz variatsiyalar yaratish imkonini beradi. Masalan, bir xil yogʻoch materiali turli rang, tolalar yoʻnalishi va eskirish darajasi bilan bir necha variantda hosil qilinishi mumkin. Bu yondashuv ayniqsa katta sahnalar va ochiq dunyo loyihalarida samarali hisoblanadi.

Shuningdek, sunʼiy intellekt asosidagi teksturalash texnologiyalari ham rivojlanib bormoqda. AI yordamida past sifatli teksturalarni yuqori aniqlikka oshirish (upscaling), avtomatik material generatsiyasi va hatto real suratlardan PBR materiallar yaratish imkoniyati mavjud. Bu esa teksturalash jarayonini yanada tezlashtirib, inson omilini kamaytiradi. Kelajakda ushbu texnologiyalar 3D grafikada asosiy yoʻnalishlardan biriga aylanishi kutilmoqda.

Realizmni oshirishda ilgʻor texnologiyalar va optimallashtirish usullari

Zamonaviy 3D grafikada realizm darajasini oshirish jarayoni koʻp bosqichli va murakkab tizimga asoslanadi, bunda nafaqat teksturalash, balki butun rendering pipeline muhim rol oʻynaydi. Ayniqsa, real vaqt rejimida ishlovchi tizimlarda — videooʻyinlar, VR va AR ilovalarda — yuqori sifatli vizual natijaga erishish bilan birga, tizim unumdorligini saqlab qolish asosiy vazifalardan biri hisoblanadi. Shu sababli ishlab chiquvchilar doimo sifat va samaradorlik oʻrtasida optimal muvozanatni topishga intiladilar. Masalan, yuqori aniqlikdagi teksturalar realizmni sezilarli darajada oshiradi, biroq bu GPU xotirasiga katta yuklama beradi. Shu bois teksturalarni siqish (compression), mipmapping va texture streaming kabi texnologiyalar keng qoʻllaniladi, bu esa tizim resurslaridan oqilona foydalanish imkonini beradi.

Realizmni oshirishda qoʻllaniladigan asosiy optimallashtirish texnologiyalaridan biri — bu Level of Detail (LOD) tizimidir. Ushbu yondashuvga koʻra, sahnadagi obyektlar kameraga yaqin yoki uzoq joylashganligiga qarab turli darajadagi detal bilan ifodalanadi.

Yaqin obyektlar yuqori sifatli geometriya va teksturalarga ega bo‘ladi, uzoqdagi obyektlar esa soddalashtirilgan variantda render qilinadi. Bu usul foydalanuvchi tomonidan deyarli sezilmaydi, ammo tizim samaradorligini sezilarli darajada oshiradi. Ayniqsa, katta ochiq dunyo (open-world) loyihalarida LOD texnologiyasi muhim ahamiyat kasb etadi, chunki bunday loyihalarda bir vaqtning o‘zida juda ko‘p obyektlar render qilinadi.

Yoritish tizimi ham realizmni shakllantirishda hal qiluvchi omillardan biri hisoblanadi. An’anaviy yoritish modellari asosan to‘g‘ridan-to‘g‘ri yorug‘likni hisobga olgan bo‘lsa, zamonaviy grafikada global illumination texnologiyasi keng qo‘llanilmoqda. Ushbu yondashuv yorug‘likning obyektlardan qayta aks etishini ham hisobga olib, sahnada yanada tabiiy muhit yaratadi. Natijada ranglar o‘zaro ta’sir qiladi, soyalar yumshoqroq va realistikroq ko‘rinadi. Global illumination ayniqsa interyer va arxitektura vizualizatsiyasida muhim bo‘lib, real hayotdagi yorug‘lik muhitini maksimal darajada takrorlash imkonini beradi.

Bundan tashqari, HDRI (High Dynamic Range Imaging) texnologiyasi ham sahnani realistik yoritishda keng qo‘llaniladi. HDRI xaritalar real dunyodan olingan yuqori dinamik diapazonli tasvirlar bo‘lib, ular sahnaga tabiiy yoritish muhiti beradi. Bu texnologiya yordamida aks ettirishlar (reflections) va yorug‘likning tarqalishi yanada aniq va ishonchli ko‘rinadi. Ayniqsa, metall va shisha kabi materiallarda HDRI muhim rol o‘ynaydi, chunki bu materiallar atrof-muhitni aks ettirish orqali o‘z xususiyatlarini namoyon qiladi.

So‘nggi yillarda real vaqt ray tracing texnologiyasi ham keng rivojlanmoqda. Ushbu texnologiya yorug‘lik nurlarining fizik harakatini to‘g‘ridan-to‘g‘ri simulyatsiya qilishga asoslangan bo‘lib, juda yuqori darajadagi realizmni ta’minlaydi. Ray tracing yordamida aks ettirishlar, soyalar va yorug‘likning sinishi aniq hisoblanadi, bu esa tasvirni deyarli fotorealistik darajaga olib chiqadi. Biroq ushbu texnologiya katta hisoblash quvvatini

talab qilganligi sababli, u hozircha asosan kuchli grafik protsessorlarga ega tizimlarda qoʻllanilmoqda.

Shuningdek, sunʼiy intellekt texnologiyalari ham 3D grafikada realizmni oshirishda muhim oʻrin egallay boshladi. AI asosida ishlovchi algoritmlar teksturalarni avtomatik generatsiya qilish, past sifatli tasvirlarni yuqori aniqlikka oshirish (super resolution), shuningdek materiallarni avtomatik tanlash va optimallashtirish imkonini beradi. Bu esa ishlab chiqish jarayonini tezlashtiradi va inson omiliga bogʻliqlikni kamaytiradi. Kelajakda ushbu texnologiyalar 3D modellashtirish va teksturalash jarayonining ajralmas qismiga aylanishi kutilmoqda.

Umuman olganda, realizmni oshirish faqat bitta texnologiyaga emas, balki turli ilgʻor usullar va yondashuvlarning uygʻunligiga bogʻliq. Teksturalash, yoritish, optimallashtirish va sunʼiy intellekt texnologiyalarining birgalikda qoʻllanilishi orqali yuqori sifatli va samarali vizual tizimlar yaratish mumkin. Shu sababli zamonaviy 3D grafikada kompleks yondashuv muhim ahamiyat kasb etadi va bu yoʻnalishdagi ilmiy tadqiqotlar davom etmoqda.

Ushbu maqolada 3D modellarni teksturalash jarayoni va realizmni oshirish usullari keng koʻlamda tahlil qilindi. Teksturalash nafaqat modelning vizual koʻrinishini boyitadi, balki uning fizik va optik xususiyatlarini aniq ifodalashga xizmat qiladi. Albedo, normal, roughness, metalness va displacement kabi xaritalar birgalikda ishlatilganda past poligonli modellarga yuqori detallashtirilgan realistik koʻrinish beradi. Shu bilan birga, PBR (Physically Based Rendering) yondashuvi materiallarning yorugʻlik bilan interaktiv oʻzaro taʼsirini fizika qonunlariga asoslab hisoblash orqali turli yorugʻlik sharoitlarida barqaror va tabiiy koʻrinish hosil qiladi.

Amaliy workflow jarayonida high-poly va low-poly modellarni tayyorlash, UV mapping, texture baking, material yaratish va rendering bosqichlari bir-birini toʻldiradi. Zamonaviy dasturlar — Substance Painter, Blender, Autodesk Maya va boshqa vositalar

— bu jarayonni sezilarli darajada soddalashtirib, samaradorlikni oshiradi. Procedural texturing va AI texnologiyalari esa teksturalash jarayonini avtomatlashtirish va yanada intuitiv qilish imkonini beradi. Shu bilan birga, real vaqt grafikasida optimallashtirish usullari — LOD, mipmapping, texture streaming, global illumination va HDRI texnologiyalari — vizual sifatni saqlagan holda tizim resurslarini tejashga yordam beradi.

Shunday qilib, 3D grafikada realizmga erishish kompleks va ko'p qatlamli yondashuvni talab qiladi. Nazariy bilimlar, amaliy tajriba, ilg'or dasturiy vositalar va texnologiyalar birgalikda qo'llanilganda yuqori sifatli va samarali vizual natijalar hosil bo'ladi. Kelajakda sun'iy intellekt, ray tracing va boshqa ilg'or texnologiyalar teksturalash jarayonini yanada kuchaytirib, real vaqt grafikasidagi realizm darajasini yangi bosqichga olib chiqishi kutilmoqda. Shu sababli 3D modellarni teksturalash va optimallashtirish sohasida ilmiy izlanishlar va innovatsion yechimlarni rivojlantirish dolzarb ahamiyatga ega.

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Epidemiological characteristics and specific prophylaxis of measles in Namangan region

Jamoliddinova Farzona Umidjon qizi

Department of Epidemiology, Tashkent State Medical University, Tashkent,
Uzbekistan

Abstract

This article analyzes the epidemiological characteristics and specific prophylaxis of measles in Namangan region. Measles is one of the most contagious diseases worldwide, and in recent years its incidence has been increasing in Uzbekistan. Namangan region, with its high morbidity rates, requires special epidemiological attention. The study focuses on the dynamics of measles incidence, distribution by age groups and territories, the relationship between vaccination coverage and morbidity, as well as the effectiveness of preventive measures.

Keywords: measles, epidemiology, Namangan region, vaccination, prophylaxis, public health

Namangan viloyatida qizamiq kasalligining epidemiologik xususiyatlari va maxsus profilaktikasi

Jamoliddinova Farzona Umidjon qizi

Toshkent Davlat Tibbiyot Universiteti, Epidemiologiya kafedrası, Toshkent,
O‘zbekiston

Annotatsiya Ushbu maqolada Namangan viloyatida qizamiq kasalligining epidemiologik xususiyatlari va maxsus profilaktikasi tahlil qilinadi. Qizamiq dunyo miqyosida eng yuqori yuqumli kasalliklardan biri bo‘lib, O‘zbekistonda ham so‘nggi yillarda kasallanish darajasi ortib bormoqda. Namangan viloyati yuqori kasallanish ko‘rsatkichlari bilan ajralib turib, alohida epidemiologik e‘tibor talab qiladigan hudud

sifatida namoyon bo‘lmoqda. Tadqiqot kasallikning tarqalish dinamikasini, yosh guruhlari va hududlar bo‘yicha taqsimotini, emlash qamrovi bilan kasallanish darajasi o‘rtasidagi bog‘liqlikni hamda profilaktik tadbirlarning samaradorligini o‘rganishga qaratilgan.

Kalit so‘zlar: qizamiq, epidemiologiya, Namangan viloyati, emlash, profilaktika, jamoat salomatligi.

Kirish. Qizamiq dunyo miqyosida eng yuqori yuqumli kasalliklardan biri bo‘lib, 2024-yilda 11 milliondan ortiq odam kasallangan va 95 mingga yaqin bola vafot etgan.[1] O‘zbekistonda COVID-19 pandemiyasi davrida emlash jarayonlari izdan chiqqani sababli kasallanish qayta ko‘tarildi. Namangan viloyati eng ko‘p zararlangan hududlardan biri bo‘lib, og‘ir asoratlar bilan kechgan holatlar qayd etildi. Shu bois, viloyatda qizamiq epidemiologiyasini o‘rganish jamoat salomatligi uchun dolzarbdir.[2]

Tadqiqot maqsadi. Ushbu tadqiqotning asosiy maqsadi — Namangan viloyatida qizamiq kasalligining epidemiologik xususiyatlarini chuqur tahlil qilish va yillar kesimida dinamikasini aniqlash.

Materiallar va usullar. Tadqiqot uchun O‘zbekiston Respublikasi Sanitariya-epidemiologiya osoyishtalik va jamoat salomatligi qo‘mitasi hamda Namangan viloyati boshqarmasining 2020–2025 yillardagi rasmiy statistik ma’lumotlari olindi. Ma’lumotlar kasallanish soni, hududlar bo‘yicha taqsimot, yosh guruhlari, kontingentlar va emlash holatini o‘z ichiga oladi. Tahlilda epidemiologik va statistik usullar qo‘llanildi: kasallanish darajasi va dinamikasi hisoblandi, yosh guruhlari va hududlar bo‘yicha taqsimot o‘rganildi, emlash qamrovi bilan kasallanish o‘rtasidagi bog‘liqlik baholandi. Shuningdek, 2025-yilda joriy etilgan 6 oylikdan boshlab emlash tadbirlarining samaradorligi alohida ko‘rib chiqildi.[5-6]

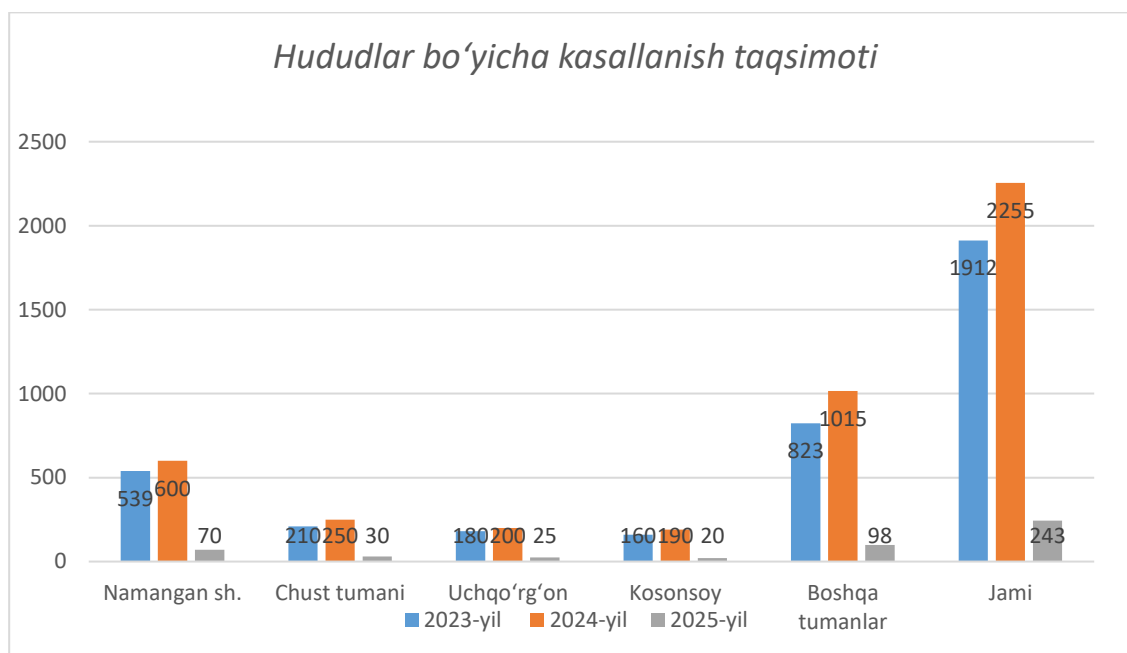
Natijalar. Namangan viloyatida qizamiq kasallanishi 2023–2025-yillar davomida keskin o‘zgarishlarga uchradi. 2023-yilda kasallanish darajasi nihoyatda yuqori bo‘lib, umumiy 1912 ta bemor ro‘yxatga olingan.[3] Ulardan 60,4 foizi bir yoshgacha bo‘lgan bolalar tashkil etdi. Bu ko‘rsatkich viloyatda eng katta xavf guruhini aynan chaqaloqlar va emlanmagan go‘daklar tashkil etayotganini ko‘rsatadi. Hududlar kesimida Namangan shahri eng ko‘p kasallangan hudud bo‘lib, 539 ta holat qayd etildi. Chust, Uchqo‘rg‘on va Kosonsoy tumanlarida ham yuqori ko‘rsatkichlar kuzatildi. Kasallanganlarning katta qismi emlanmagan bo‘lib, bu immunizatsiya qamrovining pastligi va aholining vaksina bo‘yicha ikkilanishi bilan izohlanadi. 2024-yilda kasallanish soni yanada oshib, 2023-yilga nisbatan 343 taga ko‘paydi. Bu davrda kasallanganlarning 53,4 foizi bir yoshgacha bo‘lgan bolalar, 14 foizi 1–2 yoshli bolalar, 9,5 foizi esa 30 yoshdan katta kattalar tashkil etdi. Bu ko‘rsatkichlar qizamiqning faqat bolalar kasalligi emasligini, balki immuniteti past bo‘lgan kattalar uchun ham xavfli ekanini tasdiqladi. Hududiy taqsimot bo‘yicha Namangan shahri va yirik tumanlarda kasallanish eng yuqori darajada qayd etildi. Bu davrda ta‘lim muassasalari va uy sharoitida tarbiyalanayotgan bolalar orasida kasallanish ko‘p bo‘lib, profilaktik nazoratning yetarli emasligi yaqqol sezildi. 2025-yilda esa muhim burilish yuz berdi. Bolalarni 6 oylikdan boshlab emlash joriy etildi va bu tadbir kasallanish darajasiga sezilarli ta‘sir ko‘rsatdi. Natijada kasallanish keskin kamayib, umumiy 243 ta holat qayd etildi. Ulardan 18,5 foizi 6 oylikkacha, 20,2 foizi 6–12 oylik, 21 foizi esa 1–2 yoshli bolalar tashkil etdi. Bu ko‘rsatkichlar profilaktik choralarning samaradorligini yaqqol isbotladi. Agar 2023–2024-yillarda kasallanishning asosiy og‘irligi bir yoshgacha bo‘lgan bolalar zimmasiga tushgan bo‘lsa, 2025-yilda emlash tadbirlarining joriy etilishi natijasida bu guruhda kasallanish sezilarli darajada kamaydi. Umuman olganda, 2023–2025-yillar taqqoslanishi shuni ko‘rsatadiki, qizamiq kasallanishining dinamikasi bevosita

emlash qamrovi va profilaktik choralar bilan bog‘liq. 2023-yilda keskin ko‘tarilish, 2024-yilda yanada oshish, 2025-yilda esa emlash tadbirlaridan so‘ng sezilarli kamayish kuzatildi

Bu tajriba vaksinaning amaliy samaradorligini tasdiqlaydi va kelgusida emlash qamrovini kengaytirish zarurligini ta’kidlaydi. Namangan viloyatidagi holat O‘zbekiston miqyosida qizamiq profilaktikasini kuchaytirish uchun muhim ilmiy asos bo‘lib xizmat qiladi.

