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1-SECTION

“KIMYO DARSLARIDA YASHIL MIKROBIOLOGIK SINTEZ TEXNOLOGIYALARI VOSITASIDA O‘QUVCHILARNING EKOLOGIK KOMPETENSIYALARINI SHAKLLANTIRISH METODIKASI” MAVZUSIDAGI “ EKOLOGIK KOMPETENSIYARNI O’RGANISHDAN MAQSAD ”

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Annotatsiya: *Mazkur tezisda kimyo darslarida yashil mikrobiologik sintez texnologiyalaridan foydalanish orqali o‘quvchilarning ekologik kompetensiyalarini shakllantirish masalasi yoritilgan. Ekologik kompetensiya o‘quvchining tabiat va atrof-muhitga mas’uliyatli munosabatda bo‘lishi, kimyoviy jarayonlarning ekologik oqibatlarini tushunishi, chiqindilarni kamaytirish va resurslardan oqilona foydalanish bo‘yicha amaliy ko‘nikmalarga ega bo‘lishini nazarda tutadi. Kimyo fanini ekologik mazmundagi laboratoriya va amaliy mashg‘ulotlar bilan bog‘lash o‘quvchilarning nazariy bilimlarini amaliy faoliyat bilan uyg‘unlashtirish imkonini beradi. Yashil mikrobiologik sintez texnologiyalari esa biologik resurslar va mikroorganizmlar ishtirokidagi jarayonlarni ekologik yondashuv bilan o‘rganishga xizmat qilishi mumkin.*

Kalit so‘zlar: *ekologik kompetensiya, kimyo ta’limi, yashil kimyo, yashil mikrobiologik sintez, o‘quvchi, ekologik ta’lim, bioorganik chiqindilar, laboratoriya mashg‘uloti.*

Аннотация: *В тезисе рассматривается вопрос формирования экологических компетенций учащихся посредством использования технологий зеленого микробиологического синтеза на уроках химии. Раскрывается значение экологического образования, практических занятий и лабораторных работ в развитии ответственного отношения учащихся к окружающей среде.*

Ключевые слова: *экологическая компетентность, химическое образование, зеленая химия, микробиологический синтез, учащиеся, экологическое образование.*

Abstract: *This thesis discusses the formation of students’ ecological competencies through the use of green microbiological synthesis technologies in chemistry lessons. Particular attention is paid to developing students’ understanding*

of environmental responsibility, waste reduction, rational use of resources and the environmental aspects of chemical processes.

Keywords: *ecological competence, chemistry education, green chemistry, microbiological synthesis, students, environmental education.*

KIRISH

Bugungi kunda atrof-muhitning ifloslanishi, tabiiy resurslardan oqilona foydalanish, turli xil chiqindilarni kamaytirish va ekologik xavfsizlikni ta’minlash muhim masalalardan biridir. Shu sababli umumiy o‘rta ta’lim maktablarida o‘quvchilarga ekologik bilim berish bilan bir qatorda, ularda ekologik muammolarni anglash, tahlil qilish va amaliy yechim topishga yo‘naltirilgan kompetensiyalarni shakllantirish zarur. Kimyo fani o‘quvchilarning ekologik kompetensiyalarini rivojlantirish uchun katta imkoniyatlarga ega. Chunki kimyoviy moddalar, reaksiyalar, ishlab chiqarish jarayonlari, chiqindilar va ularning atrof-muhitga ta’siri bevosita kimyo fani bilan bog‘liq.

ASOSIY QISM

Ekologik kompetensiya — o‘quvchining ekologik bilimlarni egallashi, tabiatga mas’uliyatli munosabatda bo‘lishi, ekologik muammolarni aniqlashi va ularni hal qilishga qaratilgan amaliy faoliyatni amalga oshira olish qobiliyatidir.

Kimyo darslarida ekologik kompetensiyani shakllantirish jarayonida o‘quvchilar nafaqat kimyoviy reaksiyalarning tenglamalarini yozishni, balki ushbu jarayonlarning tabiatga ta’sirini ham tushunishlari lozim. Masalan, ishlab chiqarish jarayonlarida hosil bo‘ladigan chiqindilar, suv va havoning ifloslanishi, kimyoviy moddalardan foydalanish xavfsizligi kabi masalalar o‘quvchilarning ekologik tafakkurini rivojlantirishga xizmat qiladi. Yashil kimyo tamoyillari kimyoviy jarayonlarni imkon qadar xavfsiz, tejamkor va atrof-muhitga kam zarar yetkazadigan tarzda tashkil etishga qaratilgan. Shu nuqtayi nazardan mikroorganizmlar ishtirokidagi biologik jarayonlardan foydalanish o‘quvchilarga kimyo, biologiya va ekologiya fanlari o‘rtasidagi bog‘liqlikni ko‘rsatish imkonini beradi.

Yashil mikrobiologik sintez tushunchasi doirasida mikroorganizmlarning turli biologik jarayonlardagi faoliyati, biologik xomashyolardan foydalanish, organik moddalarni biokonversiya qilish va chiqindilarni foydali mahsulotlarga aylantirish imkoniyatlari o‘rganilishi mumkin. Masalan, o‘quvchilarga bioorganik chiqindilarni faqat “chiqindi” sifatida emas, balki ma’lum biologik va kimyoviy jarayonlarda qayta ishlanishi mumkin bo‘lgan resurs sifatida tushuntirish mumkin. Bunda o‘quvchilar quyidagi ketma-ketlikni anglaydilar:

-bioorganik chiqindi
-mikrobiologik jarayon

-yangi mahsulot yoki foydali modda
-chiqindining kamayishi
-ekologik foyda

Bunday yondashuv o‘quvchilarda ekologik muammoni faqat nazariy jihatdan emas, balki amaliy jihatdan ham tushunish imkonini yaratadi. Kimyo darslarida laboratoriya va amaliy mashg‘ulotlarni tashkil etishda o‘quvchilarga quyidagi savollarni berish mumkin:

-Kimyoviy jarayon natijasida qanday chiqindi hosil bo‘ladi?
-Ushbu chiqindining atrof-muhitga ta’siri qanday?
-Chiqindini kamaytirish yoki qayta ishlash mumkinmi?
-Jarayonda biologik usullardan foydalanish mumkinmi?
-Qanday usul ekologik jihatdan xavfsizroq?
-Resurslardan qanday qilib tejamkor foydalanish mumkin?

Mazkur savollar o‘quvchilarni mustaqil fikrlashga, sabab va oqibatlarni aniqlashga hamda ekologik xulosa chiqarishga yo‘naltiradi.

Yashil mikrobiologik sintezga oid topshiriqlarni **muammoli ta’lim, loyiha metodi, kichik guruhlarda ishlash, laboratoriya tajribalari va fanlararo integratsiya** asosida tashkil etish mumkin. Bunda kimyo fani biologiya va ekologiya bilan uzviy bog‘lanadi.

XULOSA

Xulosa qilib aytganda, kimyo darslarida ekologik mazmundagi masalalar va yashil mikrobiologik sintez texnologiyalaridan foydalanish o‘quvchilarning ekologik kompetensiyalarini shakllantirish uchun metodik imkoniyat yaratadi. Bunday yondashuv o‘quvchilarda ekologik bilim, amaliy ko‘nikma, mas’uliyatli munosabat va mustaqil ekologik qaror qabul qilish qobiliyatlarini rivojlantirishga yordam beradi.

Ayniqsa, bioorganik chiqindilarni qayta ishlash, resurslardan oqilona foydalanish va biologik jarayonlarning kimyoviy mohiyatini o‘rganish orqali o‘quvchilar **“kimyo — biologiya — ekologiya”** o‘rtasidagi uzviy bog‘liqlikni tushunib boradilar. Shu sababli yashil mikrobiologik sintez texnologiyalarini kimyo ta’limiga metodik jihatdan moslashtirish ekologik ta’limning amaliy yo‘nalishini kuchaytirishi mumkin.

FOYDALANILGAN ADABIYOTLAR

Anastas P.T., Warner J.C. *Green Chemistry: Theory and Practice*. Oxford University Press, 1998.

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Kimyo fanini o‘qitish metodikasi bo‘yicha o‘quv-metodik adabiyotlar.

Umumiy o‘rta ta’lim maktablari uchun kimyo fanidan amaldagi darslik va o‘quv dasturlari.

SYNTHESIS OF 2-METHYL-5-(3,4,5-TRIMETHOXYBENZYLIDENE)-5,6,7,8-TETRAHYDROPYRAZOLO[4,3-*D*]PYRIDO[1,2-A]PYRIMIDIN-10(2*H*)-ONE

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Annotation. *Arylidene derivatives of pyrazolo[4,3-d]pyrido[1,2-a]pyrimidin-10(2H)-one were synthesized through a base-catalyzed condensation reaction between the corresponding heterocyclic ketone and various aromatic aldehydes. The transformation was carried out in methanol using sodium hydroxide as a catalyst, providing relatively mild and convenient reaction conditions. The reaction proceeds through a Knoevenagel-type condensation mechanism, involving the formation of a carbon–carbon double bond between the active methylene moiety of the heterocyclic substrate and the carbonyl group of the aromatic aldehyde.*

The use of sodium hydroxide promotes the formation of the reactive carbanion intermediate, which subsequently undergoes nucleophilic addition to the aldehyde followed by dehydration to afford the corresponding arylidene products. The method allows the introduction of different aromatic substituents into the fused heterocyclic framework and thus provides an opportunity to expand the structural diversity of the synthesized compounds. Overall, this synthetic approach is relatively simple, operationally convenient, and suitable for the preparation of structurally diverse arylidene derivatives that may be of interest for further biological and pharmacological investigations.

Keywords: *pyrazolopyridopyrimidine, arylidene derivatives, Knoevenagel condensation, aromatic aldehydes, sodium hydroxide.*

INTRODUCTION

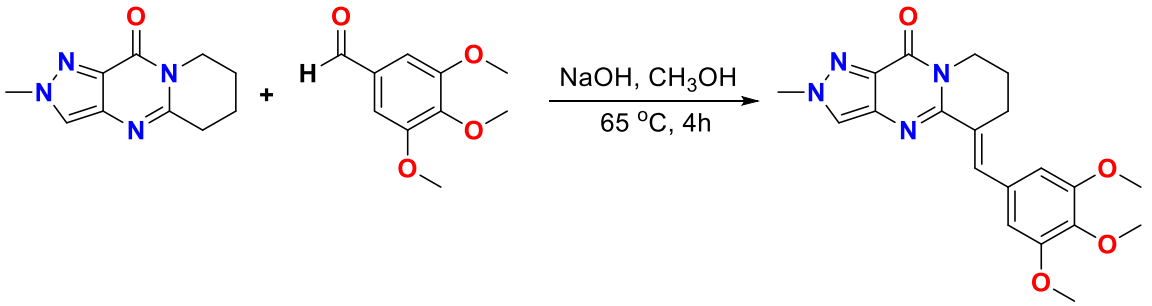
Heterocyclic compounds occupy an important position in modern medicinal chemistry because of their structural diversity and broad spectrum of biological activities. Many heterocyclic scaffolds are present in biologically active natural products and pharmaceutical agents, making them valuable frameworks for the discovery and development of new therapeutic compounds. Among these systems,

fused nitrogen-containing heterocycles have attracted particular attention due to their ability to interact with various biological targets and their potential to exhibit significant pharmacological effects.

The pyrazolo[4,3-*d*]pyrido[1,2-a]pyrimidine scaffold is of particular interest because of its rigid fused-ring architecture, high nitrogen content, and structural resemblance to biologically important purine analogues. Derivatives containing this heterocyclic framework have demonstrated potential biological properties, including anticancer, antimicrobial, and enzyme-inhibitory activities, depending on the nature and position of the substituents. Structural modification of this scaffold, particularly through the introduction of arylidene fragments, provides an effective strategy for increasing molecular diversity and investigating structure–activity relationships.

Therefore, the development of efficient synthetic approaches to new arylidene derivatives of pyrazolo[4,3-d]pyrido[1,2-a]pyrimidine is of considerable interest for the preparation of potentially biologically active compounds. Such derivatives may serve as useful candidates for further pharmacological evaluation and for the exploration of their potential anticancer and other biologically relevant activities.

Research Methodology. An arylidene derivative of 2-methyl-5,6,7,8-tetrahydropyrazolo[4,3-d]pyrido[1,2-a]pyrimidin-10(2H)-one was synthesized via the sodium hydroxide-catalyzed condensation of the corresponding tetrahydro heterocyclic compound with various aromatic aldehydes in a methanol medium. The reaction was carried out under relatively mild conditions at 65°C for 4 hours, yielding the target arylidene products with good yields. The transformation proceeds through a Knoevenagel-type condensation, in which sodium hydroxide facilitates the formation of the reactive intermediate from the heterocyclic substrate, followed by condensation with the carbonyl group of the aromatic aldehyde and subsequent elimination of water. The use of methanol as a reaction medium provided suitable conditions for the efficient interaction of the starting materials. The progress of the reaction was monitored by thin-layer chromatography (TLC), which confirmed the consumption of the starting tetrahydro compound and formation of the corresponding arylidene products. This approach offers a simple and convenient method for introducing diverse arylidene substituents into the tetrahydropyrazolo[4,3-*d*]pyrido[1,2-a]pyrimidine scaffold and may be useful for the preparation of compounds for further biological evaluation.



The chemical structures and physicochemical properties of the synthesized compounds were confirmed using a combination of spectroscopic and analytical methods. The structures of the obtained derivatives were characterized by ^{1}H and ^{13}C NMR spectroscopy, which provided information on the chemical environment of the hydrogen and carbon atoms and supported the proposed molecular structures. In addition, the melting points of the synthesized compounds were determined as an important physicochemical characteristic. Molecular mass analysis was also performed to verify the molecular composition and consistency of the obtained products with their proposed structures. The combined analytical data confirmed the successful synthesis and structural identity of the target compounds.

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ЧИСЛЕННОЕ МОДЕЛИРОВАНИЕ ГИДРОДИНАМИЧЕСКИХ ПРОЦЕССОВ В СЛОЖНОКОНФИГУРИРУЕМЫХ ТРУБОПРОВОДНЫХ СИСТЕМАХ

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Аннотация. *В представленной работе изложен оригинальный вычислительный подход, предназначенный для исследования и симуляции нестационарных гидродинамических потоков в разветвленных гидравлических сетях со сложной пространственной топологией. Динамические характеристики потока описываются посредством системы дифференциальных уравнений гиперболического типа, отражающих поведение сжимаемой среды в изолированных участках трубопровода. Ключевой акцент сделан на математической формализации и алгоритмической обработке условий сопряжения в узловых элементах графа сети, где жестко контролируется соблюдение законов сохранения массы и импульса, базирующихся на сетевых принципах Кирхгофа. Для аппроксимации исходных дифференциальных операторов задействована абсолютно устойчивая неявная конечно-разностная схема, трансформирующая исходную задачу в систему линейных алгебраических уравнений на каждом временном слое. С целью минимизации вычислительных затрат при работе с графами произвольной структуры авторами разработан модифицированный матричный метод прогонки для многосвязных систем.*

Ключевые слова: *численное моделирование, гидродинамические процессы, трубопроводные системы, законы Кирхгофа, метод прогонки.*

Abstract. *This paper presents a computational approach for studying transient hydrodynamic flows in branched hydraulic networks with complex topology. Flow characteristics are described by a system of hyperbolic differential equations modeling compressible medium behavior in pipeline segments. The focus is on formalizing coupling conditions at network junctions based on Kirchhoff's laws. For approximating differential operators, an implicit finite-difference scheme is used, transforming the problem into a system of linear algebraic equations. To minimize*

computational costs, a network sweep method is developed. Numerical analysis demonstrates high reliability and accuracy of the proposed method.

Keywords: *numerical modeling, hydrodynamic processes, pipeline systems, Kirchhoff's laws, sweep method.*

Рассматривается произвольная трубопроводная сеть, представленная в виде ориентированного графа, где ребра соответствуют линейным участкам, а вершины — точкам их сопряжения. Переходные процессы движения жидкости в рамках каждого выделенного ребра описываются классическими уравнениями неразрывности и баланса количества движения. Для демонстрации вычислительной эффективности разработанного инструментария в статье анализируется модельная задача транспорта углеводородов по магистрали, состоящей из пяти последовательно-параллельных секторов (схема приведена на Рис. 1).

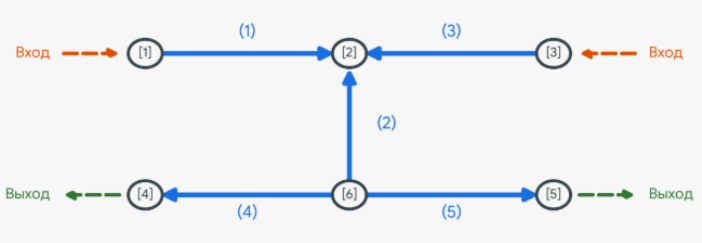

Рис. 1. Топологическая структура пятизвенного магистрального трубопровода

Направления векторов на схеме задают базовую ориентацию потока для корректного составления знаков разностных отношений. Обозначим дискретное множество ребер (сегментов) как $S = \{s_1, s_2, \dots, s_K\}$, а узловые точки (вершины) — как V. Линеаризованная гидродинамическая модель, описывающая ламинарный изотермический режим неустановившегося движения слабосжимаемой жидкости с постоянной плотностью ρ для единичного участка под номером s (имеющего длину l_s и внутренний диаметр d_s), имеет следующий вид:

$$\begin{cases} -\dfrac{\partial P^s(x,t)}{\partial x} = \dfrac{\rho}{A_s}\dfrac{\partial Q^s(x,t)}{\partial t} + 2a_s\dfrac{\rho}{A_s}Q^s(x,t), \\ -\dfrac{\partial P^s(x,t)}{\partial t} = c^2\dfrac{\rho}{A_s}\dfrac{\partial Q^s(x,t)}{\partial t}, \quad x \in (0, l_s),\ t \in (0,T),\ s \in S \end{cases} \tag{1}$$

В данных уравнениях функции $P^s(x,t)$ и $Q^s(x,t)$ определяют пространственно-временное распределение давления и мгновенного расхода среды; параметр c задает скорость распространения акустических волн в заполненном объеме, а A_s— площадь живого сечения трубы.

В рамках ламинарного режима принято, что кинематическая вязкость потока γ инвариантна относительно флуктуаций давления, что позволяет

использовать стационарное расчетное соотношение для гидравлического сопротивления:

$$2a = \frac{32\gamma}{d_2} = const.$$

Внутренние граничные условия в сопрягающих вершинах $v_j \in V$ накладывают требования непрерывности поля давлений и баланса масс (равенство входящих и исходящих потоков). Для любого узла, имеющего подмножества входящих I_j и выходящих Oj коммуникаций, справедлива следующая система условий:

$$\sum_{t\in I_j} Q^t(v_j,t) - \sum_{o\in O_j} Q^0(v_j,t) = Q_j^{ext}(t), \quad t \in [t_0,T], \tag{2}$$

$$P^i(v_j,t), \quad i \in I_j, o \in O_j, t \in [t_0,T] \tag{3}$$

Наличие подобных нелокальных связей существенно усложняет процедуру раздельного интегрирования уравнений по отдельным ветвям. На внешних границах гидравлической схемы (точках истока и стока) задаются краевые условия первого или второго рода — детерминированное управление по давлению:

$$P(v_b,t) = P_b(t), t \in [t_0,T] \tag{4}$$

либо управление по расходу:

$$Q(v_b,t) = Qb(t), \ t \in [t_0,T] \tag{5}$$

Учитывая, что гидравлическая система функционирует в непрерывном режиме до момента начала фиксации данных $[\tau,T]$, точные начальные эпюры давлений и расходов $P^S(x,t_0), Q^S(x,t_0)$ оказываются скрытыми. Для преодоления этой неопределенности вводится вектор варьируемых параметров $\lambda = \{\lambda_1,\lambda_2,\dots,\lambda_r\} \in R$, параметризующий множество потенциально возможных состояний системы:

$$P^s(x,t_0) = P_s(x;\lambda), \ Q^S(x,t_0) = Q_S(x;\lambda). \tag{6}$$

Предполагается, что аналитические функции начального профиля и краевых режимов удовлетворяют критериям корректности по Адамару, гарантируя существование и единственность решения сформулированной дифференциальной задачи.

Численная реализация и выводы

Для аппроксимации связанной краевой задачи (1)–(6) с неразделенными граничными условиями применяется дискретизация на сетках с помощью неявных конечно-разностных операторов отдельно для каждого ребра. Проблема сильной связанности узловых точек разрешается посредством применения специализированного декомпозиционного алгоритма типа сетевой прогонки. Это позволяет преобразовать глобальную разреженную матрицу в набор независимых локальных систем меньшей размерности, пригодных для эффективного распараллеливания на многопроцессорных вычислительных

архитектурах. В работе представлены результаты численных экспериментов, подтверждающие теоретические выводы.

Проведенный численный анализ доказывает высокую вычислительную надежность и точность предложенного метода при моделировании динамических режимов в сложных разветвленных сетях. Использование неявной аппроксимации гарантирует вычислительную устойчивость схемы в широком диапазоне шагов дискретизации как по пространству, так и по времени. Разработанный математический аппарат обладает свойством инвариантности к масштабу системы и может без существенных изменений транслироваться на промышленные трубопроводные комплексы произвольной топологической структуры.

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SYNTHESIS OF N-(4-CHLOROPHENYL)-2-METHYL-5,6,7,8-TETRAHYDROPYRAZOLO[4,3-*d*]PYRIDO[1,2-a]PYRIMIDIN-10(2*H*)-IMINE

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Annotation. *The novel fused nitrogen-containing heterocyclic compound N-(4-chlorophenyl)-2-methyl-5,6,7,8-tetrahydropyrazolo[4,3-d]pyrido[1,2-a]pyrimidin-10(2H)-imine can be synthesized using the method described below. The resulting molecule features a complex polycyclic core containing multiple nitrogen atoms, a structural characteristic that likely plays a key role in determining its unique chemical and biological properties. The presence of a 4-chlorophenyl substituent and a partially hydrogenated fused heterocyclic system further enhances the structural diversity of the synthesized derivative. Given the significance of nitrogen-containing fused heterocycles in medicinal chemistry, this compound is of interest as a potential biologically active scaffold and represents a promising candidate for future research into pharmacological, biological, and structure-activity relationship studies.*

Keywords: *pyrazolopyrimidine, heterocyclic compounds, organic synthesis.*

INTRODUCTION

Nitrogen-containing fused heterocyclic compounds are of significant interest in modern organic and medicinal chemistry due to their structural diversity and wide range of biological activities. Many representatives of this class have demonstrated antimicrobial, anti-inflammatory, antitumor, antiviral, and enzyme-inhibitory properties, making them attractive scaffolds for the design and development of biologically active molecules. The incorporation of several heteroatoms into a rigid fused framework can provide favorable molecular properties and enable diverse interactions with biological targets.

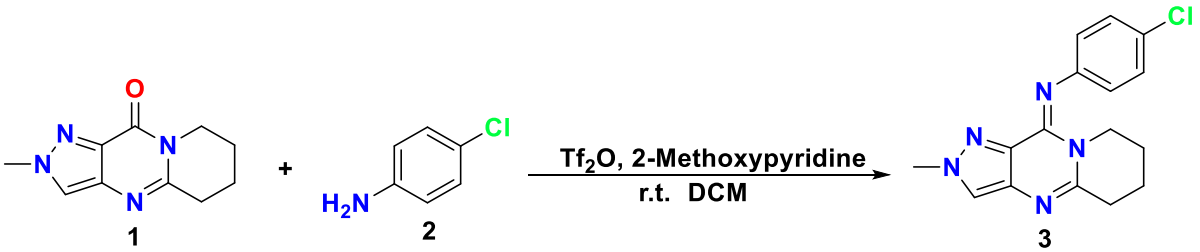
In particular, pyrazolo[4,3-*d*]pyrido[1,2-a]pyrimidine derivatives represent promising heterocyclic systems because of their unique fused-ring architecture and structural similarity to various biologically important nitrogen-containing compounds. The partially hydrogenated analogues of these systems may provide additional opportunities for structural modification and optimization of their

physicochemical and biological properties. Furthermore, the introduction of different substituents, especially aryl groups containing electron-withdrawing or electron-donating functionalities, can significantly influence the reactivity and potential biological activity of the resulting compounds.

Therefore, the development of efficient synthetic approaches toward new substituted pyrazolo[4,3-*d*]pyrido[1,2-a]pyrimidine derivatives remains an important research direction in heterocyclic and medicinal chemistry. In this study, the synthesis of **N-(4-chlorophenyl)-2-methyl-5,6,7,8-tetrahydropyrazolo[4,3-*d*]pyrido[1,2-a]pyrimidin-10(2*H*)-imine** was investigated as a novel fused nitrogen-containing heterocyclic compound. The obtained derivative expands the structural diversity of this heterocyclic class and may provide a useful scaffold for further studies of its chemical properties, biological activity, and structure–activity relationships.

Research Methodology. The target compound N-(4-chlorophenyl)-2-methyl-5,6,7,8-tetrahydropyrazolo[4,3-*d*]pyrido[1,2-a]pyrimidin-10(2*H*)-imine **1** was synthesized via the reaction of the corresponding precursor with 4-chloroaniline **2** under controlled reaction conditions. The transformation was performed in anhydrous dichloromethane, which served as an appropriate solvent for maintaining the reaction medium under moisture-free conditions. Trifluoromethanesulfonic anhydride (Tf_2O) was employed as an activating reagent to facilitate the conversion of the carbonyl functionality into the corresponding imine derivative, while 2-methoxypyridine was used as an acid scavenger to neutralize the acidic species generated during the reaction.

The reaction was carried out under a nitrogen atmosphere to minimize the influence of moisture and oxygen and to ensure reproducible reaction conditions. The use of these reagents and controlled conditions enabled efficient functionalization with the 4-chlorophenylamino group, resulting in the formation of the desired nitrogen-containing fused imine derivative. This synthetic transformation provides a convenient approach for introducing an aryl-substituted imine functionality into the pyrazolo[4,3-*d*]pyrido[1,2-a]pyrimidine **3** framework.



The reaction mixture was initially cooled to 0 °C to ensure controlled activation of the carbonyl group and to minimize the possibility of undesired side reactions during the initial stage of the transformation. Maintaining a low temperature at this stage also allowed the activating reagent to interact with the substrate under controlled

conditions. After the initial activation, the reaction mixture was gradually allowed to warm to room temperature and was stirred continuously until the transformation was complete.

The progress of the reaction was monitored periodically using thin-layer chromatography (TLC) by comparing the disappearance of the starting precursor with the formation of a spot corresponding to the new product. Completion of the reaction was determined by the absence or significant decrease of the starting material on the TLC plate. This monitoring procedure provided a convenient means of controlling the reaction progress and determining the appropriate endpoint of the synthesis.

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ВЛИЯНИЕ ИОННОГО СОСТАВА И ЖЁСТКОСТИ ВОДЫ НА КОЛЛОИДНУЮ УСТОЙЧИВОСТЬ ОРГАНИЧЕСКОГО УДОБРЕНИЯ НА ОСНОВЕ ОТХОДОВ ПТИЦЕВОДСТВА

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Аннотация: *В работе исследовано влияние ионного состава и общей жёсткости воды на коллоидно-дисперсные свойства биологически переработанного (компостирование, биогумусная стадия) органического удобрения на основе птичьего помёта. Суспензию удобрения диспергировали в модельных водах с жёсткостью 2, 6 и 12 мг-экв/л при различных соотношениях Ca^{2+} и Mg^{2+}, а также в присутствии Na^{+}. Определены размер частиц, дзета-потенциал, седиментационная устойчивость, критическая концентрация коагуляции (КПК) и склонность к засорению фильтрующих сеток. Установлено, что рост жёсткости воды приводит к снижению абсолютного значения ζ-потенциала, росту гидродинамического диаметра частиц и потере устойчивости суспензии вследствие сжатия двойного электрического слоя и мостикового связывания карбоксильных групп гуминовых коллоидов. Ионы Ca^{2+} дестабилизируют систему сильнее, чем Mg^{2+} (КПК 4,2 и около 6,0 ммоль/л соответственно), поэтому наряду с общей жёсткостью необходимо учитывать соотношение Ca:Mg. Результаты могут быть использованы при разработке рекомендаций по применению удобрения в системах капельного орошения и фертигации, а также при подборе стабилизирующих добавок.*

Ключевые слова: *органическое удобрение, птичий помёт, жёсткость воды, ионы Ca^{2+} и Mg^{2+}, коллоидная устойчивость, дзета-потенциал, критическая концентрация коагуляции, гуминовые коллоиды.*

Abstract: *This study investigated the effect of the ionic composition and overall water hardness on the colloidal-dispersed properties of biologically processed organic fertilizer based on poultry manure, subjected to composting and a vermicomposting stage. The fertilizer suspension was dispersed in model waters with hardness levels of 2, 6, and 12 meq/L at different Ca^{2+}/Mg^{2+} ratios, as well as in the presence of Na^{+}. Particle size, zeta potential, sedimentation stability, critical coagulation concentration (CCC), and the tendency to clog filter screens were determined. It was established that increasing water hardness leads to a decrease in the absolute value of the ζ-potential, an increase in the hydrodynamic diameter of particles, and a loss of suspension stability due to compression of the electrical double layer and bridging interactions involving the carboxyl groups of humic colloids. Ca^{2+} ions destabilize the system more strongly than Mg^{2+} ions (CCC values of 4.2 and approximately 6.0 mmol/L, respectively); therefore, in addition to overall water hardness, the Ca:Mg ratio should also be taken into account. The results can be used to develop recommendations for applying the fertilizer in drip irrigation and fertigation systems, as well as for selecting stabilizing additives.*

Keywords: *organic fertilizer, poultry manure, water hardness, Ca^{2+} and Mg^{2+} ions, colloidal stability, zeta potential, critical coagulation concentration, humic colloids.*

ВВЕДЕНИЕ

Экономия воды и повышение эффективности использования удобрений – одни из главных задач современного орошаемого земледелия. Поэтому всё шире внедряются капельное орошение и фертигация. При этих технологиях удобрение вносят с поливной водой, чтобы доставить элементы питания непосредственно в зону корней. Многолетнее избыточное применение минеральных удобрений привело к снижению содержания гумуса в почве и загрязнению окружающей среды, поэтому растёт интерес к органическим удобрениям на основе птичьего помёта. Удобрение на основе биологически переработанных (компостирование и биогумусная стадия) отходов птицеводства представляет собой сложную коллоидно-дисперсную систему. Её дисперсная фаза состоит из гуминовых и фульвокислот, органо-минеральных агрегатов и остатков микробной биомассы, а дисперсионная среда – из водного раствора электролитов. Устойчивость такой системы определяется зарядом карбоксильных (–COOH) и фенольных (–OH) групп на поверхности частиц и описывается теорией ДЛФО. Поливная вода для удобрения – не просто носитель, а дисперсионная среда коллоидной системы. В Узбекистане и других засушливых регионах поливная вода часто минерализована и жёстка, в ней

присутствуют ионы Ca^{2+} и Mg^{2+}. Двухвалентные катионы сжимают двойной электрический слой, нейтрализуют поверхностный заряд и образуют катионные мостики между карбоксильными группами. В результате гуминовые коллоиды коагулируют, суспензия оседает, а эмиттеры капельного орошения засоряются.

Хотя Ca^{2+} и Mg^{2+} имеют одинаковую валентность, ожидается, что их влияние на гуминовые коллоиды различается: Mg^{2+} с меньшим ионным радиусом сильнее гидратирован и слабее специфически связывается с органическими группами. На практике же качество воды обычно оценивают только по общей жёсткости (мг-экв/л), не учитывая соотношение Ca:Mg. Кроме того, мало изучено влияние Na^{+} (в почве он диспергирует частицы, а в суспензии его действие зависит от концентрации). Большинство исследований посвящено почвенным коллоидам или промышленным суспензиям, а влияние ионного состава и жёсткости воды на коллоидную устойчивость биологически переработанных удобрений на основе отходов птицеводства систематически не изучено. Цель работы: установить закономерности влияния ионного состава и общей жёсткости воды на коллоидную устойчивость биологически переработанного органического удобрения на основе отходов птицеводства. определить влияние жёсткости воды (2, 6, 12 мг-экв/л) на размер частиц, ζ-потенциал и седиментационную устойчивость; сравнить влияние различных соотношений Ca^{2+} и Mg^{2+} при одинаковой общей жёсткости; определить критические концентрации коагуляции (КПК) для Na^{+}, Mg^{2+} и Ca^{2+} и проверить соответствие правилу Шульце–Харди; оценить влияние Na^{+} на действие двухвалентных катионов; оценить риск засорения при капельном орошении и обосновать рекомендации по качеству воды. Научная новизна состоит в том, что влияние ионов Ca^{2+} и Mg^{2+} на устойчивость коллоидов удобрения из переработанного птичьего помёта изучено раздельно и по соотношению Ca:Mg, а по данным КПК и ζ-потенциала выделен вклад специфического связывания. Практическая значимость заключается в том, что результаты можно использовать для обоснования требований к качеству воды (общая жёсткость, соотношение Ca:Mg) при применении удобрения в системах капельного орошения и фертигации, а также при выборе стабилизирующих добавок.

ВЫВОДЫ

По результатам исследования влияния ионного состава и жёсткости воды на коллоидную устойчивость биологически переработанного органического удобрения на основе отходов птицеводства сформулированы следующие выводы: Влияние общей жёсткости. При росте жёсткости воды с 2 до 12 мг-экв/л абсолютное значение ζ-потенциала снизилось с 27 до 11 мВ,

гидродинамический диаметр вырос с 520 до 1650 нм, а показатель устойчивости D_t/D_0 через 24 ч упал с 0,72 до 0,30. Причина – сжатие двойного электрического слоя и нейтрализация карбоксильных групп.Различие Ca^{2+} и Mg^{2+}. При одинаковой общей жёсткости (6 мг-экв/л) устойчивость снижается с ростом доли Ca^{2+}: D_t/D_0 составляет 0,58 при только Mg^{2+} и 0,45 при только Ca^{2+}. КПК равна 4,2 ммоль/л для $CaCl_2$ и около 6,0 ммоль/л для $MgCl_2$. Ca^{2+} образует с карбоксильными группами более прочные комплексы и катионные мостики, тогда как Mg^{2+} сильнее гидратирован. Правило Шульце–Харди. Порядок КПК Na^+ (85) ≫ Mg^{2+} (6,0) > Ca^{2+} (4,2 ммоль/л) соответствует правилу валентности. Различие между двухвалентными ионами показывает вклад не только электростатического экранирования, но и специфического связывания. Влияние Na^+. Действие Na^+ зависит от концентрации: при низкой (до 5 ммоль/л) устойчивость немного растёт, при высокой (50 ммоль/л) снижается из-за роста ионной силы.

Риск засорения. С ростом жёсткости увеличивается остаток на фильтрующей сетке (на сетке 50 мкм с 31 до 71 %), что указывает на высокий риск засорения эмиттеров при капельном орошении. Прогностические показатели. Выявлена высокая корреляция между ζ-потенциалом и D_t/D_0 ($r \approx 0{,}93$) и между d_h и D_t/D_0 ($r \approx -0{,}90$). Поэтому ζ-потенциал и d_h могут служить экспресс-показателями устойчивости суспензии при изменении качества воды. Практические рекомендации. При жёсткости воды до 2 мг-экв/л удобрение можно применять без ограничений. В диапазоне 2–6 мг-экв/л следует контролировать соотношение Ca:Mg и устанавливать сетчатый фильтр. При жёсткости выше 6 мг-экв/л необходимо умягчение воды или применение стабилизирующих добавок (гумат, полиэлектролит). При оценке воды нужно учитывать не только общую жёсткость, но и соотношение Ca:Mg.

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EFFECT OF GLYCYRRHIZIC ACID-BASED COMPOUNDS ON WHEAT SEED GERMINATION AND SEEDLING GROWTH UNDER SALT STRESS

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***Abstract**: This study evaluated the effects of glycyrrhizic acid (GA)-based compounds on wheat seed germination and early seedling growth under 150 mM NaCl stress. Five treatments were compared: distilled water, NaCl alone, GA + NaCl, GA:IAA (2:1) + NaCl, and IAA:arginine + NaCl. Germination and leaf and root length were assessed. On day 12, root length reached 13.8 cm with GA:IAA (2:1) and 14.0 cm with IAA:arginine, compared with 11.7 cm under NaCl alone. The results indicate that the tested compounds may influence early wheat growth under saline conditions.*

***Keywords:** wheat; salinity stress; NaCl; glycyrrhizic acid; indole-3-acetic acid; arginine; germination; root growth; seedling.*

1. INTRODUCTION

Salinity is one of the major abiotic constraints limiting crop establishment and productivity, particularly in arid and semi-arid agricultural regions. In wheat (Triticum aestivum L.), salt stress can interfere with water uptake, ion homeostasis, photosynthesis, nutrient balance and biomass accumulation. Germination and early seedling establishment are especially important because poor establishment can reduce stand uniformity and subsequent plant performance (Isayenkov & Maathuis, 2019; Zörb et al., 2019).

At the cellular level, excessive Na+ accumulation causes ionic and osmotic disturbances. Plants respond through coordinated mechanisms involving Na+ exclusion, vacuolar sequestration and maintenance of K+/Na+ homeostasis. The SOS1 Na+/H+ antiporter, NHX transporters and HKT transporters are among the important components of these mechanisms (Munns & Tester, 2008; Deinlein et al.,

2014). These processes are associated with the ability of plants to maintain cellular ion balance under saline conditions.

In addition to genetic and physiological mechanisms, exogenous compounds that modify plant growth and stress responses are of practical interest. Glycyrrhizic acid (GA), indole-3-acetic acid (IAA) and arginine represent biologically active compounds whose effects under saline conditions require further experimental evaluation. Therefore, the present study was aimed at assessing the effects of GA-based treatments, including a GA:IAA (2:1) combination, on wheat seed germination and early seedling morphological traits under NaCl stress.

2. MATERIALS AND METHODS

The experiment was organized using five treatment variants. Variant I was the distilled-water control. Variant II contained 150 mM NaCl. Variant III consisted of GA at 10−6 concentration combined with 150 mM NaCl. Variant IV consisted of GA:IAA at a 2:1 ratio, at 10−6 concentration, combined with 150 mM NaCl. Variant V consisted of IAA:arginine at 10−6 concentration combined with 150 mM NaCl.