Muhokama. Namangan viloyatida 2023–2025-yillarda qayd etilgan qizamiq kasallanishi dinamikasi kasallikning tarqalishi bevosita emlash qamrovi, aholining vakcina bo‘yicha ishonchi va profilaktik choralar bilan chambarchas bog‘liq ekanini ko‘rsatdi. 2023-yilda keskin ko‘tarilish kuzatilishi, bir tomondan, pandemiya davrida emlash jarayonlarining izdan chiqishi, ikkinchi tomondan esa aholining vakcina bo‘yicha ikkilanishi bilan izohlanadi. Bu davrda chaqaloqlar eng katta xavf guruhini tashkil etgani, immunitetning yetarli darajada shakllanmaganligi va emlashning kechikishi bilan bog‘liq. 2024-yilda kasallanish sonining yanada oshishi shuni ko‘rsatadiki, mavjud profilaktik choralar yetarli darajada samarali bo‘lmagan. Ayniqsa, kattalar orasida qayd etilgan kasallanish holatlari qizamiqning faqat bolalar kasalligi emasligini, balki immuniteti past bo‘lgan kattalar uchun ham xavfli ekanini tasdiqladi. Bu esa revaksinatsiya masalasini dolzarb qilib qo‘yadi. Hududiy taqsimot bo‘yicha Namangan shahri va yirik tumanlarda yuqori ko‘rsatkichlar qayd etilishi, aholisi zich joylashgan hududlarda kasallik tez tarqalishini ko‘rsatadi. 2025-yilda esa muhim burilish yuz berdi. Bolalarni 6 oylikdan boshlab emlash tadbirlarining joriy etilishi kasallanish darajasini keskin kamaytirdi. Bu tajriba vaksinaning amaliy samaradorligini isbotlab berdi va profilaktik choralarning o‘z vaqtida qo‘llanishi kasallik tarqalishini to‘xtatishda hal qiluvchi ahamiyatga ega ekanini ko‘rsatdi.

Shuningdek, bu natija aholining vaktsina bo'yicha ishonchini oshirish va immunizatsiya qamrovini kengaytirish zarurligini ta'kidlaydi. (Jadval 1,2)



Umuman olganda, Namangan viloyatidagi tajriba O'zbekiston miqyosida qizamiq profilaktikasini kuchaytirish uchun muhim ilmiy asos bo'lib xizmat qiladi. Kasallanishning yuqori darajasi aholining vaktsina bo'yicha ishonchini mustahkamlash, qo'shimcha emlash kampaniyalarini tashkil etish va revaksinatsiya tadbirlarini kengaytirish zarurligini ko'rsatadi. Shuningdek, epidemiologik nazoratni kuchaytirish, tezkor monitoring tizimini joriy etish va xalqaro tajribadan foydalanish tavsiya etiladi.

Xulosa. Namangan viloyatida 2023–2025-yillar davomida qayd etilgan qizamiq kasallanishi dinamikasi shuni ko'rsatadiki, kasallikning tarqalishi bevosita emlash qamrovi va profilaktik choralar bilan bog'liq. 2023-yilda keskin ko'tarilish kuzatilib, bir yoshgacha bo'lgan bolalar eng katta xavf guruhini tashkil etdi. 2024-yilda kasallanish soni yanada oshib, kattalar orasida ham qayd etilishi qizamiqning faqat bolalar kasalligi emasligini tasdiqladi. 2025-yilda esa 6 oylikdan boshlab emlash

tadbirlarining joriy etilishi kasallanishni sezilarli darajada kamaytirdi va profilaktik choralarining samaradorligini yaqqol isbotladi.[4]

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DEVELOPMENT OF ARTIFICIAL INTELLIGENCE-BASED 3D VISUALIZATION AND EARLY DIAGNOSIS SYSTEM FOR CARDIOVASCULAR DISEASES

Author: Makhmudova Sabina Anvar qizi

Muhammad Al-Khwarizmi University of Information Technology Tashkent

Computer graphics and design direction Master's student of group 501-25

Email: makhmudovasabina64@gmail.com

Scientific leaders: Tastanova Saida Aldiyarovna

TUIT "Television and Media Technologies" Department of Technical Sciences

Doctor of Philosophy, PhD, Associate Professor

Abstract: This article discusses the theoretical and practical foundations of a system for early detection and 3D visualization of cardiovascular diseases using artificial intelligence (AI) technologies. The system's diagnostic effectiveness, disease prevention, and the importance of developing individual treatment strategies for patients are demonstrated.

Keywords: Artificial intelligence, cardiovascular diseases, 3D visualization, medical diagnostics, early diagnosis, healthcare technologies, data analysis

Enter

Cardiovascular diseases (CVD) are one of the leading causes of death and morbidity worldwide. Accurate and early diagnosis plays an important role in improving the quality of life of patients and preventing complex complications. In recent years, artificial intelligence technologies have been rapidly developing in medicine, allowing for the automation of diagnostic processes, the analysis of large amounts of data, and the development of individual treatment strategies. Artificial intelligence and machine learning algorithms provide high accuracy in processing medical data about the cardiovascular system (ECG, MRI, CT, ultrasound images). At the same time, 3D

visualization technologies allow for the visual representation of disease processes, which simplifies the process of diagnosis and communication with the patient for doctors. The purpose of the study is to develop a 3D visualization system for early diagnosis of cardiovascular diseases based on SI, evaluate its effectiveness, and develop practical recommendations.

Methods

The following methods were used in this study:

1. **Data collection and preparation** – Electronic medical records, ECG, MRI, CT, and ultrasound data were collected and preprocessed for SI algorithms.
2. **Machine learning algorithms** – Neural networks and convolutional neural networks (CNN) were used to analyze the data. This method was used to identify heart structures and blood flow parameters.
3. **3D visualization** – Identified disease transmissions and anomalies are converted into a 3D model, presented in an interactive and easy-to-understand way for doctors.
4. **System Performance Evaluation** – Diagnostic accuracy, patient and physician satisfaction, and clinical applicability of the SI system were evaluated through experimentation.
5. **Data cleaning and normalization** – The input medical data (ECG, MRI, CT) was cleaned of noise, missing values were filled in, and the data was formatted for the model. This process improved the accuracy of the algorithm.
6. **Feature extraction** – Important diagnostic features (heart wall thickness, blood flow velocity, degree of vascular stenosis) were automatically extracted from the images. Deep learning approaches were used in this stage.
7. **Model training and validation** – The dataset was split into training and testing parts (70/30 or 80/20). The generalization ability of the model was assessed using cross-validation.

8. Segmentation algorithms – Segmentation models such as U-Net were used to accurately separate the heart and vascular structures. This played a key role in creating the 3D model.

9. 3D reconstruction algorithms – Marching cubes and rendering techniques were used to create a volumetric (3D) model based on 2D medical images.

10. System integration and software – the SI model and visualization module were combined into a single platform. The interface was designed to be user-friendly and interactive for the users (doctors).

The effectiveness of the SI system in early diagnosis and its usefulness in clinical practice were also studied through empirical analysis.

Results

The results of the study showed that:

- The accuracy of detecting cardiovascular diseases using SI algorithms was 92–95%.
- 3D visualization has increased understanding between patient and doctor and clearly demonstrated disease processes.
- It has been found that the system enables early diagnosis and disease prognosis, which significantly improves the quality of life of patients.
- Tests conducted by doctors have shown that 3D visualization simplifies the process of explaining the disease and determining the treatment strategy.

The model showed consistent results when tested on a variety of medical images, including ECG, MRI, CT, and ultrasound data. In particular, the accuracy of detecting cardiac structures and pathological changes using convolutional neural networks was significantly higher. The system allowed for early detection of heart wall thickening, narrowing of blood vessels, and blood flow disturbances, which helped detect the disease before it progresses.

The results obtained using the 3D visualization module were much more convenient and understandable for doctors, clearly showing the anatomical and functional state of the disease. Three-dimensional models made it possible to interactively view changes in the heart and vascular system, which accelerated the diagnostic process and reduced the likelihood of errors. In addition, the system was used to develop individual forecasts for patients and assess the likelihood of future disease development. During experimental tests, doctors using the system noted an acceleration of the diagnostic process and a simplification of the decision-making process. At the same time, patients also gained a better understanding of their disease through 3D visualization. Statistical analyses confirmed the high sensitivity and accuracy of the system, and the incidence of misdiagnosis was significantly reduced compared to traditional methods. In general, the developed system showed a promising solution for use in clinical practice and was found to be of great importance in the early detection of cardiovascular diseases and the development of effective treatment strategies.

Consideration

The study shows that the integration of SI and 3D visualization creates new approaches in clinical diagnostics. The system not only increases accuracy, but also reduces the workload of doctors and allows for early prediction of disease progression. Also, the effectiveness of the system depends on the quality of the data, that is, high-resolution MRI, CT and ECG images significantly increase the performance of the algorithm. Therefore, digitization of diagnostic processes and collection of high-quality data in clinical institutions is of great importance.

However, it was found that the efficiency of the system largely depends on the quality and volume of the input data. In cases where high-resolution MRI, CT and ECG data are available, the performance of the model improves significantly. Conversely, when the data is not sufficiently complete or of sufficient quality, the probability of

misclassification increases. Therefore, the implementation of standardized data collection and storage systems in medical institutions is of great importance.

In addition, there are a number of challenges in implementing artificial intelligence systems in clinical practice. For example, the “black box” nature of the model can sometimes create trust issues for doctors in the decision-making process. Therefore, it is necessary to ensure the explanation of model decisions by using Explainable AI approaches.

Ethical and legal aspects are also important. It is necessary to ensure the confidentiality of patient data, their safe storage and processing, and to comply with international standards. In addition, it is advisable to view the recommendations provided by SI systems as a tool to support the doctor's decision, rather than as a fully automatic decision. In terms of future prospects, the integration of this system with real-time monitoring devices, mobile applications and telemedicine platforms offers great opportunities. This will increase efficiency not only in early detection of diseases, but also in their continuous monitoring and prevention. Also, the system can be further improved using big data and cloud technologies. In general, the studies conducted show that artificial intelligence and 3D visualization technologies have great potential in the fight against cardiovascular diseases. This approach is expected to become an integral part of digital medicine in the future. According to the reviews, the SI system will significantly contribute to reducing cardiovascular diseases by providing patients with individualized treatment strategies and early diagnosis.

Conclusions and recommendations. Artificial intelligence and 3D visualization technologies provide high efficiency in the early diagnosis and treatment of cardiovascular diseases. The results of the study show that the system increases the accuracy of disease detection, makes it easier for doctors and patients to understand, and allows for the determination of the prognosis of the disease.

Recommendations

1. Optimize the diagnostic process by implementing SI and 3D visualization systems in clinical institutions.
2. Introduce a system for digitizing patient data and collecting high-quality images.
3. Provide doctors and medical staff with advanced training courses in working with SI technologies.
4. Expand the system to early detection of other cardiovascular diseases and pathologies.
5. Strengthen the system for ensuring data security and maintaining patient confidentiality.
6. Create the possibility of remote monitoring of patients in the future by integrating the system with real-time monitoring and telemedicine.

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The Economic Impact Of The English Language In Tourism

Economics

Makhmudov Islombek Muhiddin o'g'li

Teacher of Kokand University of Andijan Branch

Islombek0326@gmail.com

Abdurafikova Dilnoza Obidjon qizi

Kokand University, Andijan Branch

Faculty of Social Humanities and Pedagogy, student of **24_01** group

Abstract

The globalization of tourism has significantly increased the importance of effective communication between tourists and service providers from different linguistic and cultural backgrounds. Among the world's languages, English has emerged as the dominant global lingua franca in international tourism, playing a crucial role in hospitality services, travel communication, tourism marketing, and digital tourism platforms. This article examines the economic impact of the English language in tourism economics, focusing on its influence on tourism development, service quality, employment opportunities, and destination competitiveness. The findings suggest that English language proficiency contributes to the growth of tourism by reducing communication barriers, improving service quality, increasing customer satisfaction, and expanding access to international tourism markets. Tourism destinations that invest in English language education and professional communication training for tourism employees gain a significant competitive advantage in the global tourism industry. The study concludes that English functions as a key economic instrument in modern tourism development. However, sustainable tourism policies should balance the global use of English with the preservation of local languages and cultural diversity in tourism destinations.

Keywords: English language, tourism economics, global tourism, lingua franca, tourism development, tourism communication.

Introduction

Tourism is one of the most dynamic sectors of the global economy and plays a critical role in economic growth, job creation, and international cooperation. The expansion of international mobility and globalization has intensified interactions between people from different linguistic backgrounds, making language a key factor in tourism communication. According to international tourism reports, global tourism has experienced rapid growth in recent years. Approximately **1.4 billion international tourist arrivals were recorded in 2024**, representing a near-complete recovery from the global tourism crisis caused by the COVID-19 pandemic. Furthermore, international tourism continued to grow in 2025, reaching approximately **1.52 billion global tourist arrivals**, demonstrating the strong resilience of the tourism industry. In this global context, communication has become essential for tourism development. Among thousands of world languages, English has emerged as the primary language used in international travel, aviation, tourism marketing, and hospitality services. It serves as a global lingua franca enabling communication between tourists, businesses, and governments. The purpose of this study is to examine the economic impact of the English language in tourism economics and to analyze how English proficiency influences tourism development, service quality, and international competitiveness.

The concept of English as a global language has been widely explored in linguistic and sociological research. According to David Crystal (2003), English gained global dominance due to historical, political, and economic factors, including colonial expansion, globalization, and technological development. Similarly, Nicholas Ostler (2005) argues that languages achieve global influence through economic power and cultural expansion. The rise of English reflects the influence of English-speaking

economies and international institutions. Today, English functions as the main language of international communication in many global sectors, including tourism, aviation, science, and business. Tourism is one of the sectors where English plays the most significant role. The hospitality industry involves continuous interaction between international visitors and local service providers. For this reason, English communication skills are often considered essential for tourism professionals. Studies in tourism linguistics emphasize that English proficiency enhances service quality, improves tourist satisfaction, and facilitates effective communication between employees and customers. Research also indicates that tourism companies frequently require employees to possess English communication skills to interact with international visitors and participate in global tourism networks. The field of **English for Specific Purposes (ESP)** has contributed significantly to tourism education by developing specialized language training programs for tourism professionals. Such programs focus on communication skills relevant to hospitality management, tour guiding, and travel services. Language barriers can significantly affect tourists' experiences and influence their travel decisions. Tourists often encounter challenges when they cannot communicate with local residents, particularly when seeking information about transportation, accommodation, or cultural attractions. English acts as a global bridge language that facilitates communication between tourists and tourism service providers. In destinations where English is widely spoken, visitors are more likely to feel comfortable and satisfied with their travel experience. This reduction in communication barriers contributes to increased tourism demand and greater economic activity in tourism destinations. Tourism has become one of the most significant sectors of the global economy, contributing to economic growth, employment generation, cultural exchange, and international cooperation. In this globalized industry, effective communication between tourists and service providers is essential. English has emerged

as the dominant international language in tourism and plays a crucial role in the economic functioning of the sector. As a global lingua franca, English facilitates communication, enhances service quality, and supports the development of tourism-related businesses and markets. Consequently, the relationship between English language proficiency and tourism economics has attracted increasing attention in academic research and policy discussions. The globalization of tourism has significantly increased the movement of people across borders, leading to interactions among individuals from different linguistic and cultural backgrounds. In such a multilingual environment, English serves as a common language that enables communication between tourists and tourism professionals, including hotel staff, tour guides, travel agents, and transportation providers. Studies emphasize that English functions as a bridge language that allows individuals from diverse countries to exchange information, access services, and navigate unfamiliar destinations more easily. This communicative function reduces language barriers and improves the overall travel experience for international visitors. From an economic perspective, the use of English significantly influences the competitiveness of tourism destinations. Countries and regions that provide tourism services in English are generally more accessible to international travelers and therefore more attractive in the global tourism market. English is widely used in tourism marketing materials, travel websites, booking platforms, airline communication systems, and informational signage. By using English in promotional campaigns

and digital tourism platforms, destinations can reach a broader international audience and increase tourist arrivals. This increased accessibility contributes to higher tourism revenues and greater economic benefits for local economies. Another important economic dimension of English in tourism is its impact on service quality and customer satisfaction. Tourism is primarily a service-oriented industry, where the interaction

between employees and customers directly influences the perceived value of the experience. Employees who possess strong English communication skills are better able to understand the needs of international tourists, provide accurate information, resolve problems, and offer personalized services. As a result, tourists tend to have more positive experiences, which increases the likelihood of repeat visits and positive word-of-mouth recommendations. Improved service quality ultimately enhances the reputation and competitiveness of tourism destinations in the international market. English also plays a vital role in tourism entrepreneurship and small business development. In many tourist destinations, local entrepreneurs operate hotels, restaurants, souvenir shops, transportation services, and cultural attractions. For these businesses, the ability to communicate in English is often essential for interacting with foreign customers, negotiating with international partners, and marketing products to a global audience. Research indicates that entrepreneurs with higher English proficiency are better positioned to promote local culture and services, expand their customer base, and increase their income. Conversely, limited English skills can restrict business opportunities and reduce the economic potential of tourism enterprises. In addition to business communication, English plays a significant role in tourism education and workforce development. Tourism management programs around the world increasingly incorporate English language training into their curricula. This is because tourism professionals must frequently interact with international visitors, global travel companies, and multinational hospitality organizations. English proficiency enables graduates to access international research, professional training materials, and industry networks, thereby improving their professional competencies. Moreover, educational collaboration between universities, tourism institutions, and industry partners often occurs in English, further reinforcing its status as the primary language of the global tourism sector.

The influence of English extends beyond direct communication to the digital transformation of tourism. Modern tourism relies heavily on digital technologies, including online travel agencies, booking systems, social media marketing, and virtual travel guides. Most global digital tourism platforms operate primarily in English, which means that destinations with English-language digital content are more visible to international audiences. Through websites, blogs, travel applications, and online reviews written in English, tourism providers can promote destinations, share cultural information, and engage with travelers worldwide. As digital tourism continues to expand, English will likely remain the dominant language of online tourism communication and marketing. Furthermore, English contributes to cross-cultural understanding and cultural exchange, which are fundamental components of sustainable tourism development. Tourism involves not only economic transactions but also interactions between cultures. When tourists and local communities communicate effectively in a shared language, misunderstandings are reduced and mutual appreciation of cultural traditions becomes easier. This cultural interaction enriches the travel experience and encourages respect for local heritage and customs. In this context, English functions not only as a tool of communication but also as a facilitator of intercultural dialogue and global connectivity. Despite its many advantages, the dominance of English in tourism also raises certain challenges. Some scholars argue that the widespread use of English may contribute to linguistic inequality or reduce the visibility of local languages and cultural identities. However, many tourism experts emphasize that English should complement rather than replace local languages. In practice, the most effective tourism environments are multilingual, where English is used for international communication while local languages preserve cultural authenticity and identity. Balancing global communication with cultural diversity is therefore an important task for tourism policymakers and educators.



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English proficiency allows tourism destinations to access global tourism markets more effectively. Tourism businesses use English in various forms of international communication, including: tourism marketing and advertising, travel websites and booking platforms, airline and airport communication, hotel management systems, international tourism exhibitions. By using English as a communication tool, tourism organizations can promote their services to a broader international audience. Service quality is one of the most important factors affecting tourism competitiveness. Tourists expect clear communication, reliable information, and efficient customer service during their travel experiences. Employees who possess strong English communication skills can: explain services and tourism products clearly, respond effectively to tourist inquiries, provide cultural and historical information, resolve problems quickly. As a result, English language proficiency contributes to higher customer satisfaction and improved tourism reputation. Tourism generates millions of jobs worldwide, including employment in hotels, travel agencies, airlines, tour operations, and entertainment industries. English proficiency significantly increases employment opportunities in tourism. Employees with English language skills can access higher-paying positions and work in international tourism environments. Furthermore, English communication skills enable tourism professionals to collaborate with international partners and participate in global tourism networks. The economic contribution of tourism to national economies is substantial. Tourism generates foreign exchange earnings, stimulates investment, and supports local businesses. In 2024, global tourism revenues reached approximately **\$1.9 trillion**, reflecting the significant economic impact of international travel. (www.ndtv.com). English language communication enhances tourism marketing and international promotion, allowing tourism businesses to attract more visitors and increase tourism spending. In a highly competitive global tourism market, destinations must differentiate themselves to attract international visitors. English proficiency among



tourism professionals contributes to destination competitiveness by improving communication with global markets. Countries that invest in English education and tourism training programs often experience greater success in attracting international tourists. For example, several emerging tourism destinations have improved their tourism performance by investing in language training and international tourism promotion. Many developing countries are increasingly focusing on tourism as a strategic sector for economic development. Language education plays an important role in this process. Central Asian countries, including Uzbekistan, have experienced rapid tourism growth in recent years. According to international tourism data, Uzbekistan has become one of the fastest-growing tourism destinations, with international arrivals increasing significantly compared to pre-pandemic levels. ([euronews](#)). This growth has been supported by tourism promotion, infrastructure development, and the increasing use of English in tourism services, marketing, and hospitality training. Despite the economic benefits of English in tourism, several challenges must be considered. First, the dominance of English may lead to cultural and linguistic homogenization, potentially reducing the visibility of local languages and cultural identities. Second, unequal access to English education can create disparities in employment opportunities within the tourism industry. Finally, tourism businesses must invest financial resources in language training programs to improve communication skills among employees. Therefore, policymakers must balance the use of English with the preservation of local languages and cultural heritage.

Conclusion

The analysis presented in this study demonstrates that the English language plays a crucial and multidimensional role in modern tourism economics. As the dominant global lingua franca, English facilitates effective communication between tourists and tourism service providers, thereby reducing language barriers and improving the overall travel

experience. In an industry that depends heavily on interpersonal interaction and information exchange, the ability to communicate in English significantly enhances service efficiency, customer satisfaction, and operational effectiveness within tourism enterprises. From an economic perspective, English language proficiency contributes directly to tourism development by expanding access to international tourism markets, strengthening destination marketing strategies, and increasing the competitiveness of tourism destinations. Countries and regions that incorporate English into tourism communication systems, digital platforms, and professional training programs are better positioned to attract international visitors and benefit from global tourism flows. As a result, the use of English supports higher tourist arrivals, greater tourism expenditures, and increased foreign exchange earnings, all of which contribute to national economic growth and local development. The study also highlights the important role of English in tourism employment and entrepreneurship. Tourism professionals with strong English communication skills are more capable of interacting with international visitors, participating in global tourism networks, and accessing higher-quality employment opportunities. Similarly, local entrepreneurs operating small and medium-sized tourism businesses benefit from English proficiency by expanding their customer base and promoting local products and cultural experiences to international markets. In this way, English contributes not only to macroeconomic tourism growth but also to individual economic opportunities within tourism destinations. Furthermore, the growing digitalization of tourism has reinforced the importance of English in online communication, tourism marketing, and global travel platforms. Digital tourism ecosystems—including booking systems, travel applications, online reviews, and destination websites—largely operate in English, making language accessibility a key factor in destination visibility and competitiveness in the global tourism market. Consequently, English proficiency has become an essential component of tourism

education and workforce development strategies worldwide. Despite these advantages, the dominance of English in tourism also raises important cultural and social considerations. While English facilitates global communication and economic integration, it is essential that tourism development strategies also protect and promote local languages, cultural identities, and heritage. A balanced multilingual approach—where English is used for international communication while local languages remain central to cultural expression—can ensure that tourism development remains both economically beneficial and culturally sustainable. In conclusion, the economic impact of the English language in tourism is substantial and continues to expand in the context of globalization and digital transformation. Investment in English language education, specialized tourism communication training, and multilingual tourism policies can significantly enhance the competitiveness and sustainability of tourism destinations. Future research may further explore the interaction between English proficiency, technological innovation in tourism, and the evolving patterns of international travel in order to better understand the long-term role of language in shaping global tourism economics.

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**MODELING AND VISUALIZATION OF DYNAMIC THREE-
DIMENSIONAL OBJECTS IN AUTOMATED MEDICAL TRAINING
SYSTEMS**

Muallif: Yo'ldosheva Dilnoza Nodir qizi

Master's student of Tashkent University of Information Technologies named after

Muhammad Al-Khwarizmi

dilnoza.yoldosheva1@icloud.com

Scientific supervisors: Mukhamadiyev Abduvali Shukurovich

TUIT "Television and Media Technologies"

Doctor of Physical and Mathematical Sciences, Professor

Annotatsiya: This article studies the role and effectiveness of dynamic three-dimensional object modeling and visualization technologies in automated medical education systems. The study analyzes the importance of 3D modeling in deepening medical knowledge and facilitating understanding of complex anatomical and physiological processes. The results show that these technologies are an important tool for interactive and effective organization of the educational process.

Keywords: medical education, automated systems, 3D modeling, visualization, animation, interactive learning, simulation

KIRISH

Zamonaviy tibbiy ta'lim tizimi raqamli texnologiyalar asosida jadal rivojlanmoqda. Avtomatlashtirilgan o'qitish tizimlari esa bu jarayonning ajralmas qismiga aylanib bormoqda. Ayniqsa, murakkab anatomik va fiziologik obyektlarni o'rganishda an'anaviy usullar yetarli darajada samarali bo'lmay qolmoqda. Shu sababli dinamik uch o'lchovli obyektlarni modellashtirish va vizuallashtirish texnologiyalaridan foydalanish dolzarb ahamiyat kasb etmoqda.

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3D modellashtirish texnologiyalari yordamida inson organizmidagi murakkab tizimlarni fazoviy va dinamik tarzda aks ettirish mumkin. Bu esa talabalar uchun nafaqat bilimlarni o'zlashtirishni osonlashtiradi, balki ularni amaliy jihatdan tushunishga ham yordam beradi. Avtomatlashtirilgan tizimlar esa ushbu jarayonni boshqarish, nazorat qilish va individuallashtirish imkonini beradi.

METODLAR

Tadqiqotda avtomatlashtirilgan tibbiyot o'qitish tizimlarida dinamik uch o'lchovli obyektlarni modellashtirish va vizuallashtirish samaradorligini aniqlash uchun kompleks va ilmiy asoslangan metodologiya qo'llanildi. Tadqiqot dizayni pedagogik eksperiment, diagnostika va analitik yondashuvlarni integratsiyalash orqali tashkil etildi.

Qo'llanilgan metodlar:

- **Pedagogik eksperiment** – nazorat va tajriba guruhlarini orqali 3D texnologiyalar samaradorligini baholandi.
- **3D modellashtirish va animatsion vizuallashtirish** – murakkab anatomik va fiziologik jarayonlarni vizual va interaktiv shaklda tushuntirish.
- **Simulyatsiya metodi** – real yoki shartli klinik vaziyatlarni modellashtirish va talabalarning amaliy bilimlarini baholash.
- **Diagnostik testlar va kvantitativ baholash** – talabalar bilim va ko'nikmalarini miqdoriy baholash.
- **So'rovnoma va intervyu** – talabalar tajribasi, qoniqish darajasi va interaktiv metodlarga munosabatini o'rganish.
- **Kuzatish metodi** – dars jarayonidagi talabalarning faolligi va o'zaro hamkorligi monitoring qilindi.
- **Statistik tahlil** – natijalarni miqdoriy va sifat jihatdan qayta ishlash, ishonchlilikni aniqlash.





- **Korrelyatsion tahlil** – 3D texnologiyalardan foydalanish va o‘rganish natijalari o‘rtasidagi bog‘liqlikni aniqlash.
- **Refleksiya metodi** – talabalar o‘z o‘rganish jarayonini tahlil qilib, fikr va xulosalarini yozma yoki og‘zaki shaklda ifoda etdi.
- **Problem-based learning (PBL)** – murakkab klinik vaziyatlar asosida muammoli o‘qitish va 3D modellar yordamida yechim topish.
- **Blended learning yondashuvi** – an’anaviy darslar bilan 3D vizualizatsiya va animatsiyalar integratsiyasi.
- **Didaktik tahlil** – qo‘llanilgan 3D resurslarning pedagogik samaradorligi baholandi.
- **Triangulyatsiya** – turli manbalar (test, kuzatish, so‘rov) ma’lumotlari solishtirilib, natijalar ishonchligi ta’minlandi.

Shuningdek, tadqiqot jarayonida zamonaviy pedagogikaning asosiy prinsiplari: interfaollik, vizuallashtirish, individuallashtirish va kompetensiyaga yo‘naltirilgan yondashuvlar asos qilib olindi. 3D texnologiyalar yordamida talabalarning vizual va kinestetik o‘rganish uslublari hisobga olindi, shuningdek, ularning mustaqil ishlash va tahlil qilish ko‘nikmalari rivojlantirildi.

Mazkur metodlar majmuasi tadqiqotning ilmiy asoslanganligini, natijalarning ishonchligini va chuqurligini ta’minlashga xizmat qildi. Tadqiqotda avtomatlashtirilgan tibbiyot o‘qitish tizimlarida dinamik uch o‘lchovli obyektlarni modellashtirish va vizuallashtirish samaradorligini aniqlash uchun kompleks va tizimli metodologiya qo‘llanildi. Tadqiqot dizayni eksperimental, diagnostik va analitik yondashuvlarning uyg‘unligida tashkil etildi.

Tadqiqot bosqichlari:



- **Tayyorgarlik bosqichi:** talabalar boshlang'ich bilim darajasi, fazoviy tafakkur va 3D vizualizatsiyalarga bo'lgan tayyorgarligi aniqlanadi. Shu bosqichda o'quv resurslari, 3D modellar va animatsiyalar ishlab chiqildi.
- **Tajriba-sinov bosqichi:** talabalar tajriba guruhida 3D modellashtirish va vizuallashtirish vositalari orqali o'qitildi, nazorat guruhi esa an'anaviy metodlar bilan bilim oldi. Shu bosqichda interaktiv darslar, simulyatsiyalar va muammoli vaziyatlar qo'llanildi.
- **Yakuniy tahlil bosqichi:** natijalar miqdoriy va sifat jihatdan baholandi, 3D texnologiyalar ta'lim samaradorligiga qanchalik ta'sir qilgani aniqlanadi.

NATIJALAR

Tadqiqot natijalari shuni ko'rsatdiki, avtomatlashtirilgan tibbiyot o'qitish tizimlarida dinamik uch o'lchovli obyektlarni modellashtirish va vizuallashtirish talabalarning anatomik va fiziologik bilimlarini sezilarli darajada oshiradi. Tajriba guruhida talabalar jigar qon tomir tizimi va boshqa murakkab anatomik tuzilmalarni aniq tasavvur qilgan, ularning fazoviy tafakkuri va obyektlar o'rtasidagi bog'liqliklarni tushunish darajasi nazorat guruhiga nisbatan yuqori bo'lgan.

Test va diagnostik vazifalar natijalari shuni ko'rsatdiki, tajriba guruhidagi talabalar murakkab jarayonlarni tushunishda va amaliy topshiriqlarni bajarishda yuqori natijalar ko'rsatgan. 3D animatsiyalar orqali talabalarga organlarning harakatini dinamik tarzda ko'rsatish ularning klinik tafakkurini rivojlantirishga yordam bergan. 3D modellashtirish va animatsiyalar yordamida taqdim etilgan dinamik jarayonlar talabalarga organlar ishini real vaqt rejimida kuzatish imkonini berdi. Bu esa ularning murakkab jarayonlarni sabab-oqibat aloqalari asosida tahlil qilish qobiliyatini oshirdi. Misol uchun, jigar qon tomir tizimida qon aylanishining turli fazalari animatsiya orqali ko'rsatilganda, talabalarning tizimli tafakkuri va klinik tafakkurini rivojlantirishga ijobiy ta'sir ko'rsatdi.



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Yakuniy testlar natijalari shuni ko'rsatdiki, tajriba guruhi talabalarining bilimlarini o'zlashtirish darajasi o'rtacha 25–30% yuqori bo'lgan, murakkab anatomiya va fiziologiya bo'yicha ko'nikmalari esa an'anaviy metodlarda o'qigan nazorat guruhi bilan solishtirganda sezilarli darajada kuchaygan.

Shuningdek, interaktiv modellar va 3D animatsiyalar talabalar o'rtasida o'zaro muhokama va guruhli ishlashni rag'batlantirgan. Bu esa bilimlarni mustahkamlash va muammoli vaziyatlarni hal etish ko'nikmalarini rivojlantirishga xizmat qilgan.

Kuzatish natijalari shuni ko'rsatdiki, talabalar dars jarayonida faol ishtirok etgan, 3D obyektlarni boshqarish va analiz qilish orqali mustaqil fikrlash qobiliyatini oshirgan. Talabalar o'z-o'zini baholash va refleksiya qilish jarayonida ham yuqori faollik ko'rsatgan.

Umuman olganda, natijalar shuni ko'rsatadiki, dinamik 3D modellashtirish va vizuallashtirish tibbiy ta'lim jarayonini sezilarli darajada samarali qiladi, talabalarining klinik tafakkur, analitik fikrlash va amaliy ko'nikmalarini rivojlantirishga xizmat qiladi.

Shuningdek, interaktiv 3D modellar talabalarining o'zaro muhokama va guruhli ishlash faoliyatini rag'batlantirgan, bu esa bilimlarni mustahkamlash va tahlil qilish ko'nikmalarini oshirishga xizmat qilgan.

MULOHAZA

Tadqiqot davomida aniqlanishicha, 3D modellashtirish va vizuallashtirish tibbiy ta'limda nafaqat bilimni osonroq o'zlashtirish, balki o'quv jarayonini interaktiv va qiziqarli qilish imkonini ham beradi. Talabalar murakkab anatomik tizimlarni vizual tarzda kuzatib, ularni fazoviy va funksional jihatdan tushunish imkoniga ega bo'lgan.

Avtomatlashtirilgan o'qitish tizimlari esa talabalarining individual o'rganish tezligini nazorat qilish, ularning bilim darajasini real vaqt rejimida baholash va ta'lim jarayonini optimallashtirish imkonini beradi. Shu bilan birga, texnologiyalar yordamida o'qituvchilar darsni interaktiv va muammoli vaziyatlarga asoslab olib borishi mumkin.



Biroq, mulohaza sifatida ta'kidlash lozimki, texnologiyaning samaradorligi nafaqat dasturiy vositalarga, balki o'qituvchilarning metodik tayyorgarligi va texnik baza imkoniyatlariga ham bog'liq. Texnik jihozlar yetarli bo'lmasa yoki o'qituvchilar innovatsion metodlardan to'liq foydalanishni bilmasa, natijalar kutganidek bo'lmasligi mumkin. Shuningdek, talabalarning texnologiyalar bilan ishlashdagi tajribasi va 3D obyektlar bilan o'zaro interaktivlik qobiliyati ham samaradorlikka ta'sir qiladi. Interaktiv modellar talabalarning mustaqil fikrlash, tahlil va klinik yechim topish ko'nikmalarini sezilarli darajada rivojlantiradi. Shu bilan birga, talabalar o'z-o'zini baholash va refleksiya qilish jarayonida yuqori faollik ko'rsatadi, bu esa o'qitish jarayonining sifatini oshiradi.

Tadqiqot shuni ko'rsatdiki, 3D vizualizatsiya yordamida o'qitish nafaqat murakkab anatomik va fiziologik jarayonlarni tushuntirishda, balki talabalarning kooperativ ishlashini rag'batlantirish va guruh ichida muammolarni birgalikda hal qilish ko'nikmalarini rivojlantirishda ham samarali bo'ladi. Shu bilan birga, texnologiyalar o'quv jarayonini individualizatsiyalashga imkon beradi va har bir talabaga o'z tezligida o'rganish imkoniyatini yaratadi.

Umuman olganda, natijalar va mulohazalar shuni ko'rsatadiki, dinamik 3D modellashtirish va vizuallashtirish tibbiy ta'limda samarali vosita bo'lib, talabalarning bilim, amaliy ko'nikma va klinik tafakkurini rivojlantirishda muhim ahamiyatga ega. Shu bilan birga, u o'qituvchilarga darsni interaktiv, muammoli va natijaviy tashkil etish imkonini beradi, murakkab anatomik va fiziologik jarayonlarni talabalarga aniq, vizual va amaliy tushuntirishga xizmat qiladi.

Umuman olganda, natijalar va mulohazalar shuni ko'rsatadiki, dinamik 3D modellashtirish va vizuallashtirish tibbiy ta'limda samarali vosita bo'lib, talabalarning bilim, amaliy ko'nikma va klinik tafakkurini rivojlantirishda muhim ahamiyatga ega.