Seed germination was recorded as a percentage. Morphometric observations included leaf length on day 7 and leaf and root length on day 12. The values reported below are the recorded values for the respective experimental variants.

3. RESULTS

3.1. Seed germination

The recorded germination values differed among the five treatments. The overall germination percentages were 78% for the distilled-water control, 63% for 150 mM NaCl, 78% for GA + NaCl, 83% for GA:IAA (2:1) + NaCl, and 100% for IAA:arginine + NaCl. The individual sample values in the experimental record were also variable within several treatments.

3.2. Leaf growth on day 7

On day 7, leaf length was 10.68 cm in the control, 9.53 cm under 150 mM NaCl, 10.37 cm in the GA + NaCl treatment, 11.22 cm in the GA:IAA (2:1) + NaCl treatment, and 11.16 cm in the IAA:arginine + NaCl treatment.

3.3. Leaf and root growth on day 12

By day 12, leaf length was 16.80 cm in the control, 15.67 cm under NaCl, 16.70 cm under GA + NaCl, 16.73 cm under GA:IAA (2:1) + NaCl, and 17.23 cm under IAA:arginine + NaCl. Root length was 12.00, 11.70, 13.00, 13.80 and 14.00 cm, respectively.

3.4. Germination rate

The germination of wheat seeds treated with GA, IAA and their supramolecular complex (GA:IAA) at concentrations of 1×10^{-5} M, 1×10^{-6} M and 1×10^{-7} M, as well as in the distilled-water control group, was evaluated. In the control group,

germination was 97.77 ± 1.11%, while the highest germination was recorded in seeds treated with IAA at 1×10^{-7} M and GA:IAA at 1×10^{-7} M, reaching 98.89 ± 1.11%. These results indicate that the applied preparations did not adversely affect seed viability or germination, which is consistent with previous studies reporting that low concentrations of biostimulants do not impair seed germination [1].

Germination rate of wheat seeds treated with GA, IAA and GA:IAA complexes.

Treatment	Germination rate (%)
Control (dH_2O)	97.77 ± 1.11
GA 10^{-5} M	98.33 ± 0.58
GA 10^{-6} M	98.00 ± 0.58
GA 10^{-7} M	98.67 ± 0.58
IAA 10^{-5} M	98.89 ± 1.11
IAA 10^{-6} M	98.33 ± 0.58
IAA 10^{-7} M	98.89 ± 1.11
GA:IAA 10^{-5} M	98.00 ± 0.58
GA:IAA 10^{-6} M	98.67 ± 0.58
GA:IAA 10^{-7} M	98.89 ± 1.11

3.5. Water uptake dynamics

Water uptake by wheat seeds was measured over 72 hours, and the results are presented in Table 2 and Figure 1. The control group absorbed 1.097 ± 0.117 g of water, whereas the highest water uptake was observed in seeds treated with IAA at 1×10^{-7} M (1.674 ± 0.070 g) and GA:IAA at 1×10^{-7} M (1.738 ± 0.099 g), which were 58% and 55.5% higher, respectively, than the control. These results indicate that the supramolecular complex of GA and IAA, particularly at low concentrations (1×10^{-7} M), significantly increases the water-uptake capacity of wheat seeds, which may improve seedling growth under stress conditions [15].

Effect of GA, IAA and 2GA:IAA solutions at different molar concentrations on the water-uptake dynamics of wheat seeds of the "Asr" variety under laboratory conditions (M ± m).

Experimental variants	Initial seed mass (g)	24 h (g)	48 h (g)	72 h (g)	Amount of absorbed water (g)
Control (dH_2O)	1.358 ± 0.053	1.783 ± 0.069	2.111 ± 0.104	2.255 ± 0.105	1.097 ± 0.117
GA 10^{-5} M	1.323 ± 0.035	1.744 ± 0.077	2.140 ± 0.123	2.597 ± 0.207	1.274 ± 0.220
GA 10^{-6} M	1.366 ± 0.028	1.757 ± 0.049	2.197 ± 0.057	2.773 ± 0.170	1.408 ± 0.162
GA 10^{-7} M	1.292 ± 0.039	1.675 ± 0.038	2.109 ± 0.052	2.785 ± 0.203	1.493 ± 0.199

IAA 10^{-5} M	1.210 ± 0.045	1.549 ± 0.085	2.083 ± 0.085	2.697 ± 0.164	1.478 ± 0.141
IAA 10^{-6} M	1.305 ± 0.071	1.621 ± 0.092	2.089 ± 0.125	2.754 ± 0.129	1.449 ± 0.059
IAA 10^{-7} M	1.305 ± 0.010	1.790 ± 0.067	2.224 ± 0.054	2.979 ± 0.060*	1.674 ± 0.070*
2GA:IAA 10^{-5} M	1.360 ± 0.053	1.804 ± 0.063	2.153 ± 0.122	2.599 ± 0.209	1.238 ± 0.157
2GA:IAA 10^{-6} M	1.347 ± 0.024	1.796 ± 0.062	2.263 ± 0.006	2.948 ± 0.078*	1.601 ± 0.090*
2GA:IAA 10^{-7} M	1.384 ± 0.067	1.895 ± 0.090	2.389 ± 0.145	3.123 ± 0.157*	1.738 ± 0.099*

*Note: * – the difference between the experimental group values and the control was statistically significant at $p < 0.05$.*

4. DISCUSSION

The recorded results show that the 150 mM NaCl treatment was associated with the lowest leaf length on day 7 (9.53 cm) and the lowest root length on day 12 (11.70 cm) among the five treatments. This pattern is consistent with the general understanding that salinity can restrict water relations and growth during early plant development. Wheat responses to salinity depend on stress intensity, genotype and developmental stage (Munns & Tester, 2008; Zörb et al., 2019).

The treatments containing the tested compounds showed higher root-length values than the NaCl-only treatment. On day 12, root length was 13.0 cm with GA + NaCl, 13.8 cm with GA:IAA (2:1) + NaCl and 14.0 cm with IAA:arginine + NaCl. The experimental record therefore suggests an association between these treatments and enhanced early root elongation under the tested conditions. The GA:IAA (2:1) treatment produced a day-7 leaf length of 11.22 cm, which was the highest among the five variants at that observation point, while the IAA:arginine treatment produced the highest recorded day-12 leaf length (17.23 cm) and root length (14.0 cm). These observations provide a basis for further experiments involving larger replication, physiological measurements and molecular markers of salt tolerance.

In particular, future work may investigate whether the observed morphological responses are accompanied by changes in ion homeostasis, osmolyte accumulation and expression of salt-responsive genes.

5. CONCLUSION

Under the experimental conditions used, 150 mM NaCl affected early wheat seedling growth, with reduced leaf and root length compared with several compound-treated variants. The GA:IAA (2:1) + NaCl treatment showed a leaf length of 11.22 cm on day 7 and a root length of 13.8 cm on day 12. The IAA:arginine + NaCl treatment showed 17.23 cm leaf length and 14.0 cm root length on day 12. The

recorded germination percentage was highest in the IAA:arginine treatment (100%). These results indicate that GA-based and related compound treatments warrant further investigation as potential modifiers of wheat early growth under saline conditions. Statistical validation and molecular analyses should be included in subsequent experiments.

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GLYCYRRHIZA GLABRA TRITERPENOIDLARI VA ULARNING

SUPRAMOLEKULYAR KOMPLEKSLARI ASOSIDA O'SIMLIK ILDIZ TIZIMINI BOSHQARISH ISTIQBOLLARI

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Annotatsiya. *Ushbu tezisda Glycyrrhiza glabra (shirinmiya) o'simligi ildizidan ajratib olingan glitsirrizin kislotasi (GK) va uning fitogormonlar bilan hosil qilgan supramolekulyar komplekslarining o'simlik ildiz tizimi arxitekturasiga ta'siri ko'rib chiqilgan. Global iqlim o'zgarishi, qurg'oqchilik va tuproq sho'rlanishi sharoitida ildiz tizimining gravitropik javobini hamda fazoviy joylashuvini boshqarish ekinlar mahsuldorligini saqlashda muhim ahamiyatga ega. Ishda GK komplekslarining hujayra membranasi sterollari va auksin tashuvchi oqsillar (AUX1, PIN) faolligini modulyatsiya qilish orqali ildiz o'sish burchagi hamda chuqurligini o'zgartirish bo'yicha ehtimoliy molekulyar mexanizmlari taxmin qilingan va original ishchi gipoteza ilgari surilgan. Shuningdek, ushbu gipotezani Arabidopsis thaliana, bug'doy va g'o'za o'simliklarida genetik mutant liniyalar hamda zamonaviy rizotronlar yordamida tekshirishning bosqichma-bosqich eksperimental sxemasi asoslangan.*

Kalit so'zlar: *glitsirrizin kislota, supramolekulyar kompleks, Glycyrrhiza glabra, ildiz tuzilishi, gravitropizm, auksin transporti, sho'rlanish, qurg'oqchilik.*

Abstract. *This thesis examines the effects of glycyrrhizic acid (GA), extracted from Glycyrrhiza glabra (licorice) roots, and its supramolecular complexes with phytohormones on plant root system architecture. Under conditions of global climate change, drought, and soil salinity, controlling the gravitropic response and spatial arrangement of root systems is vital for maintaining crop productivity. The paper proposes an original working hypothesis detailing the potential molecular mechanisms by which GA complexes alter root growth angle and depth through the modulation of cell membrane sterols and auxin transporter proteins (AUX1, PIN). Furthermore, a step-by-step experimental scheme is established to verify this hypothesis using genetic mutant lines and modern rhizotron visualization systems in Arabidopsis thaliana, wheat, and cotton plants.*

Keywords: *glycyrrhizic acid, supramolecular complex, Glycyrrhiza glabra, root architecture, gravitropism, auxin transport, salinity, drought.*

INTRODUCTION (KIRISH)

Global iqlim o'zgarishi, suv tanqisligi va tuproq sho'rlanishining kuchayishi jahon qishloq xo'jaligi oldiga ekinlar mahsuldorligini saqlab qolish va stress omillariga chidamliligini oshirish kabi keskin vazifalarni qo'ymoqda. Ushbu muammolarni hal qilishda o'simliklarning yer osti a'zosi - ildiz tizimining arxitekturasi (tuzilishi va fazoviy joylashuvi) markaziy o'rinni egallaydi. Ildizning tuproq qatlamlarida qaysi burchak ostida va qancha chuqurlikka qarab o'sishi bevosita gravitropik javob (yer tortish kuchi ta'siriga reaksiyasi) orqali boshqariladi. Chuqur ildiz tizimi o'simlikka tuproqning quyi qatlamlaridagi namlik va mineral elementlardan samarali foydalanish imkonini beradi, bu esa qurg'oqchil hamda sho'rlangan hududlarda hayotiy muhim omil hisoblanadi.

Bugungi kunda ildiz tizimini boshqarishda kimyoviy sintetik stimulyatorlardan foydalanish atrof-muhit ifloslanishi va iqtisodiy xarajatlar nuqtayi nazaridan o'zini oqlamayapti. Shu sababli, ekologik xavfsiz, tabiiy va arzon fitoregulyatorlarni izlab topish hamda amaliyotga joriy etish dolzarb hisoblanadi. O'zbekiston florasida keng tarqalgan va mahalliy xomashyo hisoblangan shirinmiya (Glycyrrhiza glabra L.) ildizidan ajratib olinadigan glitsirrizin kislotasi (GK) va uning asosidagi supramolekulyar komplekslar ana shunday istiqbolli birikmalar sirasiga kiradi.

GK ning o'ziga xosligi: U oleanan tipidagi pentatsiklik triterpenoid saponin bo'lib, o'z molekulasida ham gidrofil, ham gidrofob qismlarni saqlaydi. Bu unga boshqa biologik faol moddalar (masalan, fitogormonlar) bilan osonlikcha 'mehmon-mezbon' tipidagi supramolekulyar komplekslar hosil qilish imkonini beradi.

Muammoning qo'yilishi: Mahalliy va xorijiy adabiyotlarda GK va uning komplekslarining o'simliklar o'sishini rag'batlantirishi haqida ko'plab eksperimental ma'lumotlar mavjud bo'lsa-da, ularning ildiz tizimi arxitekturasiga, xususan, gravitropik signal uzatilishiga ta'sir qilish mexanizmlari molekulyar darajada to'liq ochib berilmagan.

Ishning maqsadi: GK va uning fitogormonlar bilan hosil qilgan supramolekulyar komplekslarining o'simlik ildiz o'sishiga ta'siri bo'yicha adabiyot ma'lumotlarini tizimlashtirish, ta'sirning ehtimoliy molekulyar mexanizmlari bo'yicha ishchi gipotezani shakllantirish va uni tekshirishning bosqichma-bosqich eksperimental sxemasini asoslashdan iborat.

METHODS (TADQIQOT USULLARI)

Ushbu tadqiqotda tizimli tahlil, qiyosiy-gipotezaviy modellashtirish va kontseptual loyihalash usullaridan foydalanildi. Ishni amalga oshirishda quyidagi bosqichma-bosqich yondashuvlar qo'llandi:

1. *Adabiyotlar skriningi va ma'lumotlar bazasi tahlili:* Nufuzli xalqaro (PubMed, Scopus, Web of Science) va mahalliy ilmiy platformalardan so'nggi

yillarga oid ma'lumotlar to'plandi. 'Glycyrrhizic acid', 'supramolecular complex', 'root system architecture' kabi kalit so'zlar yordamida qidiruv amalga oshirildi.

2. *Eksperimental natijalarni solishtirish:* Mahalliy tadqiqotchilar tomonidan GK va uning hosilalari (jumladan, salitsil kislotasi bilan kompleksi) bo'yicha olingan amaliy natijalar o'simliklar fiziologiyasining zamonaviy molekulyar modellari bilan qiyoslandi.

3. *Mexanistik modellashtirish:* Triterpenoid birikmalarning hujayra membranasi sterollari va auksin tashuvchi oqsillar (AUX1, PIN) bilan o'zaro ta'sir qilish xususiyatlari asosida mantiqiy zanjir ko'rinishidagi ishchi gipoteza sxemasi ishlab chiqildi.

RESULTS (NATIJALAR)

Olib borilgan adabiyotlar tahlili va eksperimental ma'lumotlarning umumlashtirilishi shuni ko'rsatdiki, GK o'zining amfifil tabiati tufayli dorivor va biologik faol moddalarning eruvchanligini, barqarorligini hamda o'simlik hujayralari membranasidan o'tuvchanligini keskin oshiradi. Mahalliy olimlar tomonidan olingan eng muhim natijalar va ularning qiyosiy xarakteristikasi 1-jadvalda keltirilgan.

T/r	Birikma / Kompleks nomi	Konsentratsiya / sharoit	Kuzatilgan biologik samara va effektlar
1	DAG-1 (GK : Salitsil kislota, 2:1)	10^{-7} M, xloridli sho'rlanish	G'o'zaning o'sishini rag'batlantirdi; katalaza, peroksidaza va SOD faolligini oshirdi.
2	GK + Salitsil kislota kompleksi	In vitro sharoitda apikal meristema	Uzum ko'chatlarini yetishtirishda ildiz tizimining umumiy uzunligini sezilarli darajada oshirdi.
3	Egzogen fitogormonlar (IAA, GA_3, MeJA)	Glycyrrhiza uralensis ildizlari	Tashqi tomondan berilgan fitogormonlar o'simlik ildizida GK to'planishini modulyatsiya qildi.

Jadval ma'lumotlaridan ko'rinadiki, GK va fitogormonlar almashinuvi o'rtasida ikki tomonlama teskari aloqa (cross-talk) tizimiamiy mavjud. GK nafaqat tashqi gormon yetkazuvchi transport vositasi, balki o'simlikning ichki gormonal balansi va antioksidant himoya tizimini faollashtiruvchi signal molekulasi sifatida ham namoyon bo'ladi.

DISCUSSION (MUHOKAMA)

Garchi amaliy jihatdan GK komplekslarining ildiz o'sishiga ijobiy ta'siri isbotlangan bo'lsa-da, fundamental darajada bu jarayonning mexanizmlari noma'lumligicha qolayotgan edi. Biz ushbu muammoni tushuntirish uchun fitogormonlar va membranalar darajasidagi ikkita asosiy ehtimoliy yo'lni tahlil qildik:

1. *Auksin transporti tizimiga ta'siri:* Ilmiy manbalardan ma'lumki, boshqa bir triterpenoid saponin chromosaponin I o'simlik hujayrasiga auksinni olib kiruvchi AUX1 tashuvchi oqsili bilan bevosita o'zaro ta'sirga kirishib, Arabidopsis ildizining

gravitropik javobini o'zgartira oladi. GK ham o'xshash kimyoviy tabiatga ega bo'lgani uchun, uning nishoni aynan AUX1 oqsillari bo'lishi ehtimoli yuqori.

2. *Membrana sterollari va PIN-polyarlik yo'li:* Triterpenoidlar va o'simlik sterollari biosintez jihatidan umumiy o'tmishdosh molekula - 2,3-oksidoskvalendan hosil bo'ladi. Auksin gormonining hujayradan tashqariga chiqishini ta'minlovchi PIN oqsillarining qutbli joylashishi (polyarligi) esa hujayra membranasidagi sterollarga bog'liq endotsitoz jarayoni orqali boshqariladi. GK eksogen ravishda kiritilganda, membrana lipid va sterol domenlari xossalarini o'zgartirish orqali auksin gradientiga ta'sir ko'rsatishi mumkin.

Shakllantirilgan Ishchi Gipoteza:

GK / GK-fitogormon kompleksi → Membrana xossalarining modulyatsiyasi → AUX1 / PIN oqsillari faolligi → Auksin gradientining qayta taqsimlanishi → Ildiz o'sish burchagi va chuqurligining o'zgarishi.

Hozirgi vaqtda GK ning o'simliklardagi klassik gravitropik signal uzatish zanjiri bo'lgan statolit-LAZY-RLD-PIN yo'liga bevosita ta'sir ko'rsatishi to'liq isbotlanmagan. Shuning uchun taklif etilayotgan ushbu model fundamental tekshiruvlarni talab qiladi.

Gipotezani tekshirish uchun taklif etilayotgan eksperimental sxema:

- *1-bosqich: In vitro skrining va nishonni aniqlash.* Arabidopsis thaliana, bug'doy va g'o'za ko'chatlarida 'doza-javob' bog'liqligi va gravitropik egilish kinetikasi o'rganiladi. Bunda ta'sir nishonini aniqlashtirish uchun maxsus genetik mutant liniyalardan (pgm, lzy, rld, aux1, pin3, pin7) foydalanish ko'zda tutilgan.
- *2-bosqich: Fitotron va issiqxona sinovlari.* Sun'iy iqlim kameralarida, maxsus tuproqli idishlar va zamonaviy rizotronlar (ildizni vizuallashtirish tizimlari) yordamida ildiz tizimining arxitekturasi va fazoviy joylashuvi real vaqt rejimida baholanadi.
- *3-bosqich: Dala sharoitida amaliy sinov.* Olingan natijalar asosida urug'larni ekishdan oldin qayta ishlash (urug' praymingi) usuli yordamida g'o'za va bug'doy ekinlarining qurg'oqchilik hamda sho'rlanish sharoitidagi hosildorligi va iqtisodiy samaradorligi hisoblab chiqiladi.

CONCLUSION (XULOSA)

1. Glycyrrhiza glabra triterpenoidlari va ularning supramolekulyar komplekslari o'simlik ildiz tizimining rivojlanishi hamda abiotik stresslarga (sho'rlanish, qurg'oqchilik) chidamliligini oshirishda yuqori samaradorlik namoyon etadi.

2. Mazkur moddalarning o'simlik ildiz arxitekturasi o'zgartirish mexanizmi ularning hujayra membranasi barqarorligiga hamda AUX1 va PIN tashuvchilari

orqali auksin gormonining qutbli transportini modulyatsiya qilishiga bog'liq bo'lishi mumkin.

3. Mahalliy xomashyo hisoblangan shirinmiya komponentlari asosida arzon, ekologik toza va yuqori samarali fitoregulyatorlarni yaratish hamda ularni qishloq xo'jaligiga joriy etish - chuqur ildiz tizimiga ega barqaror agrosektorlarni shakllantirishning eng istiqbolli strategik yo'nalishlaridan biridir.

4.

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OG‘IR UGLEVODOROD FRAKSIYALARINI KATALITIK QAYTA ISHLASH ASOSIDA DIZEL YOQILG‘ISI KOMPONENTLARINI OLISHNING TEXNOLOGIK ASOSLARI

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Annotatsiya. *Maqolada tarkibida C_{12} va undan yuqori molekulyar massali uglevodorodlar mavjud bo‘lgan og‘ir uglevodorod fraksiyalarini qayta ishlash orqali dizel yoqilg‘isi komponentlarini olishning texnologik asoslari ko‘rib chiqilgan. Og‘ir uglevodorod fraksiyalarining molekulyar tarkibi, yuqori qaynash harorati va tarkibidagi parafin, izoparafin, naften hamda aromatik uglevodorodlarning nisbati ularni to‘g‘ridan-to‘g‘ri motor yoqilg‘isi sifatida qo‘llash imkoniyatlarini cheklaydi. Shu sababli bunday xomashyolarni katalitik gidrokraking, gidroizomerizatsiya va gidrotozalash jarayonlari orqali qayta ishlash muhim texnologik yo‘nalish hisoblanadi. Tadqiqotda C_{12}+ fraksiyalarni dastlabki tayyorlash, fraksiyalash, katalitik qayta ishlash va yakuniy dizel komponentini ajratish bosqichlaridan iborat texnologik sxema taklif etilgan. Jarayonning asosiy parametrlarini tanlashda harorat, vodorod bosimi, xomashyo-katalizator nisbati, hajmiy tezlik va katalizatorning kislota-metall xususiyatlari hisobga olinadi. Gidrokraking jarayonida yuqori molekulyar massali uglevodorodlarning C–C bog‘lari parchalanishi natijasida dizel diapazoniga mos mahsulotlar hosil bo‘lishi, gidroizomerizatsiya esa normal parafinlarning tarmoqlangan izomerlariga aylanishi orqali past haroratli xossalarni yaxshilashi mumkin. Maqolada jarayon samaradorligini baholash uchun fraksion tarkib, zichlik, kinematik qovushqoqlik, oltingugurt miqdori, setan indeksi va past harorat xususiyatlarini aniqlash zarurligi asoslab berilgan.*

Kalit so‘zlar: *og‘ir uglevodorod fraksiyasi, C_{12}+, dizel yoqilg‘isi, gidrokraking, gidroizomerizatsiya, katalitik qayta ishlash, neft fraksiyasi, parafinlar, dizel komponenti, katalizator.*

1. Kirish

Transport sohasining jadal rivojlanishi bilan dizel yoqilg‘isiga bo‘lgan talabning ortishi mavjud uglevodorod resurslaridan samarali foydalanish masalasini yanada dolzarb qilmoqda. An’anaviy neftni qayta ishlash jarayonlarida dizel fraksiyasi asosan atmosfera va vakuum haydash, katalitik kreking, gidrotozalash hamda gidrokraking jarayonlari orqali olinadi. Biroq neftni qayta ishlash jarayonida hosil bo‘ladigan og‘ir qoldiq va ikkilamchi fraksiyalarning katta qismi yuqori molekulyar massali uglevodorodlardan tashkil topganligi sababli ularning iqtisodiy qiymatini oshirish uchun qo‘shimcha texnologik ishlov talab qilinadi.

Ayniqsa, C_{12} va undan yuqori uglerod atomlariga ega bo‘lgan uglevodorodlar dizel yoqilg‘isi diapazoniga yaqin bo‘lsa-da, ularning barchasi to‘g‘ridan-to‘g‘ri sifatli dizel komponenti sifatida foydalanishga yaroqli emas. Bunga uglevodorodlarning strukturaviy tarkibi, aromatiklik darajasi, tarmoqlanish darajasi, qaynash harorati va oltingugurtli birikmalar mavjudligi sabab bo‘ladi.

Ilmiy tadqiqotlarda dizel diapazonidagi uglevodorodlar uchun C_{12}–C_{22} oralig‘i muhim fraksiya sifatida ko‘rsatiladi. Masalan, chiqindi motor moyini katalitik qayta ishlash bo‘yicha tadqiqotda suyuq mahsulot tarkibida C_{12}–C_{22} diapazonidagi uglevodorodlarning dizelga yaqin fraksiya sifatida saqlanib qolishi qayd etilgan.

Shu sababli C_{12}+ og‘ir uglevodorod fraksiyasidan dizel yoqilg‘isi komponentlarini olishda asosiy masala xomashyoni shunchaki yengil fraksiyalarga parchalash emas, balki kerakli uglevodorod diapazonini maksimal darajada saqlab qolgan holda uning ekspluatatsion xususiyatlarini yaxshilashdan iborat.

Bunday vazifani hal qilishda katalitik gidrokraking va gidroizomerizatsiya jarayonlari alohida ahamiyatga ega.2. Tadqiqotning maqsadi

Tadqiqot maqsadi

C_{12} va undan yuqori uglevodorodlarni o‘z ichiga olgan og‘ir fraksiyani qayta ishlash orqali dizel yoqilg‘isi komponentlarini olishning maqbul texnologik sxemasini ishlab chiqishdan iborat.

Mazkur maqsadga erishish uchun quyidagi vazifalar belgilandi:

birinchidan, og‘ir fraksiyaning fizik-kimyoviy va uglevodorod tarkibini aniqlash;

ikkinchidan, C_{12}+ fraksiyaning dizel yoqilg‘isi komponenti olish uchun potensialini baholash;

uchinchidan, gidrokraking va gidroizomerizatsiya jarayonlarining texnologik imkoniyatlarini tahlil qilish;

to‘rtinchidan, katalizator va jarayon parametrlarining mahsulot tarkibiga ta’sirini aniqlash;

beshinchidan, olingan mahsulotni distillatsion ajratish va dizel komponenti sifatida baholash mezonlarini ishlab chiqish.

Asosiy qism

C_{12}+ og‘ir uglevodorod fraksiyasi tarkibida normal parafinlar, izoparafinlar, sikloparafinlar, aromatik uglevodorodlar va ayrim hollarda oltingugurt, azot va kislorod saqlovchi birikmalar mavjud bo‘lishi mumkin.

Xomashyoning tarkibi uning kelib chiqishi va avvalgi texnologik ishlov berish sharoitlariga bog‘liq. Shuning uchun og‘ir fraksiyani qayta ishlashdan oldin uning tarkibini instrumental usullar yordamida aniqlash zarur.

Bunda gaz xromatografiyasi-mass-spektrometriyasi (GC–MS), simulyatsion distillatsiya, zichlikni aniqlash, kinematik qovushqoqlik, elementar tahlil va oltingugurt miqdorini aniqlash usullaridan foydalanish mumkin.

Og‘ir neft fraksiyalarining molekulyar tarkibini chuqur o‘rganishda yuqori aniqlikdagi mass-spektrometriya usullaridan foydalanish ham mumkin. Masalan, FCC dekant moyi bo‘yicha tadqiqotlarda minglab individual molekulalar turli uglevodorod sinflari bo‘yicha tavsiflangan.

Bunday tahlil qayta ishlash texnologiyasini tanlashda muhim ahamiyatga ega, chunki parafinlarga boy xomashyo uchun izomerizatsiya, aromatiklarga boy xomashyo uchun esa gidrotozalash va gidrogenlash jarayonlari ustuvor bo‘lishi mumkin.

Og‘ir uglevodorodlarning katalitik qayta ishlanishi bir nechta parallel va ketma-ket reaksiyalar orqali sodir bo‘ladi.

Gidrokraking jarayonining umumlashtirilgan ko‘rinishini quyidagicha ifodalash mumkin:

$C_nH_{2n+2} + H_2 \rightarrow C_xH_{2x+2} + C_\gamma H_{2\gamma+2}$; bu yerda: n = x + y.

Jarayon davomida yuqori molekulyar massali uglevodorodlarning C–C bog‘lari parchalanib, molekulyar massasi kichikroq uglevodorodlar hosil bo‘ladi.

Bunda jarayonning haddan tashqari chuqurlashishi maqsadli dizel fraksiyasining kamayishiga va benzin hamda gaz fraksiyalarining ortishiga olib kelishi mumkin. Shuning uchun texnologik jarayonda konversiya va selektivlik o‘rtasidagi muvozanatni saqlash muhim.

Diesel hydrocracking bo‘yicha molekulyar darajadagi tadqiqotlar gidrokraking jarayonida metall markazlarda degidrogenlanish va kislota markazlarida C–C bog‘larining parchalanishi muhim bosqichlar ekanligini ko‘rsatgan.

Gidrokraking va gidroizomerizatsiya jarayonlarida katalizatorning bifunksional xususiyati muhim ahamiyatga ega.

Katalizatorning metall markazlari vodorodlash va degidrogenlash reaksiyalarini tezlashtirsa, kislota markazlari uglevodorod skeletining izomerizatsiyasi va C–C bog‘larining parchalanishini ta’minlaydi.

Amaliy neftni qayta ishlash jarayonlarida Ni–Mo, Ni–W kabi metall komponentlarga ega katalizator tizimlari keng qo‘llanadi. Dizel fraksiyasini chuqur gidrotozalash bo‘yicha tadqiqotlarda W–Ni–Pd asosidagi katalizatorlar yordamida aromatiklarni kamaytirish, gidrodesulfurizatsiya va dizelning setan ko‘rsatkichlarini yaxshilash imkoniyatlari ko‘rsatilgan. ScienceDirect

Katalizatorning tashuvchisi ham jarayon natijasiga sezilarli ta’sir ko‘rsatadi. Alyuminiy oksidi, silika-alumina, zeolitlar va ularning kombinatsiyalari turli darajadagi kislotalik va g‘ovaklik xususiyatlarini ta’minlaydi.

Shu sababli $C_{12}+$ fraksiyani qayta ishlashda katalizator tanlash faqat konversiya ko‘rsatkichiga emas, balki dizel diapazonidagi mahsulot selektivligiga asoslanishi kerak.

$C_{12}+$ fraksiyada normal parafinlarning miqdori yuqori bo‘lsa, gidroizomerizatsiya jarayoni mahsulotning past haroratli xususiyatlarini yaxshilash imkonini beradi.

Normal parafinlarning tarmoqlangan izoparafinlarga aylanishi quyidagi umumlashtirilgan sxema bo‘yicha kechadi:

$n\text{-}C_nH_{2n+2} \rightarrow iso\text{-}C_nH_{2n+2}$

Bunda molekulyar massa deyarli o‘zgarmaydi, ammo molekulaning strukturasi o‘zgaradi.

Natijada qotish harorati va sovuq sharoitdagi oqim xususiyatlari yaxshilanishi mumkin. Shu sababli og‘ir parafinli fraksiyalarni dizel komponentiga aylantirishda gidroizomerizatsiya gidrokraking bilan birgalikda qo‘llanishi istiqbolli hisoblanadi.

Fischer–Tropsch mumlarini transport yoqilg‘ilariga aylantirish bo‘yicha zamonaviy sharhlarda ham gidrokraking va gidroizomerizatsiyani birgalikda qo‘llash n-parafinlarni ko‘p tarmoqlangan izomerlar va transport yoqilg‘ilariga aylantirishning muhim yo‘nalishi sifatida ko‘rsatiladi.

Birinchi bosqichda xomashyo mexanik aralashmalardan tozalanadi.

Keyingi bosqichda xomashyo qaynash haroratiga ko‘ra fraksiyalarga ajratiladi. $C_{12}+$ fraksiya asosiy qayta ishlash oqimiga yo‘naltiriladi.

Gidrotozalash bosqichida oltingugurtli va boshqa heteroatomli birikmalarni kamaytirish ko‘zda tutiladi.

Shundan keyin xomashyo gidroizomerizatsiya va gidrokraking bosqichiga yuboriladi.

Reaksiya mahsulotlari sovitilib, gaz va suyuq fazalarga ajratiladi. Suyuq mahsulot distillatsiya orqali benzin, kerosin, dizel va og‘ir qoldiq fraksiyalariga ajratiladi.

Bu yerda asosiy maqsad dizel diapazonidagi fraksiyaning chiqishini maksimal darajada oshirishdir.

Gidrokraking jarayonining samaradorligiga bir qator omillar ta’sir qiladi. Ularning eng muhimlari harorat, vodorod bosimi, xomashyoning hajmiy uzatish tezligi, vodorod/xomashyo nisbati va katalizatorning xossalaridir.

Haroratning ortishi odatda xomashyoning konversiyasini oshiradi. Biroq haddan tashqari yuqori haroratda chuqur kreking kuchayib, gaz va yengil fraksiyalar hosil bo‘lishi mumkin.

Shuning uchun jarayonning optimal haroratini aniqlashda faqat umumiy konversiyani emas, balki maqsadli dizel fraksiyasining selektivligini hisobga olish lozim.

Ilmiy tadqiqotlarda og‘ir fraksiyalarni gidrokraking jarayonida harorat va reaksiya davomiyligining oshishi naphtha va dizel fraksiyalari hosil bo‘lishini oshirishi bilan birga, gaz hosil bo‘lishini ham kuchaytirishi mumkinligi ko‘rsatilgan.

Bu holat jarayon parametrlarini optimallashtirish zarurligini ko‘rsatadi.

Texnologik samaradorlikni baholash

Jarayon samaradorligini baholash uchun asosiy ko‘rsatkich sifatida maqsadli dizel fraksiyasi chiqishini olish mumkin:

$$Yd = (md / mf) \times 100$$

bu yerda:

Yd — dizel fraksiyasining chiqishi, %;

md — olingan dizel fraksiyasining massasi, g yoki kg;

mf — qayta ishlangan xomashyo massasi, g yoki kg.

Xomashyoning konversiya darajasi quyidagi formula orqali hisoblanadi:

Xomashyoning konversiyasi esa:

$X = [(mf - mr) / mf] \times 100$

bu yerda:

X — xomashyoning konversiya darajasi, %;

mf — qayta ishlangan xomashyo massasi, g yoki kg;

mr — qayta ishlashdan keyin qolgan og‘ir fraksiya massasi, g yoki kg.

Biroq faqat konversiyaning yuqori bo‘lishi texnologiyaning samarali ekanligini anglatmaydi. Agar konversiya yuqori bo‘lsa-yu, asosiy mahsulot gaz yoki benzin fraksiyasiga o‘tib ketsa, dizel komponenti olish nuqtayi nazaridan texnologik samaradorlik pasayadi.

Taklif qilinayotgan texnologiyaning asosiy afzalligi $C_{12}+$ og‘ir fraksiyaning molekulyar tarkibini maqsadli ravishda o‘zgartirish imkoniyatidir.

Jarayonning optimal sharoitlari aniqlangan taqdirda quyidagi natijalarga erishish kutiladi:

birinchidan, yuqori molekulyar massali uglevodorodlarning bir qismi dizel diapazoniga o‘tkaziladi;

ikkinchidan, normal parafinlarning izomerizatsiyasi natijasida mahsulotning past harorat xususiyatlari yaxshilanishi mumkin;

uchinchidan, gidrotozalash orqali oltingugurtli birikmalar kamaytiriladi;

to‘rtinchidan, aromatik uglevodorodlarning bir qismi gidrogenlanishi hisobiga mahsulotning ekologik va ekspluatatsion xususiyatlari yaxshilanishi mumkin;

beshinchidan, chiqindi yoki ikkilamchi og‘ir uglevodorod oqimining iqtisodiy qiymati oshiriladi.

Shu bilan birga, ushbu natijalarni aniq miqdoriy qiymatlarda ko‘rsatish uchun laboratoriya yoki pilot qurilmasida real tajribalar o‘tkazilishi zarur.

Ilmiy yangilik

Tadqiqotning asosiy ilmiy yangiligi $C_{12}+$ og‘ir uglevodorod fraksiyasini bir bosqichli termik parchalanish orqali emas, balki gidrotozalash – gidroizomerizatsiya – selektiv gidrokraking – fraksiyalash ketma-ketligi asosida qayta ishlash konsepsiyasini taklif qilishdan iborat.

Bunday yondashuvda ikki qarama-qarshi vazifa — yuqori molekulyar massali komponentlarni parchalash va dizel diapazonidagi uglevodorodlarni maksimal darajada saqlash — o‘rtasida texnologik muvozanat yaratish ko‘zda tutiladi.

Bu masala ayniqsa muhim, chunki gidrokrakingning haddan tashqari chuqurlashishi dizel komponentlari hisobiga naphtha va gaz hosil bo‘lishini oshirishi mumkin. Shu sababli katalizatorning kislotaligi va metall funksiyasini muvozanatlash muhim texnologik vazifa hisoblanadi.

Xulosa

C_{12} va undan yuqori uglevodorodlardan tashkil topgan og‘ir fraksiyalarni dizel yoqilg‘isi komponentlariga aylantirish neft-kimyo sanoatida uglevodorod resurslaridan samarali foydalanishning istiqbolli yo‘nalishlaridan biridir.

Tadqiqotda og‘ir fraksiyani dastlabki tayyorlash, fraksiyalash, gidrotozalash, gidroizomerizatsiya va selektiv gidrokrakingni o‘z ichiga olgan texnologik yondashuv taklif qilindi.

Jarayonning asosiy maqsadi xomashyoning umumiy konversiyasini maksimal darajada oshirish emas, balki dizel diapazonidagi mahsulot hosil bo‘lishining selektivligini oshirishdan iborat bo‘lishi kerak.

$C_{12}+$ fraksiyani qayta ishlashda katalizatorning bifunksional xususiyatlari, reaksiya harorati, vodorod bosimi, hajmiy tezlik va xomashyo tarkibi asosiy texnologik omillar sifatida qaraladi.

Olingan mahsulotning amaliy qiymatini aniqlash uchun GC–MS, distillatsion tahlil, zichlik, qovushqoqlik, oltingugurt miqdori, setan ko‘rsatkichi va past harorat xususiyatlarini kompleks baholash zarur.

Taklif qilinayotgan texnologik yondashuv og‘ir va ikkilamchi uglevodorod fraksiyalarini yuqori qo‘shilgan qiymatga ega transport yoqilg‘isi komponentlariga aylantirish uchun ilmiy-metodik asos bo‘lib xizmat qilishi mumkin.