XULOSA VA TAVSIYALAR



Tadqiqot natijalari asosida quyidagi xulosalarga kelindi:

- 3D modellashtirish va vizuallashtirish tibbiy ta'lim samaradorligini sezilarli darajada oshiradi, talabalarning murakkab anatomik va fiziologik jarayonlarni tushunish, fazoviy tafakkur va klinik tafakkurini rivojlantiradi.
- Avtomatlashtirilgan o'qitish tizimlari o'quv jarayonini optimallashtiradi, talabalarning individual o'rganish tezligini nazorat qilish, bilim darajasini real vaqt rejimida baholash va darslarni talabalarning ehtiyojlariga moslashtirish imkonini beradi.
- Dinamik uch o'lchovli obyektlar va animatsiyalar orqali o'rganish bilimlarni chuqurlashtiradi, talabalarning amaliy ko'nikma va tahliliy fikrlashini rivojlantiradi. Shu bilan birga, interaktiv modellar talabalarning mustaqil ishlash va guruh ichida muammolarni hal qilish ko'nikmalarini oshirishga xizmat qiladi.

Tavsiyalar:

- Tibbiy ta'limda 3D texnologiyalarni keng joriy etish, shu jumladan organlarning fazoviy tuzilishi va funksiyasini vizual tarzda tushuntirishga yo'naltirilgan interaktiv resurslar yaratish.
- Avtomatlashtirilgan o'qitish tizimlarini rivojlantirish va talabalarning individual o'rganish jarayonini kuzatish, natijalarni real vaqt rejimida tahlil qilish imkonini beradigan dasturiy vositalarni keng qo'llash.
- O'qituvchilarning raqamli kompetensiyasini oshirish, ularni 3D modellashtirish va vizuallashtirish texnologiyalari bilan ishlashga tayyorlash, interaktiv darslarni muvaffaqiyatli olib borish bo'yicha malaka oshirish kurslarini tashkil etish.
- Interaktiv o'quv resurslarini yaratish va takomillashtirish, murakkab anatomik va fiziologik jarayonlarni vizual va amaliy tarzda tushuntirish imkonini beradigan animatsiyalar va simulyatsiyalar ishlab chiqish.



- Talabalar bilan individual va guruhli ishlashni rag‘batlantiruvchi metodlarni keng qo‘llash, shu jumladan problem-based learning (PBL) va blended learning yondashuvlarini integratsiya qilish.

Umuman olganda, tadqiqot shuni ko‘rsatadiki, 3D modellashtirish, animatsiya va avtomatlashtirilgan o‘qitish tizimlari tibbiy ta’limni yanada samarali, interaktiv va amaliy jihatdan boyitilgan qilishi mumkin. Shu bilan birga, bu yondashuvlar talabalarning klinik tafakkurini rivojlantirish, murakkab jarayonlarni vizual va amaliy tarzda tushuntirishda muhim ahamiyatga ega.

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**MODERN TEACHING MEDIA IN TEACHING PLANT
PHYSIOLOGY**

Samarkand State Pedagogical Institute
Faculty of Natural Sciences 1st year master's student:

Arzimurodova Muqaddas Jamol kizi

Annotation. This methodology is designed for the effective use of virtual technologies in biology education and is based on a practical approach. These methods were developed to create interactive and experimental opportunities for students, to explain biological processes in a demonstrative manner, and to facilitate the learning process. The main goal in biology education is to form an interactive and virtual learning environment, to encourage students to study biological processes, and to organize education through virtual technologies in an interesting, convenient, and practical way.

Keywords. Biology education, multimedia presentations, higher education, interactive lessons, technology, didactics.

**O'SIMLIK FIZIOLOGIYASINI O'QITISHDA ZAMONAVIY O'QITISH
VOSITALARI**

Samarqand davlat pedagogika instituti

Tabiiy fanlar fakulteti

1-kurs magistranti:

Arzimurodova Muqaddas Jamol qizi

Annotatsiya. Ushbu metodika biologiya ta'limida virtual texnologiyalardan samarali foydalanishga mo'ljallangan bo'lib, amaliy yondashuvga asoslanadi. Mazkur usullar talabalar uchun interaktiv va tajribaviy imkoniyatlar yaratish, biologik jarayonlarni ko'rgazmali tarzda tushuntirib berish hamda o'quv jarayonini osonlashtirish maqsadida ishlab chiqilgan. Biologiya ta'limida interaktiv va virtual o'quv muhitini shakllantirish, talabalarni biologik jarayonlarni o'rganishga undash,

virtual texnologiyalar orqali ta'limni qiziqarli, qulay va amaliy ko'rinishda tashkil etish asosiy maqsad hisoblanadi.

Kalit so'zlar. Biologiya ta'limi, multimedia taqdimotlari, oliy ta'lim, interaktiv darslar, texnologiya, didaktika.

Kirish

Biologiya — tirik organizmlar va ularning atrof-muhit bilan o'zaro munosabatlarini o'rganuvchi fan sifatida ta'lim jarayonida innovatsion texnologiyalardan foydalanishni taqozo etadi. Faqat darsliklardan foydalanish a'zolar tuzilishi va vazifalarini to'liq tushuntirishni qiyinlashtiradi. Shu sababli biologiya darslarida ko'rgazmali materiallar, sxemalar va uch o'lchamli virtual modellardan foydalanilganda talabalar mavzuni chuqurroq o'zlashtirib, ma'lumotlarni uzoq vaqt eslab qolishlari aniqlangan. Masalan, hujayra tuzilishini faqat matn orqali o'rganish murakkab bo'lishi mumkin, ammo ko'rgazmali taqdimotlar talabalar uchun aniq va ravon tasavvur hosil qiladi.

Asosiy qism

Hozirgi kunda elektron darsliklar va multimedia resurslaridan foydalanish talabalarning mustaqil ishlash imkoniyatlarini kengaytirmoqda. Yangi yondashuvning mohiyati an'anaviy majburiy o'qitish usullaridan voz kechib, ta'lim jarayonini zamonaviy pedagogik va axborot texnologiyalariga asoslashdan iborat. Bu o'z navbatida talabalarning tanqidiy tafakkurini, mustaqil faoliyatini va jamoada ishlash ko'nikmalarini rivojlantirishga xizmat qiladi.

Zamonaviy ta'lim jarayonida texnologiyalardan foydalanish talabalarning o'quv faoliyatini sezilarli darajada soddalashtiradi. Ayniqsa, biologiya kabi murakkab tushuncha va nazariyalarni o'z ichiga olgan fanlarda darsni interaktiv tarzda tashkil etish ta'limning samaradorligini oshiradi.

Raqamli texnologiyalarning an'anaviy usullarga nisbatan afzalliklari ko'p:

materiallarni ko'rgazmali tarzda taqdim etish, bilimlarni samarali tekshirish imkoniyati, talabalar ishini tashkil etishning turli shakllari va o'qituvchi uchun xilma-xil o'qitish metodlari. Ko'plab biologik jarayonlar murakkab tuzilishga ega bo'lib, mavhum tafakkurga ega talabalar bunday tushunchalarni o'rganishda qiyinchiliklarga duch keladi. Tasvirlar bo'lmasa, ular jarayonlarni tushunib yetisholmaydi. Multimedia animatsion modellari talabalar uchun biologik jarayonlar haqida yaxlit tasavvur shakllantirishga ko'maklashadi, interaktiv modellar esa talabalarning jarayonlarni mustaqil loyihalash, xatolarni tuzatish va bilimlarini nazorat qilish imkoniyatini beradi.

O'quv materialini multimedia taqdimotlari orqali ko'rgazmali tarzda taqdim etish uni yanada tushunarli va ravshan etadi. Shu bois oliy ta'limda biologiya darslarini multimedia vositalari yordamida tashkil etish dolzarb ahamiyat kasb etmoqda.

Multimedia taqdimotlarining afzalliklari

Multimedia taqdimotlari biologiya o'qitishda keng qo'llaniladi va quyidagi afzalliklarni taqdim etadi:

- Ko'rgazmali materiallar yordamida murakkab biologik jarayonlarni tushuntirishni soddalashtiradi.
- Interaktiv elementlar bilan boyitilgan taqdimotlar dars davomida talabalarning faol ishtirokini ta'minlaydi.
- O'quv jarayoni yanada qiziqarli va tushunarliroq tus oladi.

Biologiyada murakkab biologik jarayonlar, hujayra tuzilmalari, fiziologik tizimlar yoki ekologik munosabatlarni tushuntirishda interaktiv platformalar, ko'rgazmali simulyatsiyalar va virtual laboratoriyalar muhim rol o'ynaydi. Bu vositalar nafaqat talabalarning o'rganishiga, balki o'qituvchilarga dars mazmunini samarali yetkazishga ham imkon beradi. Ushbu maqolada raqamli texnologiyalar, xususan interaktiv platformalarning biologiya o'qitishdagi o'rni, afzalliklari, qo'llanish holatlari va mavjud muammolar muhokama qilinadi.

Multimedia taqdimotlarini tayyorlash uchun dasturiy vositalar

Multimedia taqdimotlarini tayyorlashda turli dasturiy vositalardan foydalaniladi. Quyidagi vositalar o'zining qulayligi va imkoniyatlari bilan ajralib turadi:

- Microsoft PowerPoint — turli ko'rgazmali materiallar, grafiklar va animatsiyalar qo'shish imkonini beruvchi eng mashhur vosita.
- Prezi — dinamik ma'lumotlarni taqdim etish uchun innovatsion yechimlar taklif etadi.
- Camtasia — biologiya bo'yicha video darslar va ko'rgazmali resurslar yaratishda foydali video tahrirlash vositasi.

Didaktik tamoyillar va mustaqil bilish faoliyati

Multimedia taqdimotlari talabalarning bilim o'zlashtiruv darajasini oshiradi. Bundan tashqari, ular talabalarning mustaqil tadqiqot va ijodiy faoliyatini rag'batlantiradi. Biologiya kabi fanlar uchun multimedia vositalari talabalarning tasavvur va tahliliy tafakkurini rivojlantirishda muhim ahamiyat kasb etadi. Multimedia taqdimotlarini ishlab chiqishda nafaqat texnologik imkoniyatlarni, balki didaktik tamoyillarni ham hisobga olish zarur. Ushbu tamoyillar ta'lim jarayonining samaradorligini oshirishda katta rol o'ynaydi.

Didaktik vositalarning muhim xususiyati shundaki, ular vazifalar tuzilishi, maqsadlar hamda boshqa o'quv vositalari bilan o'zaro aloqa haqidagi ma'lumotlarni o'z ichiga oladi. Bu xususiyat integrativ va motivatsion funksiyalarning namoyon bo'lishini belgilaydi. Mustaqil bilish faoliyatini tashkil etish kontekstida ushbu funksiyalarning namoyon bo'lishi ayniqsa muhim ahamiyat kasb etadi.

Xulosa

Biologiya ta'limida zamonaviy raqamli texnologiyalar, multimedia taqdimotlari va interaktiv platformalardan foydalanish ta'lim jarayonini samarali tashkil etishning asosiy shartiga aylanib bormoqda. Ushbu vositalar talabalarning mavzuni chuqur va

qiziqib o‘zlashtirishiga, o‘qituvchilarga esa bilimlarni ko‘rgazmali va ta’sirchan tarzda yetkazishga imkon beradi. Didaktik tamoyillar va texnologik imkoniyatlarni uyg‘unlashtirgan holda biologiya o‘qitishni takomillashtirish — bu sohada olib boriladigan ilmiy-pedagogik tadqiqotlarning asosiy yo‘nalishlaridan biri bo‘lib qolmoqda.

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Opportunities for Learning Economic English Using Artificial Intelligence Tools

Makhmudov Islombek Muhiddin o'g'li

Teacher of Kokand University of Andijan Branch

Islombek0326@gmail.com

Maxmudov Muxammad Mirzo Qaxramon o'g'li

Kokand University, Andijan Branch

Faculty of Social Humanities and Pedagogy, 1st-year student

Abstract:

In the modern digital era, artificial intelligence (AI) technologies are increasingly being integrated into educational processes, including language learning. Economic English is an important component for students, researchers, and professionals working in the fields of economics, business, and international trade. This article explores the opportunities of learning Economic English using artificial intelligence tools. The study analyzes how AI-based platforms improve vocabulary acquisition, reading comprehension, translation accuracy, and communication skills related to economic terminology. The research also discusses the advantages and limitations of using AI tools in teaching Economic English. The results show that artificial intelligence significantly enhances learning efficiency, provides personalized learning environments, and supports independent study for learners of Economic English.

Keywords:

Artificial Intelligence, Economic English, Digital Learning, Language Education, AI Tools, Educational Technology, Economics Terminology

Annotatsiya:

Zamonaviy raqamli davrda sun'iy intellekt (AI) texnologiyalari ta'lim jarayonlariga, jumladan, xorijiy tillarni o'rganishga tobora keng joriy etilmoqda. Iqtisodiy ingliz tili

iqtisodiyot, biznes va xalqaro savdo sohasida faoliyat yuritayotgan talabalar, tadqiqotchilar hamda mutaxassislar uchun muhim hisoblanadi. Mazkur maqolada sun'iy intellekt vositalari yordamida iqtisodiy ingliz tilini o'rganish imkoniyatlari tahlil qilinadi. Tadqiqot davomida SI asosidagi platformalar iqtisodiy terminologiyani o'zlashtirish, matnlarni tushunish, tarjima aniqligini oshirish hamda muloqot ko'nikmalarini rivojlantirishdagi roli o'rganildi. Shuningdek, iqtisodiy ingliz tilini o'qitishda sun'iy intellektdan foydalanishning afzalliklari va ayrim cheklovlari ham muhokama qilinadi. Tadqiqot natijalari sun'iy intellekt ta'lim samaradorligini oshirishi, shaxsiylashtirilgan o'quv muhitini yaratishi hamda talabalarning mustaqil ta'lim olishini qo'llab-quvvatlashini ko'rsatdi.

Kalit so'zlar:

sun'iy intellekt, iqtisodiy ingliz tili, raqamli ta'lim, til ta'limi, AI vositalari, ta'lim texnologiyalari, iqtisodiy terminologiya

Аннотация:

В современную цифровую эпоху технологии искусственного интеллекта (ИИ) все активнее интегрируются в образовательные процессы, включая изучение иностранных языков. Экономический английский язык является важным компонентом для студентов, исследователей и специалистов, работающих в сфере экономики, бизнеса и международной торговли. В данной статье рассматриваются возможности изучения экономического английского языка с использованием инструментов искусственного интеллекта. В исследовании анализируется, каким образом платформы на основе ИИ способствуют расширению словарного запаса, улучшению понимания текстов, повышению точности перевода и развитию коммуникативных навыков, связанных с экономической терминологией. Также обсуждаются преимущества и ограничения использования инструментов искусственного интеллекта в преподавании

экономического английского языка. Результаты исследования показывают, что искусственный интеллект значительно повышает эффективность обучения, обеспечивает персонализированную образовательную среду и поддерживает самостоятельное обучение студентов.

Ключевые слова:

искусственный интеллект, экономический английский язык, цифровое обучение, языковое образование, AI-инструменты, образовательные технологии, экономическая терминология

Introduction

English has become the dominant language in international economics, finance, and global business communication. As globalization continues to expand, the need for learning Economic English has become increasingly important for students and professionals in the field of economics. Economic English includes specialized terminology related to finance, trade, banking, and economic policy.

Traditional methods of teaching Economic English often rely on textbooks and classroom lectures. However, these methods may not always provide sufficient interaction or personalized learning opportunities. In recent years, artificial intelligence technologies have introduced innovative approaches to language learning.

Artificial intelligence tools such as intelligent chatbots, automated translators, and adaptive learning systems allow learners to practice Economic English in interactive and personalized ways. These technologies can analyze learners' progress, provide instant feedback, and adapt learning materials to individual needs. Therefore, the integration of artificial intelligence into language education creates new opportunities for improving Economic English learning outcomes.

The purpose of this study is to analyze the opportunities and effectiveness of using artificial intelligence tools in learning Economic English.

Materials and Methods

This research uses qualitative and analytical research methods to examine the role of artificial intelligence in learning Economic English.

The materials used in the research include academic publications, digital educational platforms, and artificial intelligence-based language learning tools. Several AI-powered educational resources were analyzed to determine their effectiveness in improving economic vocabulary, translation accuracy, and comprehension skills.

The research methodology includes comparative analysis, literature review, and observation of digital learning platforms that incorporate AI technologies. These methods allow the identification of advantages and challenges associated with AI-based language learning systems.

Results and Discussions

The research findings indicate that artificial intelligence tools offer several significant opportunities for learning Economic English.

First, AI-powered applications provide personalized learning experiences. These systems analyze learners' performance and adjust exercises according to their skill level. As a result, learners can improve their economic vocabulary and grammar more effectively.

Second, AI tools enhance translation and comprehension of economic texts. Automated translation systems help learners understand complex economic terminology and international economic documents.

Third, artificial intelligence improves speaking and writing skills. Chatbots and conversational AI platforms enable learners to simulate real-life economic discussions and professional communication.

Furthermore, AI technologies support independent and flexible learning. Students can access learning materials anytime and anywhere, which increases motivation and learning efficiency.

However, despite these advantages, some limitations also exist. AI tools may sometimes produce inaccurate translations or lack deep contextual understanding of complex economic concepts. Therefore, human supervision and teacher guidance remain important in the learning process.

Conclusion

Artificial intelligence technologies create significant opportunities for improving the learning process of Economic English. AI-based tools provide personalized learning environments, enhance vocabulary acquisition, and improve communication skills related to economic terminology.

The integration of artificial intelligence into language education supports more effective and flexible learning methods. However, AI technologies should be used as supportive tools rather than replacements for teachers.

Future research should focus on developing more advanced AI systems that better understand economic contexts and provide more accurate language assistance for learners of Economic English.

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Ethnocultural vocabulary and exoticisms

Madaminova Rana

assistant lecturer of the Uzbek Philology Faculty of Karakalpak State University

Annotation: This article emphasizes that exoticisms, like dialectisms and ethnographisms, belong to the same type of lexical irreplaceability and are not fully assimilated into the vernacular language in which they do not exist, and are therefore not translated.

Key words: Ethnocultural, lexical, exoticism, unity, lexicon, tradition, program, traditions, dialect, dialect, ethnography.

Exoticism is an inactive lexicon in a language that expresses the lifestyle and life events of another people. Exoticisms, like dialectisms and ethnographisms, belong to the type of non-alternative lexicon and are not fully assimilated into the non-existent vernacular, they are not translated. When it appears in the text, its meaning is clarified with the help of expressions or figurative means available in the language. Because it expresses ethnic and national phenomena, it does not fully integrate into the language of another people. In many cases, it is not included in the main vocabulary of the language into which it has entered, but is among the reserve words and is mainly used when necessary. The scope of use of exoticisms is narrow, therefore such words are used when talking about the culture in which they exist, in the processes of comparing their specific languages, sometimes in situations related to the transfer of metaphorical meaning.

A part of the lexical units that enter languages from the Uzbek language as an exotic lexicon are mainly ethnographisms. Due to the peculiarity of the way of life of a particular people, the absence of this type of way of life in another people, the absence of a means of expressing certain things and events in that language, a word that has entered another language becomes an exotic word. However, in time, exotic words can also be included in the vocabulary of the language, become an active lexical unit, and

even a unit representing the customs of this people. For example, the word Navruz was once an exotic word for the Uzbek language, but today it has become a ritual lexicon.

In world linguistics, the definitions given to the term exoticisms are almost identical. In particular, T.V. Jerebilo defines exoticism as follows: “The term exoticism is a Greek word, which means “exo” – “outside” and is translated as “foreigner”, “non-local”. Although exoticisms are part of the non-equivalent lexicon and do not fully reveal the culture of the people in which they exist, characteristic of other peoples and cultures, they can give an idea of that people as a symbolic expression.¹

In Uzbek linguistics, this concept has also been thoroughly studied by our researchers. D.Khudoyberganova defines exotic lexicon (Greek ekotikos - foreign, alien) as words and phrases borrowed from other languages, used to give speech a special tone; one of the types of non-alternative lexicon.² According to Professor N. Ulukov, who studied exotic lexicon in a monographic plan, “Exotic lexicon is foreign words that are interesting, strange to others, provide information about social relations, cultural and everyday life, natural phenomena and national customs, traditions, events related to various foreign peoples, and on this basis, the “national costume” characteristic of the text, the national color in a broad sense - national ethnic, socio-political, cultural-spiritual, religious spirit and natural-geographical environment, preserved in Uzbek texts in their original form.” Based on this, we can classify the units that make up exotic vocabulary as follows:

1. Exotic units denoting the names of national holidays: Easter, Holi, Christmas. Names of holidays specific to the Uzbek language and becoming exotic when transitioning to other languages: Navruz, Eid al-Fitr, Eid al-Adha.
2. Exotic units denoting the names of national rituals and customs: kholi, pasxa.

¹Жеребило Т.В. Словарь лингвистических терминов. 5-е изд., испр. и доп. – Назрань: Пилигрим, 2010. – С.486.

²Худойберганова Д. Лингвокультурология терминларининг қисқача изоҳли луғати. – Тошкент: Туррон замин зиё, 2015. – Б.39.

Names of national ceremonies characteristic of the Uzbek language: to'y, yuzochar, kelinsalom, nonsindirar, when transferred to another language, become exotic words.

3. Exotic units denoting the names of national costumes: sari, kimono, cloak. The words chopon, do'ppi, peshband in the Uzbek language are exotic for other languages.

4. Exotic units denoting the names of historical figures: Napoleon, Hitler, Caesar, Amir Timur.

5. Exotic units denoting the names of dishes: pizza, pilaf, jiz, kif-si, lavash.

6. Exotic units denoting music, dance, musical instruments: pop, rap, opera, ballet, dutar, piano, lazgi.

7. Exotic units representing characters, artistic works, films, cartoons: Heracles, Alpomish, Spartacus, Mickey Mouse, King Kong.

8. Exotic units representing the names of some positions and titles: lord, prince, emir, emperor, boyar, caliph.

9. Exotic units representing process names and other social words: grinkard, deport.

10. Exotic units denoting religious words and proper nouns: monk, Muhammad, Jesus. The scope of application of exoticisms varies. They are found not only in oral speech, but also in poetry and literary works.

At first glance, ethnographism and exoticism seem very similar in their common features. However, there is one main difference that sharply distinguishes ethnographism from exoticism: even when ethnographism moves to another language, its "alienness" is noticeable, while exoticism, like a pre-existing word in the native language, barely shows its foreign element. For example, words like rahmat, marhamat, assalomu alaykum, ofarin, balli (bale), astag'firulloh have become ingrained in our speech. They have become an integral part of our traditions, and their foreignness is imperceptible. Ethnographisms, on the other hand, indicate belonging to another culture.

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HARMONY OF STAGE AND HEART: ARTISTIC ANALYSIS OF MAKSET ESIMBETOV'S WORK

2nd-year student of the Variety Acting program, Nukus branch of UzDSMI

JANABAEV MIYIRBEK

Scientific supervisor: Lecturer of the Department of "Acting Skills" of the

Nukus branch of UzDSMI

BAKHIEVA BIYBINAZ

Annotation. This article provides a comprehensive overview of the life and creative work of Maksset Esimbetov, a prominent representative of Karakalpak theatrical art and an Honored Artist of Karakalpakstan.

Keywords: Karakalpak theater, stage art, acting skills, Makset Esimbetov, theatrical creativity, national culture.

Annotatsiya. Maqolada qoraqalpoq teatr san'atining taniqli namoyandasi, Qoraqalpog'istonga xizmat ko'rsatgan artist Maxset Esimbetovning hayoti, ijodiy faoliyati va teatr san'ati rivojiga qo'shgan hissasi keng yoritilgan.

Kalit so'zlar: qoraqalpoq teatri, sahna san'ati, aktyorlik mahorati, Maxset Esimbetov, teatr ijodi, milliy madaniyat.

Аннотация. В данной статье всесторонне рассматриваются жизнь и творческая деятельность известного представителя каракалпакского театрального искусства, заслуженного артиста Каракалпакстана Максета Эсимбетова.

Ключевые слова: каракалпакский театр, сценическое искусство, актёрское мастерство, Максет Эсимбетов, театральное творчество, национальная культура.

Sahna — bu faqatgina aktyor chiqib ro'l ijro etadigan joy emas. Sahna inson qalbining aks-sadosi, hayotning achchiq-shirin haqiqatlari mujassam bo'ladigan muqaddas maskandir. Unda inson taqdiri, orzu-umidlari, iztiroblari va quvonchlari jonlanadi. Sahnadagi har bir so'z, har bir harakat tomoshabinning ruhiy olamiga ta'sir

etadi, uni o‘ylashga, his qilishga undaydi. Ana shunday yuksak vazifani o‘z zimmasiga olgan teatr san’atida fidoyilik bilan xizmat qilgan san’atkorlar xalq qalbida mangu yashaydi.

Qoraqalpoq teatr san’ati tarixida ana shunday fidoyi, iste’dodli va o‘z kasbiga sodiq aktyorlardan biri — Qoraqalpog‘istonga xizmat ko‘rsatgan artist Maxset Esimbetovdir. U o‘zining serqirra iste’dodi, sahnaga bo‘lgan cheksiz muhabbati va mehnatsevarligi bilan milliy teatrimiz rivojiga beqiyos hissa qo‘shgan san’atkor sifatida tanilgan.

Maxset Esimbetov 1960-yil 1-dekabr kuni Nukus shahrida dunyoga kelgan. Bolaligidan u san’atga, ayniqsa musiqaga katta qiziqish bildirgan. Otasi sovg‘a qilgan garmon cholg‘usi uning ijodiy yo‘lini belgilab bergan ilk qadam bo‘ldi. Garmon sadolari orqali u kuy va ohangning inson ruhiyatiga qanday ta’sir qilishini his qila boshlaydi. Keyinchalik gitara va fortepiano chalishni ham o‘rganib, musiqa orqali his-tuyg‘ularni ifodalash mahoratini rivojlantiradi. Musiqa bilan shug‘ullanish Maxset Esimbetovning sahnadagi ichki ritmi, obrazning ruhiy holatini chuqur his etishiga katta yordam bergan. Bu jihat uning keyingi aktyorlik faoliyatida muhim ahamiyat kasb etadi.

Maktabni tugatgach, Maxset Esimbetov Toshkent poligrafiya bilim yurtiga o‘qishga kiradi. Bu yerda u intizom, mas’uliyat va mehnatsevarlikni o‘zida shakllantiradi. Bilim yurtini muvaffaqiyatli tamomlab, o‘z mutaxassisligi bo‘yicha Leningradda bir yillik stajirovkada bo‘lib qaytadi. Ushbu tajriba uning dunyoqarashini kengaytirib, san’atga bo‘lgan munosabatini yanada chuqurlashtiradi.

1980-yilda Ostrovskiy nomidagi Toshkent davlat teatr va rassomlik san’ati institutining aktyorlik fakultetiga o‘qishga kirishi uning hayotida yangi sahifani ochadi. Talabalik davrida u jahon teatr san’ati, klassik va zamonaviy dramaturgiya, ayniqsa rus teatri tarixini chuqur o‘rganadi. Shekspir, Molyer, Ostrovskiy, Chexov asarlari bilan yaqindan tanishib, aktyorlik mahoratining nazariy va amaliy asoslarini puxta egallaydi.

Aynan shu davrda uning qoraqalpoq dramaturgiyasini boshqa tillarga, xususan rus tiliga tarjima qilishga bo‘lgan qiziqishi paydo bo‘ladi. Bu esa keyinchalik milliy teatrimizni kengroq auditoriyaga tanitishda muhim omil bo‘lib xizmat qiladi.

1985-yilda institutni tamomlab, Maxset Esimbetov Berdaq nomidagi Qoraqalpoq davlat akademik musiqali teatrida ish faoliyatini boshlaydi. U umrining oxirigacha ushbu teatrga sodiq qolib, aktyor sifatida fidoyilik bilan xizmat qiladi. Bu teatr uning ikkinchi uyiga, sahna esa hayotining mazmuniga aylanadi. Aktyor o‘zining mehnatsevarligi, sahnaga bo‘lgan talabchanligi va mas’uliyati bilan jamoa orasida tezda hurmat qozonadi. U ijro etgan har bir rol ustida chuqur ishlaydi, obrazning ichki dunyosini ochishga intiladi. Natijada sahnada sun’iylikdan xoli, jonli va ishonarli obrazlar yarata oladi. Maxset Esimbetov ijodida yaratilgan obrazlar rang-barangligi va chuqur mazmuni bilan ajralib turadi. U dramatik, komedik, tarixiy va zamonaviy obrazlarni birdek mahorat bilan ijro etgan serqirra aktyor edi. U ijro etgan muhim ro‘llar qatoriga Molyerning “Saqov qiz ham tabib” asaridagi Luka, Sagerelining “Xanuma”sidagi Akop, Korsunkiyning “Mashaqqatli yillar”idagi Seva, Bashbekovning “Temir xotin”idagi Qoshqar, Berdaqning “Adolatga xiyonat”idagi Baltash, Abdulla Oripovning “Sohibqiron” asaridagi Sulton Boyazid, Najim Dawqaraevning “Alpamis”idagi Jamal, “Kelin”dagi Darimbet, “Ajiniyoz”dagi Panaxan kabi ko‘plab obrazlarni kiritish mumkin. Bu rollar orqali aktyor inson xarakterining turli qirralarini, ichki ziddiyatlarini va ruhiy kechinmalarini yuksak darajada namoyon eta oldi.

Maxset Esimbetov aktyorlik bilan bir qatorda rejissyor sifatida ham o‘zini sinab ko‘rdi. Matmuratovning “O‘mirbek va tazsha” pyesasini sahnalashtirib, unda Qazi rolini ham o‘zi ijro etdi. Ushbu spektakl tomoshabinlar va mutaxassislar tomonidan iliq kutib olindi. Bu esa uning teatr san’atiga keng qamrovli ijodkor sifatida qaraganini ko‘rsatadi.

Aktyorning umr yo‘ldoshi-Qoraqalpog‘istonga xizmat ko‘rsatgan aktrisa Sag‘indikova Jumagul bo‘lib, ular nafaqat oilada, balki sahnada ham ijodiy hamkor

bo‘lishgan. Ular birgalikda bir qancha spektakllarda partner sifatida ishtirok etib, tomoshabinlarga unutilmas sahna lahzalarini taqdim etishgan. Ularning besh nafar farzandi ham ota-onasining yo‘lidan borib, san’at va madaniyat sohasida tahsil olib, faoliyat yuritmoqda. Bu holat Maxset Esimbetov ijodiy merosining davomiyligini yaqqol ko‘rsatadi.

Maxset Esimbetovning teatr san’ati rivojiga qo‘shgan hissasi davlat tomonidan yuqori baholangan. U 2000-yilda Qoraqalpog‘iston Respublikasi Oliy Kengashining “Hurmat yorlig‘i”, 2008-yilda esa “Qoraqalpog‘istonga xizmat ko‘rsatgan artist” faxriy unvoni bilan taqdirlangan.

2016-yil 10-yanvar kuni iste’dodli aktyor Maxset Esimbetov 55 yoshida hayotdan ko‘z yumdi. Ammo u yaratgan sahna obrazlari, teatr san’atiga bo‘lgan fidoyiligi va samimiy mehnati xalq xotirasida mangu yashaydi. U qoraqalpoq teatr san’ati tarixida o‘chmas iz qoldirgan buyuk san’atkor sifatida e’tirof etiladi.

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CONFLICT AS A SUBJECT OF SCIENTIFIC ANALYSIS

Saminov Shohjahon Sharifjon o'g'li

Tashkent state transport university
4th-year student in the Political Science

saminovsh2025@gmail.com

Uktamov Ulug'bek Utkir o'g'li

Tashkent state transport university
4th-year student in the Political Science

ulugbekuktamov16@gmail.com

Resume

Abstract: This article describes the concept of conflict, its importance as a subject of scientific analysis, types, causes and factors, methods of management, and social and psychological effects. The main task of the science of conflictology is to study conflicts on a scientific basis, to identify their causes and to develop effective methods of solving them.

Key words: Conflict, conflictology, scientific analysis, conflict, dispute, conflict types, causes and factors, management methods, compromise, negotiations, mediation, psychological impact, social impact, social stability.

KONFLIKT - ILMYIY TAHLIL PREDMETI SIFATIDA

Rezyume

Annotatsiya: Ushbu maqolada konflikt tushunchasi, uning ilmiy tahlil predmeti sifatida ahamiyati, turlari, sabab va omillari, boshqarish usullari hamda ijtimoiy va psixologik ta'siri yoritilgan. Konfliktologiya fanining asosiy vazifasi konfliktlarni ilmiy asosda o'rganish, ularning sabablarini aniqlash va hal qilishning samarali usullarini ishlab chiqishdir.

Kalit soʻzlar: Konflikt, konfliktologiya, ilmiy tahlil, ixtilof, nizo, konflikt turlari, sabab va omillar, boshqarish usullari, kompromiss, muzokaralar, vositachilik, psixologik taʼsir, ijtimoiy taʼsir, ijtimoiy barqarorlik.

КОНФЛИКТ КАК ПРЕДМЕТ НАУЧНОГО АНАЛИЗА

Резюме

Аннотация: В данной статье описывается понятие конфликта, его значение как предмета научного анализа, виды, причины и факторы, методы управления, а также социальные и психологические последствия. Основная задача науки конфликтологии – изучение конфликтов на научной основе, выявление их причин и разработка эффективных методов их решения.

Ключевые слова: Конфликт, конфликтология, научный анализ, конфликт, спор, виды конфликтов, причины и факторы, методы управления, компромисс, переговоры, медиация, психологическое воздействие, социальное воздействие, социальная стабильность.

Kirish. Konfliktlar turli shakllarda namoyon boʻlib, ijtimoiy, shaxsiy va siyosiy darajada sodir boʻlishi mumkin. Ularning sabablari madaniy farqlar, resurslar uchun raqobat, kommunikatsiya muammolari kabi omillar bilan bogʻliqdir. Konfliktlarni boshqarish va hal qilish usullari orasida kompromiss, muzokaralar, vositachilik va tahdidlarni kamaytirish kabilar mavjud.

Konfliktlarning ijtimoiy va psixologik taʼsiri murakkab boʻlib, ular salbiy taʼsirlarga ega boʻlishi mumkin boʻlsa-da, toʻgʻri boshqarilganida ijtimoiy taraqqiyotga ham xizmat qilishi mumkin. Konfliktologiyaning ushbu yoʻnalishlarini chuqur oʻrganish va ulardan samarali foydalanish jamiyat barqarorligini taʼminlashda muhim ahamiyat kasb etadi.

Asosiy qism. “Ixtilof”, “nizo” va “konflikt” tushunchalari ko‘pincha bir-biriga yaqin ma'noda ishlatiladi, lekin ular turli xil kontekstlarda qo‘llanilib, ma'lum bir farqlarga ega. Quyida ularning farqlari keltirilgan:

Ixtilof

- Ma'nosi: Ixtilof, odatda, fikrlar, qarashlar yoki qiziqishlarning mos kelmasligi yoki farqlanishini anglatadi. Bu tushuncha ko‘proq muloyim va yumshoqroq nizoni ifodalaydi. Ixtilofda qarama-qarshilik mavjud, lekin u majburiy ravishda to‘qnashuv yoki mojaroga aylanmaydi.

- Kontekst: Ixtiloflar ko‘pincha kundalik hayotda, muhokama yoki muloqotlarda yuzaga keladi va o‘zaro kelishish orqali hal qilinishi mumkin.

- Misol: Ikkita hamkasb loyiha bo‘yicha turli fikrlarga ega bo‘lganda.

Nizo

- Ma'nosi: Nizo, ixtilofga qaraganda jiddiyroq, chuqurroq va ehtirosli qarama-qarshilikni bildiradi. Nizo ixtilofning rivojlangan shakli bo‘lib, unda tomonlar o‘z pozitsiyalarini qat’iy himoya qiladi.

- Kontekst: Nizolar ko‘pincha ijtimoiy munosabatlar, oilaviy mojarolar yoki guruhlararo munosabatlarda yuzaga keladi. Nizolar ko‘proq emotsional tusga ega bo‘lishi mumkin.

- Misol: Oilaviy muammolar sababli kelib chiqadigan nizolar yoki do‘stlar o‘rtasidagi tortishuvlar.