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DEVELOPING HYPOTHESIS FORMULATION AND CONTROL-OF-VARIABLES SKILLS THROUGH VIRTUAL PHYSICS LABORATORIES: A CONCEPTUAL APPROACH

Jalolova Kamola

Abstract: *This conceptual paper examines how virtual physics laboratories can be structured to develop two specific scientific inquiry skills: hypothesis formulation and the control-of-variables strategy. Drawing on research on inquiry-based learning, scientific reasoning, and virtual experimentation, the paper proposes a compact instructional sequence that links a testable hypothesis to identification of variables, controlled comparison, data interpretation, and evidence-based evaluation. Virtual laboratories are presented as practice environments rather than replacements for physical laboratories. The approach emphasizes explicit guidance, repeated experimentation, and observable student decisions that can later be assessed empirically.*

Keywords: *virtual laboratory, physics education, hypothesis formulation, control of variables, inquiry skills, scientific reasoning*

1. INTRODUCTION

Scientific inquiry in school physics involves more than following a prescribed experimental procedure. Students must be able to propose explanations that can be tested, identify which factors should be changed or kept constant, collect evidence, and judge whether the evidence supports an initial claim. In inquiry-based learning, hypothesis generation and experimentation are closely connected processes: a hypothesis gives direction to an investigation, while a controlled experiment provides evidence that can be used to evaluate it (Pedaste et al., 2015).

Two skills are especially important in this process. The first is hypothesis formulation, understood here as constructing a testable prediction about the relation between variables. The second is the control-of-variables strategy (CVS), in which one variable of interest is changed while potentially confounding variables are held constant. CVS supports unambiguous causal inference and is widely treated as a core component of scientific reasoning (Schwichow et al., 2016). A meta-analysis of 72 intervention studies found that CVS can be improved through instruction and practice, indicating that it should not be assumed to develop automatically from participation in experiments (Schwichow et al., 2016).

Virtual laboratories offer a useful environment for focused practice because learners can repeat trials, manipulate parameters, observe outcomes immediately, and

compare experimental conditions without repeatedly setting up physical equipment. Recent reviews show that virtual experiments are used widely in physics education, particularly in areas such as mechanics and electricity, while also stressing the importance of instructional guidance and purposeful task design (Wang et al., 2025). These findings support treating virtual laboratories as purposeful practice environments whose value depends on the learning goal and design of the activity.

The educational challenge is therefore not simply to provide students with a simulation, but to design tasks that make scientific reasoning visible and necessary. Inquiry learning is generally more effective when learners receive appropriate guidance (Lazonder & Harmsen, 2016), and computer-based discovery environments have long been shown to benefit from support for processes such as hypothesis generation, experimental design, and evidence evaluation (de Jong & van Joolingen, 1998). Against this background, the purpose of this paper is to propose a narrowly focused instructional structure for using virtual physics laboratories to practice hypothesis formulation and CVS.

2. MATERIALS AND METHODS

This paper uses a focused conceptual synthesis rather than an empirical design. Peer-reviewed research was selected to represent three bodies of evidence relevant to the proposed instructional structure: (a) inquiry-learning frameworks, (b) research on hypothesis-driven experimentation and CVS, and (c) reviews and meta-analyses of virtual investigation in science and physics education. The aim was not to conduct a systematic review or estimate an effect size, but to translate established findings into a concise sequence that can be implemented within a virtual physics laboratory.

Three design principles guided the synthesis. First, the task should begin with a testable relation between variables rather than with unrestricted manipulation. Second, students should explicitly distinguish the independent variable, dependent variable, and variables that must remain constant. Third, the virtual environment should support repeated controlled comparisons and require students to connect observed data back to the original hypothesis. These principles align hypothesis generation with experimentation instead of treating them as separate classroom activities.

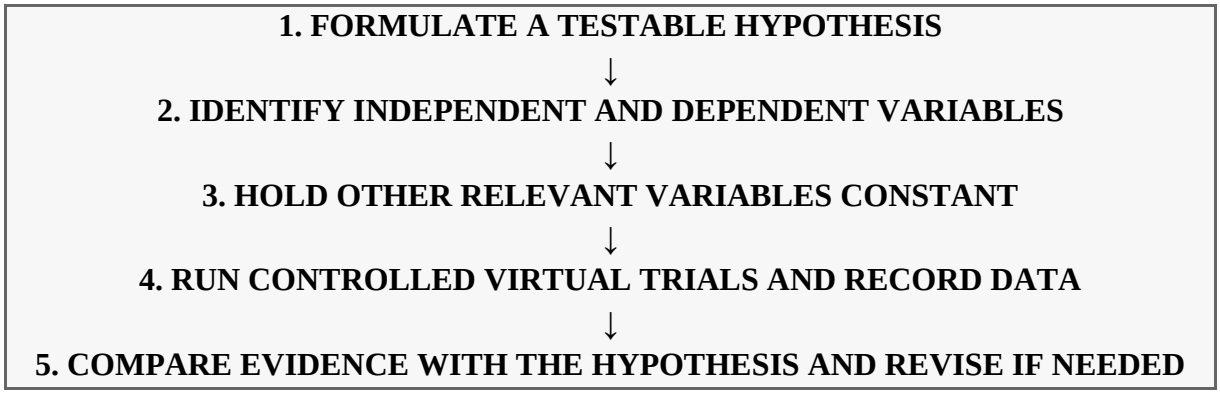
3. RESULTS AND DISCUSSION

3.1. Linking hypothesis formulation to controlled experimentation

The conceptual result of the synthesis is a five-step instructional sequence in which each decision made by the learner provides evidence of a specific inquiry skill. A useful hypothesis should identify or imply a relationship that can be tested. The learner must then determine what will be deliberately changed, what outcome will be measured, and which other conditions must remain unchanged. Only after these

decisions are made should the student run the virtual experiment. This sequence helps prevent trial-and-error interaction from being mistaken for scientific inquiry.

Figure 1. Instructional sequence connecting a hypothesis with control of variables



The sequence in Figure 1 deliberately places CVS between hypothesis formulation and data collection. This ordering matters because the value of a hypothesis depends on whether the subsequent experiment is capable of testing it. If several potentially causal variables change at the same time, the resulting evidence is confounded and cannot support a clear inference. Thus, students should be asked not only to name variables but also to justify why particular variables must remain constant.

3.2. A compact task structure for a virtual physics laboratory

Table 1 translates the sequence into observable student actions. The prompts are intentionally brief. They can be delivered by a teacher, worksheet, or interface message; the essential feature is that they direct attention to reasoning without supplying the experimental answer. This is consistent with evidence that inquiry learning benefits from guidance and that learners may otherwise have difficulty coordinating hypotheses, experimental design, and evidence (de Jong & van Joolingen, 1998; Lazonder & Harmsen, 2016).

Table 1. Suggested learning tasks and observable evidence of the two target inquiry skills

Instructional step	Student task / prompt	Observable evidence
Hypothesis	Predict a relation between two variables and justify it.	A testable prediction.
Variables	Mark the independent, dependent, and controlled variables.	Correct variable classification.
Controlled comparison	Change one variable of interest while holding the others constant.	An unconfounded plan.
Data collection	Run controlled trials and record measurements.	Comparable data across trials.

Instructional step	Student task / prompt	Observable evidence
Evaluation	Compare the data with the prediction and justify the decision.	Evidence-based judgment.

3.3. Illustrative physics example

Consider a virtual direct-current circuit in which students can change voltage and resistance and observe current. A student might propose the hypothesis: “If the applied voltage increases while resistance remains constant, the current will increase.” The hypothesis identifies a relation that can be tested. The student then treats voltage as the independent variable, current as the dependent variable, and resistance as a controlled variable. Two or more trials are conducted with different voltage values but the same resistance. The resulting current measurements are compared with the original prediction. The instructional value of the task lies not in obtaining a familiar relationship, but in requiring the learner to construct a testable claim and produce evidence from an unconfounded comparison.

Virtual environments are particularly suitable for this type of repeated comparison because parameters can be changed rapidly and previous conditions can be reproduced. However, rapid manipulation can also encourage superficial trial and error if the interface does not require planning. For this reason, hypothesis and variable-selection prompts should appear before the “run” stage, and the student should record an experimental plan before observing the outcome. The virtual laboratory therefore functions as a structured practice space for scientific reasoning rather than merely as an animated demonstration.

3.4. Educational implications and limitations

The proposed structure is intentionally narrower than a complete inquiry cycle. It does not attempt to represent all aspects of inquiry competence, such as question generation, modelling, communication, or extended reflection. Its purpose is to isolate two linked skills that can be practiced repeatedly and assessed through observable decisions. This narrow scope may be useful when teachers want to diagnose whether a student can convert a prediction into a valid experimental test before moving to more open forms of inquiry.

At the same time, the proposal is conceptual and should not be interpreted as evidence that the sequence itself improves student performance. Future classroom research should compare students’ hypothesis quality and CVS performance before and after targeted virtual-laboratory activities, ideally using performance tasks rather than only multiple-choice tests. It would also be useful to examine transfer: whether students who learn to control variables in one physics context can apply the strategy to a different experiment. Such empirical evaluation would distinguish the instructional potential of the design from its actual effectiveness.

4. CONCLUSION

Virtual physics laboratories can support scientific inquiry when their design requires students to reason about experiments rather than simply manipulate digital equipment. This paper proposed a compact sequence focused on two connected skills: formulating a testable hypothesis and applying the control-of-variables strategy. The sequence moves from hypothesis formulation to identification and control of variables, controlled virtual trials, and evidence-based evaluation. Research on scientific reasoning indicates that CVS benefits from explicit practice and guidance, while research on inquiry learning shows that support is important in simulation-based environments. The proposed structure therefore offers a practical basis for designing and later evaluating narrowly targeted virtual laboratory activities in secondary physics education.

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INVESTIGATION OF THE PHARMACOLOGICAL PROPERTIES OF JUGLANS REGIA L

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Annotation. *This study presents a review of the scientific literature concerning the chemical composition, nutritional value, and biological activities of the common walnut (*Juglans regia *L.), a plant widely cultivated and distributed under the environmental conditions of Uzbekistan. Particular attention is given to the biological significance of the bioactive constituents found in walnut kernels.*

Keywords: Juglans regia *L., walnut, phenolic compounds, flavonoids, antioxidant activity, antimicrobial activity, omega-3, omega-6, bioactive compounds.*

The common walnut (*Juglans regia* L.) belongs to the family Juglandaceae and is one of the plant species of considerable importance in the food industry, traditional medicine, and pharmacological research. In addition to its high energy value, walnut fruit contains nutritionally and biologically important constituents, including proteins, lipids, dietary fiber, vitamins, minerals, and phenolic compounds [1,2].

In recent years, increasing scientific attention has been directed toward the chemical composition and biological properties of *Juglans regia* L. Particular interest has been focused on the polyunsaturated fatty acids present in walnut kernels, as well as phenolic compounds, flavonoids, tannins, and juglone found predominantly in the leaves and green husks of the plant [3].

Lipids constitute one of the major components of walnut kernels. According to the available literature, the lipid content of walnut kernels may vary depending on the cultivar, growing conditions, degree of maturity, and analytical methods employed. A notable characteristic of walnut oil is its high proportion of polyunsaturated fatty acids. Among these, α-linolenic acid (ALA, omega-3) and linoleic acid (omega-6) are considered characteristic fatty acids of walnuts [4].

Proteins are also important nutritional components that contribute significantly to the dietary value of walnuts. In addition, dietary fiber and compounds such as tocopherols contribute to their overall biological value. The mineral composition of walnuts includes magnesium, calcium, potassium, phosphorus, and other essential elements. Among the vitamins present in walnuts, vitamin E and B-group vitamins

are particularly important. Vitamin E possesses antioxidant properties and contributes to the inhibition of lipid oxidation. Therefore, the nutritional value of walnuts is determined not only by their energy-providing macronutrients but also by their biologically active micronutrients [5].

The biological activity of *Juglans regia* L. is closely associated with its phenolic constituents. Phenolic acids, flavonoids, and tannins have been identified in the leaves, green husks, and other parts of the plant. These compounds may exhibit antioxidant activity by neutralizing free radicals and contributing to the reduction of oxidative stress.

Various polyphenolic compounds have been identified in walnut leaves. For example, modern chromatographic studies have demonstrated the presence of numerous phenolic constituents in the polyphenolic fraction of *J. regia* leaves. The antioxidant activity of these compounds, as well as their biological activity against certain bacterial and fungal strains, has also been investigated. The green husk of the walnut is another important source of biologically active compounds. Studies have examined the phenolic composition, antioxidant capacity, and antimicrobial properties of green husk extracts [6]. The presence of various phenolic constituents with potential biological activity has been demonstrated in this plant material.

One of the characteristic bioactive compounds of the genus *Juglans* is juglone. Juglone is a 5-hydroxynaphthoquinone compound that occurs in various parts of the plant, particularly in the green husk and leaves. Recent studies have investigated the redox properties of juglone and its effects on various biological processes. Its antimicrobial, anti-inflammatory, and other biological activities have been reported in the scientific literature [7].

Another important area of research concerning the bioactive constituents of walnuts is their potential influence on the cardiovascular system. Investigation of the biologically active compounds present in walnuts provides an opportunity to associate their nutritional value as a food product with their potential pharmacological significance.

The analysis of the available literature indicates that the fruit of *Juglans regia* L. represents a valuable natural source of proteins, lipids, dietary fiber, vitamins, minerals, and biologically active compounds. The high content of polyunsaturated fatty acids, particularly α-linolenic and linoleic acids, contributes substantially to the nutritional and biological importance of walnut oil. Juglone, phenolic compounds, flavonoids, and tannins found in the leaves and green husks are considered promising constituents for further investigation of antioxidant and antimicrobial activities. In the future, comprehensive studies of the chemical composition and biological activity of walnut cultivars grown under the conditions of Uzbekistan, with consideration of

geographical region, cultivar characteristics, maturity stage, and storage conditions, may represent an important area of scientific research.

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ҒЎЗА АГРОБИОЦЕНОЗИДА УЧРАЙДИГАН ОҚҚАНОТ ЗАРАРКУНАНДАЛАРИ ПОПУЛЯЦИЯЛАРИНИНГ РИВОЖЛАНИШ ДИНАМИКАСИНИ ХИСОБГА ОЛИШ

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Аннотасия: *Мақолада Тошкент вилояти Ўрта Чирчиқ туманида жойлашган Ғўза агробиотсенозида B.tabaci популятсияси июндан августгача изчил ошиб борди. Июн ойида имаго зичлиги 14,3 дона/барг бўлган бўлса, июлда 22,6 ва августда 46,8 дона/баргга етди. Шундай қилиб, июн–август даврида имаго зичлиги тахминан 3,3 баробар ошган. Личинкалар сони эса 4,8 донадан 34,4 донагача кўпайиб, тахминан 7,2 баробар ошган. Натижалар оққанотлар популятсияси динамикасининг экологик омиллар билан боғлиқлигини кўрсатиб, биологик ҳимоя тадбирларини режалаштириш учун амалий асос яратади.*

Калит сўзлар*: Bemisia tabaci, Trialeurodes vaporariorum, оққанот, Ўратчиричқ, агробиотсеноз, популятсия динамикаси, мониторинг, биологик ҳимоя, энтомофаг, ғўза, иссиқхона, ҳарорат, нисбий намлик, фитосанитар мониторинг.*

Аннотасия *В статье установлено, что в агробиоценозе хлопчатника, расположенном в Уртачирчикском районе Ташкентской области, численность популяции B. tabaci последовательно увеличивалась с июня по август. Если в июне плотность имаго составляла 14,3 особи/лист, то в июле она достигла 22,6, а в августе — 46,8 особи/лист. Таким образом, в период с июня по август плотность имаго увеличилась примерно в 3,3 раза. Численность личинок возросла с 4,8 до 34,4 особи/лист, то есть примерно в 7,2 раза. Полученные результаты свидетельствуют о взаимосвязи динамики численности популяции белокрылки с экологическими факторами и создают практическую основу для планирования мероприятий по биологической защите растений.*

Ключевые слова: *Bemisia tabaci, Trialeurodes vaporariorum, белокрылка, Уртачирчикский район, агробиоценоз, динамика популяции, мониторинг, биологическая защита, энтомофаг, хлопчатник, теплица, температура, относительная влажность, фитосанитарный мониторинг.*

Abstract: *The article establishes that in the cotton agrobiocenosis located in the Urtachirchik district of the Tashkent region, the population size of B. tabaci has consistently increased from June to August. If the imago density was 14.3 individuals/leaf in June, it reached 22.6 in July and 46.8 in August. Thus, between June and August, the imago density increased by approximately 3.3 times. The number of larvae increased from 4.8 to 34.4 individuals/leaf, or approximately 7.2 times. The results obtained indicate a correlation between the population dynamics of the whitefly and environmental factors and create a practical basis for planning biological protection measures.*

Keywords: *Bemisia tabaci, Trialeurodes vaporariorum, whitefly, Urtachirchik district, agrobiocenosis, population dynamics, monitoring, biological protection, entomophage, cotton, greenhouse, temperature, relative humidity, phytosanitary monitoring.*

КИРИШ

Ўзбекистон агробиоценозларида иқтисодий аҳамиятга эга бўлган оққанот турлари ичида ғўза оққаноти (*Bemisia tabaci* Genn.), иссиқхона оққаноти (*Trialeurodes vaporariorum* West.) ҳамда цитрус оққаноти (*Dialeurodes citri* Ashm.) кенг тарқалган. Ушбу турлар полифаг хусусиятга эга бўлиб, ғўза, помидор, бодринг, бақлажон, қалампир ва бошқа қишлоқ хўжалик экинларида ривожланади. Зараркунанда имаголари ва личинкалари ўсимлик ширасини сўриб озиқланиши натижасида фотосинтетик фаоллик пасаяди, транспиratsiя жараёнлари бузилади, ўсимликларнинг физиологик ҳолати ёмонлашади ва ҳосилдорлик кескин камаяди. Бундан ташқари, улар бир қатор вирусли касалликларнинг табиий вектори ҳисобланиб, фитосанитар хавф даражасини янада оширади.

Кўплаб хорижий тадқиқотларда оққанотларнинг ривожланиши муҳит ҳарорати ва ҳавонинг нисбий намлигига юқори даражада боғлиқлиги қайд этилган. Илмий адабиётларда қайд этилишича, ҳаво ҳарорати 28-32°C ҳамда нисбий намлик 40-60 % атрофида бўлган шароитларда тухум қўйиш интенсивлиги, эмбрионал ривожланиш, личинкалар яшовчанлиги ва имаголар фаоллиги энг юқори даражага етади. Ҳароратнинг 20-22°C дан пасайиши ёки ҳаво намлигининг юқори бўлиши ривожланиш суръатларини секинлаштириб, популяция ўсишини чеклайди.

Ўзбекистон шароитида баҳолаш мақсадида 2023-2025 йилларда Тошкент вилоятининг Ўрта Чирчиқ туманларида жойлашган ғўза агробиоценозларида мунтазам кузатувлар амалга оширилди. Кузатувлар ҳар ўн кунда бир марта ўтказилиб, ҳар бир ҳисобда барглардаги имаголар, тухумлар, личинкалар ва

ғумбаклар сони аниқланди. Бир вақтнинг ўзида ҳаво ҳарорати ва ҳавонинг нисбий намлиги қайд қилиниб, уларнинг оққанот популяцияси динамикасига таъсири баҳоланди.

2023–2025-йилларда Тошкент вилояти Ўрта Чирчиқ туманида олиб борилди. Тадқиқот обйекти сифатида ғўза агробиоценозидаги Бемисиа табаси Генн. ва иссиқхона шароитидаги Триалеуродес вапорариорум West. популяциялари олинди. Кузатувлар ҳар 10 кунда амалга оширилди. Барглар кўздан кечирилиб, имаго, тухум, личинка ва ғумбаклар сони дона/барг ҳисобида қайд етилди. Шу билан бирга, кузатув кунларидаги ҳаво ҳарорати ва нисбий намлик кўрсаткичлари қайд қилинди. Жадвалда келтирилган қийматлар кузатув даврлари бўйича ўртача кўрсаткичларни ифодалайди.

1-жадвал

Ғўза агробиотсенозида оққанотлар (*Bemisia tabaci* Genn. ва *Trialeurodes vaporariorum* West.) популятсиясининг ривожланиш динамикаси (Тошкент вилояти Ўртачирчиқ тумани, 2023–2025-й.)

Оққанот тури	Ой	Имаго, дона/барг	Тухум, дона/барг	Личинка, дона/барг	Ғumbak, дона/барг	Ҳарорат,° С	Нисбий намлик, %
Bemisia tabaci	Июн	14.3	2.4	4.8	3.2	30.2	39
Bemisia tabaci	Июл	22.6	8.2	18.4	10.6	32.4	33
Bemisia tabaci	Август	46.8	14.6	34.4	26.3	30.0	36
Trialeurodes vaporariorum	Сентабр	42.7	14.6	34.4	26.3	28.4	43
Trialeurodes vaporariorum	Октабр	19.2	9.8	18.7	16.4	23.8	54
Trialeurodes vaporariorum	Ноябр	4.2	8.6	20.4	28.2	16.5	66

Изох: Кузатувлар ҳар 10 кунда амалга оширилди; жадвалда кузатув даврининг ўртача кўрсаткичлари берилган

Ғўза агробиотсенозида B.tabaci популятсияси июндан августгача изчил ошиб борди. Июн ойида имаго зичлиги 14,3 дона/барг бўлган бўлса, июлда 22,6 ва августда 46,8 дона/баргга етди. Шундай қилиб, июн–август даврида имаго зичлиги тахминан 3,3 баробар ошган. Личинкалар сони эса 4,8 донадан 34,4 донагача кўпайиб, тахминан 7,2 баробар ошган. Бу ҳолат ёзги даврда популятсиянинг фаол кўпайганини кўрсатади.

T. vaporariorum учун энг юқори имаго зичлиги сентабр ойида — 42,7 дона/барг қайд этилган. Октабр ва ноябр ойларида ҳароратнинг пасайиши билан имаго сони мос равишда 19,2 ва 4,2 дона/барггача камайган. Бу кузатувлар иссиқхона микроиқлими оққанотларнинг ривожланиш динамикасида муҳим омил эканлигини кўрсатади.

Шу билан бирга, мазкур кузатувлар асосида сабабий боғлиқликни қатъий тасдиқлаш учун кўп йиллик такрорлар, фенологик фазалар, ўсимлик навлари ва статистик коррелятсион таҳлилни қўшиш мақсадга мувофиқ. Шунингдек, иқтисодий зарар чегаралари маҳаллий шароитда алоҳида аниқл

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A MULTIMODAL COMPUTER VISION FRAMEWORK FOR SEPARATING WATER STRESS, SALINITY AND DISEASE SYMPTOMS IN IRRIGATED COTTON

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Abstract. *In the arid, irrigated Bukhara region, cotton suffers from water stress, secondary soil salinization and disease, which produce visually similar leaf symptoms and make image-only diagnosis unreliable. This paper proposes a multimodal framework that combines canopy imagery with continuous agrometeorological and soil measurements to separate these stress causes and to estimate disease severity. We describe the data acquisition design, a two-stage model architecture and a validation protocol based on independent field-scouting labels and laboratory salinity calibration. The framework will first be tested on cotton, then extended to other crops.*

Keywords: *computer vision; cotton; plant stress; soil salinity; multimodal learning; precision agriculture*

1. INTRODUCTION

Cotton is a strategic crop for Uzbekistan, and its production depends almost entirely on irrigation. In the arid conditions of the Bukhara region, irrigated fields are exposed to three overlapping threats: water stress, secondary soil salinization and plant disease. Early and correct diagnosis matters because the appropriate response differs: water stress calls for a change in irrigation, salinity for leaching or drainage measures, and disease for plant protection.

Deep learning has become the dominant approach for image-based plant diagnosis (Kamilaris & Prenafeta-Boldú, 2018). Mohanty, Hughes and Salathé (2016) showed that convolutional networks can classify plant diseases with high accuracy on curated images, but they also reported that performance falls markedly on images taken under conditions different from the training set. A more fundamental problem is that many models treat every visible symptom as a disease. In reality, salinity and water deficit also cause leaf discolouration, growth reduction and wilting (Munns & Tester, 2008), so an image alone may not identify the cause. We call this the symptom disambiguation problem.

The aim of this paper is to propose a framework that addresses this problem for irrigated cotton by fusing canopy images with environmental and soil measurements, and to define a validation protocol that can show whether the fusion actually helps.

2. MATERIALS AND METHODS

2.1. Study design and data sources

The framework is designed for an experimental cotton field in the Bukhara region, observed over one year. Three data streams are collected. (1) Imagery: RGB images of the canopy captured at fixed intervals and at key phenological stages, complemented by Sentinel-2 satellite data for field-scale context. (2) In situ measurements: a solar-powered automatic agrometeorological station records air temperature, humidity, pressure, rainfall, wind, solar radiation, leaf wetness, leaf temperature, and soil temperature, moisture and salinity at three depths. (3) Reference labels: expert field scouting of disease presence and severity on an ordinal scale, together with soil samples for laboratory measurement of electrical conductivity of the saturated paste extract (ECe), which is used to calibrate the in-field salinity sensors.

2.2. Model architecture

The model has two stages. In the first stage, a convolutional or transformer-based image backbone (He et al., 2016; Dosovitskiy et al., 2021), pre-trained on a large public dataset and fine-tuned on the field images, extracts visual features. In the second stage, these features are concatenated with tabular features derived from the station: soil salinity and moisture profiles, leaf wetness duration, and the difference between leaf and air temperature, which is a well-established indicator of plant water status (Idso et al., 1981). A classification head assigns the dominant stress class (healthy, water stress, salinity, disease or combined), and a regression head estimates disease severity. Yield estimation from the time series of predictions is planned as a later extension.

2.3. Validation protocol

To avoid optimistic estimates, training and test sets will be separated by spatial blocks and by date, so that neighbouring images of the same plants never appear on both sides. Performance will be reported as macro-averaged F1 and a confusion matrix for the stress classes, and as mean absolute error for severity. An ablation will compare an image-only model with the multimodal model, and the analysis will focus on the confusion between salinity and water stress, which is where the added sensors are expected to help most.

3. RESULTS AND DISCUSSION

3.1. Expected outcomes

Experimental results are not reported here; this paper presents the framework and the validation protocol. The central hypothesis is that the multimodal model will separate salinity and water stress more accurately than the image-only model, since soil salinity, soil moisture and canopy temperature carry information that is not visible in the image. If the hypothesis is confirmed, the framework can support site-specific decisions on irrigation, leaching and plant protection.

3.2. Limitations

Several limitations should be noted. The study covers one crop, one site and one season, so generalization to other crops and to other agroecological zones of Uzbekistan must be tested separately. The in-field salinity readings are meaningful only after calibration against laboratory ECe values, which is therefore a prerequisite for the salinity analysis. Finally, expert scouting labels are themselves subjective, and inter-observer agreement should be measured where possible.

4. CONCLUSION

We proposed a multimodal computer vision framework that combines canopy imagery with agrometeorological and soil data to separate water stress, salinity and disease in irrigated cotton, together with a validation protocol designed to test the added value of the extra data. The next steps are completing the field data collection, calibrating the salinity sensors and evaluating the model against the protocol described above, before extending the method to other crops.

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COMPARATIVE EVALUATION OF THE CHEMICAL COMPOSITION AND NUTRITIONAL VALUE OF HULLESS BARLEY (*HORDEUM VULGARE* L.) AND VETCH (*VICIA* SPP.) GENOTYPES

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Annotatsiya. *Ushbu tezisda arpa (*Hordeum vulgare *L.) va vika (*Vicia *spp.) genotiplarining ozuqaviy qiymati qiyosiy jihatdan baholangan. Tadqiqotda genotiplarning xom protein, xom yog', xom kletchatka, azotsiz ekstraktiv moddalar (AEM), xom kul miqdori, shuningdek, 1 kg oziqadagi oziqa birligi va hazmlanuvchi protein miqdori tahlil qilingan. Natijalarga ko'ra, doni qobiqsiz O'zbekiston-30 arpa navi doni qobiqli Bolg'ali naviga nisbatan xom protein va hazmlanuvchi protein miqdorining yuqoriligi bilan ajralib turdi. Vika genotiplarida xom protein miqdori arpa genotiplariga nisbatan sezilarli darajada yuqori bo'lib, Mirzacho'l-1 va Mirzacho'l-2 navlari ozuqaviy ko'rsatkichlari bo'yicha istiqbolli ekanligi aniqlandi. Olingan natijalar O'zbekiston-30 arpa navi hamda Mirzacho'l-1 va Mirzacho'l-2 vika navlaridan*

chorvachilikda protein va energiya jihatidan muvozanatlashtirilgan oziqa bazasini shakllantirishda foydalanish imkoniyatini ko‘rsatadi.

Kalit so‘zlar: *arpa,* Hordeum vulgare *L., vika,* Vicia *spp., O‘zbekiston-30, Mirzacho‘l-1, Mirzacho‘l-2, xom protein, xom yog‘, kletchatka, azotsiz ekstraktiv moddalar, hazmlanuvchi protein, oziqa birligi, ozuqaviy qiymat.*

Abstract. *This study comparatively evaluates the nutritional value of barley (Hordeum vulgare L.) and vetch (Vicia spp.) genotypes. The contents of crude protein, crude fat, crude fiber, nitrogen-free extract (NFE), and crude ash, as well as feed units and digestible protein per 1 kg of feed, were analyzed. The results showed that the hulless barley cultivar Uzbekistan-30 was characterized by higher crude protein and digestible protein contents compared with the hulled barley cultivar Bolgali. The crude protein content of the vetch genotypes was considerably higher than that of the barley genotypes, with the Mirzachul-1 and Mirzachul-2 cultivars demonstrating promising nutritional characteristics. The findings indicate that the Uzbekistan-30 barley cultivar and the Mirzachul-1 and Mirzachul-2 vetch cultivars have potential for use in livestock feeding to develop a nutritionally balanced feed base in terms of protein and energy.*

Keywords: *barley, Hordeum vulgare L., vetch, Vicia spp., Uzbekistan-30, Mirzachul-1, Mirzachul-2, crude protein, crude fat, crude fiber, nitrogen-free extract, digestible protein, feed unit, nutritional value.*

INTRODUCTION

In livestock production, determining the nutritional value of cereal and legume crops is of considerable scientific and practical importance for establishing a complete and well-balanced feed base. In assessing feed quality, the contents of crude protein, crude fat, crude fiber, nitrogen-free extract (NFE), and ash, as well as feed units and digestible protein, are considered among the key nutritional criteria. The relative proportions of these components determine the energy and protein value of feed and provide a basis for evaluating its efficient utilization in livestock diets.

Barley (*Hordeum vulgare* L.) is one of the major cereal feed crops widely used in livestock production, and its grain is particularly characterized by its high energy value. According to the literature, barley grain dry matter contains, on average, 11–12% crude protein, approximately 2% crude fat, about 5% crude fiber, and 2–3% ash. The high starch content of barley grain is one of the major factors determining its energy value. According to FAO data, the nitrogen-free extract (NFE) content of barley grain is approximately 67–68% [1].

The nutritional value of barley can vary considerably depending on the biological characteristics of the genotype, whether the grain is hulled or hulless,

and the growing conditions. Hulless barley forms, in particular, are considered promising for livestock feeding. Compared with hulled barley, hulless barley generally contains less crude fiber and may have a relatively higher crude protein content. According to Feedipedia, conventional barley grain contains, on average, 11.8% crude protein and 5.2% crude fiber, whereas the corresponding values in hulless barley are 14.4% and 2.3%, respectively. These characteristics may contribute to improved digestibility and nutritional efficiency of hulless barley [2].

Vetch (*Vicia* spp.) is of particular importance as a protein-rich leguminous forage crop. Studies investigating the chemical composition of vetch seeds have revealed significant differences among genotypes in terms of crude protein, crude fat, crude fiber, nitrogen-free extract (NFE), and mineral contents. Research on *Vicia sativa* seeds has shown that the crude protein content of some genotypes may reach 32–35% of dry matter. These findings highlight the high nutritional value of vetch as a valuable protein source for livestock feeding [3].

The nutritional characteristics of barley and vetch biologically complement each other. Barley is characterized by a high energy value, primarily due to its high content of starch and other readily digestible carbohydrates, whereas vetch is distinguished by its high protein content. Therefore, the intercropping of cereal and legume crops or the combined use of their products in livestock diets may contribute to optimizing the energy-to-protein balance of feed [4].

Studies evaluating the nutritional value of vetch–barley mixtures have shown that increasing the proportion of vetch in the mixture generally increases crude protein content, whereas a higher proportion of barley may positively affect dry matter yield and the contribution of energy-rich components. Qamar et al. reported a decrease in crude protein concentration as barley progressively replaced vetch in vetch–barley mixtures. Other studies have demonstrated that growing vetch and barley in appropriate proportions can improve protein yield and overall forage quality compared with cereal monocropping [3, 4].

In assessing the biological value of feed, the amount of digestible protein is as important as the crude protein content. A high total protein content does not necessarily indicate that the protein is fully digested and utilized by the animal. Similarly, crude fiber content influences feed digestibility. Excessive levels of crude fiber may limit the digestibility and utilization of nutrients and energy. From this perspective, the relatively low crude fiber content of hulless barley genotypes represents an important breeding and nutritional trait [5].

Nitrogen-free extract (NFE) represents a major fraction of the readily digestible carbohydrates in feed and therefore plays an important role in determining its energy value. Consequently, the comprehensive evaluation of crude protein, crude fat, and crude fiber together with NFE content allows a more accurate characterization of the nutritional advantages of different genotypes. Ash content, in turn, serves as an indirect indicator of the total mineral content of feed and provides an additional criterion for assessing the mineral nutritional value of the genotypes [5].

Materials and Methods. The study materials included hulless barley (*Hordeum vulgare* L. convar. *coeleste* (L.) A. Trof.) accessions ICB 121646, ICB 119155, and ICB 119152 introduced from the international research centers ICARDA and ICBA; accessions of hairy vetch (*Vicia villosa* Roth) and common vetch (*Vicia sativa* L.); the cultivars Uzbekistan-30, Mirzachul-1, and Mirzachul-2 developed from these germplasm sources; and the breeding lines Mirzachul-3, L-2, L-14, and L-23. The hulled barley cultivar Bolgali was used as the standard control. The chemical composition and nutritional value of the samples were determined using the methods described by N.A. Lukashik and V.A. Tashilin in *Zootechnical Analysis of Feeds* («Зоотехнический анализ кормов»).

Results and Discussion. The results showed that the crude protein content of the barley genotypes ranged from 6.8 to 7.4%. The hulled barley cultivar Bolgali contained 6.8% crude protein, whereas the hulless barley cultivar Uzbekistan-30 contained 7.4%, representing a difference of 0.6 percentage points. The crude fat content ranged from 2.0 to 2.3%, crude fiber from 36.5 to 38.2%, nitrogen-free extract (NFE) from 39.1 to 40.3%, and crude ash from 6.2 to 6.8%. In addition, the feed value per 1 kg of feed ranged from 0.80 to 0.85 feed units, while the digestible protein content ranged from 48.1 to 52.3 g/kg.

Based on these results, the hulless barley cultivar Uzbekistan-30 demonstrated a nutritional advantage over the hulled barley cultivar Bolgali, particularly in terms of its higher crude protein and digestible protein contents.

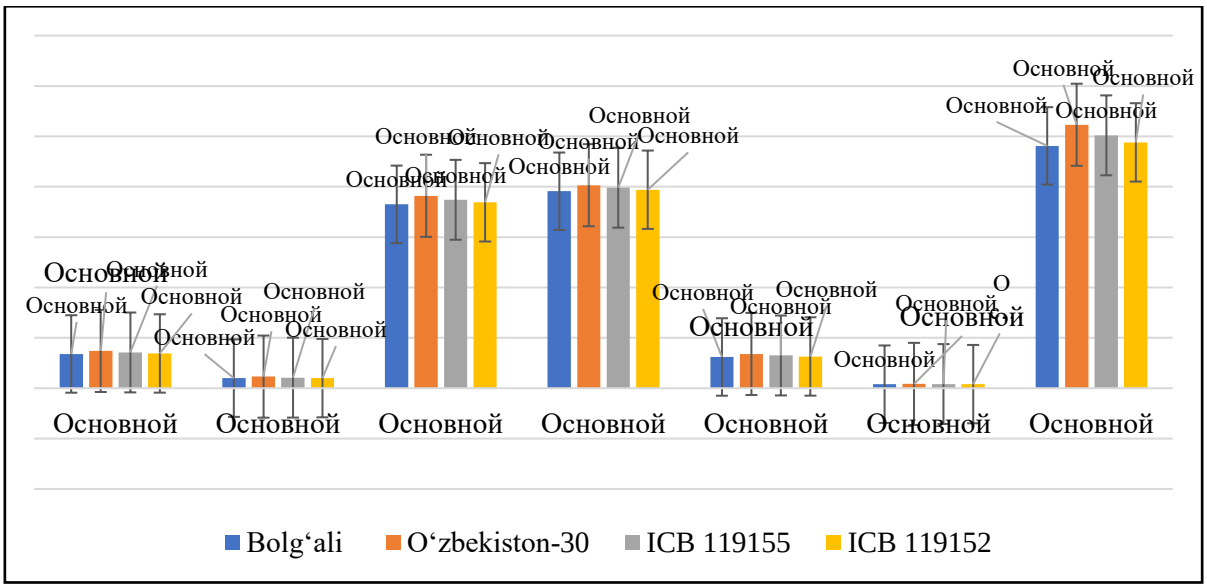

Figure 3. Nutritional value of barley genotypes.

Note: 1 – Crude protein, %; 2 – Crude fat, %; 3 – Crude fiber, %; 4 – Nitrogen-free extract (NFE), %; 5 – Crude ash, %; 6 – Feed units per 1 kg of feed; 7 – Digestible protein per 1 kg of feed, g.

Vetch is an important forage crop for livestock due to its high protein content. As noted above, the crude protein content of barley ranged from 6.8 to 7.4%, whereas that of the vetch genotypes ranged from 17.6 to 20.8%. Thus, the crude protein content of vetch was approximately three times higher than that of barley. The nutritional value of vetch was also characterized by its relatively lower crude fiber content. While the crude fiber content of barley ranged from 36 to 38%, it ranged from 26 to 30% in vetch.

Nitrogen-free extract (NFE) is another important indicator used to evaluate the chemical composition and nutritional value of feed. NFE represents primarily readily digestible carbohydrate fractions, including sugars, starch, and other soluble carbohydrates, which serve as important sources of energy for animals.