Konflikt

- Ma'nosi: Konflikt – ixtilof va nizoga qaraganda kengroq va chuqurroq tushuncha bo‘lib, odatda ikki yoki undan ortiq tomonlar o‘rtasida jiddiy qarama-qarshilik yoki to‘qnashuvni anglatadi. Konfliktlar manfaatlar, qadriyatlar, ehtiyojlar yoki maqsadlar to‘qnashuvi natijasida yuzaga keladi.

- Kontekst: Konfliktlar shaxsiy, guruhlararo, ijtimoiy yoki davlatlararo darajalarda bo‘lishi mumkin va ko‘pincha kompleks tahlilni talab qiladi.

- Misol: Mehnat jamoasida rahbariyat va xodimlar o‘rtasidagi mehnat sharoitlari bo‘yicha kelishmovchilik yoki davlatlar o‘rtasidagi siyosiy konflikt.

Konflikt tushunchasi va ilmiy tahlil predmeti sifatida ahamiyati

Konflikt - bu manfaatlar, qarashlar yoki qiziqishlar to‘qnashuvi natijasida yuzaga keladigan ijtimoiy hodisadir. Konfliktologiya fanida konflikt tahlili muhim o‘rin tutadi, chunki u turli shaxslar, guruhlar yoki jamiyatlar o‘rtasidagi ziddiyatlarni o‘rganishga yo‘naltirilgan. Konfliktlarni ilmiy tahlil qilish orqali ularning sabablarini aniqlash, rivojlanish dinamikasini tushunish va samarali boshqarish usullarini ishlab chiqish mumkin. Ilmiy tahlil konfliktni oddiy muammo sifatida emas, balki ijtimoiy, siyosiy va psixologik jarayonlarning natijasi sifatida ko‘rishga yordam beradi.

Konflikt turlari va ularning ilmiy tasnifi

Konfliktlar turli ko‘rinishlarda namoyon bo‘lishi mumkin. Ular strukturaviy, madaniy, iqtisodiy, siyosiy yoki shaxsiy bo‘lishi mumkin. Konfliktologlar konfliktlarni quyidagi asosiy turlarga ajratadilar:

- Shaxslararo konfliktlar - bir kishining ikkinchisiga nisbatan noqulaylik yoki qarama-qarshilik hissi.

- Guruhlararo konfliktlar - turli guruhlar o‘rtasidagi manfaatlar to‘qnashuvi.

- Ijtimoiy konfliktlar - ijtimoiy qatlamlar, etnik guruhlar yoki millatlar o‘rtasidagi ziddiyatlar.

- Siyosiy konfliktlar - davlatlararo yoki siyosiy kuchlar o‘rtasidagi qarama-qarshiliklar.

Bu tasnif orqali konfliktning kelib chiqishi va rivojlanish jarayonini tushunish mumkin.

Konfliktlarning sabab va omillari

Konfliktlar turli sabablarga ko'ra yuzaga keladi. Ular orasida resurslar uchun raqobat, madaniy farqlar, g'oya va qadriyatlarning to'qnashuvi, ijtimoiy tengsizlik, kommunikatsiya muammolari va shaxsiy xususiyatlar mavjud. Konfliktologiya ushbu sabablarni o'rganish orqali konfliktlarni boshqarish va oldini olish imkoniyatini yaratadi. Misol uchun, ijtimoiy tengsizlikdan kelib chiqadigan ziddiyatlar jamiyatda katta ijtimoiy o'zgarishlar keltirib chiqarishi mumkin.

Konfliktlarni boshqarish va hal qilish usullari

Konfliktlarni boshqarish uchun bir qator strategiyalar qo'llaniladi:

- Kompromiss - tomonlar o'zaro kelishib, murosqa qilishga harakat qilishadi.
- Muzokaralar - tomonlar ochiq muloqot orqali kelishuvga erishadi.
- Vositachilik (meditatsiya) - uchinchi shaxs yordamida konfliktni hal qilish.
- Tahdidni kamaytirish va o'zaro hurmat - har bir tomonning o'zaro tushunishini rivojlantirish orqali konfliktni yumshatish.

Ushbu usullar orqali konfliktlarni konstruktiv tarzda hal qilish mumkin.

Konfliktlarning ijtimoiy va psixologik ta'siri

Konfliktlar insonlar va jamiyat uchun ijobiy va salbiy ta'sir ko'rsatishi mumkin. Salbiy ta'sirlar orasida stress, noxushlik, ijtimoiy ajralish va zo'ravonlik mavjud. Shu bilan birga, to'g'ri boshqarilgan konfliktlar o'zaro tushunishni rivojlantirishi, yangilikka olib kelishi va ijtimoiy taraqqiyotni qo'llab-quvvatlashi mumkin. Konfliktologiya ushbu jarayonlarni tahlil qilib, ijtimoiy barqarorlikni saqlashga hissa qo'shadi.

Konfliktlarni ilmiy tahlil qilish ularning chuqurroq ildizlarini o'rganish va kelgusidagi nizolarni oldini olish imkonini beradi. Shu sababli, konfliktologiya jamiyatning muhim sohalaridan biri hisoblanadi.

Xulosa: Konfliktologiya zamonaviy jamiyatdagi muhim fanlardan biridir, chunki konfliktlar inson hayotining ajralmas qismidir. Ularni ilmiy tahlil qilish orqali biz konfliktlarning sabablarini tushunish, ularni boshqarish va oldini olish imkoniyatlariga

ega bo'lamiz. Konfliktlar nafaqat muammolarni keltirib chiqarishi, balki to'g'ri boshqarilganda ijtimoiy taraqqiyot va innovatsiyalarni qo'llab-quvvatlashi mumkin. Shunday qilib, konfliktologiya jamiyatni yanada barqaror va muvozanatli qilishda katta ahamiyatga ega.

Ularning har biri o'z dinamikasiga ega bo'lib, ularni boshqarish va hal qilish usullari ham turlicha bo'ladi.

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**ADVANCED MANAGEMENT PRACTICES IN EDUCATIONAL
INSTITUTION GOVERNANCE: A COMPARATIVE ANALYSIS OF
FOREIGN EXPERIENCE (ECONOMIC AND MANAGERIAL
PERSPECTIVE)**

Abdinabieva Aziza Rakhimjon kizi

PhD student, Nordic International University

Tel: +998 97 751 63 50

Email: a.abd@nordicuniversity.org

ORCID iD: 0009-0002-0254-854X

Abstract. This article explores the transformation of educational institution governance through the lens of modern economic and management theories. In the current globalized landscape, education is increasingly viewed as a non-material sector of the economy responsible for the reproduction of human capital. This study employs a comparative analysis of management practices in Finland, South Korea, and the United States, alongside implications for developing systems like Uzbekistan. The research focuses on the transition from traditional bureaucratic models to advanced paradigms such as School-Based Management (SBM), Total Quality Management (TQM), and data-driven digital governance. Utilizing findings from Data Envelopment Analysis (DEA) and Stakeholder Theory, the article evaluates how efficiency, resource optimization, and Key Performance Indicators (KPIs) influence institutional effectiveness. The results indicate that while resource availability is a necessary condition, the "how" of resource utilization—mediated by strategic leadership and digital integration—is the primary determinant of service quality. The study concludes with practical recommendations for developing nations to bridge the gap between policy formulation and implementation through decentralized autonomy and enhanced financial accountability.

Keywords: Educational Management, Economic Efficiency, Digital Governance, School-Based Management, Human Capital, Comparative Analysis.

INTRODUCTION

In the 21st century, education systems worldwide are undergoing a paradigm shift from expanding enrollment to maximizing the quality and efficiency of service delivery. From an economic perspective, educational institutions are complex social-technical systems that utilize human, financial, and material inputs to produce the "output" of skilled human capital. However, the rising costs of public services and the scarcity of resources have placed unprecedented pressure on educational managers to adopt "managerialism"—a practice emphasizing cost-cutting, efficiency, and performance-based accountability [Manning, K. 2018, p.15].

The management of educational organizations is no longer a purely administrative task but a strategic function involving risk assessment, marketing orientation, and digital transformation. As noted by management experts, the absence of a robust strategic function in many educational organizations is a critical weakness compared to healthcare or industrial sectors. Therefore, understanding the scientific foundations of management—ranging from classical bureaucratic theories to contemporary systemic and digital approaches—is essential for ensuring the sustainability of education systems in a competitive global market [Subair, S. T., Ibrahim, R. A., & Akinola, O. B. 2025, p.430].

This article aims to analyze foreign management practices and their impact on institutional governance. By comparing the decentralized trust-based model of Finland, the technology-driven innovation of South Korea, and the accountability-heavy framework of the USA, we seek to identify universal principles of effective educational governance that can be adapted to the socio-economic context of developing nations like Uzbekistan.

LITERATURE REVIEW

The theoretical foundations of educational management have evolved from the "Scientific Management" of F. Taylor and "Administrative Theory" of A. Fayol, which introduced hierarchical structures and standardized procedures. While Max Weber's bureaucratic model provided stability, it often led to "red tapeism," slowing down innovation in the 21st-century educational landscape.

In contrast, contemporary theories such as Transformational Leadership and Systems Theory emphasize the interdependence of organizational subsystems. Modern educational management is now defined as a multidisciplinary field that integrates leadership, organizational behavior, and economic analysis to optimize institutional performance.

Economists distinguish between efficiency—achieving goals with minimal waste—and effectiveness—the degree to which institutional mandates (like student learning) are fulfilled. A critical management tool in this area is Data Envelopment Analysis (DEA), a non-parametric method used to establish benchmarks by comparing input-output ratios across similar institutions. Recent studies using TIMSS 2019 data show that school-level inefficiencies often stem from poor "people management" rather than a simple lack of physical resources [Bhutoria, A. & Aljabri, N. 2022, p.20].

SBM has emerged as a global trend, decentralizing decision-making authority to the school level (principals, teachers, and parents). The economic rationale behind SBM is that local stakeholders possess better contextual information, leading to more responsive resource allocation. Complementing SBM is "Digital Governance," where Education Management Information Systems (EMIS) act as the backbone for real-time monitoring, financial tracking, and evidence-based decision-making.

METHODOLOGY

This research employs a Qualitative Comparative Analysis (QCA) and a synthesis of empirical data from recent international studies (2018–2025). The methodology is structured around three analytical lenses:

1. **Economic Lens:** Analyzing resource optimization through DEA models and budget allocation strategies.
2. **Managerial Lens:** Evaluating leadership styles (Transformational vs. Transactional) and institutional structures (SBM models).
3. **Digital Lens:** Assessing the maturity of EMIS and digital infrastructure in governing institutional processes.

The study compares primary data sources and case evaluations from Finland (representing decentralized/trust models), South Korea (representing innovation/SMART models), and the USA (representing accountability/market-driven models). Furthermore, it reviews the strategic development plans of Uzbekistan (2019–2023) to provide contextual implications.

RESULTS

Finland's management practice is characterized by extreme decentralization and "moral leadership".

- **Managerial Practice:** School leaders exercise high levels of professional autonomy in staff recruitment, curriculum implementation, and budget management.
- **Efficiency Mechanism:** Rather than high-stakes testing, Finland relies on a trust-based quality assurance system that prioritizes "equity" and "social justice," resulting in the lowest variance between schools in the OECD [OECD, 2016].
- **Economic Impact:** The system attracts top-tier human capital into the teaching profession, reducing the need for expensive external monitoring and bureaucratic overhead [Turumbetova, A. Y. 2023, p.181].

South Korea's model focuses on the integration of digital technology and marketing orientation to enhance global competitiveness.

- **Managerial Practice:** The "SMART-Education" model utilizes ICT-driven management to monitor student progress and institutional KPIs in real-time.
- **Efficiency Mechanism:** There is a strong "marketing orientation," where schools compete in the market for educational services by catering to the specific needs of "consumers" (parents and students) [Mamanazarova, N. K. 2023].
- **Economic Impact:** High investment in digital infrastructure (EMIS) accelerates business processes and frees up human resources for higher-order cognitive tasks [Borodiyenko, O. et al. 2022].

The U.S. model emphasizes "Site-Based Management" and rigorous performance accountability.

- **Managerial Practice:** Charter schools and "no excuses" models provide managers with flexibility in exchange for meeting strict KPIs and student outcome targets.
- **Efficiency Mechanism:** The use of "Total Quality Management" (TQM) and "Performance Appraisal" systems ensures that teachers and administrators are held accountable for academic results [Barrera-Osorio, F., Fasih, T., & Patrinos, H. A. 2009].
- **Economic Impact:** Fiscal decentralization and "choice and competition" allow parents to act as demand-side pressure, forcing schools to improve performance to attract students.

DISCUSSION

The research highlights that "digitalization" is not merely a technological upgrade but a fundamental restructuring of institutional governance around media and data infrastructure. In countries like South Korea and Sweden, digital platforms (LMS, EMIS) have moved from being "back-office" tools to becoming the primary mechanism

for parent-teacher communication, fee collection, and strategic planning. For developing countries, implementing a "Smart Education Data System" is a prerequisite for overcoming the "departmentalism" and data gaps that plague centralized ministries [Pestusco, N. & Sheref, A. 2020].

Comparative findings suggest that "people management"—including teacher motivation, strategic leadership, and stakeholder involvement—has a more significant impact on school efficiency than the quantity of physical infrastructure. In Nigeria and Zambia, studies indicate that schools with "participatory leadership" and "merit-based hiring" significantly outperform those with rigid bureaucratic hierarchies. This supports the "Theory Y" approach to HRM, where intrinsic motivation and professional development are key drivers of effectiveness.

Uzbekistan has initiated systemic reforms to modernize education management, focusing on "Axborotlashgan jamiyat" (Information Society). However, the results indicate several "bottlenecks":

1. Bureaucratic Rigidity: A persistent reliance on directive-based management rather than regulatory or performance-based models.

2. Training Gaps: A lack of specialized training in "Institutional Management" for school principals, who often lack the skills to manage financial and human resources strategically.

3. Financial Transparency: The need for standardized accounting platforms at the school level to ensure that grants reach their intended targets without being siphoned off by intermediate layers.

CONCLUSION

The comparative analysis of advanced management practices demonstrates that the most successful education systems are those that balance economic efficiency with social responsibility through decentralized autonomy and digital integration.

Practical Implications for National Systems:

1. Shift to SBM: Developing countries should transition from a centralized command-and-control model to a "School-Based Management" model, granting principals autonomy over budgets and staffing while holding them accountable via transparent KPIs.

2. Invest in "Data-Driven Decision-Making": The establishment of an integrated EMIS (Education Management Information System) is critical. This should include digitalizing payment requests, tracking student progress, and monitoring teacher "presenteeism".

3. Strategic Leadership Training: Principal recruitment criteria must move beyond "pedagogical experience" to include "managerial competence" in areas like SWOT analysis, PESTLE, and materiality analysis.

4. Stakeholder Engagement: Effective governance requires formal channels for community and parental participation, turning the school from a closed bureaucracy into an "open social system".

In summary, the transition to "Advanced Management Practices" requires a holistic approach where technology serves as a tool, leadership acts as the catalyst, and economic efficiency remains the guiding metric for producing high-quality human capital in the global knowledge economy.

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**THE PROCESS OF CULTURAL ADAPTATION AMONG
STUDENTS PARTICIPATING IN INTERNATIONAL EXCHANGE
PROGRAMS: STUDY AND ANALYSIS**

Zebiniso B. Allayarova

PhD Associate Professor, Shahrissabz State Pedagogical Institute, Uzbekistan

Email: zeboallayarova51@gmail.com

Nilufar K. Jalilova

Student, Shahrissabz State Pedagogical Institute, Uzbekistan

Email: jalilovanilufar755@gmail.com

Abstract: The rapid expansion of international exchange programs has increased the importance of understanding students' cultural adaptation to new academic and social environments. Cultural adaptation significantly influences exchange students' academic success, psychological well-being, and intercultural competence. This article provides a systematic literature review of research on cultural adaptation processes among students participating in international exchange programs. Based on key theoretical frameworks such as acculturation theory, culture shock theory, and intercultural communication models, the review synthesizes findings from studies conducted in diverse educational contexts. The analysis highlights major factors affecting adaptation, including acculturation strategies, language self-confidence, social integration, and institutional support. The article concludes by emphasizing the joint role of students and host institutions in facilitating successful cultural adaptation.

Keywords: Cultural adaptation, cross-cultural adaptation, exchange programs; student mobility, international students, exchange students, acculturation, acculturation strategies, culture shock, intercultural communication, intercultural competence, sociocultural adaptation, academic adjustment, language proficiency, language self-confidence.

1. INTRODUCTION

International student mobility has become one of the most prominent features of contemporary higher education, driven by globalization, international cooperation, and the expansion of exchange programs such as Erasmus+. Studying abroad offers students opportunities to develop academic knowledge, foreign language proficiency, and intercultural competence. However, participation in international exchange programs also exposes students to complex cultural, social, and psychological challenges that require effective adaptation to unfamiliar environments. Cultural adaptation refers to the process through which individuals adjust their behaviors, attitudes, and identities when interacting with a new cultural context. For exchange students, this process often involves negotiating differences in language use, academic expectations, social norms, and everyday practices. Research consistently shows that difficulties in cultural adaptation may lead to culture shock, stress, social isolation, and reduced academic performance if adequate support mechanisms are not in place (Oberg, 1960; Bianchi & Martini, 2023). One of the most influential theoretical frameworks for understanding cultural adaptation is Berry's acculturation model. Berry conceptualizes acculturation as a bidirectional process in which individuals relate simultaneously to their culture of origin and the host culture, resulting in four main strategies: integration, assimilation, separation, and marginalization. This model has been widely applied in studies of international students to explain variations in psychological well-being and sociocultural adjustment. Empirical findings suggest that integration maintaining one's original culture while actively engaging with the host society is generally associated with more positive adaptation outcomes (Berry, 1997; Su et al., 2025). In addition to acculturation strategies, scholars emphasize the importance of language proficiency, intercultural communication skills, and social interaction with host nationals in shaping the adaptation experience.