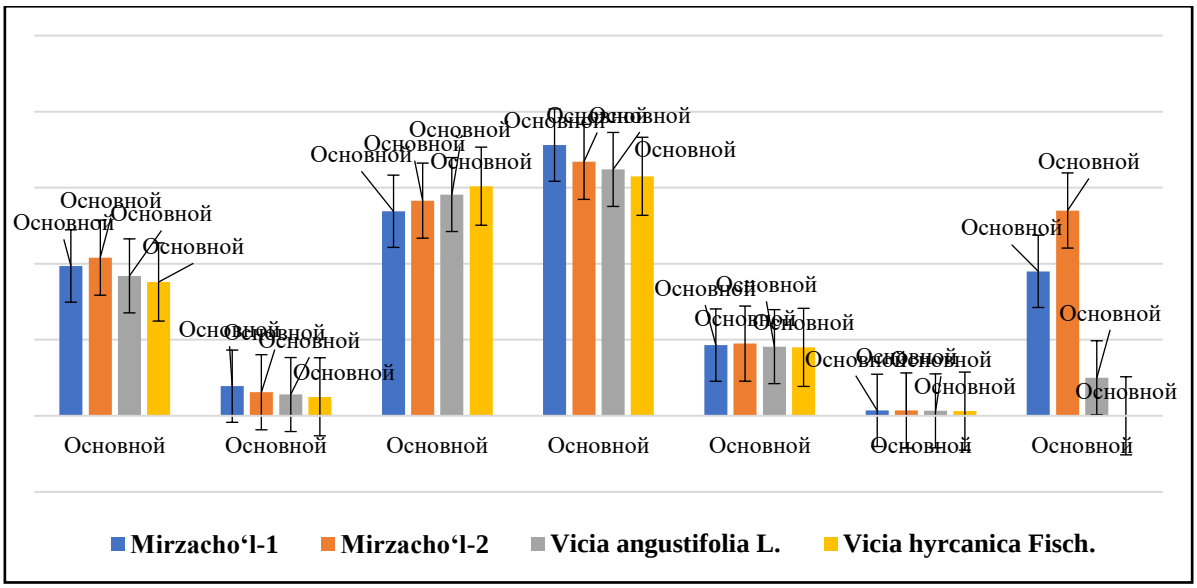

Figure 4. Nutritional value of vetch genotypes.

Note: 1 – Crude protein, %; 2 – Crude fat, %; 3 – Crude fiber, %; 4 – Nitrogen-free extract (NFE), %; 5 – Crude ash, %; 6 – Feed units per 1 kg of feed; 7 – Digestible protein per 1 kg of feed, g.

The crude ash content ranged from 9.0 to 9.5%, while the feed value per 1 kg of feed ranged from 0.62 to 0.72 feed units. The digestible protein content ranged from 123 to 150 g per kg of feed. When compared with *Vicia hyrcanica* Fisch., the digestible protein content was found to be 19.0 g/kg higher in the Mirzachul-1 cultivar, 27.0 g/kg higher in the Mirzachul-2 cultivar, and 5.0 g/kg higher in the narrow-leaved vetch.

CONCLUSION

Overall, the hulless barley cultivar Uzbekistan-30 demonstrated superior nutritional characteristics compared with the hulled barley cultivar Bolgali, particularly in terms of crude protein, crude fat, nitrogen-free extract (NFE), and digestible protein content per kilogram of feed. However, no substantial difference in crude fiber content was observed between the two barley cultivars.

The Mirzachul-1 and Mirzachul-2 vetch cultivars exhibited superior nutritional characteristics compared with the other vetch genotypes. This advantage was associated with their higher crude protein content, lower crude fiber content, and higher levels of nitrogen-free extract (NFE). Furthermore, the digestible protein content per kilogram of feed in the Mirzachul-1 and Mirzachul-2 cultivars was found to be 19–27 g/kg higher than that of *Vicia hyrcanica* Fisch. Overall, the Uzbekistan-30 barley cultivar and the Mirzachul-1 and Mirzachul-2 vetch cultivars were identified as promising feed resources with potential to improve feed quality and contribute to increased livestock productivity.

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GIBRID OLEOGEL-SORBENTLARNI TADQIQ QILISH USULLARI

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Annotatsiya. *Ushbu maqolada vermikulit va amfifil oligomer asosida olingan gibrid oleogel-sorbentlarning tuzilishi, g'ovaklik xususiyatlari hamda neft va neft mahsulotlarini yutish qobiliyatini baholash usullari keltirilgan. Neft yutish sig'imi gravimetrik usulda (dixlormetan, tetragidrofuran, geksan, benzol, toluol, benzin, dizel yoqilg'isi va xom neftda), neftni ushlab turish qobiliyati sentrifugalash orqali, emulsiyalangan moyning sorbsiyasi esa pH 4–9 oralig'ida davriy sharoitda o'rganildi. Taklif etilgan usullar majmuasi gibrid oleogel-sorbentlarning xossalarini yagona metodik asosda taqqoslash imkonini beradi.*

Kalit so'zlar: *oleogel, gibrid oleogel-sorbent, vermikulit, neft yutish sig'imi, g'ovaklik, sorbsiya kinetikasi, sorbsiya izotermasi, neft bilan ifloslangan suv.*

Abstract. *This article presents methods for evaluating the structure, porosity, and oil and petroleum product absorption capacity of hybrid oleogel-sorbents obtained from vermiculite and an amphiphilic oligomer. Oil sorption capacity was determined gravimetrically (in dichloromethane, tetrahydrofuran, hexane, benzene, toluene, gasoline, diesel fuel, and crude oil), oil retention capacity was determined by centrifugation, and the sorption of emulsified oil was studied under batch conditions in the pH range of 4–9. The proposed set of methods makes it possible to compare the properties of hybrid oleogel-sorbents on a unified methodological basis.*

Keywords: *oleogel, hybrid oleogel-sorbent, vermiculite, oil sorption capacity, porosity, sorption kinetics, sorption isotherm, oil-polluted water.*

Аннотация. *В данной статье представлены методы оценки структуры, пористости, а также способности к поглощению нефти и нефтепродуктов гибридных олеогель-сорбентов, полученных на основе вермикулита и амфифильного олигомера. Нефтеёмкость определяли гравиметрическим методом (в дихлорметане, тетрагидрофуране, гексане, бензоле, толуоле, бензине, дизельном топливе и сырой нефти),*

нефтеудерживающую способность — центрифугированием, а сорбцию эмульгированного масла изучали в периодическом режиме в диапазоне pH 4–9. Предложенный комплекс методов позволяет сравнивать свойства гибридных олеогель-сорбентов на единой методической основе.

Ключевые слова: *олеогель, гибридный олеогель-сорбент, вермикулит, нефтеёмкость, пористость, кинетика сорбции, изотерма сорбции, нефтезагрязнённая вода.*

KIRISH

An’anaviy sorbentlar (faollashtirilgan ko‘mir, tabiiy minerallar, sintetik polimerlar) sorbsion sig‘imi, neftga nisbatan tanlab ta’sir qilishi, qayta foydalanish imkoniyati va tannarxi bo‘yicha turlicha cheklovlarga ega. Oleogellar suyuq moyni uch o‘lchamli tarmoq ichida ushlab turadigan tizimlar bo‘lib, ularning g‘ovak tuzilishi va nopolyar organik birikmalarga yaqinligi neft sorbenti sifatida qiziqish uyg‘otadi. Organik-anorganik gibrid oleogel-sorbentlarda esa mineral matritsa material barqarorligini ta’minlasa, polimer faza gidrofob yutish markazlarini hosil qiladi.

Mahalliy xomashyo sifatida Tebinbuloq koni vermikuliti qiziqarli mineral matritsa hisoblanadi: uning tarkibidagi faol silanol va alyuminiy gidroksid guruhlari amfifil oligomerlar bilan samarali bog‘lanish hosil qiladi. Polietilenpoliamin, kroton aldegidi tizimlari asosida mos ravishda MMV-2 oligomerlari sintez qilingan, ularning faollashtirilgan vermikulit bilan kompozitlari esa gibrid oleogel-sorbentlar sifatida o‘rganilmoqda.

Biroq gibrid sorbentlarning xossalarini baholashda qo‘llaniladigan usullar turlicha bo‘lib (yutish vaqti, ortiqcha suyuqlikni ajratish sharti, sinov suyuqligi turi), bu turli tadqiqotlar natijalarini o‘zaro taqqoslashni qiyinlashtiradi. Bundan tashqari, sorbsion xossalarni ishonchli isbotlash uchun sorbsiya kinetikasi va izotermalarini aniqlash zarur. Shu bois gibrid oleogel-sorbentlarni tadqiq qilishning yagona metodik majmuasini shakllantirish ilmiy va amaliy ahamiyatga ega.

Tadqiqotning maqsadi MMV-2 asosidagi gibrid oleogel-sorbentlarning morfologiyasi, g‘ovakligi, neft mahsulotlarini yutish va ushlab turish qobiliyati hamda emulsiyalangan moyni sorbsiyalash xossalarini baholash usullarini tizimlashtirish va ularni amalda qo‘llash natijalarini keltirishdir.

METODOLOGIYA

Tadqiqot ob’yekti sifatida Tebinbuloq koni vermikuliti asosidagi polimer-mineral gibrid oleogel-sorbentlar olindi. MMV-2 oligomeri polietilenpoliamin va kroton aldegidi asosida sintez qilingan va ularning tuzilishi FTIR, ^{1}H-YaMR va ^{13}C-YaMR usullari bilan tasdiqlangan. Gibrid namunalar oligomerlar va

faollashtirilgan (kengaytirilgan) vermikulit asosida olingan. Gibrid oleogel-sorbentlarning ichki va sirtqi morfologik tuzilishi maydon emissiyali skanerlovchi elektron mikroskopi (FE-SEM, Hitachi, Yaponiya) yordamida tadqiq etildi. Kesma yuza (cross-section) tahlilidan oldin elektron oqimi ta'sirida zaryadlanishning oldini olish va tasvir aniqligini oshirish maqsadida namunalar sirtiga ion-changlatish qurilmasida o'ta yupqa oltin-palladiy (Au-Pd) nano-plyonkasi qoplandi.

G'ovaklik darajasini aniqlash. Namunalarning g'ovaklik darajasi Onvukamike ishlab chiqqan metodik yondashuv bo'yicha aniqlandi. Har bir oleogel uchun uchta parallel namuna tahlil qilindi. Namunalarning massasi analitik tarozida, geometrik o'lchamlari shtangensirkul yordamida o'lchanib, hajm qiymatlari hisoblandi. G'ovaklik quyidagi tenglama bo'yicha topildi:

$$porosity = \left(1 - \frac{\rho_A}{\rho_R}\right) \times 100\% \quad (1)$$

bu yerda ρ_A - gibrid oleogel-sorbentning ko'rinadigan (hajmiy) zichligi bo'lib, quruq namuna massasining (m, g) uning geometrik hajmiga (V, sm^3) nisbati sifatida aniqlanadi; ρ_R - haqiqiy zichlik bo'lib, u kompozit tarkibiga kiruvchi MMV oligomeri va kengaytirilgan vermikulitning haqiqiy zichliklari hamda ularning massa ulushlari asosida additivlik qoidasi yordamida hisoblandi. Hisoblashda MMV oligomeri uchun 1,15 g/sm^3, kengaytirilgan vermikulit uchun 2,50 g/sm^3 qiymatlar qabul qilindi.

Neft mahsulotlarini yutish qobiliyati. Oleogel namunalari tarozida tortib olinib, neft mahsulotiga botirildi. Odatda 6 soat ichida nopolyar organik birikmalarni yutish hisobiga muvozanatga erishiladi. Yutish tugagach, namunalar olinib, ortiqcha neft mahsulotidan xalos bo'lish uchun 30 soniya davomida tabiiy ravishda osib qo'yildi va darhol tortildi. Neft mahsulotlarini yutish qobiliyati (C_a, g/g) quyidagi tenglama bilan hisoblandi:

$$C_a = \frac{(M - M_0)}{M_0} \quad (2)$$

bu yerda M_0 - oleogelning boshlang'ich quruq massasi, M - neft mahsulotini yutgandan keyingi massasi.

Neftni ushlab turish qobiliyati. Neft mahsulotlari bilan to'yingan oleogellarning neftni ushlab turish qobiliyati Manzokko usulining modifikatsiyasi bilan aniqlandi. Taxminan 0,1 g oleogel namunasi hajmi 10 ml bo'lgan ikki bo'lakli sentrifuga probirkasiga joylandi va 13 000 ayl/min tezlikda 30 daqiqa sentrifugalandi. Neft saqlash quvvati quyidagi tenglama bilan hisoblandi:

$$oil\ holding\ capacity(\%) = \frac{m_0}{m_1} \times 100 \quad (3)$$

bu yerda m_0 - sentrifugalashdan keyin oleogelda qolgan neft massasi, m_1 -sentrifugalashdan oldingi neftning umumiy massasi. Barcha o‘lchovlar uch marta takrorlandi.

Neft yutish sig‘imini gravimetrik usulda aniqlash. Gibrid oleogel-sorbent namunalarining neft va moysimon mahsulotlarni yutish qobiliyati gravimetrik usulda o‘lchandi. Sinov suyuqliklari sifatida dixlormetan, tetragidrofuran, geksan, benzol, toluol, benzin, dizel yoqilg‘isi va xom neft ishlatildi.

Tajriba boshida filtr qog‘ozidan tayyorlangan bo‘sh paket sinov suyuqligiga botirildi, suyuqlik bilan to‘yingach chiqarilib, ortiqcha suyuqlik oqib tushishi uchun qisqa muddat ushlab turildi va massasi (W_b) aniqlandi. Keyin 0,2 g quritilgan gibrid gel namunasi paketga joylanib, sinov suyuqligiga botirildi va xona haroratida 24 soat saqlandi. Belgilangan vaqtdan so‘ng paket pinset yordamida chiqarilib, ortiqcha suyuqlik oqib tushgach, umumiy massasi (W_s) o‘lchandi. Neft yutish sig‘imi (Q, g/g) quyidagicha hisoblandi:

$$(\%) = \frac{W_s - W_b - W_d}{W_d} \times 100 \quad (4)$$

bu yerda W_d - quruq gel namunasining massasi, g; W_s - suyuqlik bilan to‘yingan namuna joylangan paketning massasi, g; W_b - suyuqlik bilan namlangan bo‘sh paketning massasi, g. Har bir namuna uchun o‘lchovlar bir xil sorbsiya vaqtida kamida to‘rt marta mustaqil takrorlandi; o‘rtacha qiymat va standart og‘ish hisoblandi.

NATIJALAR VA MUHOKAMA

Emulsiyalangan moysimon moddalarni sorbsiyalash samaradorligi, sorbsiya kinetikasi va muvozanat izotermalari laboratoriyada davriy usulda o‘rganildi. Hajmi 1000 ml bo‘lgan model va sanoat oqova suvi namunalariga ma’lum miqdorda sorbent kiritilib, aralashma xona haroratida 200 ayl/min tezlikda mexanik aralashtirildi. Jarayonning pH ga bog‘liqligi HCl va NaOH eritmalari yordamida pH 4–9 oralig‘ida o‘rganildi. Belgilangan vaqtlarda olingan namunalar sentrifugalanib, mikrofiltrlash orqali ajratildi va filtratdagi qoldiq moy miqdori Horiba infraqizil moy analizatorida tetraxloretilen bilan ekstraksiya usulida aniqlandi. Shu asosda sorbsion sig‘im, kinetika va muvozanat izotermalari hisoblandi.

Statik sorbsiya izotermalarini qurish uchun MMV-2 gibrid oleogel-sorbentining turli massalari (0,3; 0,6; 0,9; 1,0; 1,2; 1,5 va 2,1 g) tortib olinib, 1000 ml moyli suv namunalari bilan optimal pH muhitida aralashtirildi. Tajribalar takrorlanib, o‘rtacha qiymatlar asosida solishtirma sorbsion sig‘im hisoblandi. Immobilizatsiya barqarorligini baholash (desorbsiya testi) uchun absorbsiyadan keyingi namunalar toza distillangan suvda qayta chayqatildi va

yutilgan moysimon fraksiyalarning suv fazasiga qaytib chiqish koeffitsiyenti tahlil qilindi.

Sintez qilingan MMV-2 oligomerining tuzilishi FTIR, ^{1}H- va ^{13}C-YaMR spektroskopiyasi bilan tasdiqlandi. Vermikulitni kislotali-termik faollashtirishning optimal sharoitlarida mineralning faol markazlari va kristallik tuzilishi saqlanib qolishi aniqlandi.

Usullarning ba'zi jihatlarini alohida qayd etish lozim. Birinchidan, dielektrik polimer-mineral namunalarda Au-Pd qoplama zaryadlanishni kamaytirib, kesma yuza tasvirining aniqligini oshiradi. Ikkinchidan, g'ovaklik qiymati haqiqiy zichlikni additivlik qoidasi bo'yicha hisoblashga tayanadi, shuning uchun qabul qilingan zichliklar (1,15 va 2,50 g/sm³) natijaning asosiy noaniqlik manbai bo'lishi mumkin. Uchinchidan, gravimetrik usulda namlangan bo'sh paketning massasi (W_b) ayirib tashlanishi filtr qog'ozida ushlanib qolgan suyuqlikning ta'sirini bartaraf etadi.

Shuningdek, C_a (6 soat, 30 soniya oqizish) va Q (24 soat, filtr paketi) protokollari sorbsiya vaqti va ortiqcha suyuqlikni ajratish sharti bo'yicha farq qiladi, shu sabab ularning qiymatlarini bir-biri bilan to'g'ridan-to'g'ri taqqoslash to'g'ri emas; taqqoslash faqat bir xil protokol doirasida amalga oshirilishi kerak. Sentrifugalash orqali aniqlanadigan OHC va suvdagi desorbsiya testi esa yutilgan moyning mustahkam ushlanishini turli mexanik va gidrodinamik ta'sirlarda baholaydi. Tadqiqotning cheklovlari sifatida tajribalar laboratoriya sharoitida, asosan xona haroratida o'tkazilganini, sanoat oqova suvlari tarkibi esa o'zgaruvchan bo'lishi mumkinligini ta'kidlash mumkin.

XULOSA

Tebinbuloq koni vermikuliti va MMV-2 oligomerlari asosidagi gibrid oleogel-sorbentlarni tadqiq qilish uchun morfologiya (FE-SEM), neft yutish va ushlab turish, sorbsiya kinetikasi hamda izotermalarni qamrab oluvchi usullar majmuasi shakllantirildi. Gravimetrik usul turli sinov suyuqliklarida - organik erituvchilar, neft mahsulotlari va xom neftda sorbsiya sig'imini bir xil sharoitda o'lchashga imkon beradi. Emulsiyalangan moyni davriy sorbsiyalash tajribalari pH ta'siri, kinetika, izoterma va desorbsiya barqarorligini baholash imkonini berdi. Taklif etilgan metodik majmua boshqa polimer-mineral gibrid sorbentlarni ham yagona asosda taqqoslash uchun qo'llanilishi mumkin.

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PHYSIOLOGICAL AND BIOCHEMICAL CHARACTERISTICS OF HULLESS BARLEY (HORDEUM VULGARE L.) AND VETCH (VICIA SATIVA L. AND VICIA VILLOSA ROTH) GENOTYPES UNDER SALINITY STRESS CONDITIONS

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Annotatsiya Annotatsiya. *Tadqiqotda o'rta darajada sho'rlangan tuproq sharoitida doni qobiqsiz arpa va vika genotiplarining fiziologik-biokimyoviy moslashuv xususiyatlari baholandi. Genotiplarda K^+/Na^+ nisbati, natriy translokatsiya indeksi, prolin, H_2O_2, MDA, SOD, katalaza va amilaza faolligi hamda barglarning nisbiy suv miqdori (RWC) tahlil qilindi. Natijalarga ko'ra, O'zbekiston-30 arpa navi hamda Mirzacho'l-1 va Mirzacho'l-2 vika navlari yuqori antioksidant faollik, prolin to'planishi, suv saqlash qobiliyati va past oksidlovchi zararlanish bilan tavsiflandi. Ushbu navlarning sho'rlanish sharoitiga nisbatan yuqori fiziologik-biokimyoviy moslashuvchanligi aniqlandi.*

Kalit so'zlar: *doni qobiqsiz arpa,* Hordeum vulgare *L., vika,* Vicia *spp., sho'rlanish stressi, genotip, prolin, K^+/Na^+ nisbati, antioksidant tizim, superoksid dismutaza (SOD), katalaza (CAT), vodorod peroksid (H_2O_2),*

malondialdegid (MDA), α-amilaza, nisbiy suv miqdori (RWC), stressga chidamlilik.

Abstract. *This study evaluated the physiological and biochemical adaptation of hulless barley and vetch genotypes under moderately saline soil conditions. The K^+/Na^+ ratio, sodium translocation index, proline, H_2O_2 and MDA contents, SOD, catalase and amylase activities, and relative water content (RWC) were analyzed. The results showed that the Uzbekistan-30 barley cultivar and the Mirzachul-1 and Mirzachul-2 vetch cultivars were characterized by higher antioxidant activity, proline accumulation, water retention capacity, and lower oxidative damage. These cultivars demonstrated greater physiological and biochemical adaptation to salinity stress.*

Keywords: *hulless barley, Hordeum vulgare L., vetch, Vicia spp., salinity stress, genotype, proline, K^+/Na^+ ratio, antioxidant system, superoxide dismutase (SOD), catalase (CAT), hydrogen peroxide (H_2O_2), malondialdehyde (MDA), α-amylase, relative water content (RWC), salt tolerance.*

INTRODUCTION

Soil salinity is one of the major abiotic stress factors limiting the growth, development, and productivity of agricultural crops. Under saline conditions, the development of osmotic and ionic stress in plant cells disrupts water relations, mineral nutrition, photosynthesis, and various metabolic processes. In particular, excessive accumulation of Na^+ ions and a decrease in the K^+/Na^+ ratio adversely affect cellular ion homeostasis. Furthermore, salinity-induced accumulation of reactive oxygen species (ROS), including superoxide radicals and hydrogen peroxide (H_2O_2), intensifies oxidative stress [1]. Plant tolerance to salinity is closely associated with the maintenance of ion homeostasis, osmotic adjustment, and the efficient functioning of the antioxidant defense system.

Barley (*Hordeum vulgare* L.) is considered one of the relatively salt-tolerant cereal crops; however, its genotypes differ considerably in their responses to salinity stress. Studies have demonstrated that salinity reduces growth and biomass accumulation, decreases relative water content in leaves, and increases Na^+ accumulation in barley genotypes. In contrast, salt-tolerant genotypes are characterized by their ability to maintain a higher K^+/Na^+ ratio, greater leaf water content, and enhanced cell membrane stability under saline conditions. Therefore, leaf water retention capacity, commonly expressed as relative water content (RWC), is considered an important physiological indicator for assessing the response and tolerance of plants to salinity stress [2, 3].

Salinity is one of the major abiotic stress factors limiting the growth and productivity of agricultural crops, inducing osmotic and ionic stress as well as

enhancing oxidative processes in plants. Under salinity stress, the accumulation of reactive oxygen species (ROS), particularly hydrogen peroxide (H_2O_2), increases in plant cells, thereby intensifying membrane lipid peroxidation and leading to the accumulation of malondialdehyde (MDA). In response to such stress, plants accumulate osmoregulatory compounds, such as proline, and enhance the activity of antioxidant enzymes, including superoxide dismutase (SOD) and catalase (CAT) [4, 5].

In barley (*Hordeum vulgare* L.) genotypes, salinity tolerance is associated with the maintenance of leaf water status, regulation of Na^+/K^+ homeostasis, proline accumulation, and the efficient functioning of the antioxidant defense system. Salt-tolerant genotypes generally exhibit higher SOD and CAT activities and relatively lower levels of H_2O_2 and MDA, thereby reducing oxidative damage. Furthermore, salinity may affect α-amylase activity and starch mobilization during seed germination, consequently restricting early seedling growth. In leguminous crops, including vetch (*Vicia* spp.) genotypes, proline accumulation, maintenance of plant water status, and enhanced antioxidant enzyme activity have also been identified as important physiological and biochemical mechanisms of adaptation to salinity stress. Therefore, the integrated assessment of proline, H_2O_2 and MDA contents, SOD, CAT, and α-amylase activities, as well as leaf water retention capacity, can serve as important criteria for evaluating the salinity tolerance of plant genotypes [6, 7].

MATERIALS AND METHODS

Proline content was determined according to the method described by Bates et al. (1973). Superoxide dismutase (SOD) activity was assayed following the method of Giannopolitis and Ries (1977), while catalase (CAT) activity was determined according to Aebi (1984). Malondialdehyde (MDA) content, as an indicator of lipid peroxidation, was measured using the thiobarbituric acid (TBA) method described by Heath and Packer (1968). Hydrogen peroxide (H_2O_2) content was determined according to Velikova et al. (2000), and leaf relative water content (RWC) was assessed following Barrs and Weatherley (1962). α-Amylase activity was determined according to Bernfeld (1955), while β-glucan content was quantified using the McCleary method in accordance with AOAC Official Method 995.16.

RESULTS AND DISCUSSION

Plants have developed various physiological and biochemical adaptive mechanisms that enable them to withstand or acclimate to stressful environmental conditions. Among these mechanisms, the maintenance of an appropriate K^+/Na^+ ratio plays an important role in preserving cellular ion

homeostasis and enhancing tolerance to salinity stress. In the present study, the K^+/Na^+ ratio was 1.9 in the Uzbekistan-30 cultivar, compared with 1.7 and 1.6 in the ICB 119155 and ICB 119152 genotypes, respectively. The higher K^+/Na^+ ratio observed in Uzbekistan-30 indicates a more favorable ionic balance and a relatively lower accumulation of Na^+ in relation to K^+ compared with the other genotypes. This ability to restrict excessive Na^+ accumulation and maintain K^+ homeostasis may reduce Na^+-induced ion toxicity and contribute to improved cellular stability under saline conditions.

The sodium translocation index was 0.40 in the Uzbekistan-30 cultivar, whereas values of 0.50 and 0.70 were recorded for the ICB 119155 and ICB 119152 genotypes, respectively. The lower sodium translocation index observed in Uzbekistan-30 indicates a reduced transfer of Na^+ from the roots to the shoots, suggesting a greater ability of this cultivar to restrict Na^+ accumulation in aboveground tissues. Such regulation of Na^+ translocation may contribute to reduced ion toxicity and improved tolerance of Uzbekistan-30 to saline conditions.

Proline accumulation is considered an important physiological and biochemical indicator of plant adaptation to salinity stress. Under stressful conditions, proline acts as a compatible osmolyte and contributes to the maintenance of cellular osmotic balance, stabilization of proteins and membranes, and protection of cellular structures. In the present study, proline content reached 16.8 in the Uzbekistan-30 cultivar, whereas values of 14.6 and 11.0 were recorded in the ICB 119155 and ICB 119152 genotypes, respectively. The higher proline accumulation observed in Uzbekistan-30 under saline conditions indicates a more pronounced osmotic adjustment response and may contribute to the greater salinity tolerance of this cultivar.

The adverse effects of salinity stress on plants are closely associated with the excessive generation of reactive oxygen species (ROS). Under saline conditions, ROS such as the superoxide anion ($O_2^{\bullet -}$) and hydrogen peroxide (H_2O_2) accumulate in plant cells and may negatively affect plant growth and development. Excessive accumulation of ROS can damage lipids, proteins, and nucleic acids, ultimately resulting in structural and functional impairment of cells. Malondialdehyde (MDA), a major product of membrane lipid peroxidation, is widely used as an important biochemical indicator of oxidative damage to cell membranes.

To counteract oxidative stress, plants possess a complex antioxidant defense system involving enzymes such as superoxide dismutase (SOD) and catalase (CAT), which play essential roles in the detoxification of ROS.

According to the data presented in the figure, SOD activity was 4.5 in the Uzbekistan-30 cultivar, compared with 4.3 in ICB 119155 and 3.8 in ICB 119152. The higher SOD activity observed in Uzbekistan-30 indicates a more active enzymatic antioxidant defense response under salinity stress.

The enhanced SOD activity observed in the Uzbekistan-30 cultivar was associated with the activation of the antioxidant defense system under salinity stress. Increased SOD activity was accompanied by enhanced catalase (CAT) activity, contributing to the efficient detoxification of reactive oxygen species. As a result, the accumulation of hydrogen peroxide (H_2O_2) was reduced. The H_2O_2 content was 1.3 in Uzbekistan-30, compared with 1.5 and 2.2 in the ICB 119155 and ICB 119152 genotypes, respectively. The lower H_2O_2 level in Uzbekistan-30 may be associated with greater CAT activity and its effective involvement in the decomposition of H_2O_2.

Malondialdehyde (MDA) is widely used as an indicator of membrane lipid peroxidation and cellular membrane damage under stress conditions. The MDA content was 4.6 in the Uzbekistan-30 cultivar, whereas values of 7.2 and 7.0 were recorded in ICB 119155 and ICB 119152, respectively. The substantially lower MDA level observed in Uzbekistan-30 indicates reduced lipid peroxidation and less oxidative damage to cell membranes under salinity stress. These results suggest that the more efficient antioxidant defense system of Uzbekistan-30 contributes to maintaining cellular membrane integrity and enhancing its adaptation to saline conditions.

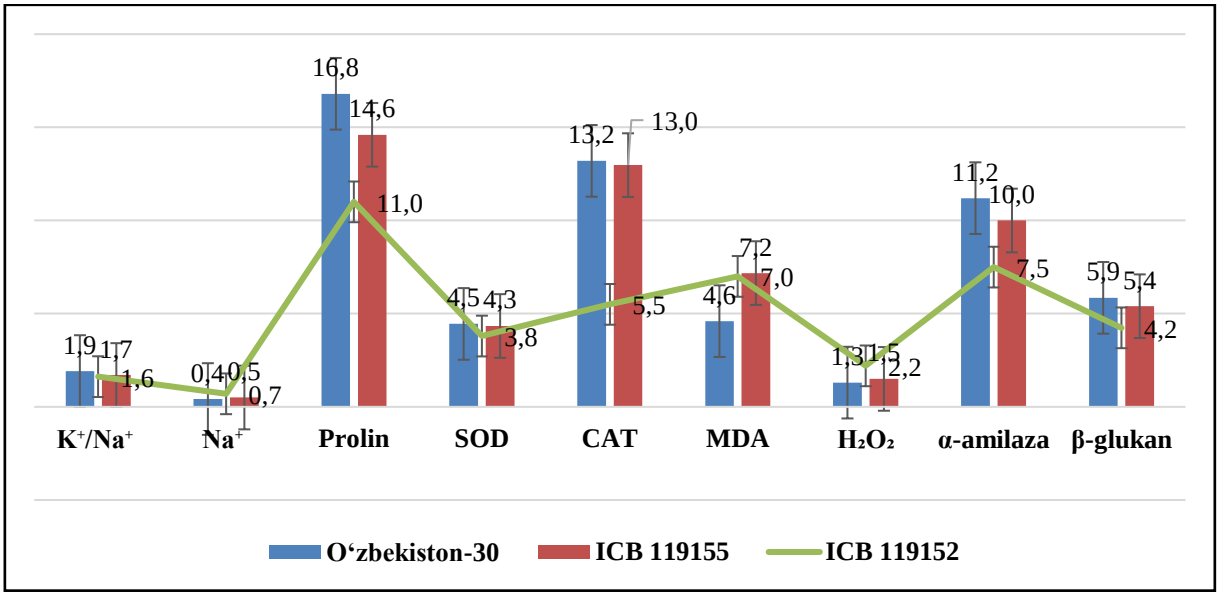

Figure 1.

Physiological and biochemical characteristics of hulless barley genotypes under saline conditions.

Note: *Plants were grown under moderately saline soil conditions.*

Amylase activity was 11.2 in the Uzbekistan-30 cultivar, compared with 10.0 and 7.5 in the ICB 119155 and ICB 119152 genotypes, respectively. The higher amylase activity observed in Uzbekistan-30 may indicate more efficient carbohydrate mobilization and metabolic activity under salinity stress, which may contribute to the better adaptation of this cultivar to saline conditions.

β-Glucan content is an important biochemical and nutritional characteristic of hulless barley, particularly with regard to its potential application in the food industry. The β-glucan content was 5.9 in the Uzbekistan-30 cultivar, whereas values of 5.4 and 5.2 were recorded in the ICB 119155 and ICB 119152 genotypes, respectively. The higher β-glucan content of Uzbekistan-30 may enhance its nutritional value and potential for use in functional food products.

Leaf relative water content (RWC) is an important physiological indicator used to assess plant water status and tolerance to salinity and drought stress. The RWC was 92.2% in the Uzbekistan-30 cultivar, compared with 84.0% in ICB 119155 and 89.9% in ICB 119152. The higher RWC recorded in Uzbekistan-30 indicates its greater ability to maintain leaf hydration and cellular water balance under saline conditions, suggesting a more effective physiological adaptation to salinity stress.

Among the vetch genotypes, the K^+/Na^+ ratio was 2.18 in the Mirzachul-1 cultivar, 2.05 in Mirzachul-2, 1.78 in Mirzachul-3, 1.69 in L-2, 1.57 in L-14, and 1.48 in L-23. These results showed that Mirzachul-1 and Mirzachul-2 maintained higher K^+/Na^+ ratios than the other genotypes. A higher K^+/Na^+ ratio indicates a more favorable ionic balance and a relatively lower accumulation of toxic Na^+ ions in relation to K^+, suggesting a more efficient mechanism of ionic homeostasis under salinity stress.

This response was also reflected in the sodium translocation index, which ranged from 0.38 to 0.65 among the studied genotypes. The observed values indicate differences among the genotypes in the translocation of Na^+ from roots to shoots. More effective restriction of Na^+ transport to aboveground tissues may contribute to reduced Na^+ toxicity and improved adaptation to saline conditions. Mirzachul-1 and Mirzachul-2 exhibited a more favorable response for this parameter compared with the other genotypes.

Proline content was 18.6 in the Mirzachul-1 cultivar and 17.4 in Mirzachul-2. These values were higher than those recorded in the other studied genotypes. The greater accumulation of proline in Mirzachul-1 and Mirzachul-2 suggests a stronger osmotic adjustment response, which may contribute to the maintenance of cellular water balance and enhanced tolerance to salinity stress.

SOD activity was 5.32 in the Mirzachul-1 cultivar and 5.08 in Mirzachul-2. Higher SOD activity was observed in these cultivars compared with the other studied genotypes, indicating a more active antioxidant defense system under salinity stress. The enhanced SOD activity was accompanied by increased catalase (CAT) activity, which may have contributed to the more efficient detoxification of hydrogen peroxide (H_2O_2) and, consequently, to a reduction in its accumulation in plant tissues.

The MDA content was 3.42 in Mirzachul-1 and 3.68 in Mirzachul-2. The lower MDA levels observed in these cultivars compared with the other genotypes indicate reduced membrane lipid peroxidation and lower oxidative damage under saline conditions. These findings suggest that Mirzachul-1 and Mirzachul-2 possess a more effective antioxidant defense system that contributes to the maintenance of cell membrane integrity under salinity stress.

In addition, Mirzachul-1 and Mirzachul-2 exhibited higher amylase activity than the other studied genotypes. Enhanced amylase activity may facilitate more efficient carbohydrate mobilization and energy supply under stress conditions, thereby contributing to improved metabolic adaptation and greater tolerance to salinity stress.

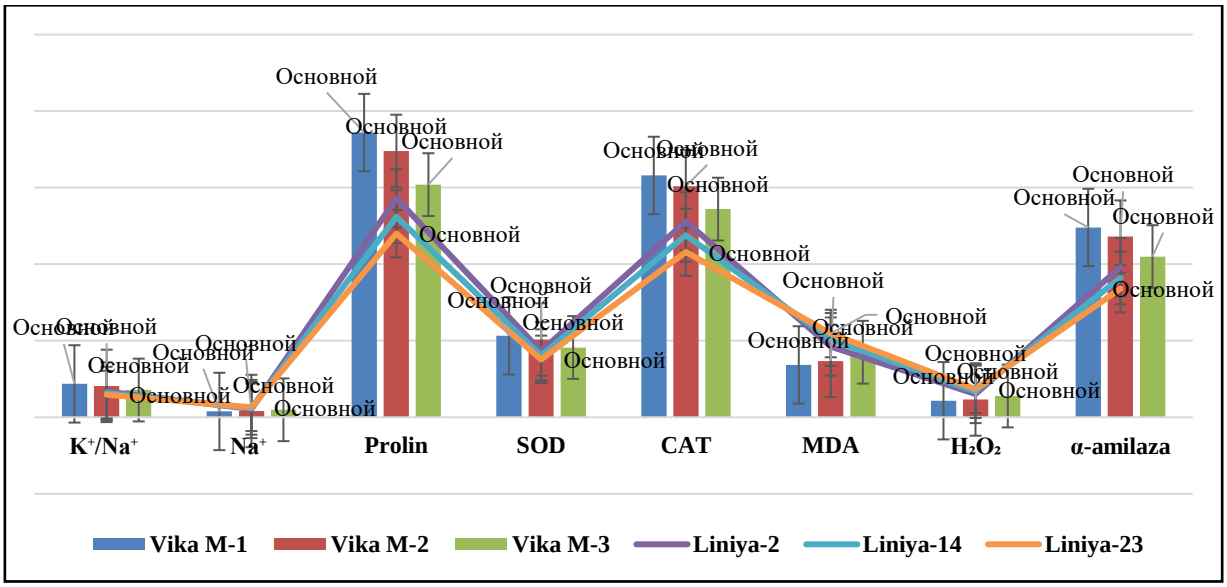

Figure 2.

Physiological and biochemical characteristics of vetch cultivars and genotypes under saline conditions.

Note: *Plants were grown under moderately saline soil conditions.*

Leaf relative water content (RWC) varied among the studied vetch genotypes. The highest RWC was recorded in the Mirzachul-1 cultivar (94.8%), followed by Mirzachul-2 (93.2%), Mirzachul-3 (89.6%), L-2 (87.8%), L-14 (85.4%), and L-23 (83.1%). The higher RWC values observed in Mirzachul-1

and Mirzachul-2 indicate their greater ability to maintain leaf hydration and cellular water balance under saline conditions. These results suggest that these cultivars possess more effective water-retention mechanisms, which may contribute to their improved physiological adaptation and tolerance to salinity stress compared with the other studied genotypes.

CONCLUSION

Overall, the results demonstrated that the tolerance of barley and vetch genotypes to saline conditions is associated with distinct physiological and biochemical adaptation mechanisms. Among the studied hulless barley genotypes, the Uzbekistan-30 cultivar exhibited greater salinity tolerance, as evidenced by its higher K^+/Na^+ ratio, lower sodium translocation index, greater proline accumulation, and enhanced activities of superoxide dismutase (SOD) and catalase (CAT). The efficiency of the antioxidant defense system was further supported by the lower accumulation of hydrogen peroxide (H_2O_2) and malondialdehyde (MDA), indicating reduced oxidative damage under salinity stress.

Among the studied vetch genotypes, the Mirzachul-1 and Mirzachul-2 cultivars demonstrated greater physiological and biochemical adaptation to salinity stress than the other genotypes. Their stress tolerance was associated with a favorable K^+/Na^+ balance, regulation of Na^+ translocation, increased proline accumulation, and enhanced SOD and CAT activities. The effectiveness of their antioxidant defense system was also reflected in the relatively low H_2O_2 and MDA levels. Furthermore, the high relative water content (RWC) recorded in Mirzachul-1 (94.8%) and Mirzachul-2 (93.2%) indicates a greater capacity to maintain tissue hydration under stress conditions. Collectively, these findings suggest that Uzbekistan-30 barley and Mirzachul-1 and Mirzachul-2 vetch cultivars possess promising physiological and biochemical traits associated with enhanced tolerance to salinity and water-deficit stress.

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CURRENT STATE of *CRAMBE EDENTULA* FISCH. & C.A.MEY. EX KORSH.COENOPOPULLATIONS UNDER THE CONDITIONS OF THE USTYURT REGION OF KARAKALPAKSTAN

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Annotation. *The state of 4 cenopopulations of a rare species Crambe edentula for the Republic of Uzbekistan has been studied. The ontogenetic structure of the species is associated with the ecological-cenotic conditions of growth and fluctuations in weather conditions. C. edentula can be considered a threatened species because all studied cenopopulations are incomplete, due to the absence of a fraction of young individuals. This is evidenced by the types of cenopopulations, which are assessed as young, maturing, transitional, and mature. The investigated species is recommended for inclusion in the Red Book of the Republic of Uzbekistan.*

Key words. *Coenopopulation, ontogenetic spectrum, juveniles, succession, Red Book.*

INTRODUCTION

Crambe Edentula Fisch. & C.A. Mey. Ex Korsh – katran toothless (Brassicaceae) perennial; root thin, woody; several stems, 45-70 cm tall, glabrous, ribbed, branched, deciduous from below, leafless from above; leaf blades ovate, somewhat diamond-shaped, 4-8 cm long, 3-6 cm wide, slightly wedge-shaped at the base, PET-iols (2-2.5 cm long) rigidly hairy, especially from below, also along veins and edges, angularly toothed or subtentire; upper stem leaves linear-awl-shaped, small. Inflorescence loose, branching, elongated branches; the leaves are oblong, up to 3 mm long, glabrous; the petals are white, 4-5 mm long, oblong-ovate, tapering at the base, up to 2.5-3 mm wide; all filaments are toothless, longer, slightly expanded on both sides; the peduncles are 3-7 mm long, upright; the gynophore is very short, but distinct (1-1.5 mm long), elliptical, firm, smooth, glaucous. Flowering time: May-June; fruiting: July. (Mohammad Sadegh Amiri, Shahryar Saeidi Mehrvarz & Mohammad Reza Joharchiст 243 – 247,)

According to P. V. Veselova (2012), *Crambe edentula* is included in the Red Book of Kazakhstan (1981), a Southwestern Turan (or East Caspian) rare,

relict species. Within the Northern Turan, it is found in Mangishlak and Ustyurt. According to the literature, *Crambe edentula* – katran toothless (Brassicaceae) is found in Karakalpakia (Ustyurt) on the slopes of ravines. It usually grows in places that are difficult for humans and livestock to reach, in particular, along the edges of chinks, canyons, and chalk hills. It is protected in the Ustyurt Nature Reserve. According to the research conducted within the framework of the creation of the "State Plant Cadastre of the Mangistau region" (2004-2006), the state (number, dynamics of age composition, etc.) of the natural populations of the toothless katran does not cause concern. This circumstance, together with the inclusion of *C. edentula* in the Red Book of the Mangistau region and the protection of the species at the regional level, gives grounds for the recommendation to exclude it from the list of rare species of the Republican Red Book.

Two rare and interesting species of *Crambe edentula* (Brassicaceae) and *Crinitariagrimmii* (Asteraceae) have been studied in Iran (Amirietal., 2018). *C. edentula* is very rare in Iran and only one location is known. In particular, its habitat has recently been severely affected by road construction and intensive grazing. Therefore, it is recommended to protect the territory and propagate the species in Botanical gardens. The article presents diagnostic morphological features, taxonomic observations, conservation status, and the distribution map.

The article by H. F. Shomurodov and others (2015) describes the distribution of some rare species not listed in the Red Book of Uzbekistan growing in the Karakalpak part of Ustyurt *(Crambe edentula, Lagochilus acutilobus, Crataegus korolkowii, Allium delicatulum)*, provides geographical coordinates, information about the habitat, the species composition of communities with these species, and the number of individuals. *Crambe edentula,* which grows on the scree, rocks and on the clay slopes of ravines, is mainly distributed on the eastern coast of the Caspian Sea (Mangishlak, Ustyurt, Bolshiye Balhani) and in Kopet-Daga.

However, there is still no data about the state of the population of *Crambe edentula* in the conditions of the Karakalpak Ustyurt – the rarest relict species of the Turan deserts. Current climate data shows a sharp increase in drought in the last 15 years in the territory of Southern Ustyurt, where the populations of the species are confined, which confirms the need to study the current state of the coenopopulation of the species.

RESEARCH METHODS

The objects of the study are *Crambe edentula* Fish. Et Mey.

Crambe edentula is a perennial herb. It is found in the scree, rocks, on the

clay slopes of ravines. Collected in the vicinity of the wells of Dahli, Goklenkui, Kazahli and on the northern shore of the Sarikamish Lake. It grows in thickets, sometimes separately on the washed-out slopes of ravines, on stony-gravelly and fine-grained soils. The range of the species is Ustyurt, Kizilkum, Mangishlak Peninsula, the eastern coast of the Caspian Sea, Bolshiye Balhani and Kopet-Daga (Allaniyazov and Saribaeva, 1983).

The material was collected in 2019-2020. Route studies cover various ecotopes of the Karakalpak part of the Ustyurt plateau. Familiarized with the herbarium samples of *Crambe edentula*, stored in the fund of the National Herbarium (TASH) of the Institute of Botany of the Academy of Sciences of the Republic of Uzbekistan.

Geobotanical descriptions were made in all communities where the population structure of the species was studied, according to the generally accepted method on sites of 100 m^2 (Field Geobotany, 1964; Shennikov, 1964).

The degree of participation is indicated by numbers according to the 7-point Drude system [1907]: single-sol, rarely-sp^1, quite rarely–sp^2, mediocre-sp^3, often-cop^1, very often-cop^2, copiously-cop^3.

The names of plants are given according to the latest summary of S. K. Cherepanov [Cherepanov, 1995] and according to the site www.theplantlist.org. The life form of plants is given according to the 11-volume "Plant Determinant of Central Asia" [1968-2016].

Coenopopulations are described according to the classifications of A. A. Uranov and O.V. Smirnova [1969] and "delta-omega" by L.A. Jivotovskiy [2001]. Delta (Δ) is the age index [Uranov,1975], which evaluates the age level of a coenopopulation at any given time, and omega (ω) is the efficiency of a plant of the i – th ontogenetic state (the value of the "load" on the energy resources of the environment, expressed as a fraction of the load produced by plants of the average age generative state of this population). According to this classification, coenopopulations can be young, mature, transitional, aging, and old.

Population density is determined by the number of individuals per unit area. At the same time, special attention was paid to the average density, that is, the number per unit of total space, or ecological density – the number per unit of inhabited space that can actually be occupied by a population [Odum, 1986].

RESULTS AND DISCUSSION

In the course of field studies on Ustyurt (2019-2020), four communities with the participation of *Crambe edentula* were identified. A brief ecological and phytocenotic description of these coenopopulations (CP) is given below.

The first coenopopulation of *C. Edentula* is found in the Kaplankir area as part of the goji-katran community (figure 1.1). The soil of the territory described is sandy. Geographic coordinates: N41, 2221E56, 0401. The plant community is dominated by *C. edentula.* The projected grass cover is 8%. In the place where this coenopopulation grows, 18 species of vascular plants have been recorded (table 1.1). Of these, shrubs - 3, semi-shrubs - 5, perennials - 4 and annuals - 6.

In the salsola-saxaul-caragan community (studied in the Shorja region), *C. edentula* is found as a member of the community (figure 1.2). The soil of the territory described is gypsum – bearing. Geographical coordinates: N42, 2148 E57, 4128. CP 2 grows under cliffs, where *Caragana grandiflora*, *Haloxylon aphyllum* and *Salsola orientalis* are dominant and subdominant in the plant community. The projected grass cover is 12%. The botanical composition of the community consists of 19 species of flowering plants (table 1.1). Of these, shrubs - 3, semi-shrubs - 4, perennials - 6 and annuals - 6

The third coenopopulation of the studied species is found in the northern part of the lake Sarikamish in the sagebrush-saxaul community between the chinka gorges in the say (figure 1.3). The soil of the territory described is gypsum – bearing. Geographic coordinates: N56, 6511E42, 2154. The plant community is dominated by *Haloxylon aphyllum.* The projected grass cover is 15%, *C. edentula* is found as a member of the community. Where this coenopopulation grows, 13 species of vascular plants have been recorded (table 1.1). Of these, shrubs - 4, semi-shrubs - 2, perennials - 5 and annuals – 2.

The fourth coenopopulation of *C. Edentula* was recorded in the eastern part of the lake Sarikamish (8 km north of the border of Turkmenistan) as part of the atraphaxis-white sagebrush community along the dry watercourse (say) (figure 1.4). The soil of the territory described is sandy. Geographical coordinates: N57, 6458E42, 2138. The plant community is dominated by *Artemisia terrae-albae.* The projected grass cover is 10%, *C. edentula* is found as a member of the community. In the place where this cenopopulation grows, 10 species of vascular plants have been registered (table 1.1). Of these, shrubs - 2, semi-shrubs - 4, perennials - 3 and annuals - 1.

CONCLUSION

Thus, the studied coenopopulations of *Crambe edentula* are normal, but incomplete. The ontogenetic spectra of specific coenopopulations are left-sided and right-sided. The ontogenetic spectrum of coenopopulations does not correspond to the characteristic one and does not reflect the biological characteristics of individuals of this species. The ontogenetic structure of the species is related to the ecological and coenotic conditions of growth and

fluctuations in weather conditions. *C. edentula* can be considered a threatened species, since all the studied coenopopulations are incomplete, due to the lack of a fraction of young individuals. This is also evidenced by the types of coenopopulations that are evaluated as young, mature, transitional, and mature.

The studied species is recommended for inclusion in the Red Book of the Republic of Uzbekistan. The total area of the populations is no more than 6 hectares. The number of populations within the studied coenopopulations does not exceed 500 individuals.

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CHLORELLA VULGARIS BIOMASSASINI OLISH SHAROITLARINI OPTIMALLASHTIRISH VA UNING QISHLOQ XO‘JALIGIDA BIOLOGIK FAOL PREPARAT SIFATIDA QO‘LLASH

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Annotatsiya: *Ushbu maqolada Samarqand viloyati sharoitida Chlorella vulgaris mikroalgasini laboratoriya sharoitida ko‘paytirish, uning biomassasini shakllantirish uchun maqbul oziqa muhitini aniqlash va olingan biomassadan qishloq xo‘jaligida biologik faol preparat sifatida foydalanish imkoniyatlari o‘rganildi. Tadqiqotlarda «04» oziqa muhiti, go‘ng sharbati bilan boyitilgan muhit hamda Knop eritmasidan foydalanildi. Kulturani o‘stirish jarayonida hujayralar sonining dinamikasi, nam va quruq biomassaning miqdori aniqlandi. Natijalar Chlorella vulgaris biomassasini olishda oziqa muhitining tarkibi muhim ahamiyatga ega ekanligini ko‘rsatdi.*

Kalit so‘zlar: *Chlorella vulgaris, mikroalga, biomassa, «04» oziqa muhiti, Knop eritmasi, go‘ng sharbati, biologik faol preparat, qishloq xo‘jaligi.*

Abstract; *The article investigates the cultivation of the microalga Chlorella vulgaris under laboratory conditions in the Samarkand region, with particular attention to nutrient media and biomass production. The study used the “04” nutrient medium, manure extract-enriched medium, and Knop solution. The dynamics of algal cell growth and the production of wet and dry biomass were determined during cultivation. The obtained results demonstrate that the composition of the nutrient medium plays an important role in the growth and biomass formation of Chlorella vulgaris. The study also discusses the potential application of Chlorella biomass as a biologically active preparation in agriculture.*

Keywords: *Chlorella vulgaris, microalgae, biomass, nutrient medium, Knop solution, manure extract, biologically active preparation, agriculture.*

INTRODUCTION

Hozirgi vaqtda qishloq xo‘jaligida ekologik xavfsiz, iqtisodiy jihatdan samarali va biologik faol preparatlardan foydalanish masalasi muhim ilmiy-amaliy yo‘nalishlardan biri hisoblanadi. Qishloq xo‘jaligi ekinlari va chorvachilik uchun qo‘llaniladigan biologik mahsulotlarning tabiiy xomashyodan olinishi, ularning tarkibida biologik faol moddalar mavjudligi hamda ishlab chiqarish texnologiyasining nisbatan soddaligi katta ahamiyatga ega.

Mikroalgalar ana shunday istiqbolli biologik resurslardan biridir. Ular tez ko‘payishi, biomassani qisqa muddatda shakllantirishi va tarkibida turli biologik faol komponentlar mavjudligi bilan ajralib turadi. Ayniqsa, Chlorella vulgaris yashil mikroalgasi laboratoriya va ishlab chiqarish sharoitlarida yetishtirish imkoniyati yuqoriligi sababli tadqiqotchilar e’tiborini tortib kelmoqda.

Chlorella vulgaris biomassasining shakllanishi tashqi muhit omillariga, jumladan, oziqa muhitining tarkibi, harorat, yorug‘lik, gaz almashinuvi va suspenziyaning aralashtirilishiga bog‘liq. Shu sababli mikroalga biomassasini ko‘p miqdorda olish uchun uning o‘sishi uchun qulay sharoitlarni aniqlash muhim hisoblanadi.

Tadqiqotning Samarqand viloyati sharoitida olib borilishi ham amaliy ahamiyatga ega. Hududda mavjud mahalliy resurslardan, jumladan, organik chiqindilardan foydalanib, mikroalga biomassasini olish imkoniyatlarini o‘rganish kelgusida biologik preparatlar ishlab chiqarishning iqtisodiy samaradorligini oshirishga xizmat qilishi mumkin.

MATERIALS AND METHODS

Tadqiqot obyekti sifatida Chlorella vulgaris mikroalgasining toza kulturasi olindi. Mikroalga namunalarini toza kulturaga ajratish va keyingi ko‘paytirish ishlari Muzafarov va Milogradova tomonidan yashil hamda ko‘k-yashil suvo‘tlarini yetishtirish uchun ishlab chiqilgan va O‘rta Osiyo sharoitiga moslashtirilgan «04» oziqa muhitiga go’ng sharbati qo’shilgan asosida olib borildi. Nazorat varianti sifatida mineral elementlarga asoslangan Knop eritmasi ishlatildi.

Tajriba uchun tayyorlangan oziqa muhitlari 500 ml hajmdagi kolbalarga 300 ml dan quyildi. Har bir kolbaga 30 ml dan Chlorella suspenziyasi kiritildi. Kulturaning o‘sish holati 24 va 48 soatdan keyin, shuningdek tajribaning 8-kunida baholandi.

Chlorella vulgarisni ko‘paytirishda oziqa muhitining tarkibi bilan bir qatorda harorat, yorug‘lik va gaz almashinuvi muhim omillar sifatida hisobga olindi. Tajriba materiallarida mikroalga biomassasini ko‘paytirish uchun 25–35 °C

harorat, 10–50 ming lyuks yorug‘lik va suspenziyani muntazam aralashtirish zarurligi ko‘rsatilgan.

Tajribada mineral oziqa muhiti tayyorlash uchun zarur tuzlar belgilangan miqdorda tortilib, suvda eritildi. Tayyorlangan oziqa muhiti 1 litr hajmdagi maxsus idishlarga yoki akvariumlarga joylashtirildi. Dastlabki ekish vaqtida Chlorella hujayralarining miqdori 1 ml suspenziyada 2 mln hujayrani tashkil etdi. Mikroalgalar sonining o‘zgarishi mikroskop yordamida muntazam ravishda hisoblab borildi.

Chlorella vulgaris biomassasining o‘sish dinamikasini aniqlashda hujayralar sonining boshlang‘ich ko‘rsatkichga nisbatan o‘zgarishi asosiy mezon sifatida qabul qilindi.

Nam biomassani aniqlash uchun avval toza filtr qog‘ozi elektron tarozida tortildi. So‘ngra yaxshilab aralashtirilgan Chlorella suspenziyasidan 10 ml namuna olindi va filtr qog‘ozidan o‘tkazildi. Filtr qog‘ozi mikroalga biomassasi bilan birga qayta tortildi. Olingan qiymat tegishli hisoblash orqali 1 litr kultivatsion muhitga aylantirildi.

Tajriba natijalari matematik jihatdan o‘rtacha qiymat va xatolik ko‘rinishida ifodalandi.

RESULTS

Tadqiqotlar davomida Chlorella vulgarisning turli oziqa muhitlarida o‘sish dinamikasi o‘rganildi. Tajriba natijalari oziqa muhitining tarkibi mikroalga hujayralarining ko‘payish tezligiga sezilarli ta’sir ko‘rsatishini ko‘rsatdi. 48 soatlik kultivatsiyadan keyin birinchi tajriba kolbasida Chlorella hujayralari dastlabki ko‘rsatkichga nisbatan 3,7 marta, ikkinchi kolbada 1,5 marta, uchinchi kolbada esa 1,2 marta oshgan. Tajribaning 8-kuniga kelib birinchi kolbadagi hujayralar soni boshlang‘ich miqdorga nisbatan 8,5 marta, ikkinchisida 5,3 marta, chiqindi suv ishlatilgan uchinchi variantda esa 3,2 marta ko‘paygan.

Bu natijalar oziqa muhitida mikroalganing rivojlanishi uchun zarur mineral va organik komponentlarning mavjudligi muhimligini ko‘rsatadi. Xususan, birinchi variantda kuzatilgan yuqori ko‘payish koeffitsienti Chlorella vulgaris uchun ushbu oziqa muhitining tarkibi qulay bo‘lganligini ko‘rsatadi.

Tadqiqotning keyingi bosqichida Chlorella vulgarisning nam va quruq biomassasi aniqlandi. Tajribalar 15–18 kunlik kultivatsiyadan keyin amalga oshirildi. Nam va quruq biomassaning miqdori mikroalga yetishtirilgan muhitning turiga qarab farq qilgan.

1-jadval

Chlorella vulgarisning nam va quruq biomassasi

Oziqa muhiti	Nam biomassa, mg/l	Quruq biomassa, mg/l
«04» + go‘ng sharbati	111,9 ± 1,2	1,2122 ± 0,5
Knop eritmasi	103,3 ± 2,2	1,1002 ± 1,1

Jadval ma’lumotlaridan ko‘rinadiki, «04» + go‘ng sharbati asosidagi oziqa muhitida nam biomassa miqdori 111,9 ± 1,2 mg/l, Knop eritmasida esa 103,3 ± 2,2 mg/l ni tashkil etgan.

Tajriba natijalarining yana bir muhim jihati shundaki, Chlorella vulgaris biomassasini olish uchun faqat mineral komponentlardan foydalanish bilan cheklanib qolmasdan, mahalliy organik resurslardan ham foydalanish imkoniyati mavjud. Go‘ng sharbatining oziqa muhitiga qo‘shilishi bunday yondashuvning amaliy imkoniyatlarini ko‘rsatadi.

Mikroalga biomassasini olishda kultivatsiya davomiyligi ham muhim ko‘rsatkich hisoblanadi. Tajriba ma’lumotlariga ko‘ra, 48 soat ichida hujayralar sonining sezilarli darajada oshishi kuzatilgan va 8-kun yakuniga kelib hujayralar soni yanada

DISCUSSION

Olingan natijalar Chlorella vulgaris biomassasini shakllantirishda oziqa muhitining tarkibi hal qiluvchi omillardan biri ekanligini ko‘rsatmoqda. Mikroalga fotosintez orqali organik moddalarni sintez qilishi bilan birga, hujayra biomassasining hosil bo‘lishi uchun mineral elementlar va boshqa oziq komponentlariga ehtiyoj sezadi.

Tadqiqotda qo‘llanilgan «04» oziqa muhiti O‘rta Osiyo sharoitiga moslashtirilganligi sababli mahalliy sharoitda Chlorella vulgarisni yetishtirish uchun amaliy jihatdan qulay variantlardan biri sifatida qaralishi mumkin. Tajriba natijalarida «04» + go‘ng sharbati variantida nam biomassaning yuqoriroq bo‘lishi organik komponentdan foydalanish imkoniyatini ko‘rsatadi.

Go‘ng sharbatidan foydalanishning yana bir muhim tomoni — mahalliy qishloq xo‘jaligi resurslarini qayta ishlash imkoniyatidir. Chorvachilik xo‘jaliklarida hosil bo‘ladigan organik chiqindilarni biologik jarayonlarga jalb etish orqali bir tomondan chiqindilardan foydalanish, ikkinchi tomondan esa mikroalga biomassasini olish mumkin. Chlorella biomassasining qishloq xo‘jaligidagi biologik faol preparat sifatidagi istiqboli uning tarkibidagi biologik faol komponentlar bilan bog‘liq.

Shunday qilib, hozirgi tajriba natijalari Chlorella vulgaris biomassasini olishning dastlabki texnologik bosqichlarini asoslab beradi, keyingi tadqiqotlar esa uning biologik faol preparat sifatidagi samaradorligini miqdoriy jihatdan baholash imkonini beradi.

CONCLUSION

Samarqand viloyati sharoitida Chlorella vulgaris mikroalgasini laboratoriya sharoitida yetishtirish natijalari oziqa muhitining tarkibi uning o‘sishi va biomassaning shakllanishiga bevosita ta’sir ko‘rsatishini ko‘rsatdi.

Chlorella vulgarisni kultivatsiya qilishda «04» oziqa muhiti va Knop eritmasidan foydalanish mumkinligi aniqlandi. 48 soatlik kultivatsiyadan so‘ng hujayralar sonining 3,7 martagacha, 8-kunda esa ayrim variantlarda 8,5 martagacha oshishi mikroalganing faol ko‘payish xususiyatini ko‘rsatdi.

Tadqiqot natijalari Chlorella vulgarisni mahalliy sharoitda biomassasi olinadigan istiqbolli mikroalga sifatida baholash imkonini beradi. Olingan biomassa kelgusida biologik faol preparatlar olish uchun xomashyo sifatida ishlatilishi mumkin.

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TECHNOLOGY FOR PRODUCING AN ECOLOGICAL FLAME RETARDANT FROM SPENT ALUMINIUM OXIDE

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Abstract. *This thesis evaluates the conversion of spent aluminium oxide from the Shurtan Gas Chemical Complex into an aluminium-hydroxide-based flame retardant for polymer materials. Local process studies and international experimental papers were compared. The analysis considered feedstock variability, alkaline treatment, particle properties and fire-performance indicators. The evidence shows that the performance of the recovered product depends not only on aluminium content but also on purity, dispersion and formulation. A controlled comparison with commercial aluminium hydroxide and subsequent surface modification are proposed as the next research steps.*

Keywords: *Shurtan Gas Chemical Complex, spent aluminium oxide, aluminium hydroxide, flame retardant, polyethylene, secondary raw material, fire resistance.*

INTRODUCTION

The use of mineral flame retardants in polymer materials improves fire safety while also raising the question of how industrial residues and secondary raw materials should be managed. Spent aluminium oxide formed during gas purification at the Shurtan Gas Chemical Complex is of interest as an aluminium-containing secondary resource. Converting this material into a useful flame retardant could reduce waste, support the use of locally available reagents and lower the material cost of polymer composites.

However, spent oxide is not chemically equivalent to pure Al_2O_3. Yunusov et al. [1] reported that the Shurtan residue contained vanadium at 0.28–1.40, titanium at 0.18–0.72, sodium at 0.74–1.25, calcium at 0.35–0.92 and chlorine at 0.80–2.50 wt%. Therefore, the process should not be designed around a single average composition. Each feedstock batch requires incoming quality control.

MATERIALS AND METHODS

The study was conducted as a comparative analysis of published local process studies [2, 3] and international papers on aluminium-hydroxide-containing polymer composites [4–7]. Sources were selected according to the

availability of a clear process description and results suitable for comparison. This thesis presents published indicators and differences calculated from them; it does not report new experimental measurements.

In the local process, the spent oxide is first thermally treated at 500 °C, then wet-ground in the presence of NaOH and transferred to an aluminate solution in an autoclave. After crystallisation at 55 °C, the precipitate is washed, dried at 100 °C and fractionated [2]. The ideal chemical basis of the process can be represented by the following equations:

$$Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2Na[Al(OH)_4]$$

$$Na[Al(OH)_4] \rightleftharpoons Al(OH)_3\downarrow + NaOH$$

RESULTS AND DISCUSSION

For the conversion of pure aluminium oxide to aluminium hydroxide, the theoretical mass ratio is approximately 1.53 kg of $Al(OH)_3$ per 1 kg of Al_2O_3. This value is a theoretical material-balance limit rather than an actual process yield. Sodium, chlorine and other impurities in the spent feedstock affect reagent consumption, washing requirements and product purity. Consequently, the product cannot be assessed from precipitate mass alone. The aluminium balance, moisture, phase composition and residual salts must also be determined.

Flame-retardant performance in polymers is evaluated using several indicators. Xu et al. [4] reported that, in HDPE with a total filler content of 40 wt%, the LOI increased from 17.5 vol% for neat polymer to 21.6 vol% after adding 40% ATH. In a formulation containing 30% ATH + 5% expandable graphite + 5% red phosphorus, LOI reached 30.1% and the UL-94 classification was V-0. The same formulation reduced pHRR from 1345.0 to 280.3 kW/m² relative to neat HDPE. Thus, a multicomponent system can be more effective than ATH alone at the same total filler level, but transferring this result directly to the Shurtan product requires a separate experiment.

Kong et al. [5] showed that surface-modified hydroxides can disperse more effectively in LLDPE and, at a 50 wt% loading, can provide an LOI of 34% and a V-0 classification. This finding demonstrates that particle-surface condition is as important as the chemical name of the flame retardant. Nevertheless, differences in polymer type, modifiers and test conditions mean that the reported values should not be treated as a universal performance ranking.

For further development of the local technology, a three-stage comparative experiment is appropriate: neat polymer, a composite containing commercial ATH and a composite containing ATH recovered from Shurtan residue. In the next stage, the local product can be combined with a surface modifier or expandable graphite. Polymer grade, mineral loading, particle size,

specimen thickness and thermal history must be kept constant for all samples. This design makes it possible to separate the effect of feedstock origin from the effect of dispersion.

CONCLUSION

Spent aluminium oxide from the Shurtan Gas Chemical Complex is a promising secondary raw material for producing an aluminium-hydroxide-based ecological flame retardant. Its technological performance depends on controlling feedstock variability, reducing residual salts after alkaline treatment and managing particle properties. The literature comparison indicates that combining aluminium hydroxide with other flame retardants or modifying its surface can improve fire-performance indicators. Further studies should compare the local product with commercial ATH under identical conditions and evaluate LOI, UL-94, calorimetry, mechanical properties and resource consumption together.

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CIRCULAR RECOVERY OF ALUMINIUM HYDROXIDE FROM GAS PURIFICATION RESIDUE FOR FIRE RESISTANT POLYETHYLENE

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Abstract. *The study examines a circular route for converting spent aluminium-containing adsorbent from the Shurtan Gas Chemical Complex into a functional filler for fire-resistant polyethylene. Published local process descriptions were combined with experimental studies of aluminium hydroxide, hybrid flame-retardant systems and modified mineral particles. The comparison shows that recovery efficiency and polymer performance must be evaluated as one chain: variable residue composition affects purification, while particle dispersion and formulation determine the final fire response. A staged validation programme based on aluminium balance, phase analysis and matched polymer tests is proposed.*

Keywords: *circular economy, Shurtan Gas Chemical Complex, aluminium-containing waste, aluminium hydroxide, polyethylene, flame retardant, mineral filler.*

INTRODUCTION

Gas purification units use mineral adsorbents that gradually lose their operating capacity and become a solid waste stream. When such a residue contains recoverable aluminium, disposal alone represents a loss of material value. The spent aluminium oxide generated at the Shurtan Gas Chemical Complex may therefore be considered both an environmental liability and a potential feedstock for aluminium hydroxide. Aluminium hydroxide is widely used as a halogen-free flame-retardant filler because it releases water during heating and contributes to the formation of a protective inorganic residue.

The circular-economy value of this approach depends on more than the presence of aluminium. The recovered powder must have a controlled chemical composition, suitable particle size and acceptable compatibility with the polymer matrix. A process that produces a large mass of wet precipitate but leaves soluble salts or poorly dispersed agglomerates may transfer the environmental problem into the finished composite. This thesis therefore focuses on the links between

residue quality, recovery operations and the performance of polyethylene composites.

MATERIALS AND METHODS

The analysis was based on local studies of spent aluminium oxide processing [1, 2] and published experiments on flame-retardant polymer systems [3–7]. The work is a structured literature comparison and does not claim new laboratory measurements. Reported values were retained with their original test conditions whenever available. Results from different polymer matrices were used to identify design principles, not to create a universal ranking.

The local route includes thermal pretreatment, alkaline conversion, crystallisation of aluminium hydroxide, washing, drying and particle classification [1]. In simplified form, the main reactions are:

$$Al_2O_3 + 2NaOH + 3H_2O \rightarrow 2Na[Al(OH)_4]$$

$$Na[Al(OH)_4] \rightleftharpoons Al(OH)_3\downarrow + NaOH$$

Theoretical stoichiometry was separated from measured process yield. For pure Al_2O_3, complete conversion corresponds to approximately 1.53 kg of $Al(OH)_3$ per kilogram of oxide. The value decreases in practical terms when the feed contains inert phases, moisture or elements that remain outside the aluminium balance.

RESULTS AND DISCUSSION

Feedstock variability and process control

Yunusov et al. [3] reported ranges of 0.28–1.40 wt% vanadium, 0.18–0.72 wt% titanium, 0.74–1.25 wt% sodium, 0.35–0.92 wt% calcium and 0.80–2.50 wt% chlorine in the Shurtan residue. The fivefold difference between the lower and upper vanadium values illustrates why reagent dosing should be linked to batch analysis. Sodium and chlorine are especially important after alkaline treatment because residual soluble salts can influence conductivity, moisture uptake and polymer processing.

The first control point should be the dry feed. Mass loss during thermal pretreatment should be recorded separately from the aluminium content. The second control point is the aluminate liquor, where dissolved aluminium and the composition of the insoluble residue should be measured. The third is the washed precipitate, for which moisture, phase composition and residual sodium should be determined. These controls permit a genuine aluminium recovery yield to be distinguished from the mass of a wet or contaminated precipitate.

Polymer performance and formulation effects

Published polyethylene studies show that aluminium hydroxide is effective only within a complete formulation. Xu et al. [4] reported an LOI of

21.6 vol% for HDPE containing 40% ATH, compared with 17.5 vol% for neat HDPE. When ATH was combined with expandable graphite and red phosphorus at a total filler level of 40%, LOI reached 30.1% and the UL-94 classification improved to V-0. The pHRR decreased from 1345.0 kW/m² for neat HDPE to 280.3 kW/m² for the three-component formulation. These values demonstrate the benefit of formulation synergy, but they do not establish the performance of recovered ATH without a matched comparison.

Particle surface is another independent design variable. Kong et al. [5] reported that surface-modified hydroxides in LLDPE achieved an LOI of 34% and a V-0 classification at a 50 wt% loading. The result indicates that interfacial adhesion and dispersion can be as important as the nominal mineral composition. Research on aramid-reinforced LDPE [6] also shows that improved flame retardancy may be accompanied by a substantial change in melt flow. Consequently, the selected formulation must be evaluated for both fire response and processability.

Proposed validation sequence

A practical validation sequence should begin with four matched formulations: neat polyethylene, polyethylene with commercial ATH, polyethylene with recovered ATH and polyethylene with surface-modified recovered ATH. The polymer grade, total mineral loading, particle-size range, specimen thickness and thermal history should be fixed. LOI and UL-94 can provide initial screening, while cone calorimetry, tensile testing and melt-flow measurements can identify trade-offs.

The next step is a mass and resource balance for the recovery process. The balance should include dry residue, alkaline liquor, insoluble solids, washed precipitate, wash water and any recycle stream. A kilogram of finished composite meeting the selected fire and mechanical criteria is a more meaningful economic basis than a kilogram of uncharacterised powder. This approach connects environmental benefit with product performance and avoids claiming circularity solely from waste diversion.

CONCLUSION

Spent aluminium oxide from the Shurtan Gas Chemical Complex can serve as a feedstock for aluminium hydroxide intended for fire-resistant polyethylene, provided that recovery and formulation are controlled as a single system. Residue variability requires batch-based chemical control, while product quality depends on washing, phase composition, moisture and dispersion. Literature evidence supports the use of hybrid flame-retardant systems and surface modification, but the local product must be compared with commercial

ATH under identical conditions. The proposed validation sequence combines aluminium balance, phase analysis, polymer fire tests, mechanical testing and resource accounting. It provides a realistic basis for developing a circular technology without confusing theoretical conversion with demonstrated industrial performance.

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МОНИТОРИНГ ПАТОГЕННЫХ И АНТИБИОТИКОРЕЗИСТЕНТНЫХ БАКТЕРИЙ В ЭКОЛОГИЧЕСКИХ ОБЪЕКТАХ И БИОЛОГИЧЕСКИЙ КОНТРОЛЬ НА ОСНОВЕ БАКТЕРИОФАГОВ

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Аннотация: *Широкое распространение антибиотикорезистентных микроорганизмов представляет собой одну из наиболее актуальных проблем современной медицины и экологической безопасности. Окружающая среда, особенно водные объекты, сточные воды и почва, играет существенную роль в сохранении и распространении микроорганизмов, а также в циркуляции генетических детерминант антибиотикорезистентности. В связи с этим систематический мониторинг микробиологических показателей окружающей среды, включая выявление патогенных и антибиотикорезистентных бактерий, приобретает особую значимость.*

Высокая специфичность бактериофагов в отношении бактерий-хозяев обусловливает перспективность их применения в качестве средств целенаправленного биологического контроля. Взаимосвязь экологического мониторинга и фагоконтроля рассматривается с позиций концепции One Health. Обоснована перспективность данного подхода для экологического биоконтроля, а также его потенциальное значение для последующих исследований в области фаготерапии.

Abstract: *The widespread dissemination of antimicrobial-resistant microorganisms represents one of the most pressing challenges in modern medicine and environmental safety. The environment, particularly aquatic ecosystems, wastewater, and soil, plays a significant role in the persistence and dissemination of microorganisms, as well as in the circulation of genetic determinants of antimicrobial resistance. Therefore, systematic monitoring of microbiological indicators in environmental settings, including the detection of pathogenic and antimicrobial-resistant bacteria, is of particular importance.*

The high specificity of bacteriophages toward their bacterial hosts makes them promising tools for targeted biological control. The relationship between

environmental monitoring and phage-based control is considered within the framework of the One Health concept. The potential of this integrated approach for environmental biocontrol, as well as its possible significance for further research in the field of phage therapy, is substantiated.

Ключевые слова: *экологический мониторинг, антибиотикорезистентность, патогенные бактерии, бактериофаги, фагочувствительность, фагоконтроль, биологический контроль, сточные воды, фаготерапия.*

Keywords: *environmental monitoring, antimicrobial resistance, pathogenic bacteria, bacteriophages, phage susceptibility, phage-based control, biological control, wastewater, phage therapy.*

ВВЕДЕНИЕ

Рост распространённости микроорганизмов, устойчивых к антимикробным препаратам, в настоящее время рассматривается как серьёзная медико-биологическая проблема глобального масштаба. Оценка антибиотикорезистентности исключительно в контексте клинических инфекций является недостаточной, поскольку устойчивые бактерии и генетические детерминанты резистентности циркулируют не только среди людей, но и в популяциях животных и различных компонентах окружающей среды [1, 2, 11].

Водные объекты, сточные воды, почва и другие экологические компоненты могут выступать резервуарами различных микроорганизмов и участвовать в распространении патогенных бактерий и детерминант антибиотикорезистентности. Особого внимания с позиции микробиологической безопасности заслуживают сточные воды, образующиеся в населённых пунктах, медицинских учреждениях и на фармацевтических предприятиях [2, 3].

В связи с этим современный мониторинг качества окружающей среды должен включать не только оценку физико-химических характеристик, но и систематическую оценку микробиологических рисков. Выявление патогенных бактерий, их видовая идентификация, а также определение чувствительности к антимикробным препаратам могут рассматриваться как важные составляющие экологического микробиологического мониторинга [1, 3, 12].

Одним из перспективных альтернативных подходов к контролю антибиотикорезистентных бактерий является использование бактериофагов. Бактериофаги представляют собой вирусы, специфически инфицирующие бактерии; литические фаги реплицируются в клетке-

хозяине и приводят к её лизису [4]. Выраженная специфичность бактериофагов к определённым бактериальным хозяевам создаёт предпосылки для их применения в качестве инструментов целенаправленного биологического контроля [4, 5].

ОСНОВНАЯ ЧАСТЬ

В рамках экологического мониторинга предполагается исследование образцов, отобранных из открытых водоёмов, сточных вод, источников питьевого водоснабжения и, при необходимости, почвы. Отбор образцов осуществляется в стерильных условиях с последующей транспортировкой в лабораторию в соответствии с установленными микробиологическими требованиями. При бактериологическом исследовании из образцов выделяются микроорганизмы, после чего изучаются их морфологические, культуральные и биохимические свойства. При необходимости для видовой идентификации могут применяться современные молекулярно-генетические методы. Чувствительность выделенных бактериальных штаммов к антибиотикам оценивается с использованием стандартных микробиологических методов. Выделенные антибиотикорезистентные штаммы на последующем этапе могут использоваться в качестве тест-культур при поиске соответствующих бактериофагов и оценке их литической активности.