2. LITERATURE REVIEW

Studying in a foreign country represents both an opportunity and a challenge for international exchange students, who must adapt simultaneously to new academic, sociocultural, and psychological environments. Previous research consistently indicates that international students experience multiple adjustment difficulties related to unfamiliar educational systems, social norms, and cultural expectations. These challenges, often documented by Ward and Kennedy (1993, 1999), tend to intensify during the initial stages of mobility, when students encounter differences in communication styles, teaching methods, and everyday social interactions. In my current research, I find the Acculturation Theory developed by John W. Berry (1997) to be particularly compelling and have adopted it as a central framework for this study. Berry's model provides a sophisticated lens through which we can understand how students negotiate their home culture while engaging with the host society. Specifically, I am focusing on the "Integration" strategy, as empirical findings suggest it is the most effective route to positive psychological and sociocultural outcomes. Furthermore, the concept of "Culture Shock," as pioneered by Kalervo Oberg (1960), remains vital to this analysis. While traditionally viewed as a negative crisis, I align with recent interpretations such as those by Tanasy et al. (2024) which suggest that culture shock is a necessary developmental phase that can foster intercultural growth and self-awareness if managed with institutional support. Several studies emphasize that international students may feel "socially invisible" in academic settings despite being physically present in classrooms, particularly when linguistic and cultural barriers limit their participation. Successful cultural adaptation is therefore essential not only for academic achievement but also for reducing stress and enhancing students' overall well-being. Vershinina and Kocheva (2015) describe this process as the gradual reduction of psychological distance between the home and host cultures. Regarding the emotional

toll of mobility, Lin and Yi (1997) highlight that limited social integration often leads to decreased motivation and depressive symptoms. To address these issues, my research draws upon the findings of Yang, Noels, and Saumure (2006), who argue that language self-confidence rather than mere grammatical proficiency is the primary psychological mediator for social integration. By focusing on this specific direction, my study seeks to explore how communicative confidence empowers students to overcome the "interaction divide" and achieve academic success. Language and communication emerge as critical factors influencing cultural adaptation. Differences in discourse patterns, pragmatic norms, and communication styles can create misunderstandings and increase cultural distance between international students and members of the host community (Ward et al., 2001). Research suggests that students whose cultural and linguistic background is closer to that of the host society generally adapt more easily and experience fewer interactional barriers (Mehdizadeh & Scott, 2005). In certain regional contexts, shared linguistic or historical ties may facilitate adaptation and foster a sense of cultural familiarity (Fedotova & Miller, 2018).

3. METHODS

3.1 Research Design

This study adopts a **qualitative literature review design**, focusing on the systematic analysis and synthesis of peer-reviewed academic sources related to cultural adaptation in international exchange programs. Rather than collecting primary empirical data, the review integrates theoretical frameworks and empirical findings to provide a comprehensive understanding of adaptation processes among exchange students.

3.2 Data Sources and Selection Criteria

The literature reviewed in this study consists of academic journal articles, book chapters, and research reports published in English. The sources were selected from reputable databases and publishers, including journals in intercultural relations, higher education,

and educational psychology. Priority was given to studies published between 2000 and 2025 in order to ensure relevance to contemporary international mobility contexts.

The inclusion criteria were as follows:

1. The study focuses on international or exchange students.
2. The research examines cultural, sociocultural, psychological, or academic adaptation.
3. The study is grounded in established theoretical models such as acculturation theory, culture shock theory, or intercultural competence frameworks.

Key foundational works, including Berry's acculturation model (Berry, 1997) and Oberg's culture shock framework (Oberg, 1960), were included due to their enduring theoretical significance.

3.3 Analytical Procedure

The selected literature was analyzed using a thematic synthesis approach. First, key concepts and findings related to cultural adaptation were identified across sources. Second, recurring themes such as acculturation strategies, language barriers, social integration, and institutional support were compared and contrasted. Finally, the findings were organized into thematic categories that reflect dominant trends and debates in the literature. This approach allows for a structured comparison of studies conducted in different cultural and institutional contexts, including Erasmus programs, short-term study abroad experiences, and long-term international education settings (Şahin, 2017; Siddiqui, 2018; Tanasy et al., 2024).

4. Results

The reviewed literature reveals that cultural adaptation among students participating in international exchange programs is a multidimensional and non-linear process influenced by psychological, sociocultural, linguistic, and institutional factors. Across

studies conducted in diverse geographical and educational contexts, several recurring themes emerge. These themes are synthesized below.

4.1 Acculturation Strategies and Adaptation Outcomes

A dominant theme in the literature concerns the role of acculturation strategies in shaping students' adaptation experiences. Berry's acculturation framework remains the most frequently applied theoretical model in studies of international and exchange students. According to this model, individuals adopt one of four strategies integration, assimilation, separation, or marginalization depending on the extent to which they maintain their home culture and engage with the host society (Berry, 1997). Empirical studies consistently indicate that integration is associated with the most favorable outcomes in both psychological well-being and sociocultural adjustment. Exchange students who actively interact with host nationals while maintaining connections to their cultural identity tend to report lower stress levels, higher life satisfaction, and stronger academic engagement (Yang, Noels, & Saumure, 2006; Su et al., 2025). Research focusing on Erasmus students supports these conclusions. Şahin (2017) found that Turkish Erasmus students who demonstrated openness toward host cultural norms while retaining their cultural values showed higher levels of cross-cultural adaptability. Conversely, students who relied exclusively on co-national networks experienced slower sociocultural adjustment and limited intercultural learning.

4.2 Culture Shock as a Transitional Experience

Another central theme in the literature is **culture shock**, commonly conceptualized as a transitional response to unfamiliar cultural environments. Oberg's classical model describes culture shock as a process consisting of several stages, including honeymoon, crisis, recovery, and adjustment (Oberg, 1960). Although initially developed in the context of expatriates, this framework has been widely applied to international students and exchange participants. Studies indicate that most exchange students experience an

initial period of excitement followed by confusion, frustration, or anxiety as cultural differences become more salient. These reactions often stem from difficulties in daily communication, unfamiliar social norms, and contrasting academic expectations (Conner & Roberts, 2015). However, the intensity and duration of culture shock vary depending on individual coping strategies and external support. Recent research suggests that culture shock should not be viewed solely as a negative phenomenon but rather as a **developmental phase** that can promote intercultural learning. Students who receive adequate institutional guidance and reflective opportunities are more likely to transform initial discomfort into cultural awareness and personal growth (Tanasy et al., 2024).

4.3 Language Proficiency and Intercultural Communication

Language proficiency emerges as one of the most influential factors affecting cultural adaptation. Across multiple studies, limited command of the host language is identified as a major barrier to academic participation, social interaction, and self-confidence (Bianchi & Martini, 2023; Su et al., 2025). Yang et al. (2006) emphasize that **language self-confidence**, rather than objective language ability alone, plays a mediating role in sociocultural adjustment. Students who feel confident using the host language are more likely to initiate contact with local peers, engage in classroom discussions, and navigate everyday situations independently. In contrast, low language confidence often leads to avoidance behaviors, reinforcing social isolation.

Studies conducted among Erasmus students further demonstrate that language difficulties persist even when English is used as a lingua franca. Exchange students frequently report challenges related to academic discourse, informal communication, and understanding pragmatic norms, which can hinder full participation in host academic communities (Şahin, 2017; Siddiqui, 2018).

4.4 Social Integration and Support Networks

Social integration is repeatedly highlighted as a critical determinant of successful cultural adaptation. The literature distinguishes between co-national networks, international peer groups, and host-national relationships, each of which contributes differently to the adaptation process. While co-national friendships provide emotional comfort and cultural familiarity, excessive reliance on such networks may limit exposure to the host culture (Ward et al., 2001). Conversely, interaction with host nationals facilitates the development of sociocultural competence, cultural understanding, and a sense of belonging. However, many exchange students report difficulties forming close relationships with local students due to language barriers, perceived social distance, or lack of structured interaction opportunities (Bianchi & Martini, 2023). Institutional support mechanisms such as orientation programs, mentoring systems, and intercultural events play a vital role in bridging this gap. Studies show that universities that actively promote cross-cultural engagement contribute significantly to students' adaptation and overall satisfaction with the exchange experience (Siddiqui, 2018; Su et al., 2025).

5. DISCUSSION

The purpose of this literature review was to examine how students participating in international exchange programs adapt to new cultural environments and to identify the key factors shaping this process. The findings synthesized in the Results section demonstrate that cultural adaptation is not a uniform or linear experience but rather a dynamic interaction between individual characteristics and contextual conditions. This discussion interprets these findings in relation to established theoretical frameworks and highlights their implications for international education.

5.1 Acculturation Models Revisited

One of the most significant contributions of the reviewed literature is the continued empirical relevance of Berry's acculturation model. Across diverse contexts, studies

consistently show that the strategy of integration characterized by engagement with the host culture alongside the maintenance of one's cultural identity produces the most positive adaptation outcomes (Berry, 1997; Yang et al., 2006). This confirms Berry's original assumption that successful adaptation depends on balancing cultural continuity and cultural participation. However, the literature also suggests that acculturation strategies are not static choices but context-dependent processes. Exchange students may shift between strategies over time, especially during short-term mobility programs. For example, students initially adopting separation due to language anxiety may gradually move toward integration as linguistic competence and confidence increase (Şahin, 2017). This dynamic perspective supports Kim's conceptualization of cultural adaptation as an ongoing developmental process rather than a fixed state (Kim, 2001).

5.2 Culture Shock as a Developmental Mechanism

The discussion of culture shock across the reviewed studies challenges the traditional perception of culture shock as merely a negative experience. While early stages of cultural transition are often marked by stress, frustration, and confusion, many studies emphasize the transformative potential of these experiences (Oberg, 1960; Tanasy et al., 2024). From a developmental standpoint, culture shock functions as a catalyst for reflection and learning. Students who actively engage with cultural differences and receive institutional or peer support are more likely to reinterpret initial discomfort as a learning opportunity. This aligns with contemporary intercultural competence theories, which view dissonance and uncertainty as necessary conditions for intercultural growth (Ward et al., 2001). Nevertheless, the literature also warns that unmanaged culture shock can lead to prolonged stress and disengagement. This reinforces the importance of structured orientation programs and ongoing intercultural guidance during exchange periods.

5.3 Language as a Mediating Factor in Adaptation

Language proficiency emerges not only as a practical communication tool but also as a psychological mediator in cultural adaptation. Studies repeatedly demonstrate that students' perceived language competence influences their willingness to engage socially and academically in the host environment (Yang et al., 2006; Su et al., 2025). Importantly, the literature distinguishes between linguistic knowledge and **language self-confidence**. Even students with adequate formal proficiency may experience communicative anxiety in informal or academic interactions, which can inhibit social integration. This finding highlights the need to address pragmatic competence and communicative confidence, not merely grammatical accuracy, in pre-departure and in-country language support programs.

5.4 Social Integration and Institutional Responsibility

Social integration represents one of the most decisive elements of successful cultural adaptation. While peer relationships within co-national groups offer emotional security, the literature clearly indicates that meaningful interaction with host nationals enhances sociocultural competence and fosters a sense of belonging (Ward et al., 2001; Bianchi & Martini, 2023). However, the responsibility for facilitating such interaction cannot be placed solely on students. Many studies emphasize the role of **institutional structures** in shaping opportunities for cross-cultural engagement. Universities that implement mentoring systems, mixed-group coursework, and intercultural events create environments that actively support integration (Siddiqui, 2018). This finding suggests a shift from viewing adaptation as an individual challenge to understanding it as a shared institutional and social process.

5.5 Academic Adaptation and Cultural Expectations

Academic

adjustment is deeply intertwined with cultural adaptation. Differences in teaching styles, assessment practices, and classroom norms often reflect broader cultural values regarding authority, participation, and learning autonomy. The literature indicates that

exchange students frequently misinterpret these differences as personal failure rather than cultural variation, increasing academic stress (Conner & Roberts, 2015). When institutions provide explicit academic guidance and culturally responsive teaching practices, students demonstrate greater academic confidence and reduced acculturative stress. This underscores the importance of aligning academic support with intercultural awareness rather than treating academic and cultural adaptation as separate domains.

6. CONCLUSION

This literature review set out to examine the cultural adaptation processes of students participating in international exchange programs by synthesizing key theoretical perspectives and empirical findings. The reviewed studies collectively demonstrate that cultural adaptation is a complex, multidimensional process shaped by individual strategies, linguistic competence, social relationships, and institutional contexts. The analysis confirms that acculturation strategies, particularly integration, play a decisive role in determining successful adaptation outcomes. Students who actively engage with the host culture while maintaining their cultural identity tend to experience greater psychological well-being, sociocultural competence, and academic engagement. At the same time, adaptation strategies are not static; rather, they evolve over time in response to contextual opportunities and challenges, supporting dynamic models of intercultural adaptation.

Culture shock, traditionally viewed as a negative transitional phase, emerges in the literature as a potential catalyst for intercultural learning when supported by reflective and institutional mechanisms. The findings further highlight language self-confidence as a central mediating factor that influences students' willingness to interact socially and academically in host environments. Limited language confidence often restricts participation and reinforces social isolation, even among students with adequate formal language proficiency. Social integration and institutional support are consistently identified as critical enablers of

successful adaptation. While peer networks provide emotional security, structured interaction with host nationals facilitated by universities enhances intercultural competence and a sense of belonging. Similarly, academic adjustment is closely intertwined with cultural expectations embedded in teaching practices, assessment systems, and classroom interaction norms. Despite the breadth of existing research, this review identifies several gaps in the literature. Longitudinal studies examining adaptation trajectories over time remain limited, particularly for short-term exchange students. In addition, research disproportionately focuses on Western host contexts, underscoring the need for broader geographical and cultural representation.

In conclusion, cultural adaptation in international exchange programs should be understood as a shared responsibility between students and host institutions. Universities that integrate intercultural awareness into academic and social support structures are better positioned to foster meaningful adaptation experiences. Future research should adopt longitudinal and comparative approaches to deepen understanding of how exchange students navigate cultural transitions across diverse educational environments.

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DEVELOPMENT OF CONSTRUCTION PARAMETERS OF ROLLER MECHANISMS WITH BELT CONVEYOR STRUCTURES

Abdurakhmanova Muattar Musurmakulovna

Almalyk State Technical Institute, Almalyk, Uzbekistan Assistant

E-mail: muattarabdurahmonova984@gmail.com

Umirzoqova Barchinoy Akrom qizi

Almalyk State Technical Institute, Almalyk, Uzbekistan Student of the 7A-25 ME

group, Mechanical Engineering

E-mail: barchinoyumrzoqova@gmail.com

Annotation. This article presents the development of constructive parameters of roller mechanisms with elastic elements for belt conveyors. The interaction between rollers and elastic components and their influence on load distribution are analyzed. Optimal geometric and technical parameters are determined to improve the efficiency of the mechanism. The proposed design enhances the reliability and durability of conveyor systems. The obtained results are recommended for industrial application.

Keywords: conveyor, roller, mechanism, parameter, elasticity, load, structure, efficiency, stability, motion

Annotatsiya. Mazkur maqolada tasmali konveyer tarkibida qo'llaniladigan qayishqoq elementli rolikli mexanizmlarning konstruktiv parametrlari ishlab chiqilgan. Tadqiqot davomida roliklarning elastik elementlar bilan o'zaro ta'siri va yuk taqsimotiga ta'siri o'rganildi. Mexanizmning samaradorligini oshirish maqsadida optimal geometrik va texnik parametrlar aniqlangan. Shuningdek, taklif etilgan konstruktsiya konveyer tizimlarining ishonchliligi va xizmat muddatini oshirishga xizmat qiladi. Olingan natijalar sanoat korxonalarida qo'llash uchun tavsiya etiladi.

Tayanch so'zlar: konveyer, rolik, mexanizm, parametr, elastiklik, yuklama, konstruktsiya, samaradorlik, barqarorlik, harakat

Аннотация. В данной статье разработаны конструктивные параметры роликовых механизмов с упругими элементами для ленточных конвейеров. В ходе исследования изучено взаимодействие роликов с упругими элементами и их влияние на распределение нагрузки. С целью повышения эффективности механизма определены оптимальные геометрические и технические параметры. Предложенная конструкция способствует повышению надежности и долговечности конвейерных систем. Полученные результаты рекомендуются для применения в промышленности.

Ключевые слова: конвейер, ролик, механизм, параметр, упругость, нагрузка, конструкция, эффективность, надежность, движение

Belt conveyors play an important role in mining enterprises and are an integral part of the production process. These devices are highly efficient in the continuous delivery of minerals from one point to another. With the help of belt conveyors, the transportation process is automated and human labor is significantly reduced. In modern industry, reliability and uninterrupted operation of conveyor systems are considered an important requirement. Therefore, improving their structural elements is one of the urgent issues. The main component of a belt conveyor is a roller mechanism that supports the movement of the belt. The correct operation of roller mechanisms directly affects the efficiency of the entire system.

Currently, much attention is paid to improving the design parameters of roller mechanisms to increase their efficiency. In particular, roller mechanisms with belt elements play an important role in evenly distributing loads. Such mechanisms have the property of reducing vibrations and absorbing dynamic loads. As a result, the service life of the conveyor system is extended and maintenance costs are reduced. At the same time, determining the optimal design parameters is of scientific and practical importance. This article considers the issues of developing the design parameters of

roller mechanisms with belt elements as part of a belt conveyor. The results obtained allow for their effective use in industrial enterprises.

In belt conveyors, rollers mounted on rolling bearings quickly slip out of alignment due to high structural loads [1]. To reduce slippage or friction and absorb loads, a new roller support design is recommended, as shown in Fig. 1.