Для выделения бактериофагов из объектов окружающей среды могут применяться методы обогащения с использованием бактерии-хозяина, последующей фильтрации и определения литической активности. Фаговую активность в отношении бактерий предполагается оценивать с использованием spot-теста и метода двойного агара по образованию характерных зон лизиса [4, 6].

При отборе бактериофагов необходимо учитывать их литическую активность, спектр хозяев, степень воздействия на различные бактериальные штаммы и стабильность. Для последующего практического применения принципиальное значение имеет также оценка генетической и биологической безопасности фагов [5, 7].

Результаты и обсуждение. Интеграция экологического мониторинга с бактериофаг-опосредованным биологическим контролем может быть реализована по принципу «выявление — оценка — контроль». На первом этапе проводится оценка микробиологического состояния экологического объекта. На втором этапе осуществляется идентификация патогенных и антибиотикорезистентных бактерий и определяется профиль их антибиотикорезистентности. На третьем этапе проводится поиск и

подбор литических бактериофагов, активных в отношении выявленных бактериальных штаммов. Такой комплексный подход расширяет информативность экологического мониторинга, поскольку позволяет оценивать не только факт присутствия определённого микроорганизма, но и его антибиотикорезистентность и фагочувствительность. Это, в свою очередь, создаёт возможность формирования более полного профиля микробиологического риска исследуемого экологического объекта.

Особый интерес в данном направлении представляют сточные воды. В их составе могут одновременно присутствовать остаточные количества антибиотиков, патогенные микроорганизмы и генетические детерминанты антибиотикорезистентности. Это обусловливает важность сточных вод как объекта исследования процессов экологической циркуляции и распространения антибиотикорезистентности [2, 3]. Результаты исследований свидетельствуют о возможности использования бактериофагов в системах очистки сточных вод с целью целенаправленного снижения численности определённых бактериальных групп и повышения эффективности биологического контроля [6, 8]. В этом контексте антибиотикорезистентные бактерии, выделенные в ходе экологического мониторинга, могут рассматриваться как тест-объекты для поиска и отбора бактериофагов с соответствующей литической активностью.

Ключевым биологическим свойством бактериофагов является их специфичность по отношению к бактериям-хозяевам. В отличие от антибиотиков, воздействующих на широкий спектр микроорганизмов в зависимости от конкретного препарата, бактериофаги потенциально позволяют осуществлять более направленное воздействие на определённые бактериальные популяции. Именно эта особенность представляет особый интерес для разработки методов целенаправленного биологического контроля [4, 5]. Вместе с тем применение фагов в целях биоконтроля требует тщательной оценки их биологических и генетических характеристик. В частности, лизогенные фаги потенциально могут участвовать в горизонтальном переносе генетического материала между бактериями. Поэтому при отборе фагов для биоконтроля приоритетное значение должны иметь литический тип взаимодействия с бактерией-хозяином, геномная безопасность и высокая специфичность действия [7, 9].

Перспективным направлением является также формирование коллекций бактериофагов на основе результатов экологического

мониторинга. В частности, поиск бактериофагов, активных в отношении *Escherichia coli, Klebsiella pneumoniae, Pseudomonas aeruginosa* и других бактерий, имеющих клиническое значение и выделенных из воды или сточных вод, позволяет одновременно изучать экологическое распространение данных микроорганизмов и их потенциальное медицинское значение [6, 8].

Концептуальной основой данного подхода является принцип **One Health**, согласно которому здоровье человека, животных и окружающей среды тесно взаимосвязано. Поэтому противодействие антибиотикорезистентности требует комплексного и межсекторального подхода [1, 10]. Своевременное выявление резистентных бактерий в окружающей среде и ограничение их дальнейшего распространения может рассматриваться как дополнительное направление общей стратегии профилактики инфекций и сдерживания антибиотикорезистентности.

При этом принципиально важно разграничивать понятия «фаготерапия» и «фагоконтроль». Фаготерапия подразумевает применение бактериофагов с целью лечения бактериальных инфекций у человека или животных. В отношении экологических объектов более корректными являются термины «фагоконтроль» или «биологический контроль на основе бактериофагов».

Вместе с тем изучение фагочувствительности патогенных и антибиотикорезистентных бактерий, выделенных из экологических объектов, может иметь дополнительное значение для развития исследований в области клинической фаготерапии. В частности, выявление литической активности бактериофага, выделенного из экологического источника, в отношении штаммов бактерий, имеющих клиническое значение, может служить основанием для дальнейшего изучения его терапевтических свойств [4, 5].

Таким образом, взаимосвязь между экологическим мониторингом, фагоконтролем и потенциальным применением бактериофагов в терапии может быть представлена в виде последовательной научно-практической цепочки: *экологический объект → выявление патогенной бактерии → оценка антибиотикорезистентности → поиск соответствующего литического бактериофага → определение фагочувствительности → экологический фагоконтроль → перспективные исследования в области фаготерапии.*

ЗАКЛЮЧЕНИЕ

Систематический мониторинг патогенных и антибиотикорезистентных бактерий в объектах окружающей среды имеет важное значение для оценки экологической составляющей проблемы антибиотикорезистентности. Водные объекты и сточные воды представляют особый интерес как потенциальные резервуары и пути распространения резистентных микроорганизмов и генетических детерминант антибиотикорезистентности [1–3].

Интеграция бактериофагов в систему экологического мониторинга создаёт предпосылки для перехода от простого выявления антибиотикорезистентных бактерий к их целенаправленному биологическому контролю. Специфичность и литическая активность бактериофагов обосновывают перспективность дальнейшего изучения их в качестве инструментов контроля антибиотикорезистентных бактерий [4, 5].

Параллельная оценка чувствительности выделенных бактерий к антибиотикам и бактериофагам позволяет получить более полную характеристику их биологических свойств и расширяет возможности комплексного изучения антибиотикорезистентности. Данный подход формирует научно-практическую связь между экологической и медицинской микробиологией и создаёт основу для последующих исследований в области фаготерапии.

Таким образом, формирование интегрированной системы «экологический мониторинг → мониторинг антибиотикорезистентности → фагоконтроль» может рассматриваться как перспективное направление современной микробиологии в рамках концепции One Health. Его дальнейшее развитие требует накопления данных о распространённости резистентных бактерий в различных экологических объектах, расширения коллекций литических бактериофагов и оценки их биологической и генетической безопасности.

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ГЕОЛОГИЧЕСКОЕ СТРОЕНИЕ И СЫРЬЕВЫЕ РЕСУРСЫ АНГРЕНСКОГО МЕСТОРОЖДЕНИЯ КАОЛИНОВ

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Аннотация. *В статье рассмотрены геологическое строение Ангренского месторождения и условия залегания каолиновых образований. Охарактеризованы палеозойские породы и сформированная по ним кора выветривания, а также юрская угленосная и каолиновая толщи. Выделены подугольные, межугольные, надугольные и пестроцветные каолины, рассмотрены их литологические особенности, мощность и качественные показатели. Приведены сведения о запасах первичных и вторичных каолинов, категориях их разведанности и особенностях использования. Показана связь геологического строения с распределением каолинового сырья и его вовлечением в процессы разработки месторождения.*

Ключевые слова: *Ангренское месторождение, каолины, геологическое строение, кора выветривания, угленосная свита, первичные каолины, вторичные каолины, сырьевые ресурсы.*

Abstract. *The paper considers the geological structure of the Angren kaolin deposit and the occurrence of kaolin formations. Paleozoic rocks and the weathering crust developed on them, as well as Jurassic coal-bearing and kaolin-bearing sequences, are characterized. Subcoal, intercoal, supra-coal and variegated kaolins are distinguished according to their geological position and lithological features. Data on the reserves, quality indicators and categories of primary and secondary kaolins are presented. The relationship between geological structure, distribution of kaolin raw materials and their involvement in the development of the deposit is considered.*

Keywords: *Angren deposit, kaolins, geological structure, weathering crust, coal-bearing sequence, primary kaolins, secondary kaolins, mineral resources.*

ВВЕДЕНИЕ

Ангренское месторождение характеризуется сложным сочетанием угленосных и каолинсодержащих образований, пространственное

положение и вещественный состав которых определяются особенностями геологического строения территории. Каолиновые образования имеют различное положение в разрезе и связаны как с корой выветривания палеозойских пород, так и с юрской толщей.

В геологическом строении участка принимают участие породы палеозойского, юрского, мелового, третичного и четвертичного возраста. Наиболее существенное значение для формирования каолиновых образований имеют верхнекарбоновые вулканогенные и вулканогенно-обломочные породы, подвергшиеся интенсивному выветриванию.

Цель работы — охарактеризовать геологическое строение Ангренского месторождения, условия формирования и распространения каолиновых образований, а также обобщить сведения об их сырьевых ресурсах и особенностях освоения.

Материалы и методы. Для характеристики каолиновых образований использовались сведения об их минеральном и литологическом составе, мощности и условиях залегания, а также данные о содержании Al_2O_3 и Fe_2O_3 и категориях запасов. При анализе сырьевых ресурсов учитывались балансовые и забалансовые запасы, а также генетические и литологические различия между первичными и вторичными каолинами. Геологическое строение рассматривалось с учётом последовательности залегания основных породных комплексов и пространственной связи каолиновых образований с корой выветривания и угленосной толщей.

Геологическое строение и каолиновая кора выветривания. Палеозойские образования представлены породами верхнего карбона: кварцевыми порфирами, андезито-дацитовыми порфирами, гранит-порфирами и туфами кварцевых порфиров и порфиритов. Верхняя часть этих пород подверглась глубокому выветриванию, сопровождавшемуся разрушением алюмосиликатов, выносом щелочных катионов и образованием глинистых минералов.

В коре выветривания выделялись три зоны, последовательно расположенные снизу вверх: зона выветрелых пород, зона каолинизированных пород и зона первичных каолинов. Каолины, образованные по порфировым и кварц-порфировым породам, характеризуются серовато-белой глиноподобной массой с утратой исходной порфировой структуры и значительным количеством кварца. В породах отмечаются пирит и отдельные сульфидные минералы.

Первичные каолины, образованные из туфов, представлены серовато-белой мучнистой массой с брекчиевидной структурой. При увлажнении они размокают и образуют пластичную массу. Таким образом, первичные каолины непосредственно связаны с процессами преобразования исходных палеозойских пород в пределах коры выветривания.

Юрская угленосная толща. Юрские отложения залегают на коре выветривания и подразделяются на угленосную и каолиновую свиты. Угленосная свита представлена переслаиванием угля, глин, алевролитов и песчаников и включает подугольную, угольную и надугольную подсвиты.

Подугольная подсвита залегает непосредственно на коре выветривания и сложена преимущественно песчаниками и алевролитами на каолиновой основе. В породах присутствуют обуглившиеся растительные остатки, линзочки угля и рассеянный пирит. Породы относятся к подугольным каолинам. В отдельных участках их мощность изменяется от 26 до 74 м, тогда как за пределами зоны разлома коры выветривания уменьшается до 1–2 м.

Угольная подсвита представлена пластами бурого угля нижнего и верхнего угольных комплексов, чередующимися с прослойками и линзами глин, алевролитов и песчаников каолинитового состава. Эти породы объединяются в группу неугольных каолинов. Межугольные каолины представлены песчаниками, алевролитами и глинами с преобладанием кварца в песчаной части и присутствием обломков туфов, порфиров и гранитов.

Надугольная подсвита залегает на верхнем угольном комплексе и распространена на значительной части площади. Её мощность изменяется от 2 до 30 м. В разрезе преобладают глины, содержание которых достигает 75 %, переслаивающиеся с песчаниками и алевролитами. По составу породы относятся к серым надугольным каолинам. В них встречаются обуглившийся растительный детрит, пирит и марказит.

Каолиновая свита и сырьевые ресурсы. Каолиновая свита залегает несогласно на надугольной подсвите. Породы имеют каолинистый состав и представлены преимущественно пестроцветными каолинами. Они сложены чередованием песчано-глинистых пород, алевролитов и песчаников. Окраска изменяется от красной и розовой до бурой, встречаются серые, тёмно-серые, сине-серые и бурые глины. Основная масса пород представлена каолинитом.

Первичные каолины имеют значительные разведанные ресурсы. В рассматриваемых материалах их балансовые запасы составляли 83 216 тыс. т, забалансовые — 38 131 тыс. т. Для их подсчёта учитывались кондиции, в том числе минимальная мощность каолинового горизонта 2 м.

Вторичные каолины представлены серыми надугольными и пестроцветными разновидностями, входящими в состав пород вскрыши. Они были детально разведаны в 1959–1963 гг. Для серых надугольных каолинов балансовые запасы категорий В и C_1 составляли соответственно 88 789 и 123 311 тыс. т, или 212 100 тыс. т при естественной влажности. Для пестроцветных каолинов балансовые запасы категорий В и C_1 составляли 35 437 и 180 274 тыс. т, всего 215 711 тыс. т. Забалансовые запасы категории C_1 составляли 15 305 тыс. т.

Качественные показатели различались между разновидностями. Для серых надугольных каолинов содержание Al_2O_3 составляло 23,70 % для категории В и 22,84 % для C_1, а Fe_2O_3 — соответственно 2,07 и 1,39 %. Для пестроцветных каолинов содержание Al_2O_3 составляло 26,84 и 25,29 %, Fe_2O_3 — 5,23 и 4,21 % соответственно.

При подсчёте запасов вторичных каолинов минимальная мощность включаемых в подсчёт запасов пород составляла 3 м. Для балансовых запасов минимальное содержание Al_2O_3 принималось 18 % для серых надугольных глин и 22 % для пестроцветных каолинов. Для забалансовых запасов соответствующие значения составляли 14 и 15,5 %.

Эксплуатация и связь с вскрышными породами. Особенности открытой разработки угольных пластов непосредственно влияли на положение каолиновых пород в горнотехническом разрезе. После вскрытия угольных пластов часть каолиновых образований переходила в состав вскрышных пород и размещалась во внешних отвалах. Серые надугольные каолины частично использовались Ангренским керамическим комбинатом.

В эксплуатационных данных для разреза «Ангренский» указана добыча пестроцветных и серых надугольных каолинов 3063 тыс. т; потери составляли 2003 тыс. т, отправлено потребителю 273 тыс. т, складировано 2790 тыс. т. Эти сведения характеризуют непосредственную связь между геологическим положением каолинов и технологией разработки угольного месторождения.

ЗАКЛЮЧЕНИЕ

Геологическое строение Ангренского месторождения определяется сочетанием палеозойских пород, коры выветривания и перекрывающих её

юрских угленосных и каолиновых образований. Каолиновые породы имеют различное геологическое положение и происхождение: первичные каолины связаны с корой выветривания палеозойских пород, а вторичные — преимущественно с юрской угленосной толщей и породами вскрыши.

В вертикальном разрезе последовательно прослеживаются подугольные, угольные и надугольные образования, выше которых распространена каолиновая свита с пестроцветными каолинами. Различия литологического состава, мощности и качественных показателей определяют неоднородность сырьевого потенциала отдельных разновидностей.

Значительные запасы первичных и вторичных каолинов и их различное положение в разрезе обусловливают необходимость учитывать геологическое строение при освоении месторождения. Открытая разработка угля сопровождается вовлечением каолинсодержащих пород в состав вскрышных отложений, что связывает геологическую характеристику месторождения с последующим горнотехническим преобразованием территории.

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2-SECTION

MODERN METHODS FOR COMPUTER AIDED DESIGN OF INFORMATION DEVICES IN ROBOTIC SYSTEMS

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Abstract. *Information devices connect a robot's physical environment to its control system. Their design must therefore address sensing performance, signal processing, mechanical integration, and the timing of data delivery. This article examines how computer-aided design can support these tasks through coordinated models, reusable components, simulation, and structured documentation. It distinguishes manual design, computer-aided design, and fully automatic design, and explains the organizational and technical resources required by a design system. A staged workflow is proposed for translating a technical specification into an implemented and tested device. Particular attention is given to the transfer of geometric models into simulation environments, the relationship between synthesis and analysis, and the verification of sensor and control interfaces. The article is a conceptual engineering review; it reports no experimental measurements or quantified performance gains. Its central argument is that design automation is most useful when requirements, models, and test evidence remain consistent throughout development. Simulation can support engineering decisions, but its conclusions depend on model assumptions and must be checked against physical behavior before deployment.*

Keywords: *computer-aided design; robotic systems; information devices; sensor integration; model-based design; simulation; design verification.*

Annotatsiya. *Informatsion qurilmalar robotning fizik muhiti bilan uning boshqaruv tizimi o'rtasidagi aloqani ta'minlaydi. Shu sababli ularni loyihalashda o'lchash xususiyatlari, signallarga ishlov berish, mexanik integratsiya va ma'lumotlarni uzatish vaqti hisobga olinishi kerak. Ushbu maqolada o'zaro muvofiqlashtirilgan modellar, qayta foydalaniladigan komponentlar, simulyatsiya va tizimli hujjatlashtirish orqali kompyuter yordamida loyihalash mazkur vazifalarni qanday qo'llab-quvvatlashi*

mumkinligi ko‘rib chiqiladi. Qo‘lda loyihalash, kompyuter yordamida loyihalash va to‘liq avtomatik loyihalash o‘rtasidagi farqlar ochib berilib, loyihalash tizimi uchun zarur tashkiliy va texnik resurslar tushuntiriladi. Texnik topshiriqni amalda yaratilgan va sinovdan o‘tkazilgan qurilmaga aylantirish uchun bosqichli ish jarayoni taklif etiladi. Geometrik modellarni simulyatsiya muhitlariga o‘tkazish, sintez va tahlil o‘rtasidagi bog‘liqlik hamda sensor va boshqaruv interfeyslarini tekshirishga alohida e’tibor qaratiladi. Maqola konseptual muhandislik sharhi bo‘lib, unda tajribaviy o‘lchovlar yoki samaradorlik oshishining miqdoriy natijalari keltirilmaydi. Asosiy fikr shundan iboratki, ishlab chiqish davomida talablar, modellar va sinov dalillari o‘zaro muvofiq bo‘lganda loyihalashni avtomatlashtirish eng katta foyda beradi. Simulyatsiya muhandislik qarorlarini qabul qilishga yordam berishi mumkin, biroq uning xulosalari modeldagi farazlarga bog‘liq bo‘lib, qurilmani foydalanishga topshirishdan oldin uning real ishlashi bilan solishtirib tekshirilishi kerak.

Kalit so‘zlar: *kompyuter yordamida loyihalash; robototexnik tizimlar; informatsion qurilmalar; sensorlar integratsiyasi; modelga asoslangan loyihalash; simulyatsiya; loyihani verifikatsiya qilish.*

Аннотация. *Информационные устройства обеспечивают связь между физической средой робота и его системой управления. Поэтому при их проектировании необходимо учитывать измерительные характеристики, обработку сигналов, механическую интеграцию и временные параметры передачи данных. В статье рассматривается, как системы автоматизированного проектирования могут поддерживать решение этих задач посредством согласованных моделей, повторно используемых компонентов, имитационного моделирования и систематизированного документирования. Раскрываются различия между ручным, автоматизированным и полностью автоматическим проектированием, а также объясняется назначение организационных и технических ресурсов, необходимых для функционирования системы проектирования. Предлагается поэтапный рабочий процесс преобразования технического задания в реализованное и испытанное устройство. Особое внимание уделяется переносу геометрических моделей в среды имитационного моделирования, взаимосвязи синтеза и анализа, а также проверке интерфейсов датчиков и системы управления. Статья представляет собой концептуальный инженерный обзор и не содержит результатов экспериментальных измерений или количественных оценок повышения эффективности. Основной тезис*

заключается в том, что автоматизация проектирования приносит наибольшую пользу при сохранении согласованности требований, моделей и данных испытаний на протяжении всего процесса разработки. Имитационное моделирование может поддерживать принятие инженерных решений, однако его выводы зависят от допущений модели и должны быть проверены посредством сопоставления с реальным поведением устройства до его ввода в эксплуатацию.

Ключевые слова: *автоматизированное проектирование; робототехнические системы; информационные устройства; интеграция датчиков; проектирование на основе моделей; имитационное моделирование; верификация проекта.*

Introduction

A robotic system requires reliable information about its own condition and the environment in which it operates. Sensors, signal-conditioning circuits, data-acquisition modules, and processing units supply this information to the controller. In this article, the term information devices refers to these components and their associated interfaces. Their function extends beyond collecting measurements: they must deliver interpretable data within the time and accuracy limits required by the task.

Designing such devices involves several connected engineering decisions. A sensor may meet an accuracy requirement while exceeding the available space or power budget. A communication interface may transmit all required variables but introduce delays that affect control. Mechanical placement can also change measurement quality. These dependencies make it difficult to develop the sensing subsystem independently of the robot's mechanical and control architecture.

Technical literature discusses information devices in mechatronic modules, robotics applications, and industrial automation [1–3]. Building on that scope, this article examines computer-aided design as a coordinated engineering process. The objective is to explain how a design system should organize requirements, models, software, and documentation, and how modern simulation methods can be incorporated without treating their outputs as proof of physical performance.

Scope and Analytical Approach

The discussion uses a conceptual analysis of engineering activities and a focused examination of technical documentation. The underlying workflow is organized around requirements definition, model development, design synthesis,

analysis, implementation, and testing. Software documentation provides examples of model exchange and simulation capabilities [4, 5]. Research on digital twins and the published scope of industrial robot safety standards provide additional context [6–8]. This is not a systematic literature review or an experimental comparison of design platforms.

The proposed workflow is evaluated by the consistency of its inputs and outputs. At each stage, an engineering decision should be linked to a requirement and an appropriate form of evidence. A geometry check can establish whether a component fits within an assembly; it cannot establish whether the component meets a measurement accuracy requirement. Likewise, successful software execution cannot by itself confirm that the sensor interface will behave correctly on the target hardware.

Design Methods and the Role of the Engineer

Design begins with a technical specification that defines the intended function, operating conditions, and acceptance criteria. For a robotic information device, this specification should identify the quantities to be measured, required measurement ranges, permitted uncertainty, sampling requirements, interface characteristics, and relevant environmental constraints. Ambiguous requirements should be resolved before they become assumptions in a model.

Three modes of design can be distinguished by the role of computational tools and human judgment. In manual design, engineers develop and check solutions without an integrated computational design environment. In computer-aided design, software supports modeling, calculation, drawing, and documentation, while engineers select assumptions and evaluate the outputs. Fully automatic design performs a defined sequence of transformations or searches without human intervention during that sequence. The boundaries of this distinction are summarized in Table 1.

Table 1. Design methods and responsibility.

Design method	Computational role	Engineering responsibility
Manual design	No integrated computational design workflow	Develop the solution and perform checks directly
Computer aided design	Software supports modeling, analysis, and documentation	Define assumptions, select solutions, and evaluate outputs

Design method	Computational role	Engineering responsibility
Fully automatic design	A predefined process generates or transforms solutions	Specify the problem and assess the generated solution

Automation does not remove the need to define the engineering problem. A generated layout or optimized parameter set remains conditional on the constraints, data, and models used to produce it. Engineers must determine whether these conditions represent the intended application and whether omitted effects could invalidate the proposed solution.

Architecture of a Computer Aided Design System

A computer-aided design system is an organizational and technical environment that combines engineering methods with computational resources. Its functions may include component selection, geometric modeling, mathematical analysis, circuit development, configuration management, and the production of manufacturing documents. These functions should exchange consistent data so that changes in one part of the design are reflected in the others.

The system can be divided into engineering subsystems and supporting services. Engineering subsystems perform defined tasks, such as developing a sensor arrangement or analyzing a signal-processing chain. Supporting services maintain shared libraries, project data, access controls, and document versions. This distinction helps prevent a drawing application or simulation package from being mistaken for a complete design system.

Seven categories of support are useful for describing architecture. Organizational support defines responsibilities, review procedures, and approval authority. Methodological support specifies how engineering tasks are performed and checked. Mathematical support supplies models, numerical methods, and optimization algorithms. Information support provides component data, calibration records, and design history. Software support implements the required functions. Technical support consists of computing resources, interfaces, and test equipment. Linguistic support establishes the languages, notation, and data definitions used to describe the design.

These categories are interdependent. A component library has limited value if its records omit units or operating conditions. An analysis algorithm cannot produce a meaningful comparison when different teams use incompatible coordinate frames. A design system should therefore make units, parameter definitions, and model versions explicit rather than leaving them to individual

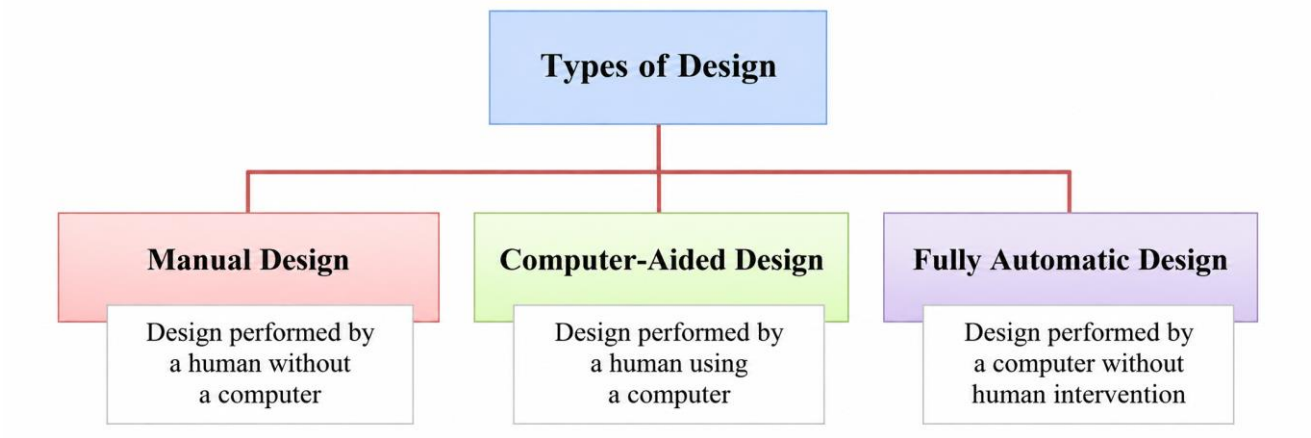

Figure 1. Classification of Design Types

interpretation.

A Staged Workflow for Information Device Design

The development process can be organized into three stages with feedback between them. The first stage establishes a conceptual description of the device and its place in the robot. It identifies the measurement function, intended data path, operating environment, and interactions with other subsystems. Functional diagrams and interface descriptions are appropriate outputs at this level.

The second stage converts the concept into parameterized models. Engineers select candidate sensors and processing arrangements, define signal and communication characteristics, and establish models that can be used for analysis. The required model depends on the question being investigated. A geometric model supports placement and interference checks, whereas a dynamic model supports the study of time-dependent behavior. An electrical model is needed when circuit characteristics determine signal quality.

The third stage develops the implementation and the evidence needed for acceptance. Its outputs include manufacturing drawings, circuit and connection diagrams, software configurations, calibration instructions, and test procedures. Prototype results may reveal missing assumptions or incompatible requirements, requiring a return to earlier stages. Table 2 identifies the principal outputs and checks for each stage.

Table 2. Design stages and verification evidence

Stage	Main outputs	Required checks
Concept definition	Functional description, measurement requirements, and interface boundaries	Requirements are interpretable and consistent with the robot task
Model development	Parameterized geometry, signal models, and candidate components	Units, assumptions, interfaces, and modeled behavior are appropriate
Implementation and testing	Drawings, software configuration, calibration instructions, and test records	The implemented device satisfies acceptance criteria under specified conditions

Synthesis and analysis operate throughout the workflow. Synthesis creates a candidate architecture or parameter set; analysis examines whether it satisfies the specification. An unsuccessful analysis should lead to a documented revision



Figure 2. CAD (Computer-Aided Design) System

rather than an unexplained change of requirements. When a requirement itself must change, the reason and consequences should be reviewed explicitly.

Modern Computational Methods

Parametric Modeling and Component Reuse

Parametric modeling represents dimensions and design properties as related variables. It allows engineers to examine alternative sensor positions, mounting arrangements, and enclosure dimensions without constructing each design independently. Reusable components can also reduce repeated drafting and calculation, provided that their interface definitions and operating limits remain valid for the new application.

Reuse requires more than copying a previous model. The designer should check the component's revision, measurement range, power requirements, communication protocol, and calibration assumptions. A reused component that worked in one robot may require a different analysis when installed in another environment or operated under different loading conditions.

Model Exchange and Multidomain Simulation

Model exchange connects geometric development with engineering analysis. MathWorks documents the import of CAD assemblies, Unified Robot Description Format models, and Robotics System Toolbox models into Simscape Multibody. The imported description is reconstructed using bodies, joints, and constraints, subject to the supported input format [4]. This provides an example of how an existing assembly description can be used as the basis for a simulation model.

After import, engineers should verify units, coordinate frames, joint definitions, and the properties required by the analysis. A model that displays correctly may still contain inappropriate mass properties or missing physical effects. Sensor noise, signal delay, friction, and actuator behavior should be represented when they materially affect the question being studied. Model complexity should follow the intended decision: additional detail is useful only when it improves the credibility or relevance of the analysis.

Model Based Development and Hardware Testing

Model-based development links the intended behavior of a subsystem to executable models and test cases. For example, a designer can examine how a selected sampling interval or filtering strategy affects the data available to a controller. MathWorks describes robotics development capabilities that include sensor modeling, control design, and verification progressing from simulation to hardware-in-the-loop testing [5]. These capabilities illustrate possible stages of development rather than guaranteed outcomes for every project.

Software-in-the-loop testing evaluates executable software within a simulated environment. Hardware-in-the-loop testing connects selected physical hardware to a simulation of other system elements. The latter can expose interface and execution-timing problems that are absent from an idealized

model. Both approaches require suitable test scenarios and a clear statement of which parts of the system are represented physically and which are simulated.

Digital Twins and Operational Feedback

A digital twin can extend modeling into commissioning and operation by linking a virtual representation to information about the physical system. Malik, Shao, and Tarakhovsky examine the components that should be represented in a digital twin of a manufacturing robot system and discuss its use throughout the installation's lifecycle [6]. Their work supports treating the robot as an integrated system rather than modeling isolated geometry alone.

For an information device, operational feedback could be used to compare modeled sensor behavior with measured behavior or to investigate changes after replacement and recalibration. Such use requires an explicit procedure for updating parameters and checking data quality. A static three-dimensional model should not be treated as an operational digital twin merely because it depicts the same robot.

Sensor Integration and Functional Documentation

The sensing subsystem should be designed as a complete measurement path. Its elements include the measured physical quantity, the sensing element, signal conditioning, acquisition, processing, and delivery to the controller. Each interface introduces assumptions about units, ranges, timing, and data validity. Recording these assumptions makes it possible to test whether the subsystem can supply the information required for control.

A functional automation diagram identifies what each component does and how information moves between components. A connection diagram records the physical or electrical connections needed for implementation. A control algorithm describes how measured information is used to select an action. These documents serve different purposes and should remain consistent as the design changes.

Useful documentation also specifies the behavior of the system when measurements become unavailable or invalid. Depending on the application, engineers may need to address a disconnected sensor, an out-of-range value, a lost communication message, or a failed calibration check. Acceptance tests should examine the resulting behavior as well as normal operation. Detecting a fault is insufficient if the controller continues to use the affected measurement as valid input.

Verification and Safety Considerations

Design verification asks whether the implementation satisfies its specified requirements. Validation examines whether those requirements and the resulting

system are suitable for the intended use. A measurement device may satisfy its specified sampling rate and still provide insufficient information for the robot's actual task. This distinction should guide the selection of simulation scenarios and physical tests.



Figure 3

Robots can perform repetitive tasks with consistent behavior under suitable conditions, but their accuracy is not guaranteed by automation. Incorrect programming, calibration errors, sensor faults, mechanical compliance, and unsuitable operating conditions can all affect the result. Consequently, a design claim should identify the conditions under which it was evaluated and the evidence supporting it.

Industrial robot safety must be considered at both the robot and application levels. ISO 10218-1:2025 addresses industrial robots, while ISO 10218-2:2025 addresses industrial robot applications and robot cells [7, 8]. These references are relevant to industrial use and should not be assumed to cover medical, consumer, or other robot categories. The applicable requirements must be selected for the actual system and use case.

Simulation supports the identification of possible problems, but it does not automatically establish compliance or safe operation. Physical tests remain necessary where acceptance depends on real measurements, interfaces, or behavior. The final design record should connect each requirement to the model, inspection, calculation, or test used to evaluate it.

Discussion

The proposed workflow places consistency at the center of design automation. Parametric models support the examination of alternatives; shared component data support reuse; simulation supports analysis before implementation. Their practical value depends on whether the information passed between them describes the same design. An outdated sensor record or an unrecorded parameter change can undermine a technically sophisticated analysis.

Automation can reduce repeated engineering work, but this article does not quantify reductions in development time, cost, or physical testing. Those outcomes would require a defined baseline and a controlled comparison or documented project evidence. For the same reason, no particular software platform is presented as universally preferable. Platform selection should follow

the required modeling functions, exchange formats, hardware interfaces, and competence of the engineering team.

A practical evaluation of the workflow would compare otherwise comparable projects using predefined indicators, such as review effort, integration defects, and agreement between simulated and measured behavior. Such an evaluation would test the proposed benefits rather than assume them. The present article provides an engineering structure for that work and identifies the records needed to make its results interpretable.

Conclusion

Computer-aided design of robotic information devices should coordinate requirements, sensing models, mechanical integration, software, and implementation documents. The distinction between manual, computer-aided, and fully automatic design clarifies which tasks are performed computationally and which decisions remain the responsibility of the engineer.

A staged process with explicit feedback allows candidate solutions to be revised when analysis or testing reveals a problem. Parametric modeling, model exchange, and simulation can support this process when their assumptions and interfaces are checked. Hardware testing and operational feedback then provide evidence about behavior that a purely virtual model cannot establish on its own.

The principal recommendation is to maintain a traceable relationship between the specification, the current design, and the evidence used for acceptance. This relationship makes design automation auditable and gives engineers a defensible basis for deciding whether an information device is ready for integration into a robotic system.

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A MODEL FOR IMPROVING AND IMPLEMENTING SOFTWARE TO DEVELOP STUDENTS' DIGITAL-TECHNOLOGICAL COMPETENCE

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Abstract. *This article presents a model for improving and implementing software to develop students' digital and technological competence. The novelty lies in integrating pedagogical and digital technologies into a unified model. The study employs system analysis, modeling, and comparative analysis. The findings confirm improved effectiveness in developing students' professional competencies.*

Keywords: *digital and technological competence, software, implementation model, digital technologies, educational process, students, professional competencies.*

Аннотация. *В статье представлена модель совершенствования и внедрения программного обеспечения для развития цифрово-технологической компетентности студентов. Новизна исследования заключается в интеграции педагогических и цифровых технологий в единую модель. Использованы методы системного анализа, моделирования и сравнительного анализа. Результаты подтверждают повышение эффективности формирования профессиональных компетенций обучающихся.*

Ключевые слова: *цифрово-технологическая компетентность, программное обеспечение, модель внедрения, цифровые технологии, образовательный процесс, студенты, профессиональные компетенции.*

Resumen. El presente artículo propone un modelo para la mejora e implementación de software orientado al desarrollo de la competencia digital y tecnológica de los estudiantes. La novedad del estudio radica en la integración de tecnologías pedagógicas y digitales en un modelo educativo unificado. En la investigación se emplean métodos de análisis sistémico, modelización y análisis comparativo. Los resultados obtenidos confirman la contribución del modelo

propuesto a la mejora de la eficacia del proceso de desarrollo de las competencias profesionales de los estudiantes.

Palabras clave: competencia digital y tecnológica, software, modelo de implementación, tecnologías digitales, proceso educativo, estudiantes, competencias profesionales.

INTRODUCTION

The modern digital transformation of the education system necessitates the development of students' digital and technological competence as one of the key components of their professional training [3]. In the context of the active integration of information and communication technologies, the development and implementation of software that ensures the effective development of students' digital skills is becoming increasingly important.

Despite the considerable number of studies in this field, issues related to the comprehensive improvement of software in accordance with modern educational requirements remain insufficiently explored. Therefore, the purpose of this study is to develop a model for improving and implementing software aimed at enhancing the effectiveness of developing students' digital and technological competence.

Literature Review on the Research Topic. An analysis of the scientific literature shows that the development of students' digital and technological competence has been widely addressed in both national and international studies. Particular attention is paid to the use of digital educational technologies, electronic educational resources, and specialized software to improve the quality of students' professional training [1].

At the same time, most existing studies focus on individual aspects of the digitalization of the educational process. The issues of comprehensive improvement and implementation of software that ensures the systematic development of students' digital and technological competence remain insufficiently studied. This highlights the need to develop a model that integrates modern pedagogical approaches, digital technologies, and software tools into a unified educational system.

Research Methodology. The methodological foundation of the study was based on systemic, competency-based, and activity-based approaches. The research employed methods of analyzing and generalizing scientific literature, comparative analysis, systems analysis, pedagogical modeling, and expert evaluation [2]. The development of the model for improving and implementing software was carried out taking into account the modern requirements of the digital transformation of education and the principles of developing students'

digital and technological competence. The effectiveness of the proposed model was evaluated based on an analysis of its structural components, functional capabilities, and alignment with educational objectives.

Analysis and Results of the Study. In the context of the digital transformation of higher education, one of the priority areas is the development of students' digital and technological competence through modern software tools. The analysis conducted showed that existing digital educational platforms and software products offer a wide range of functional capabilities; however, in most cases, they are focused on addressing specific educational tasks and do not ensure the comprehensive development of students' digital and technological competence. This necessitates the development of a model that integrates pedagogical, technological, and organizational components into a unified system [4].

The proposed model for improving and implementing software is based on the principles of systematicity, modularity, adaptability, interactivity, and practical orientation. The structure of the model includes interconnected components: target, content, technological, organizational, diagnostic, and outcome-based components.

The target component defines the main objectives of the software aimed at developing students' sustainable digital competencies [5], enhancing their skills in working with modern information technologies, digital educational resources, cloud services, data analysis tools, and collaborative interaction tools.

The content component provides for the integration of theoretical materials, practical assignments, interactive modules, electronic educational resources, multimedia content, and automated knowledge assessment tools. This approach ensures the consistent acquisition of digital technologies by students and contributes to the development of their professional competencies.