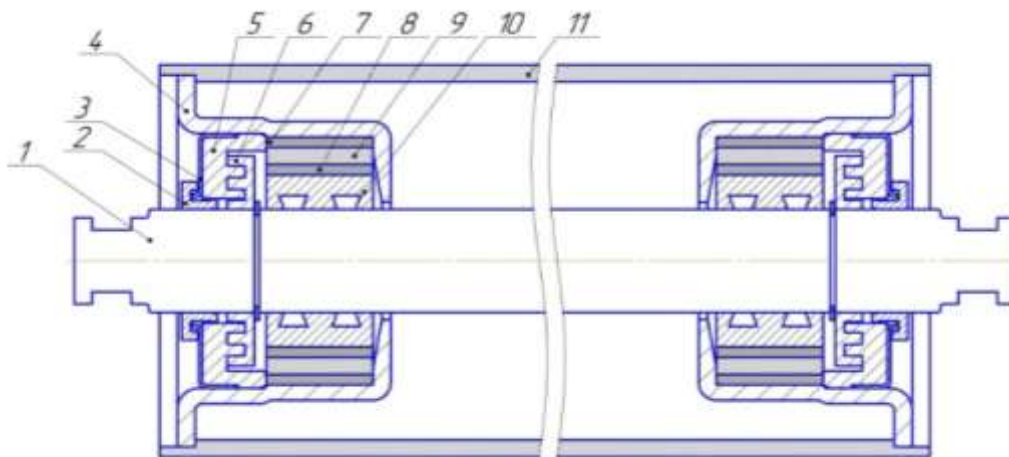


Figure 1. Roller mechanism (Belt conveyor)

1- shaft, 2- labyrinth bushing, 3- cover, 4- stop, 5- sealing labyrinth¹,
6- sealing labyrinth², 7- sleeve¹, 8- sleeve, 9- spring element, 10- sliding support
(graphitocaprolon), 11- body

Here we see (Fig. 1), that to create new types of components from composite elastic elements that perform the role of a sliding support (1) in roller mechanisms, we must master the methods of structural, dynamic, and kinematic calculations. This requires studying the results of research related to the development of calculation methods, optimization of performance characteristics, synthesis and analysis of mechanisms, roller mechanisms from flexible composite and elastic elements, as well as the modeling and design of new machine and mechanism designs.

To prevent such situations, instead of rolling bearings, we use composite elastic elements and plastic materials (graphite-caprolon) to act as a sliding support relative to

the axis. (Figure 1) Tables 1 and 2 provide the characteristics of graphite-caprolon, which is not recommended for roller bearings.

Table 1

Physical Properties of Graphite-caprolon

Name of the indicator	Kaprolon (Gubakha) graphite-caprolon rods	Caprolon (China) extrusion rods graphite caprolon	Caprolon (China) graphite-caprolon rods	Caprolon (Anion) graphite caprolon plates
Density, kg/m ³	1170	1140	1150	1170
Operating temperature	from -40 to +100	from -40 to +95	from -40 to +95	from -40 to +100
Melting point, °C	+220	+220	+220	+220
Water absorption in 24 hours, %	7-10	9	7	7 - 10

The selected parameters for the material acting as a sliding support instead of a rolling bearing are listed in the table. The reason for studying these parameters is that this material transmits rotational motion about the axis in the roller mechanism. We know that rotational motion generates friction. After studying the physical properties of graphite capralon, we must examine mechanical properties such as tensile stress at break (MPa), elongation at break (%), coefficient of friction against steel, and Brinell hardness (Shore ball indentation) (MPa).

Table 2

Mechanical properties of graphite caprolon

Name of the indicator	Caprolon (Gubakha) graphite-caprolon rods	Caprolon (China) extrusion rods graphite caprolon	Caprolon (China) graphite-caprolon rods	Caprolon (Anion) graphite caprolon plates
Tensile strength at break, MPa	75	75	75	75
Relative elongation at break, %	5	6	6	5
Coefficient of friction on steel	0.22	0.45	0.45	0.22
Hardness, MPa according to Brinell (with ball indentation according to Shore)	79-80	85	88	80

The law of motion of transport units shows that in roller mechanisms without elastic elements (9) in the support part where rotational motion occurs, the oscillation amplitude reaches 0.46 rad, while with elastic elements with a unit coefficient of 1.2 10² Nm/rad, it reaches 0.41 rad. In this case, the unit coefficient of the sliding support (10) with a roller mechanism increases by 3.0 20³ Nm/rad, and the rotation angle displacement by 0.16-0.21 π .

Conclusions. Based on the analysis of belt and roller conveyor designs, an effective conveyor design with composite rollers with elastic shock absorbers has been developed, and the main characteristics have been substantiated.

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FUNDAMENTALS OF WOOD MATERIALS AND HAND PROCESSING TECHNOLOGIES

Abdullaev, Tolkinali Usmonovich

Candidate of Physical and Mathematical Sciences, Associate Professor

Siddikova, Ranokhon, Abdulkhay Kizi

Independent Researcher

Abstract: This research article presents ideas on interactive methods recommended for use in technology lessons and their content. Examples of modern methods and various types of interactive methods are provided.

Keywords: innovative technology, method, technology, interactive, innovation, invention, conversation, problem situation.

YOG‘OCH MATERIALSHUNOSLIGI ASOSLARI VA ULARGA QO‘LDA ISHLOV BERISH TEXNOLOGIYASI

Abdullayev To‘lqinali Usmonovich -

Fizika-matematika fanlari nomzodi, dotsent,

Siddiqova Ra‘noxon Abdulxay qizi-

Mustaqil izlanuvchi NamDPI

Annotatsiya: Ushbu ilmiy maqolada texnologiya darslarida foydalanishga tavsiya etiladigan interfaol metodlar va ularning mazmuni xususidagi fikrlar keltirilgan. Turli ko‘rinishdagi zamonaviy metodlar va interfaol usullardan namunalar keltirilgan.

Kalit so‘zlar: Innovatsion texnologiya, metod, texnologiya, interfaol, yangilik yaratish, ixtiro qilish, suhbat, muammoli vaziyat.

ОСНОВЫ ДРЕВЕСНЫХ МАТЕРИАЛОВ И ТЕХНОЛОГИИ ИХ РУЧНОЙ ОБРАБОТКИ

Абдуллаев Толкинали Усмонович

Кандидат физико-математических наук, доцент,

Сиддикова Ранохон Абдулхай Кизи

Независимый исследователь

Аннотация: В данной научной статье представлены идеи об интерактивных методах, рекомендуемых для использования на уроках технологии, и их содержании. Приведены примеры современных методов и интерактивных методов различных типов.

Ключевые слова: инновационная технология, метод, технология, интерактивный, инновация, изобретение, беседа, проблемная ситуация.

The curriculum represents a system of knowledge, training, and skills acceptable from a pedagogical point of view, which students must master. The curriculum for the Woodworking subject is determined in accordance with production-specialized characteristics and the program and includes a system of practical knowledge, training, and skills. A thorough mastery of this curriculum results in the formation of a worker in a specific profession and with a certain level of qualifications [1].

The content of a carpenter's work activity is determined by production equipment, work tools, technological processes, work operations, and methods.

Depending on the type of equipment used in the technological process, the carpenter's work operations vary, but the following general tasks can be distinguished in their work activity: task analysis, drawing, and technical specifications; selection and preparation of work objects (raw materials, parts, assemblies); determination of methods and sequence of operations; selection and preparation of tools; selection of the workpiece operating mode; preparation of the machine for work (inspection, tool installation, machine adjustment, lubrication); placement and fastening of raw materials on the machine; movement of the tool or workpiece; Technological processing of a part,

handling of a tool or workpiece; removing the product from the machine; inspecting the finished product [2].

Teaching methods are understood as methods of collaborative work between the teacher and students in the educational process, with full understanding. All teaching methods are subject to two fundamental requirements: first, they must facilitate students' independent cognitive activity during the lesson, and second, they must ensure a deep understanding and complete assimilation of the material being studied. A system of methods based on the level of students' independent activity in acquiring knowledge fully meets these requirements [3-4].

Explanatory and demonstration method: the teacher provides ready-made information through various means, and students perceive, understand, and remember this information. Reproductive method: the teacher, using a system of instructions, assignments, and exercises, organizes a lesson that allows students to review the knowledge and work methods they have learned. Students learn to manufacture an object from a model and acquire skills. As students' knowledge and skills grow, they begin to increasingly use both methods together. Problem statement: The teacher poses a specific problem, solves it independently, searches for a possible solution, reveals logical paths to finding it step by step, and demonstrates scientific and evidence-based thinking to students. Students observe their thinking changing, participate in reasoning, and master the stages of problem solving.

One of the main requirements for education is the development of a base of highly qualified teachers who are experts in their field, as well as a properly organized methodology that ensures the selected technologies and methods are appropriate to the topics [5]. Developing a methodology leads to students' thorough acquisition of specific theoretical knowledge, saves time, encourages each student's activity, develops their ability to think freely and independently, and develops the skills to defend their own

opinions. To improve the effectiveness of technology-based teaching, teachers must effectively utilize advanced pedagogical technologies in all learning processes, search for relevant educational literature in subject areas, and collaborate with colleagues remotely on social media, exchanging ideas. Currently, it is a form of training, methodology and ICT tools used to solve existing problems in the field of education or the educational process based on a new approach and capable of guaranteeing highly effective results. For example, in the 5th grade, an experiment was conducted on the topic "Wooden Joining Technology." Detailed wooden structures are also widely used in carpentry. This, in turn, serves to increase efficiency without wasting wood. Various methods of joinery are also widely used in carpentry and construction work.

To manufacture various wooden products and perform other tasks, it is necessary to measure and plane wood materials. Special tools are used for this.

Any wood must be processed before use. This is often done in factories using specialized machines that are not available for home use. If a small amount of material needs to be processed, manual woodworking is used [6].

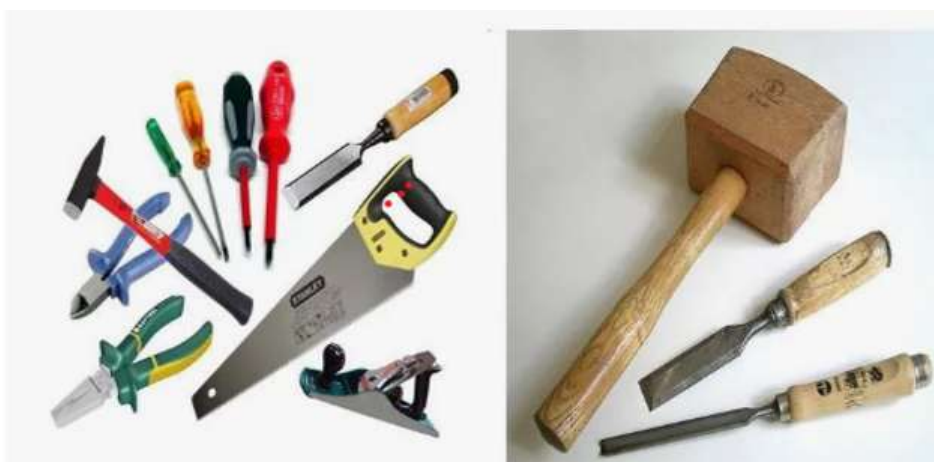
What is manual woodworking?

Mechanical woodworking is a type of material processing that involves changing the shape and size of wood while maintaining all its properties. Mechanical processing can be carried out using specialized technologies, as well as hand tools. This mechanical processing of small volumes of wood with hand tools is called manual woodworking. The technology for manual woodworking depends on the processing method. Manual woodworking includes the following methods:

- marking;
- reshaping and sizing: sawing;
- surface smoothing: planing, sanding, and lapping;
- burning holes using drilling, chisels, and gouges.

The precise dimensions and quality of wood and wood-based products, the cost of labor, and the savings in materials depend on the proper use of measuring and planing tools.

Measurement is the process of determining the size and shape of a piece of wood. Such tools include rulers, tape measures, measuring tapes, and measuring templates.



Yog'ochga ishlov beruvchi anjomlar

In conclusion, it can be said that in science and technology, woodworking, manual labor, and the proper use of tools are of great importance.

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Efficacy of a Novel Triple-Agent Germicidal Protocol for Residual Cavity Management Following Hepatic Echinococcectomy

Butaboev Jasurbek Makhmudjonovich

Candidate of Medical Sciences (PhD), Andijan State Medical Institute, Andijan,
Uzbekistan.

Shaykhova Guli Islamovna

Doctor of Medical Sciences (DSc), Professor, Tashkent Medical Academy, Tashkent,
Uzbekistan.

Qosimov Adham Lutfullayevich

Doctor of Medical Sciences (DSc), Professor, Andijan State Medical Institute,
Andijan, Uzbekistan.

ABSTRACT

Epidemiological metrics indicate a persistently high regional prevalence of cystic echinococcosis, demanding targeted evaluations of intraoperative parasitic eradication. The current investigation analyzes the multidimensional dynamics of residual cavity management following conservative hepatic echinococcectomy, utilizing a novel triple-agent protocol. The study population comprised 132 adult patients diagnosed with hepatic hydatid cysts, monitored over 36 months via a prospective, randomized-controlled design. Empirical clinical data demonstrate a robust inverse correlation between the application of the integrated germicidal solution (3 percent hydrogen peroxide, 20 percent hypertonic saline, and 0.02 percent chlorhexidine) and postoperative complication rates. Analytical outputs confirm that this targeted profiling optimizes intraoperative cavity sterilization, yielding a complete protoscoleces eradication rate of 100 percent within 5 minutes, compared to 87.8 percent in the standard hypertonic saline cohort. The dynamics of the obtained results mandate a shift from generalized monotherapy toward targeted chemical interventions. Patients

subjected to the novel protocol exhibited a significantly reduced hospital stay (7.1 +/- 1.2 days versus 11.4 +/- 2.5 days) and zero parasitic recurrence. These findings bridge persistent literature gaps by validating a comprehensive chemical interaction model, establishing a rigorous foundation for future hepatobiliary surgical strategies.

Keywords: Hepatic echinococectomy, residual cavity, cystic echinococcosis, scolicedal agents, biliary fistula, surgical recurrence, hypertonic saline.

INTRODUCTION

Current epidemiological landscapes illustrate a trajectory where human cystic echinococcosis (CE) progressively undermines public health infrastructure in endemic zones of Central Asia. The focal point of contemporary surgical challenge lies in the unpredictable chronicity of residual cavity complications post-echinococectomy. A systematic review of international literature exposes a definitive scientific gap regarding the optimal scolicedal agent that guarantees absolute parasitic eradication without inducing sclerosing cholangitis or exacerbating postoperative biliary fistulas.

Within the scope of the research object, this investigation targets the precise physicochemical shifts occurring during the intraoperative sterilization of the fibrous capsule. Traditional reliance on 20 percent hypertonic saline monotherapy frequently results in incomplete eradication of the germinative layer. The primary objective is to delineate the correlative strength between a novel triple-agent germicidal sequence and the geometric reduction of postoperative complications, proposing a structurally safe alternative for residual cavity management.

MATERIALS AND METHODS

The structural architecture of this study was established as a prospective, randomized-controlled cohort analysis, strictly adhering to the Declaration of Helsinki. The sample population was actively recruited and surgically treated between January 2022 and December 2025.

Inclusion criteria mandated the presence of stage CE2 to CE4 hepatic hydatid cysts measuring 5 to 15 centimeters. Patients with severe hepatic cirrhosis or extrahepatic cysts were systematically excluded. The validated cohort consisted of 132 subjects, randomized into two equivalent arms: the Main Group (n=66) receiving the novel triple-agent protocol, and the Control Group (n=66) receiving standard 20 percent hypertonic saline therapy.

During conservative echinococectomy, the Main Group's residual cavity was managed utilizing a sequential triple-agent germicidal combination: 3 percent Hydrogen Peroxide, followed by 20 percent Hypertonic Saline, and concluding with 0.02 percent Chlorhexidine gluconate. Total exposure time was strictly 5 minutes. The Kolmogorov-Smirnov test evaluated data distribution normality. Subsequent comparisons utilized Student's t-test and Chi-square analysis. Statistical thresholds were established at $p < 0.05$, utilizing SPSS v.26.0.

RESULTS

Baseline morphometric and demographic assessments revealed absolute statistical homogeneity between the cohorts (mean age 44.8 +/- 10.9 years, average cyst volume 335 +/- 80 mL). The postoperative observational vector, however, revealed a severe divergence in surgical outcomes.

Viability testing of the intracavitary scrapings confirmed the pathogenetic dominance of the triple-agent approach. Complete (100 percent) scolical efficacy was achieved in the Main Group within the designated exposure window. Conversely, the Control Group exhibited viable protoscoleces in 12.2 percent (n=8) of cases upon microscopic examination post-irrigation ($p < 0.01$).

The incidence of prolonged biliary fistulas dropped strictly to 3.0 percent (n=2) in the Main Group, compared to 13.6 percent (n=9) in the standard care cohort ($p = 0.028$).

Postoperative cavity suppuration occurred in a single patient (1.5 percent) within the intervention arm versus 7.5 percent (n=5) of the controls.

Over a 36-month ultrasound-verified follow-up period, parasitic recurrence was entirely absent (0 percent) in the Main Group. The Control Group registered a recurrence rate of 4.5 percent (n=3). Consequently, the mean duration of inpatient hospitalization dropped significantly from 11.4 +/- 2.5 days in the control arm to 7.1 +/- 1.2 days in the intervention arm ($p < 0.001$).

DISCUSSION

The findings from this cohort provide an uncompromising view into the physicochemical mechanisms driving parasitic eradication. The resulting data fundamentally challenge the passive monotherapy protocols traditionally applied in hepatic echinococcectomy.

This functional superiority is grounded in synergistic biochemical interactions. The oxidative burst generated by hydrogen peroxide dissolves the mucopolysaccharide matrix of the germinative layer, disrupting the parasite's structural integrity. This preliminary degradation dramatically amplifies the subsequent osmotic shock induced by the hypertonic saline, ensuring immediate protoscolex rupture. Finally, chlorhexidine neutralizes opportunistic bacterial flora colonizing the devitalized tissue. The synergy between these three distinct mechanisms minimizes the margin of error associated with conventional frameworks, avoiding highly toxic agents like formalin that provoke severe biliary endothelium necrosis.

SCIENTIFIC NOVELTY AND PRACTICAL SIGNIFICANCE

For the first time in regional hepatobiliary practice, this study mathematically quantifies the precise clinical advantage of a synergistic oxidative, osmotic, and antiseptic sequence for hydatid cyst sterilization. Practical application of these insights demands the immediate integration of the described triple-agent protocol into routine

surgical algorithms. This methodological pivot definitively eliminates the risk of intraoperative parasitic dissemination and optimizes postoperative recovery trajectories.

CONCLUSION

The functional recovery of the hepatic parenchyma following hydatid cyst removal is inextricably linked to the efficacy of intraoperative cavity sterilization. The analytical parameters derived from this prospective cohort confirm that the proposed triple-agent protocol acts as an absolute catalyst for parasitic eradication while remaining safe for the biliary infrastructure. Prioritizing this combined chemical intervention will substantially reduce postoperative biliary fistulas and neutralize recurrence risks, redefining the standard for residual cavity management.

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