The technological component of the model includes the use of web platforms, mobile applications, cloud technologies, distance learning systems, artificial intelligence technologies, educational data analysis tools, and digital instruments for monitoring learning activities [6]. The integration of these technologies makes it possible to ensure flexibility in the educational process and increase student engagement.

The organizational component provides for the phased implementation of the software. At the first stage, the level of students' digital and technological competence is diagnosed and their educational needs are analyzed. The second stage involves the design and adaptation of the software in accordance with the specific requirements of the educational program. At the third stage, the software

product is practically implemented in the educational process, accompanied by methodological support for teachers and students. The final stage involves monitoring the results, evaluating the effectiveness of the model, and its subsequent improvement.

Table 11.

Criteria and Indicators for Assessing Students' Digital and Technological Competence

Competence Criterion	Indicators	Assessment Method	Expected Outcome
Digital Literacy	Proficiency in using computers and mobile devices, operating systems, and office applications	Practical tasks, testing	Development of skills for independent and effective use of digital tools
Information Literacy	Searching, selecting, analyzing, evaluating, and processing information	Case-based tasks, practical assignments	Development of skills for critical analysis and effective use of information
Digital Communication Competence	Use of email, videoconferencing, cloud platforms, and online collaboration tools	Observation, project-based activities	Development of effective digital interaction and communication skills within a team
Digital Content Creation Competence	Creation of text documents, presentations, infographics, videos, and other digital products	Portfolio assessment, project work	Development of the ability to independently create digital products
Technological Competence	Use of modern software platforms, learning management systems (LMS), mobile applications, and artificial intelligence tools	Practical activities	Development of skills for applying modern technologies in professional activities
Cybersecurity Competence	Password protection, personal data security, and compliance with safe Internet practices	Testing, situational tasks	Development of an information security culture

[1] **Source: developed by the author.**

Self-Directed Learning Competence	Use of electronic educational resources, independent learning, and self-development	Electronic portfolio, monitoring	Strengthening skills for lifelong learning and self-development
Professional Digital Competence	Use of specialized software relevant to the field of study and development of digital solutions	Project work, practical tasks	Development of the ability to effectively apply digital technologies in professional activities

The diagnostic component is based on a system of qualitative and quantitative indicators that make it possible to assess the level of development of students' digital and technological competence [7]. The main criteria include the level of proficiency in using digital tools, the ability to apply modern information technologies to solve professional tasks, digital communication skills, information security awareness, data analysis skills, and the ability to independently master new digital services.

The analysis of the research results showed that the implementation of the developed model contributes to improving the effectiveness of the educational process by expanding opportunities for independent learning, personalizing educational trajectories, and automating the assessment of learning outcomes. The use of software ensures a higher level of students' digital activity, increases learning motivation, and contributes to the development of critical thinking, digital literacy, and professional mobility.

The practical significance of the proposed model lies in the possibility of applying it in educational institutions of various profiles regardless of the field of study. The model has a modular structure, which allows it to be adapted to the requirements of a specific educational program, students' level of preparation, and the characteristics of the digital educational environment.

The results obtained indicate that the comprehensive improvement and implementation of software creates favorable conditions for developing students' digital and technological competence, improving the quality of professional training, and meeting the modern requirements of digital transformation in higher education [8]. The proposed model can serve as a methodological and practical basis for further development of the digital educational environment of higher education institutions and improvement of professional learning technologies.

CONCLUSION

The study confirmed the feasibility of developing and implementing a model for improving software to foster students' digital and technological competence. The proposed model provides comprehensive integration of modern digital technologies, pedagogical approaches, and software tools, thereby contributing to the effectiveness of the educational process and the quality of students' professional training.

The findings indicate that the use of the developed model contributes to the development of students' digital competencies, enhances their motivation to learn, and increases their readiness for professional activities in the digital economy. The practical significance of the study lies in the potential application of the model in higher education institutions across various fields of study. Further research should focus on the experimental validation of the model and the evaluation of its effectiveness under different educational conditions.

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UZLUKSIZ TA’LIM TIZIMIDA YOSHLARNI HARBIY-VATANPARVARLIK RUHIDA TARBIYALASH JARAYONINING PEDAGOGIK-INNOVATSION MEXANIZMLARI VA FALSAFIY TALQINI

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Annotatsiya: *Ushbu tezis uzluksiz ta’lim tizimida yoshlarni harbiy-vatanparvarlik ruhida tarbiyalash jarayonining pedagogik-innovatsion mexanizmlari hamda ularning falsafiy talqinini tahlil qiladi. Tadqiqotda kompetensiyaviy yondashuv, aksiologik tahlil, dizayn-tadqiqot va aralash metodlar uyg‘unlashtirildi. Yangilik sifatida “motivatsiya–tajriba–refleksiya–baholash” zanjiri hamda raqamli simulyatsiyalar, loyihaviy ta’lim va servis-learning integratsiyasi asosidagi model taklif etiladi.*

Abstract: *The thesis examines pedagogical and innovative mechanisms for cultivating military-patriotic education among youth within lifelong education and provides a philosophical interpretation of its value foundations. The methodology combines a competency-based approach, axiological analysis, design-based research, and mixed methods. Scientific novelty is presented through the “motivation–experience–reflection–assessment” chain and an integrated model using digital simulations, project-based learning, and service-learning to strengthen civic responsibility and readiness for practical action.*

Kalit so‘zlar*: uzluksiz ta’lim; harbiy-vatanparvarlik tarbiyasi; pedagogik innovatsiya; kompetensiya; aksiologiya; raqamli simulyatsiya; refleksiya; baholash.*

Keywords*: lifelong education; military-patriotic education; pedagogical innovation; competency; axiology; digital simulation; reflection; assessment.*

ASOSIY QISM

Uzluksiz ta’lim tizimida yoshlarni harbiy-vatanparvarlik ruhida tarbiyalash jarayoni deganda maktabgacha bosqichdan oliy ta’limgacha, shuningdek, kasbiy qayta tayyorlash va norasmiy ta’lim yo‘nalishlarida fuqarolik burchi, ijtimoiy mas’uliyat, jamoaviy hamkorlik va himoyaviy tayyorgarlikni uyg‘un shakllantirishga qaratilgan izchil pedagogik ta’sirlar majmui tushuniladi. Mazkur jarayon mexanizmi qiymatlarning (vatan, burch,

sha’n) shaxs motivatsiyasiga aylanishi, amaliy tajriba orqali mustahkamlanishi va refleksiya hamda baholash vositalari bilan barqarorlashuvida namoyon bo‘ladi. Masalan, kollej yoki universitetda “xavfsizlik madaniyati” modulini loyiha ishiga bog‘lab, jamoa bilan vaziyatli topshiriqlarni bajarish yoshda “men qila olaman” ishonchini hamda mas’uliyatni kuchaytiradi. Jahon miqyosida 2023 yilda internetdan foydalanuvchilar ulushi 65 foizdan oshgani haqidagi ko‘rsatkichlar raqamli pedagogik vositalar ta’sir doirasini kengaytirishini ko‘rsatadi, bu esa ta’limdagi innovatsiyalarni harbiy-vatanparvarlik tarbiyasiga tatbiq etish imkonini sezilarli oshiradi. Ilmiy izoh sifatida kompetensiyaviy yondashuv shaxsning bilimni emas, balki vaziyatda harakat qila olish qobiliyatini mezon qiladi, shu sababli tarbiya mazmuni qiymat–faoliyat–natija triadasi bo‘yicha loyihalanishi zarur [1].

Pedagogik-innovatsion mexanizmlarning falsafiy talqini, avvalo, aksiologik asoslarni aniqlashdan boshlanadi, chunki vatanparvarlik tushunchasi qadriyat sifatida individual ongda ma’no kasb etmaguncha barqaror xulq-atvorga aylanmaydi. Bu mexanizmda qadriyatlar ijtimoiy tajriba, til va ramzlar orqali interiorizatsiyalanib, keyin esa amaliy faoliyatda eksteriorizatsiya qilinadi, ya’ni shaxs o‘z e’tiqodini xatti-harakatga ko‘chiradi. Masalan, tarixiy xotira bilan bog‘liq muzey-pedagogika darslari keyinchalik jamoat xavfsizligi bo‘yicha volontyorlik amaliyotiga ulanib ketganda, “bilish” va “qilish” o‘rtasidagi tafovut kamayadi. Ta’lim psixologiyasida motivatsiya tadqiqotlari ko‘pincha ichki motivatsiya tashqi rag‘batdan ko‘ra uzoq muddatli natija berishini ko‘rsatadi; amaliy ta’limdagi barqarorlik ko‘rsatkichlari dastur yakunidan keyin 6–12 oyda saqlanib qolgan ko‘nikmalar ulushi bilan baholanadi. Ilmiy izoh nuqtayi nazaridan, pragmatizm va faoliyat falsafasi tarbiya samaradorligini “qadriyatning amalda tasdiqlanishi” orqali o‘lchashni taklif etadi, shu bois innovatsion mexanizmlar refleksiya va portfel baholash bilan mustahkamlanishi kerak [2].

Uzluksiz ta’limda mexanizmlarni institutsional darajada loyihalash deganda boshqaruv, o‘quv rejalari, o‘qituvchi kompetensiyalari va ta’lim muhitining yagona tizim sifatida ishlashi nazarda tutiladi. Mexanizmning ishlash tartibi “maqsad–mazmun–metod–muvofiqlashtirish–monitoring” zanjiri orqali amalga oshadi, bunda har bir bo‘g‘in raqamli va an’anaviy vositalar bilan qo‘llab-quvvatlanadi. Masalan, umumta’lim maktabida sinf rahbari, jismoniy tarbiya o‘qituvchisi va psixolog birgalikda “risklarni boshqarish va jamoada qaror qabul qilish” mavzusida integratsiyalashgan haftalik o‘tkazsa, bu ham jismoniy, ham kommunikativ, ham axloqiy kompetensiyalarni bir paytda faollashtiradi. Ta’lim sifatini baholashda ishtirokchilar qamrovi, davomat,

yakuniy topshiriqlar bajarilish foizi va kuzatuv varaqalari bo‘yicha indikatorlar qo‘llanadi; amaliyotda 80–90 foiz davomat ko‘rsatkichi barqarorlikning minimal sharti sifatida talqin qilinadi. Ilmiy izoh sifatida tizimli yondashuv ta’limni “elementlar yig‘indisi” emas, balki “o‘zaro ta’sir qiluvchi subsistemalar” deb ko‘radi, shuning uchun harbiy-vatanparvarlik tarbiyasi alohida tadbirlar majmui emas, o‘quv jarayoniga singdirilgan dizayn bo‘lishi lozim [3].

Pedagogik innovatsiyalar orasida raqamli simulyatsiya va stsenariy asosida o‘qitish mexanizmi alohida ahamiyatga ega, chunki u xavfsiz muhitda murakkab vaziyatlarni modellashtirish imkonini beradi. Ushbu mexanizmda o‘quvchi real hayotga yaqin sharoitda qaror qabul qiladi, xatoni ko‘radi, qayta urunadi va refleksiya orqali sabab-oqibat bog‘lanishlarini tushunadi. Masalan, “favqulodda vaziyatda evakuatsiya” bo‘yicha VR yoki kompyuter simulyatsiyasi qo‘llansa, o‘quvchi marshrut tanlash, vaqtni rejalash va jamoa bilan muvofiqlashish kabi ko‘nikmalarni sinab ko‘radi. Ta’lim texnologiyalari bozorida VR/AR yechimlari ulushi yildan yilga o‘sayotgani haqidagi ochiq hisobotlar (yillik o‘sish sur’atlari ko‘pincha 20–30 foiz diapazonida tilga olinadi) bunday vositalarning tez tarqalishini ko‘rsatadi, demak, ularni tarbiyaviy maqsadlarga moslashtirish dolzarb. Ilmiy izoh sifatida kognitiv yuklama nazariyasi simulyatsiyada axborot oqimini bosqichma-bosqich berish zarurligini asoslaydi, aks holda ko‘nikma shakllanishi o‘rniga charchoq va befarqlik kuchayishi mumkin [4].

Loyihaviy ta’lim va servis-learning mexanizmi harbiy-vatanparvarlik tarbiyasini “jamiyatga foyda keltiradigan amaliy xizmat” bilan bog‘lagani uchun pedagogik jihatdan samarali hisoblanadi. Bu mexanizmning ishlashi muammoni aniqlash, manfaatdor tomonlar bilan kelishish, loyiha rejasini tuzish, natijani jamoatchilikka taqdim etish va refleksiya bosqichlari orqali kechadi. Masalan, talaba-yoshlar mahallada “xavfsiz yo‘lak” tashabbusi doirasida yo‘l belgilari bo‘yicha targ‘ibot, xavfsiz yurish qoidalari bo‘yicha trening va monitoring o‘tkazsa, burch va hamjihatlik qadriyatlari konkret harakatga aylanadi. Ta’limda servis-learning dasturlarida ishtirok etganlarning ijtimoiy ishonch va fuqarolik faolligi ko‘rsatkichlari oshishi ko‘plab tadqiqotlarda qayd etiladi; amaliy mezon sifatida loyiha ishtirokchilari soni, bajarilgan ish soatlari va hamkor tashkilotlar soni olinadi. Ilmiy izoh nuqtayi nazaridan, konstruktivizm nazariyasi bilimning ijtimoiy hamkorlikda “qurilishi”ni ta’kidlaydi, shu bois loyihaviy mexanizm tarbiyaviy maqsadlarda ham barqaror natija beradi [5].

Refleksiya va baholash mexanizmi tarbiya jarayonida “ko‘rinmas natijalar”ni aniqlash va ularni rivojlantirish traektoriyasiga aylantirishga xizmat

qiladi. Mexanizmning yurishi diagnostika mezonlarini belgilash, o‘zini-o‘zi baholash vositalarini joriy etish, murabbiy fikr-mulohazasini berish va portfel asosida dinamikani kuzatish bosqichlaridan iborat bo‘ladi. Masalan, haftalik reflektiv kundalik, “kritik hodisa” tahlili va rubrika asosida baholash birgalikda qo‘llansa, o‘quvchi o‘zida mas’uliyat, intizom va jamoaga sadoqatning qaysi jihatlari sustligini aniq ko‘ra boshlaydi. Amaliyotda rubrikalar 4–5 pog‘onali shkalada tuziladi va semestr davomida kamida 3 marta o‘lchov olish o‘sish dinamikasini ishonchliroq ko‘rsatadi, chunki bitta o‘lchov vaziyatga bog‘liq tasodifiylikni oshiradi. Ilmiy izoh sifatida pedagogik o‘lchash nazariyasi validlik va reliabellikni ta’minlash zarurligini uqtiradi; shuning uchun indikatorlar xulqiy, kognitiv va affektiv komponentlarni alohida aks ettirishi lozim [1].

Mazkur mexanizmlarni falsafiy-ontologik nuqtayi nazardan izohlash shuni ko‘rsatadiki, tarbiya jarayoni shaxsning “kimman” degan savoliga “men jamiyatning mas’ul a’zosiman” degan javobni amaliy faoliyat orqali barqarorlashtiradi. Mexanizm ichida identifikatsiya, normativ yo‘nalish va ma’naviy iroda o‘zaro bog‘lanadi, ya’ni shaxs qadriyatni tan oladi, me’yorni qabul qiladi va uni hayotiy odatga aylantiradi. Masalan, jamoaviy intizomni talab qiladigan sport-mashg‘ulotlari, saf tayyorgarligi elementlari va “jamoa yetakchiligi” treninglari bir butun tizimga keltirilsa, o‘quvchi o‘zining hissasini jamoa natijasiga bog‘lab fikrlay boshlaydi. Tarbiyaviy dasturlarda haftasiga 2 soatlik amaliy modul va oyiga 1 marta ijtimoiy loyiha tadbiri kiritilishi vaqt resursi nuqtayi nazaridan minimal, biroq barqaror ta’sir beruvchi konfiguratsiya sifatida qo‘llanishi mumkin; bunda yil davomida 60–70 soat atrofida maqsadli ta’sir shakllanadi. Ilmiy izoh sifatida normativ etika va fuqarolik fazilatlari konsepsiyasi tarbiyani shaxsiy manfaat bilan umumiy manfaat o‘rtasidagi muvozanatni topish jarayoni deb ko‘radi, demak, mexanizmlar faqat buyruqbozlikka emas, ma’no va mas’uliyatga tayanishi kerak [2].

Pedagogik-innovatsion modelni operatsionlashtirish uchun mezonlar tizimi zarur bo‘lib, u natijalarni taqqoslash va boshqaruv qarorlarini asoslash imkonini beradi. Mexanizm sifatida mezonlar “bilim va tushuncha”, “amaliy ko‘nikma”, “motivatsion-aksiologik yo‘nalish” hamda “ijtimoiy xulq” bloklariga ajratilib, har bir blok indikatorlar bilan to‘ldiriladi. Masalan, “amaliy ko‘nikma” blokida birinchi yordam ko‘rsatish, jamoada vazifani taqsimlash, xavfsizlik algoritmlariga rioya qilish kabi indikatorlar kuzatuv varaqasi orqali baholanadi. Quyidagi jadval indikatorlarni soddalashtirilgan ko‘rinishda jamlaydi: Mezon bloki: Bilim, indikator: xavfsizlik qoidalarini izohlash; O‘lchov: test; Mezon bloki: Ko‘nikma, indikator: algoritm bo‘yicha harakat; O‘lchov: chek-list; Mezon bloki: Qadriyat, indikator: burchga munosabat;

O‘lchov: so‘rovnoma; Mezon bloki: Xulq, indikator: jamoat ishida ishtirok; O‘lchov: portfel. Ilmiy izoh sifatida bunday ko‘p manbali baholash triangulyatsiya tamoyiliga mos keladi va natijani birgina test bilan cheklashdan ko‘ra ishonchliroq qiladi [3].

Tarixiy tajriba mexanizmlarni talqin qilishda muhim dalillilik beradi, chunki harbiy-vatanparvarlik tarbiyasi turli davrlarda turlicha vositalar orqali amalga oshirilgan va undan metodik xulosalar chiqarish mumkin. Mexanizm sifatida tarixiy xotira “ramz–matn–marosim–amaliyot” ketma-ketligida ishlaydi: ramzlar e’tiborni jalb qiladi, matnlar ma’no beradi, marosimlar emotsional birlashuv yaratadi, amaliyot esa xulqiy odatni mustahkamlaydi. Masalan, Amir Temur davrida tartib-intizom va “Tuzuklar”dagi me’yoriy qoidalar davlat boshqaruvi va harbiy tashkilotchilikni uyg‘unlashtirgan tarixiy fakt sifatida ta’limda tahliliy keys ko‘rinishida berilishi mumkin, bunda maqsad shaxsni buyruqqa bo‘ysundirish emas, balki tartibning ijtimoiy samaradorligini tushuntirishdan iborat bo‘ladi. Tarixiy-pedagogik tadqiqotlarda manbalar bilan ishlashda kamida 2–3 turdagi hujjatni solishtirish tavsiya etiladi, chunki biryoqlama manba talqinni toraytiradi; bu qoida ta’lim materiallarini tanlashda ham qo‘l keladi. Ilmiy izoh sifatida germenevtika yondashuvi matn va kontekst birligini talab qiladi, shuning uchun tarixiy faktlar bugungi ta’lim ehtiyojlariga mos ma’no qatlamlari bilan izohlanishi lozim [5].

XULOSA

Uzluksiz ta’lim tizimida yoshlarni harbiy-vatanparvarlik ruhida tarbiyalash samaradorligi qadriyatlarni amaliy tajriba bilan bog‘laydigan pedagogik-innovatsion mexanizmlarni izchil integratsiya qilishga bevosita bog‘liq. Taklif etilgan “motivatsiya–tajriba–refleksiya–baholash” zanjiri shaxsda burch va mas’uliyatni ichki e’tiqod darajasiga ko‘tarib, uni real vaziyatlarda harakatga aylantirishni ta’minlaydi. Raqamli simulyatsiya, loyihaviy ta’lim va servis-learning vositalari xavfsiz, ma’noli va ijtimoiy foydali faoliyat maydonini yaratib, tarbiyaning ontologik asosini “o‘zini jamiyat bilan bir butun his etish” tajribasida mustahkamlaydi. Refleksiya va ko‘p manbali baholash indikatorlari esa natijani ko‘rinadigan va boshqariladigan qiladi, bu esa ta’lim muassasalarida dasturiy takomillashtirish uchun ishonchli asos bo‘lib xizmat qiladi.

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RAQAMLI TA’LIM MUHITIDA BOSHLANG‘ICH SINF O‘QUVCHILARINING MUSTAQIL FIKRLASH KO‘NIKMALARINI RIVOJLANTIRISH METODIKASI

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Annotatsiya. *Mazkur maqolada raqamli ta’lim muhitida boshlang‘ich sinf o‘quvchilarining mustaqil fikrlash ko‘nikmalarini rivojlantirishning pedagogik va metodik asoslari tahlil qilinadi. Zamonaviy ta’lim jarayonining raqamlashtirilishi boshlang‘ich sinf o‘quvchilarining axborotni izlash, tanlash, tahlil qilish, taqqoslash, baholash va mustaqil xulosa chiqarish imkoniyatlarini kengaytirmoqda. Biroq raqamli vositalarning mavjudligi o‘z-o‘zidan mustaqil fikrlashning rivojlanishini kafolatlamaydi. Buning uchun raqamli texnologiyalar maqsadli pedagogik metodlar bilan uyg‘unlashtirilishi zarur. Maqolada raqamli ta’lim muhitining didaktik imkoniyatlari, mustaqil fikrlash ko‘nikmasining tarkibiy komponentlari, interaktiv topshiriqlar, muammoli ta’lim, raqamli loyiha, gamifikatsiya, multimedia vositalari va refleksiv faoliyatning pedagogik imkoniyatlari yoritilgan. Shuningdek, boshlang‘ich sinf o‘quvchilarining mustaqil fikrlashini rivojlantirishga yo‘naltirilgan metodik model taklif etilgan. Tadqiqot natijalari raqamli vositalardan pedagogik jihatdan maqsadli foydalanish o‘quvchilarning bilish faolligi, mustaqil qaror qabul qilishi, muammoni hal qilish va o‘z fikrini asoslash ko‘nikmalarini rivojlantirishga xizmat qilishini ko‘rsatadi.*

Kalit so‘zlar: *raqamli ta’lim, boshlang‘ich ta’lim, mustaqil fikrlash, raqamli kompetensiya, interaktiv ta’lim, raqamli pedagogika, muammoli ta’lim, gamifikatsiya, multimedia, ta’lim texnologiyalari.*

Kirish

Raqamli texnologiyalarning ta’lim tizimiga jadal kirib kelishi o‘qitishning mazmuni, shakllari va metodlariga sezilarli ta’sir ko‘rsatmoqda. Bugungi kunda ta’lim oluvchi turli xil axborot manbalariga tezkor kirish imkoniyatiga ega. Shu sababli zamonaviy ta’limning asosiy vazifalaridan biri o‘quvchiga ko‘proq ma’lumot berish emas, balki mavjud axborot bilan mustaqil ishlash, uni tahlil qilish, ishonchliligini baholash va amaliy vaziyatlarda qo‘llash ko‘nikmalarini shakllantirishdan iborat.

Ayniqsa, boshlang‘ich ta’lim bosqichida mustaqil fikrlash ko‘nikmalarini shakllantirish alohida ahamiyat kasb etadi. Chunki aynan boshlang‘ich sinflarda bolaning bilishga bo‘lgan qiziqishi, savol berish faolligi, kuzatuvchanligi, mantiqiy va obrazli tafakkuri rivojlanadi. Ushbu tabiiy imkoniyatlarni zamonaviy raqamli vositalar bilan uyg‘unlashtirish o‘quvchilarning ta’lim jarayonidagi faolligini oshirishga xizmat qilishi mumkin.

Biroq raqamli texnologiyalardan foydalanishning o‘zi mustaqil fikrlashni avtomatik ravishda shakllantirmaydi. Agar raqamli platformalar faqat tayyor ma’lumotni yetkazish yoki test savollariga javob berish vositasi sifatida ishlatilsa, o‘quvchi texnologiyaning faol foydalanuvchisiga aylanishi mumkin, ammo mustaqil fikrlovchi subyekt sifatida rivojlanmasligi ehtimoli mavjud. Shu sababli raqamli ta’lim muhitini tashkil etishda texnologik imkoniyatlarni pedagogik maqsad bilan uyg‘unlashtirish muhimdir.

Tadqiqot metodologiyasi

Tadqiqotning metodologik asosini kompetensiyaviy, shaxsga yo‘naltirilgan, faoliyatga asoslangan va konstruktivistik ta’lim yondashuvlari tashkil etadi. Tadqiqotda ilmiy-pedagogik adabiyotlarni nazariy tahlil qilish, qiyosiy tahlil, pedagogik kuzatuv, umumlashtirish, tizimlashtirish va metodik modellashtirish usullaridan foydalanildi.

Mustaqil fikrlash ko‘nikmasini baholashda o‘quvchining savol berishi, axborotni mustaqil izlash, turli manbalarni taqqoslash, sabab-oqibat aloqalarini aniqlash, muammoga bir nechta yechim taklif qilish, o‘z fikrini dalillar asosida izohlash va xulosalar chiqarish qobiliyatlari asosiy mezon sifatida belgilandi.

Raqamli ta’lim muhitining samaradorligini aniqlashda esa texnologiyaning mavjudligi emas, balki undan qanday pedagogik maqsadda foydalanilishi asosiy mezon sifatida qaraldi.

Mustaqil fikrlash tushunchasining mazmuni

Mustaqil fikrlash shaxsning mavjud bilim va tajribalariga tayangan holda muammoni anglash, axborotni tahlil qilish, turli fikrlarni taqqoslash, dalillar asosida qaror qabul qilish va o‘z xulosasini mustaqil shakllantirish qobiliyatidir.

Boshlang‘ich sinf o‘quvchisida mustaqil fikrlash hali to‘liq shakllangan kompetensiya sifatida emas, balki bosqichma-bosqich rivojlanadigan ko‘nikmalar majmuasi sifatida namoyon bo‘ladi. Ushbu ko‘nikmalar qatoriga kuzatish, savol berish, taxmin qilish, taqqoslash, guruhlash, sababni aniqlash, muqobil variantlarni ko‘rib chiqish va xulosa chiqarish kiradi.

Raqamli muhit mazkur jarayon uchun katta axborot resurslarini taqdim etadi. Biroq o‘quvchi axborot oqimida mustaqil yo‘nalish topa olishi uchun o‘qituvchi unga aniq algoritm va metodik strategiyalarni taklif qilishi zarur.

Raqamli ta’lim muhitining didaktik imkoniyatlari

Raqamli ta’lim muhiti o‘quvchilarning mustaqil faoliyatini tashkil etish uchun bir qator imkoniyatlarga ega. Birinchidan, o‘quvchi turli formatdagi axborot — matn, rasm, audio, video, animatsiya va interaktiv modellar bilan ishlashi mumkin. Ikkinchidan, raqamli vositalar individual ta’lim trayektoriyasini tashkil etish imkonini beradi. Uchinchidan, o‘quvchi o‘z faoliyati natijasini tezkor ko‘rishi va xatolarini aniqlashi mumkin.

Masalan, tabiiy fanlar darsida o‘quvchilarga o‘simliklarning o‘sishi haqidagi qisqa video va bir nechta rasmlar taqdim etilib, “O‘simlikning rivojlanishiga qaysi omillar ta’sir qilishi mumkin?” degan savol beriladi. O‘quvchilar tayyor javobni tanlash o‘rniga kuzatilgan ma’lumotlar asosida taxminlarini shakllantiradilar.

Shunday qilib, raqamli texnologiya axborot manbai bo‘lishdan tashqari, o‘quvchining fikrlash jarayonini faollashtiruvchi didaktik vositaga aylanishi mumkin.

Interaktiv topshiriqlar orqali mustaqil fikrlashni rivojlantirish

Raqamli muhitda interaktiv topshiriqlardan foydalanish o‘quvchilarning faol ishtirokini ta’minlash imkonini beradi. Oddiy testdan farqli ravishda interaktiv topshiriqlar o‘quvchidan obyektlarni guruhlash, ketma-ketlikni aniqlash, sabab va oqibatni bog‘lash, xatoni topish yoki muammoni hal qilishni talab qilishi mumkin.

Masalan, matematika darsida o‘quvchiga bitta masalaning turli yechimlari berilib, ulardan qaysi biri mantiqan to‘g‘ri ekanligini aniqlash vazifasi beriladi. Bunda o‘quvchi faqat javobni tanlamaydi, balki o‘z tanlovini izohlashi kerak.

Bu usul mustaqil fikrlashning muhim elementi bo‘lgan “fikrni asoslash” ko‘nikmasini rivojlantiradi.

Raqamli muammoli ta’lim

Muammoli ta’limni raqamli muhit bilan integratsiyalash boshlang‘ich sinf o‘quvchilarining mustaqil fikrlashini rivojlantirish uchun samarali imkoniyat yaratadi. Raqamli vositalar orqali o‘quvchiga muammoli vaziyatni video, animatsiya, virtual model yoki interaktiv tasvir ko‘rinishida taqdim etish mumkin.

Masalan, “Nima uchun yomg‘irdan keyin ayrim joylarda suv tez yo‘qoladi, boshqa joylarda esa uzoq vaqt saqlanib qoladi?” degan savol asosida o‘quvchilar kuzatish, taxmin qilish va sabablarni izlashga jalb etiladi.

Bu jarayonda o‘qituvchi tayyor javobni bermaydi. U o‘quvchilarga qo‘shimcha savollar berib, mustaqil xulosa chiqarishga yo‘naltiradi.

Raqamli loyiha faoliyati

Raqamli loyiha faoliyati o‘quvchilarning mustaqil fikrlashini rivojlantirishning samarali shakllaridan biridir. O‘quvchilar kichik guruhlarda yoki individual tarzda ma’lum bir mavzu bo‘yicha raqamli mahsulot yaratishlari mumkin.

Masalan, “Mening yashil maktabim”, “Suvni tejash”, “Mening mahallam”, “Tabiatni muhofaza qilish”, “Kelajak maktabi” kabi mavzularda elektron taqdimot, raqamli poster, qisqa video yoki interaktiv hikoya tayyorlash mumkin.

Loyiha jarayonida o‘quvchi mavzuni tanlaydi, axborot izlaydi, uni saralaydi, muhim va ikkilamchi ma’lumotlarni ajratadi, o‘z fikrini shakllantiradi va yakuniy mahsulotni yaratadi. Demak, raqamli loyiha nafaqat texnologik ko‘nikmalarni, balki mustaqil fikrlashning yuqori darajalarini ham rivojlantiradi.

Axborot bilan mustaqil ishlash

Raqamli ta’lim muhitida eng muhim masalalardan biri o‘quvchini axborotni tanlash va baholashga o‘rgatishdir. Internetda mavjud bo‘lgan barcha ma’lumotlarni bir xil darajada ishonchli deb qabul qilish mumkin emas.

Boshlang‘ich sinflarda bu ko‘nikma sodda misollar orqali shakllantirilishi mumkin. Masalan, o‘qituvchi bir mavzu bo‘yicha ikki xil qisqa ma’lumot taqdim etadi va o‘quvchilardan “Qaysi ma’lumotga ko‘proq ishonish mumkin va nima uchun?” deb so‘raydi.

Bunda o‘quvchi manbaning muallifi, mazmuni, dalillari va mantiqiyligini hisobga olishga o‘rgatiladi. Mazkur yondashuv keyinchalik media va axborot savodxonligining shakllanishiga zamin yaratadi.

Gamifikatsiyaning imkoniyatlari

Raqamli ta’lim muhitida gamifikatsiya, ya’ni o‘yin elementlaridan foydalanish boshlang‘ich sinf o‘quvchilarining motivatsiyasini oshirishga xizmat qiladi. Biroq gamifikatsiya faqat ball, reyting yoki mukofot berish bilan cheklanmasligi kerak.

Ta’limiy o‘yinlarda o‘quvchidan strategiya tanlash, muammoni hal qilish, qaror qabul qilish va natijani baholash talab qilinsa, ular mustaqil fikrlashni rivojlantirish vositasiga aylanadi.

Masalan, o‘quvchiga virtual ekologik hududni boshqarish topshirig‘i berilishi mumkin. U cheklangan resurslardan foydalanib, qaysi obyektni qayerga joylashtirish va qanday qaror qabul qilishni mustaqil belgilaydi. Bunday topshiriqlar sabab-oqibat aloqalarini tushunishga yordam beradi.

Multimedia vositalaridan foydalanish

Video, animatsiya va interaktiv grafikalar boshlang‘ich sinf o‘quvchilarining murakkab tushunchalarni obrazli idrok etishiga yordam beradi.

Biroq multimedia materialining pedagogik qiymati uning chiroyli yoki qiziqarli bo‘lishida emas, balki o‘quvchini fikrlashga undashida namoyon bo‘ladi.

Shu sababli videoni oddiy tomosha qildirish o‘rniga “Videoda qanday muammo ko‘rsatildi?”, “Sizningcha, keyin nima sodir bo‘ladi?”, “Nima sababdan bunday hodisa yuz berdi?” kabi savollar bilan birgalikda qo‘llash maqsadga muvofiq.

Bu usul o‘quvchini passiv tomoshabindan faol tahlilchiga aylantiradi.

Raqamli refleksiya

Mustaqil fikrlashni rivojlantirishda refleksiya muhim o‘rin tutadi. Dars yakunida o‘quvchidan “Bugun nimani o‘rgandim?”, “Qaysi topshiriq menga qiyin bo‘ldi?”, “Muammoni qanday hal qildim?”, “Boshqa qanday yechim bo‘lishi mumkin?” kabi savollarga javob berish so‘ralishi mumkin.

Raqamli muhitda refleksiya elektron so‘rovnoma, qisqa audio javob, raqamli kundalik yoki interaktiv “exit ticket” orqali tashkil etilishi mumkin.

Refleksiya o‘quvchiga o‘zining fikrlash jarayonini anglashga yordam beradi. Bu esa metakognitiv ko‘nikmalarning rivojlanishi uchun muhim asos yaratadi.

O‘qituvchining roli

Raqamli ta’lim muhitida o‘qituvchining roli kamaymaydi, aksincha, mazmunan o‘zgaradi. O‘qituvchi endilikda faqat axborot beruvchi emas, balki raqamli ta’lim jarayonining dizayneri, fasilitatori va yo‘naltiruvchisi sifatida faoliyat yuritadi.

O‘qituvchi raqamli vositani tanlashda uchta asosiy savolga javob berishi kerak: mazkur vosita qanday ta’limiy maqsadga xizmat qiladi, u o‘quvchini qanday fikrlash faoliyatiga jalb qiladi va undan foydalanish natijasida o‘quvchida qanday yangi ko‘nikma shakllanadi?

Agar raqamli vosita faqat vaqtni tejash yoki darsni vizual jihatdan bezash uchun ishlatilsa, uning pedagogik samaradorligi cheklangan bo‘ladi. Agar u o‘quvchini izlash, tahlil qilish, taqqoslash va xulosa chiqarishga undasa, u mustaqil fikrlashni rivojlantiruvchi vositaga aylanadi.

Raqamli ta’lim muhitida metodik model

Boshlang‘ich sinf o‘quvchilarining mustaqil fikrlashini rivojlantirish uchun quyidagi metodik ketma-ketlikni taklif etish mumkin:

Muammoli vaziyat → axborotni izlash → axborotni tahlil qilish → muqobil yechimlarni ishlab chiqish → mustaqil qaror qabul qilish → raqamli mahsulot yaratish → natijani taqdim etish → refleksiya.

Mazkur modelning birinchi bosqichida o‘quvchida bilishga ehtiyoj tug‘diriladi. Ikkinchi bosqichda u zarur axborotni izlaydi. Uchinchi bosqichda

ma’lumotlarni tahlil qiladi va taqqoslaydi. Keyin bir nechta yechim variantlarini ishlab chiqadi va ulardan birini tanlaydi. Keyingi bosqichda tanlangan g‘oyani amaliy yoki raqamli mahsulotga aylantiradi. Yakunda o‘z natijasini taqdim etadi va faoliyatini refleksiv tahlil qiladi.

Mazkur model o‘quvchini tayyor bilimni qabul qilishdan mustaqil bilim yaratish jarayoniga olib o‘tishga xizmat qiladi.

Raqamli ta’limda pedagogik xavflar

Raqamli ta’lim muhitining imkoniyatlari bilan bir qatorda ayrim pedagogik xavflar ham mavjud. Birinchidan, o‘quvchining tayyor javoblarni internet yoki raqamli vositalardan to‘g‘ridan-to‘g‘ri olishi mustaqil fikrlash jarayonini susaytirishi mumkin. Ikkinchidan, ortiqcha ekran vaqti bolaning tabiiy, harakatli va ijtimoiy faoliyatini cheklashi mumkin. Uchinchidan, raqamli vositalardan haddan tashqari foydalanish o‘qituvchi va o‘quvchi o‘rtasidagi bevosita muloqotning kamayishiga olib kelishi mumkin.

Shuning uchun raqamli texnologiyalar an’anaviy pedagogik vositalarning to‘liq o‘rnini bosmasligi kerak. Eng samarali yondashuv raqamli va real amaliy faoliyatni uyg‘unlashtirishdan iborat. Masalan, o‘quvchi avval raqamli muhitda ma’lumot izlaydi, keyin real tajriba o‘tkazadi va yakunda natijasini raqamli shaklda taqdim etadi.

Natijalar va muhokama

Nazariy tahlil shuni ko‘rsatadiki, raqamli ta’lim muhitining mustaqil fikrlashni rivojlantirishdagi samaradorligi texnologiyaning o‘ziga emas, balki undan foydalanish metodikasiga bog‘liq. O‘quvchiga tayyor javobni taqdim etuvchi raqamli vositalardan ko‘ra, uni izlash, tanlash, tahlil qilish, taqqoslash va qaror qabul qilishga undovchi vositalar yuqoriroq pedagogik qiymatga ega.

Muammoli raqamli topshiriqlar o‘quvchining mustaqil qaror qabul qilishini kuchaytiradi. Raqamli loyihalar axborot bilan ishlash va g‘oyani mahsulotga aylantirish imkonini beradi. Gamifikatsiya motivatsiyani oshiradi. Multimedia vositalari murakkab hodisalarni obrazli tahlil qilishga yordam beradi. Refleksiv topshiriqlar esa o‘quvchining o‘z fikrlash jarayonini anglashiga sharoit yaratadi.

Shu bilan birga, raqamli pedagogikaning asosiy tamoyili “texnologiya uchun texnologiya” emas, balki “pedagogik maqsad uchun texnologiya” bo‘lishi kerak. Ya’ni har qanday raqamli vosita aniq o‘quv natijasiga xizmat qilishi lozim.

Xulosa

Raqamli ta’lim muhiti boshlang‘ich sinf o‘quvchilarining mustaqil fikrlash ko‘nikmalarini rivojlantirish uchun keng pedagogik imkoniyatlarga ega. Biroq

ushbu imkoniyatlardan samarali foydalanish raqamli vositalarning mavjudligidan ko‘ra, ularning metodik jihatdan to‘g‘ri tashkil etilishiga bog‘liq.

Tadqiqot asosida raqamli muammoli ta’lim, raqamli loyiha faoliyati, interaktiv topshiriqlar, gamifikatsiya, multimedia, axborot bilan mustaqil ishlash va refleksiv faoliyat boshlang‘ich sinf o‘quvchilarining mustaqil fikrlashini rivojlantirishning samarali yo‘nalishlari sifatida belgilandi.

Boshlang‘ich ta’limda raqamli texnologiyalardan foydalanishning asosiy maqsadi o‘quvchini tayyor axborotni qabul qiluvchi emas, balki axborotni izlovchi, tahlil qiluvchi, baholovchi va undan yangi bilim yaratishda foydalanuvchi faol subyektga aylantirishdan iborat bo‘lishi kerak.

Shu nuqtayi nazardan raqamli ta’lim muhitida mustaqil fikrlashni rivojlantirish uchun **“muammo – izlanish – tahlil – yechim – mahsulot – taqdimot – refleksiya”** tamoyiliga asoslangan metodik tizimni joriy etish maqsadga muvofiq. Mazkur yondashuv boshlang‘ich sinf o‘quvchilarining nafaqat raqamli kompetensiyasini, balki tanqidiy va mustaqil fikrlash, muammoni hal qilish, axborot savodxonligi hamda kreativ faoliyat ko‘nikmalarini kompleks rivojlantirishga xizmat qiladi.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN DEVELOPING EFL STUDENTS' SPEAKING SKILLS

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***Abstract**: The rapid development of artificial intelligence (AI) has created new opportunities for English as a Foreign Language (EFL) education. In particular, AI-powered conversational tools can provide learners with opportunities to practice speaking beyond the traditional classroom environment. This paper examines the potential role of artificial intelligence in developing EFL students' speaking skills. AI-based tools can offer learners interactive conversations, immediate feedback, vocabulary support, pronunciation practice, and opportunities for repeated speaking activities. These features may be especially valuable for students who experience anxiety or have limited opportunities to communicate in English outside the classroom. At the same time, the effective integration of AI requires appropriate pedagogical guidance because AI tools cannot fully replace authentic human communication. The paper argues that AI should be considered a supplementary pedagogical tool that supports, rather than replaces, teacher-led instruction and real-life communication.*

***Keywords**: Artificial intelligence, EFL, speaking skills, conversational AI, language learning, speaking practice, communicative competence.*

INTRODUCTION

Speaking is one of the most important but challenging skills for learners of English as a foreign language. Although EFL students may acquire considerable knowledge of grammar and vocabulary, they often experience difficulties when they need to use English spontaneously in real communication. Limited classroom time, large classes, fear of making mistakes, and lack of opportunities for interaction can restrict students' speaking practice.

Recent developments in artificial intelligence have introduced new possibilities for language education. AI-powered conversational applications can simulate communication with learners and provide opportunities for repeated speaking practice. Unlike traditional classroom activities, AI-based systems may allow students to practice English at different times and in different locations. Learners can participate in conversations, ask questions, receive responses, and repeat activities according to their individual needs.

The integration of AI into EFL instruction is therefore becoming an increasingly relevant area of research. However, the educational value of AI depends not simply on the availability of technology but on how it is incorporated into pedagogical practice. Teachers need to select appropriate activities, establish learning objectives, monitor students' progress, and encourage learners to transfer their AI-based practice to communication with real people.

The Role of AI in Speaking Development

One of the major advantages of AI in speaking instruction is the opportunity for increased speaking practice. In a traditional classroom, each student may have only a limited amount of time to speak because classroom interaction is shared among many learners. AI-based conversational tools can potentially provide individual learners with additional opportunities to produce English.

For example, students can practice common communicative situations such as introducing themselves, ordering food, asking for directions, making complaints, participating in job interviews, or discussing everyday topics. Such activities can help learners develop their ability to produce language in meaningful contexts rather than simply memorizing isolated vocabulary and grammar rules.

Another important function of AI is personalized learning. Students in the same EFL classroom often have different levels of vocabulary, grammar knowledge, pronunciation, and speaking fluency. AI tools can provide practice that corresponds to individual learners' needs. A student with limited vocabulary can request simpler questions or explanations, whereas a more advanced learner can participate in longer and more complex conversations.

AI can also support immediate feedback. During speaking practice, learners may receive information about pronunciation, grammar, vocabulary, or sentence construction. Immediate feedback can help students recognize their errors and attempt to correct them. However, feedback should be interpreted carefully because AI-generated feedback may not always be completely accurate or pedagogically appropriate. Teacher supervision therefore remains important.

AI and Speaking Anxiety

Speaking anxiety is another factor that can influence EFL learners' oral performance. Some students feel nervous when speaking in front of their classmates because they are afraid of making mistakes or being judged by others. As a result, they may avoid participating in speaking activities even when they possess sufficient linguistic knowledge.

AI-based conversational practice may create a relatively low-pressure environment in which learners can practice repeatedly. Students can make mistakes, reformulate their answers, and repeat a conversation without the social pressure that may occur during face-to-face communication. This may encourage learners to become more willing to produce spoken English.

Nevertheless, reduced anxiety during interaction with an AI system does not automatically mean that learners will become confident communicators in real-life situations. Therefore, AI practice should gradually be connected to authentic interpersonal communication. For example, students might first practice a job interview with an AI tool and subsequently conduct the same interview with a partner or teacher.

From AI Practice to Real-Life Communication

A major pedagogical issue is the transfer of AI-based speaking practice to real-life communication. Successful language learning requires learners not only to produce grammatically acceptable sentences but also to respond appropriately to unpredictable communicative situations.

To achieve this goal, teachers can design a three-stage speaking model. In the first stage, learners practice a communicative situation with an AI tool. In the second stage, they reflect on their performance, identify vocabulary or grammatical problems, and repeat the activity. In the final stage, learners perform a similar task with a human partner.

For instance, students learning English for professional purposes could first ask an AI assistant to simulate a hotel receptionist and then practice checking in a guest. After receiving feedback, students could repeat the activity with classmates. Finally, they could participate in a more spontaneous role-play in which the guest presents an unexpected problem or complaint.

This approach can help bridge the gap between controlled digital practice and authentic communication. The teacher's role is particularly important in designing situations that require learners to negotiate meaning, respond spontaneously, and use language appropriately.

Challenges of Using AI in EFL Speaking Classes

Despite its potential benefits, AI integration also presents several challenges. First, AI systems may provide inaccurate or unnatural language models. Students who accept every AI response without critical evaluation may learn inappropriate expressions or incorrect information.

Second, excessive dependence on AI may reduce opportunities for human interaction. Language is fundamentally social, and learners need to communicate

with real people who have different accents, communication styles, cultural backgrounds, and expectations.

Third, access to technology may differ among learners. Some students may have better devices, internet connections, or previous experience with digital technologies. Teachers should therefore consider issues of accessibility and digital literacy.

Finally, AI should not replace the teacher. Teachers provide contextualized feedback, emotional support, classroom interaction, and pedagogical decision-making that AI cannot fully reproduce. AI is most useful when it functions as an additional resource within a well-designed instructional framework.

CONCLUSION

Artificial intelligence offers significant possibilities for developing EFL students' speaking skills. AI-powered conversational tools can increase opportunities for speaking practice, provide personalized interaction, support vocabulary and pronunciation development, and potentially reduce students' fear of making mistakes. These advantages can be particularly useful for learners who have limited opportunities to use English outside the classroom.

However, AI should not be viewed as a replacement for teachers or authentic human communication. Its effectiveness depends on the pedagogical principles underlying its use. A productive approach is to combine AI-mediated practice with teacher guidance, peer interaction, role-play, and real-life communicative tasks.

Therefore, future EFL instruction can benefit from treating AI as a bridge between classroom learning and real-world communication. Further empirical research is needed to examine how different AI tools influence speaking fluency, accuracy, pronunciation, confidence, and communicative competence over extended periods of language learning.

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NORMALLASHTIRISH USULI YORDAMIDA MA'LUMOTLAR BAZASINI LOYIHALASH

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Annotatsiy. *Ushbu maqolada relyatsion ma'lumotlar bazasini (MB) loyihalashda normallashtirish jarayonining ahamiyati, uning asosiy qoidalari va amaliy bosqichlari ko'rib chiqiladi. Ma'lumotlar ortiqchaligini kamaytirish, modifikatsiya anomaliyalarining oldini olish va ma'lumotlar yaxlitligini ta'minlashda normal shakllarning (1NF, 2NF, 3NF, BCNF) o'rni tahlil qilinadi. Shuningdek, maqolada funksional bog'liqliklar, turli kalitlar (asosiy, nomzod) va ma'lumotlar bazasining unumdorligiga normallashtirishning ijobiy hamda salbiy ta'sirlari keng yoritilgan.*

Kalit so'zlar: *Ma'lumotlar bazasi, relyatsion model, normallashtirish, anomaliya, normal shakllar, ma'lumotlar yaxlitligi, asosiy kalit, funksional bog'liqlik, tranzaksion tizimlar, denormallashtirish.*

Аннотация. *В статье рассматриваются значение процесса нормализации при проектировании реляционных баз данных (БД), его основные правила и практические этапы. Анализируется роль нормальных форм (1НФ, 2НФ, 3НФ, НФБК) в снижении избыточности данных, предотвращении аномалий модификации и обеспечении целостности данных. Также подробно освещены функциональные зависимости, различные виды ключей (первичный, потенциальный) и положительное и отрицательное влияние нормализации на производительность базы данных.*

Ключевые слова: *база данных, реляционная модель, нормализация, аномалия, нормальные формы, целостность данных, первичный ключ, функциональная зависимость, транзакционные системы, денормализация.*

Abstract. *This article examines the importance of normalization in relational database design, its fundamental rules, and its practical stages. It analyzes the role of normal forms (1NF, 2NF, 3NF, BCNF) in reducing data redundancy, preventing modification anomalies, and ensuring data integrity. The article also covers in detail functional dependencies, different types of keys (primary and candidate), and both the positive and negative effects of normalization on database performance.*

Keywords: *database, relational model, normalization, anomaly, normal forms, data integrity, primary key, functional dependency, transactional systems, denormalization.*

KIRISH

Zamonaviy axborot tizimlarining samaradorligi va ishonchliligi to'g'ridan-to'g'ri ma'lumotlar bazasining qanday loyihalangani bilan bog'liq. Hozirgi kunda axborot hajmining keskin o'sishi (Big Data) sharoitida ma'lumotlarni saqlash, qayta ishlash va ularni xavfsiz boshqarish har qachongidan ham dolzarb ahamiyat kasb etmoqda. Noto'g'ri loyihalashtirilgan ma'lumotlar bazasi ma'lumotlar ortiqchaligiga (duplikatsiyaga) olib keladi, bu esa o'z navbatida xotiraning samarasiz sarflanishiga hamda tizimning kiritish, yangilash va o'chirish (Insert, Update, Delete) operatsiyalarida turli anomaliyalarni yuzaga keltiradi.

Boshlang'ich loyihalash bosqichida relyatsion model qoidalariga rioya etilmasligi sababli, dastlabki paytda muammolar sezilmasligi mumkin, ammo ma'lumotlar bazasi kengaygani sari tizimning ishlash tezligi pasayadi, ma'lumotlar yaxlitligi buziladi. Ushbu muammolarni tizimli ravishda hal qilish uchun 1970-yillarda Edgar Kodd (E.F. Codd) tomonidan relyatsion model doirasida normallashtirish (normalization) usuli ishlab chiqilgan va fanga kiritilgan. Edgar Kodd relyatsion algebrani qo'llagan holda ma'lumotlarni tartibga solishning matematik asoslarini yaratib berdi.

Agar jadval normallashtirilmasa, quyidagi uch turdagi asosiy muammoli anomaliyalar yuzaga kelishi muqarrardir:

- Yangilash anomaliyasi (Update Anomaly): Bitta obyekt haqidagi ma'lumot (masalan, xodimning yashash manzili) bir nechta qatorlarda takrorlansa, uni o'zgartirish uchun barcha qatorlarni topib yangilash kerak bo'ladi. Tizimda minglab qatorlar bo'lganda, birortasi esdan chiqsa, ma'lumotlar nomuvofiqligi yuzaga keladi va tizim bir shaxs uchun ikki xil manzilni ko'rsatishni boshlaydi.
- Kiritish anomaliyasi (Insert Anomaly): Yangi yozuv qo'shish uchun ba'zi bir majburiy bo'lmagan, lekin o'zaro bog'liq ma'lumotlarni kiritish talab

qilinib qolishi mumkin. Masalan, hali hech qanday talaba biriktirilmagan yangi fakultetni ro'yxatdan o'tkazib bo'lmasligi mumkin, chunki talabalar jadvalida fakultet nomi talaba bilan birga saqlanadi.

- O'chirish anomaliyasi (Delete Anomaly): Biror yozuvni o'chirish natijasida tizim uchun muhim bo'lgan boshqa yondosh ma'lumotlar ham tasodifan o'chib ketishi. Masalan, oxirgi kurs talabasi haqidagi ma'lumotlar o'chirilganda, u o'qigan guruh yoki fakultet haqidagi yagona ma'lumotlar ham ma'lumotlar bazasidan yo'qolib qolishi mumkin.

ASOSIY QISM

Ma'lumotlar bazasidagi jadvallarni (munosabatlarni) mantiqiy jihatdan shunday qismlarga ajratish va tuzish jarayonini chuqur tahlil qilishki, unda ma'lumotlar ortiqchaligi minimallashtiriladi, funksional bog'liqliklar to'g'ri tashkil etiladi va ma'lumotlar ishonchliligi ta'minlanadi. Tadqiqot obyekti sifatida korporativ relyatsion ma'lumotlar bazalari olindi. Usul sifatida mantiqiy modellashtirish, relyatsion algebra va ma'lumotlarni normallashtirish algoritmlaridan foydalanildi.

Normallashtirishni amalga oshirish uchun avvalo kalitlar va funksional qaramlik tushunchalarini anglash zarur. Funksional bog'liqlik (Functional Dependency) — agar A atributning har bir qiymati B atributning faqat bitta qiymatiga aniq mos kelsa, demak B atribut A ga funksional jihatdan bog'liq hisoblanadi (A -> B). Ushbu matematik qoidalar normallashtirishning asosini tashkil qiladi.

Normallashtirish jarayoni qadam-baqadam amalga oshiriladi va har bir mantiqiy bosqich "Normal shakl" (Normal Form - NF) deb ataladi. Tadqiqotda usul sifatida quyidagi normal shakl bosqichlari amaliyotga joriy etilishi ko'rib chiqildi:

- Birinchi normal shakl (1NF): Jadval 1NF qoidasiga javob berishi uchun har bir ustun bo'linmas (atomar) qiymatga ega bo'lishi shart hamda jadvalda takrorlanuvchi guruhlar bo'lmasligi lozim. Bitta katakchada bir nechta qiymat (vergul bilan yozilgan telefon raqamlar yoki fanlar ro'yxati) bo'lishiga yo'l qo'yilmaydi. Har bir qator o'ziga xos bo'lishi va asosiy kalit (Primary Key) bilan identifikatsiya qilinishi shart.
- Ikkinchi normal shakl (2NF): Tizim avvalo 1NF talablariga to'liq javob berishi kerak. Bundan tashqari, barcha kalit bo'lmagan atributlar murakkab asosiy kalitning (ikkita ustundan tashkil topgan kalitning) faqatgina bir qismiga emas, balki uning to'liq o'ziga qat'iy bog'liq bo'lishi shart. Bu qoida tizimni qisman qaramlikdan tozalaydi.

➢ Uchinchi normal shakl (3NF): Jadval 2NF holatida bo'lishi va kalit bo'lmagan atributlar o'rtasida tranzitiv bog'liqlik bo'lmasligi kerak. Tranzitiv qaramlik — bu X -> Y ga, Y esa Z ga bog'liq bo'lgan holat. Ya'ni, har bir kalit bo'lmagan maydon faqatgina bevosita asosiy kalitga bog'liq bo'lishi lozim.

➢ Boyce-Codd normal shakli (BCNF): Bu shakl 3NF ning kuchaytirilgan versiyasi. Ba'zi murakkab jadvallarda bir nechta o'zaro kesishuvchi nomzod kalitlar (Candidate Keys) ishtirok etishi mumkin. BCNF shartiga ko'ra, har qanday funksional bog'liqlikdagi aniqlovchi (determinant) albatta nomzod kalit bo'lishi shart.

Normallashtirish qoidalarini amaliyotga (masalan, ta'lim muassasasining o'quv jarayonini boshqarish tizimiga) tatbiq etish natijasida ma'lumotlar bazasining optimal, takrorlanishlardan xoli strukturasi shakllantirildi. Tadqiqot natijalari shuni ko'rsatadiki, ma'lumotlar jadvallari kerakli mayda qismlarga (masalan, Talabalar, Fanlar, O'qituvchilar va ularning bog'lanish jadvallariga) ajratilganda ma'lumotlarni boshqarish samaradorligi keskin oshadi.

Tadqiqot davomida normallashtirishning har bir bosqichi tizimga qanday ijobiy ta'sir ko'rsatishi baholandi. Buni aniqroq ko'rsatish uchun quyidagi qiyosiy jadval ishlab chiqildi:

1-Jadval.

Normallashtirish shakllari va ularning ma'lumotlar bazasiga ta'siri

Normal shakl	Amalga oshiriladigan texnik ishlar	Tizim uchun olingan ijobiy natija
1NF (Birinchi NF)	Ustunlardagi aralash va ro'yxat ko'rinishidagi qiymatlar atomar holatga keltirildi. Yagona identifikator o'rnatildi.	Ma'lumotlar bazasining so'rovlarga (SQL) javob berish aniqligi oshdi. Asosiy kalit orqali yozuvlarning yagonaligi ta'minlandi.
2NF (Ikkinchi NF)	Jadval 1NF dan o'tkazilib, qisman bog'liqliklar aniqlandi va ular alohida (Foreign Key) jadvallarga ko'chirildi.	Ma'lumotlarning mantiqsiz ortiqcha takrorlanishi bartaraf etildi. Disk xotirasidan foydalanish sezilarli darajada optimallashtirildi.
3NF (Uchinchi NF)	Tranzitiv bog'liqliklar aniqlanib, ular mustaqil obyekt sifatda ajratib olindi	Tizimda ma'lumotni kiritish, yangilash va o'chirish anomaliyalarining

	(masalan, Viloyat->Tuman munosabati).	(Modification anomalies) to'liq oldi olindi.
BCNF (Boyce-Codd)	Barcha aniqlovchilar tekshirilib, faqat nomzod kalitlarga o'tkazildi.	Murakkab kesishuvchi kalitlardagi ziddiyatlar yo'qoldi, eng yuqori darajadagi strukturaviy yaxlitlikka erishildi.

Normallashtirish jarayonini muvaffaqiyatli amalga oshirish natijasida axborot tizimlarida quyidagi fundamental afzalliklarga erishildi:

➢ Ma'lumotlar yaxlitligi va xavfsizligi: Yagona ma'lumot faqat bitta mantiqiy joyda saqlanadi. Agar xodimning lavozimi yoki maoshi o'zgarsa, uni yuz minglab tranzaksiyalar ichidan emas, balki faqat bitta "Lavozimlar" jadvalidan o'zgartirish kifoya qiladi. Bu esa xatoliklarni nolga tushiradi.

➢ Tizim moslashuvchanligi va kengayuvchanligi (Scalability): Yangi jadvallar, modullar yoki munosabatlarni mavjud strukturaga arxitekturani buzmagan holda qo'shish osonlashadi. Dasturchilar uchun kod yozish jarayoni mantiqan soddalashadi.

➢ Ma'lumotlar xavfsizligini taqsimlash: Turli xil maxfiylik darajasidagi ma'lumotlarni (masalan, parollar va moliyaviy ma'lumotlar) alohida jadvallarga ajratish orqali foydalanuvchilarning ruxsatlarini (permissions) xavfsiz boshqarish imkoniyati yaratiladi.

Cheklovlar va Denormallashtirish ehtiyoji: Natijalar tahlili shuni ham ko'rsatdiki, normallashtirish darajasi me'yoridan ortib ketib, baza juda ko'p mayda jadvallarga parchalanib ketsa, hisobotlarni olish jarayoni sekinlashadi. Sababi, so'rov (SQL Query) yuborganda ma'lumotlarni foydalanuvchiga yaxlit ko'rsatish uchun ko'plab jadvallarni o'zaro bog'lash (JOIN operatsiyalari) talab etiladi. Bu esa serverning protsessor va operativ xotira resurslarini ko'p sarflaydi. Shu sababli, ma'lumotlarni tahlil qilish va murakkab hisobotlar tayyorlashga mo'ljallangan OLAP (Online Analytical Processing - Ma'lumotlar ombori) tizimlarida o'qish tezligini oshirish uchun ataylab qisman takrorlanishlarga yo'l qo'yiladi. Bu mantiqiy jarayon "Denormallashtirish" (Denormalization) deb ataladi. Biroq, kundalik operatsiyalarni bajaruvchi OLTP (Online Transaction Processing) tizimlari uchun 3NF normallashtirish darajasi majburiy qoida bo'lib qoladi.

XULOSA

Xulosa qilib aytganda, normallashtirish usuli relyatsion ma'lumotlar bazalarini arxitektura qilishning eng fundamental va voz kechib bo'lmas qoidalaridan biridir. Amalga oshirilgan tahlil va tadqiqotlar shuni isbotladiki,

ma'lumotlarni uchinchi normal shaklgacha (3NF) olib chiqish bugungi kunda aksariyat elektron tijorat, bank tizimlari, ta'lim platformalari kabi tranzaksion tizimlar uchun oltin me'yor hisoblanadi.

To'g'ri loyihalashtirilgan ma'lumotlar bazasi nafaqat bugungi kundagi xotira hajmini tejaydi, balki kelajakda axborot tizimining katta bosim (Highload) ostida ham qotib qolmasdan, barqaror ishlashini kafolatlaydi. Loyihalash bosqichida normallashtirish qoidalariga rioya etish orqali ma'lumotlar ziddiyati butunlay bartaraf etiladi, xavfsizlik va o'zgartirish qulayligi ta'minlanadi. Zamonaviy dasturiy injiniring amaliyotida ma'lumotlar bazasi muhandislari (DBA) loyihaning o'ziga xosligidan kelib chiqib, normallashtirish (yaxlitlik uchun) va denormallashtirish (tezlik uchun) o'rtasidagi oltin o'rtaliqni topishlari tizimning uzoq muddatli muvaffaqiyatining asosiy kalitidir.

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DEVELOPMENT AND EVALUATION OF SOFTWARE FOR MONITORING EMPLOYEE WORK ACTIVITIES USING FACIAL RECOGNITION (FACE ID)

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Abstract. *This article proposes the architecture and evaluation methodology of a software prototype that records employees' arrival and departure times using facial biometrics and generates working-hours reports. The system captures a facial image through a camera, detects the face, compares the feature vector with the templates in the registered database, and logs the event. The figures presented in the Results section are not based on real enterprise experience; they are sample simulation data created for demonstration and calculation purposes.*

Keywords: *Face ID, facial recognition, biometric identification, employee monitoring, working time tracking, software prototype, privacy.*

INTRODUCTION

Recording working hours, detecting late arrivals, and preparing attendance reports in enterprises require administrative resources. Paper-based logs or PIN-based methods have risks such as recording attendance on behalf of another person, delayed data entry, and manual report compilation. Facial biometrics enables the automation of attendance events by comparing an employee with a registered biometric template. However, biometric accuracy depends on environmental conditions, camera characteristics, lighting, facial pose, and demographic factors. NIST emphasizes the need to test biometric systems in terms of accuracy, speed, and performance under various conditions. In addition, the privacy of biometric data and presentation attack detection (PAD) are important considerations [1–3].

Materials and Methods. The proposed prototype consists of an access terminal equipped with a webcam and a central server. For practical implementation, Python 3.11, OpenCV (for image capture and face detection), a recognition model for calculating facial embeddings, FastAPI (REST API), PostgreSQL (for the employee and event databases), and a React or HTML/JavaScript-based dashboard can be used. Model and library versions should be strictly specified before conducting experiments.

Operational sequence:

1. Obtaining the employee's consent and completing registration;
2. Capturing the facial image;
3. Performing face quality and liveness/PAD checks;
4. Extracting the embedding vector;
5. Comparing the vector with registered templates based on distance or similarity;
6. If the predefined threshold is exceeded, recording the entry/exit event with the employee ID and timestamp;
7. Displaying reports through an authorized dashboard.

Architecture modules:

(a) **Capture Service** — camera stream;

(b) **Face Processing** — face detection, alignment, and embedding;

(c) **Matching Service** — identification;

(d) **Attendance Engine** — entry/exit processing according to the schedule;

(e) **API & Dashboard** — search and reporting;

(f) **Audit & Security** — roles, encryption, access logs, and data retention periods.

Main database tables:

Employee(employee_id, name, department, status);

BiometricTemplate(template_id, employee_id, encrypted_vector, created_at, consent_ref);

AttendanceEvent(event_id, employee_id, event_type, timestamp, terminal_id, confidence, review_status);

AuditLog(actor_id, action, timestamp).

Instead of permanently storing raw facial images, it is recommended to store protected biometric templates, restrict data access, and delete the data after the specified retention period.

Evaluation Metrics: Identification accuracy (correctly identified cases / total test cases), false match rate (FMR), false non-match rate (FNMR), average

response time, incorrect attendance records, and system availability. Before deployment in production, testing under different lighting conditions, camera angles, and user groups is necessary. NIST SP 800-63B emphasizes presentation attack detection (PAD), alternative authentication methods, and the protection of sensitive data in biometric systems [2].

Results. he data presented in Table 1 and the graphs (Figures 1 and 2) are hypothetical simulation data intended to demonstrate the methodology; they do not represent results measured in a real-world environment or guaranteed performance indicators of a finished product.

Table 1.

Indicator	Model Value	Description
Number of registered employees	500	Test scenario
Observation period	5 working days	Hypothetical
Manual recording errors	65	14+12+15+11+13
Face ID prototype errors	17	4+3+5+2+3
Error reduction	73.8%	(65−17)/65 × 100
Total stage latency	480 ms	120+280+80

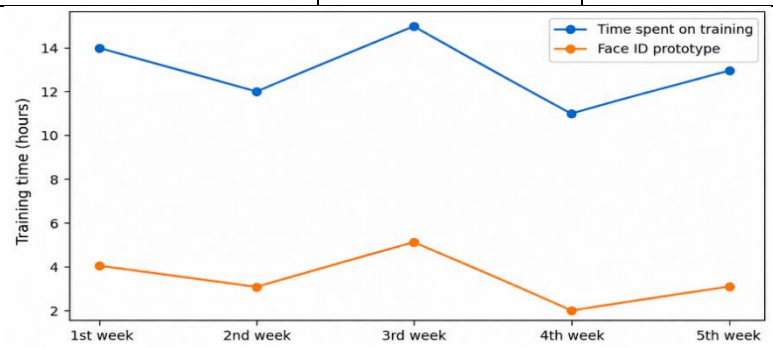

Figure 1. Number of Errors in Manual Recording and the Face ID Prototype (Simulation).

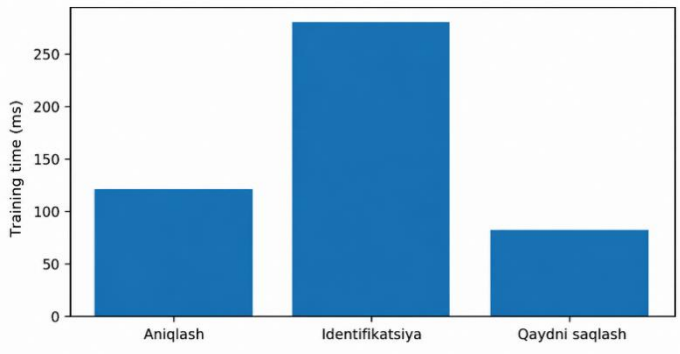

Figure 2. Latency by Process Stage in the Model.

Total Calculated Latency: T = 120 + 280 + 80 = 480 ms.

Calculation Example: The error reduction is calculated using the formula R = (E_manual − E_face) / E_manual × 100%. With the given model values, R

= (65 − 17) / 65 × 100% = 73.8%. The average latency per event is calculated as T_total = T_detect + T_match + T_write = 120 + 280 + 80 = 480 ms. These figures do not confirm the actual performance of the system; repeated measurements using the same hardware and test dataset are required for validation.

DISCUSSION

The model calculations demonstrate that errors and time consumption can be separately monitored and measured in an automated recording system; however, the simulation does not prove recognition accuracy or its impact on employee discipline in a real-world environment. For an actual evaluation, a representative test dataset collected with employee consent, a confusion matrix by error type, FMR/FNMR, p50/p95 latency, and continuous system operation should be recorded.

LIMITATIONS

Variations in camera quality and lighting, attempts to deceive the facial recognition system using photographs or videos, the presence of multiple faces simultaneously, masks or changes in appearance, network interruptions, and incorrect matching may affect system performance. Therefore, the system should not be used as the sole source of evidence for payroll or disciplinary decisions; employees should be provided with the opportunity to review their attendance records and submit objections.

For biometric data, a clearly defined purpose, informed consent, a specified retention period, a deletion mechanism, encryption, role-based access control, and an alternative attendance method should be implemented. NIST recommendations emphasize protecting biometric data as sensitive information, providing an alternative method, and evaluating presentation attack detection (PAD) [2,3].

CONCLUSION

This article proposes a modular software prototype for recording employee attendance using Face ID, together with a database structure and an evaluation methodology. In the illustrative calculation, the number of errors decreased from 65 to 17 (73.8%), while the process latency was 480 ms; these values are only simulation examples. As a next step, the prototype should be tested under real-world conditions using consent-based data, biometric error rates should be reported separately, and privacy controls should be evaluated.

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NUMERICAL SIMULATION OF TRANSIENT LAMINAR FLOW DEVELOPMENT IN A CIRCULAR PIPE FOLLOWING A STEP CHANGE IN PRESSURE GRADIENT

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Abstract. *This article presents a finite-difference formulation for the transient development of laminar flow in a circular pipe following a step change in the applied axial pressure gradient. Under the assumptions of an incompressible Newtonian fluid and fully developed, axisymmetric motion, the axial momentum equation reduces to a one-dimensional radial diffusion problem for the velocity field u(r,t). The governing partial differential equation is discretized in space with a centered second-order finite-difference operator and advanced in time with the unconditionally stable Crank–Nicolson scheme, yielding a tridiagonal linear system at every time step. The numerical model is shown to relax, under sustained constant forcing, toward the classical parabolic Poiseuille profile. The steady-state solution and the characteristic viscous diffusion time scale are stated explicitly, and their role in judging whether a simulated flow has genuinely reached the fully developed regime is discussed. The scope of the model is delimited from adjacent transient phenomena: it captures viscous momentum diffusion only and does not represent axial pressure-wave propagation or fluid–structure interaction, so it cannot be used to assess water-hammer behaviour or shifts in the laminar-to-turbulent transition threshold.*

Keywords: *transient pipe flow; finite-difference method; Crank–Nicolson scheme; MATLAB; Poiseuille flow; numerical modeling*

1. INTRODUCTION

Rapid changes in pumping rate or in boundary pressure initiate time-dependent, or transient, flow in pipes. During the resulting start-up phase, the velocity distribution across the pipe cross-section depends jointly on radial position and time, and it approaches the steady laminar (Poiseuille) profile only

gradually, at a rate governed by the fluid's kinematic viscosity and the pipe radius. Because this transient stage is difficult to characterize by direct measurement alone, numerical simulation is a valuable complement: it resolves the full spatio-temporal development of the velocity field and makes explicit the point at which a fully developed steady state is actually reached.

The laminar start-up problem treated here is one of several transient phenomena examined in the author's master's dissertation [1], which also considers other unsteady flow regimes in pipes. The present article isolates the laminar start-up component of that work in order to state its physical assumptions, its numerical discretization, and — most importantly — the scope and limits of the conclusions that can legitimately be drawn from it, consistently and in a form suitable for independent evaluation.

2. MATHEMATICAL MODEL

Consider a straight circular pipe of radius R containing an incompressible Newtonian fluid of density ρ and kinematic viscosity ν = μ/ρ. The flow is assumed axisymmetric, with negligible radial velocity, an axially fully developed velocity field u(r,t), and a prescribed, spatially uniform axial pressure gradient. Under these assumptions the axial momentum (Navier–Stokes) equation reduces to a linear diffusion equation for u(r,t):

$$\frac{\partial u}{\partial t} = G(t) + \nu\left(\frac{\partial^2 u}{\partial r^2} + \frac{1}{r}\frac{\partial u}{\partial r}\right), \quad G(t) = -\frac{1}{\rho}\frac{\partial p}{\partial z}$$

with initial condition u(r,0) = 0. The symmetry of the flow about the pipe axis requires $\partial u/\partial r = 0$ at r = 0, and the no-slip condition at the wall requires u(R,t) = 0. A constant forcing term G(t) = G_0 for t > 0 represents the start-up response to a step change in the pressure gradient. This one-dimensional radial model contains only viscous momentum diffusion; it deliberately excludes axial acoustic (pressure-wave) propagation, which requires a compressible flow formulation.

3. NUMERICAL METHOD

The radial domain is discretized with nodes $r_i = i\Delta r$ for i = 0, …, N, where $\Delta r = R/N$, and the time axis with $t_n = n\Delta t$. At interior nodes, the radial Laplacian is approximated with a centered second-order finite difference for $\partial^2 u/\partial r^2$ and a centered difference for the term $(1/r)\partial u/\partial r$. At the axis (r = 0), the removable singularity of the cylindrical Laplacian is handled through its symmetry limit, $4(u_1 - u_0)/\Delta r^2$, and the no-slip condition sets $u_n = 0$ at the wall. Denoting by L_h the discrete radial diffusion operator (i.e., ν times the discretized Laplacian), one Crank–Nicolson time step reads:

$$\left(I - \frac{\Delta t}{2} L_h\right) U^{n+1} = \left(I + \frac{\Delta t}{2} L_h\right) U^n + \frac{\Delta t}{2} (G^{n+1} + G^n)\mathbf{1}$$

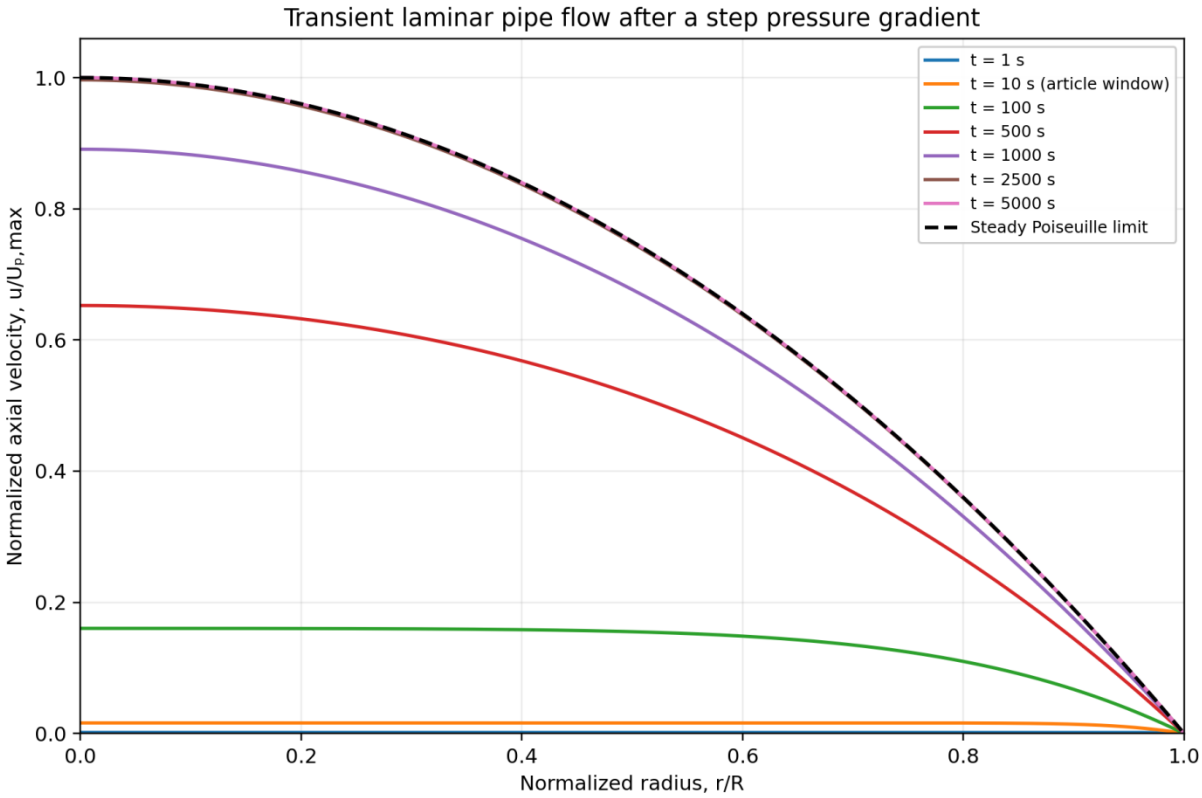
The coefficient matrix on the left-hand side is tridiagonal at every time step and can be solved efficiently with the Thomas algorithm or with a general-purpose linear solver; MATLAB's backslash (mldivide) operator is a convenient choice for this purpose [2]. The Crank–Nicolson scheme is unconditionally stable and second-order accurate in time, while the centered spatial differences are second-order accurate away from the boundary treatment at the axis. As with any finite-difference scheme, however, the formal order of accuracy is a statement about the asymptotic rate of convergence, not a guarantee of accuracy at any single, fixed grid resolution; a defensible convergence claim requires grid refinement and time-step refinement to be carried out independently of one another, holding the other fixed while halving the parameter under study.

4. RESULTS AND INTERPRETATION

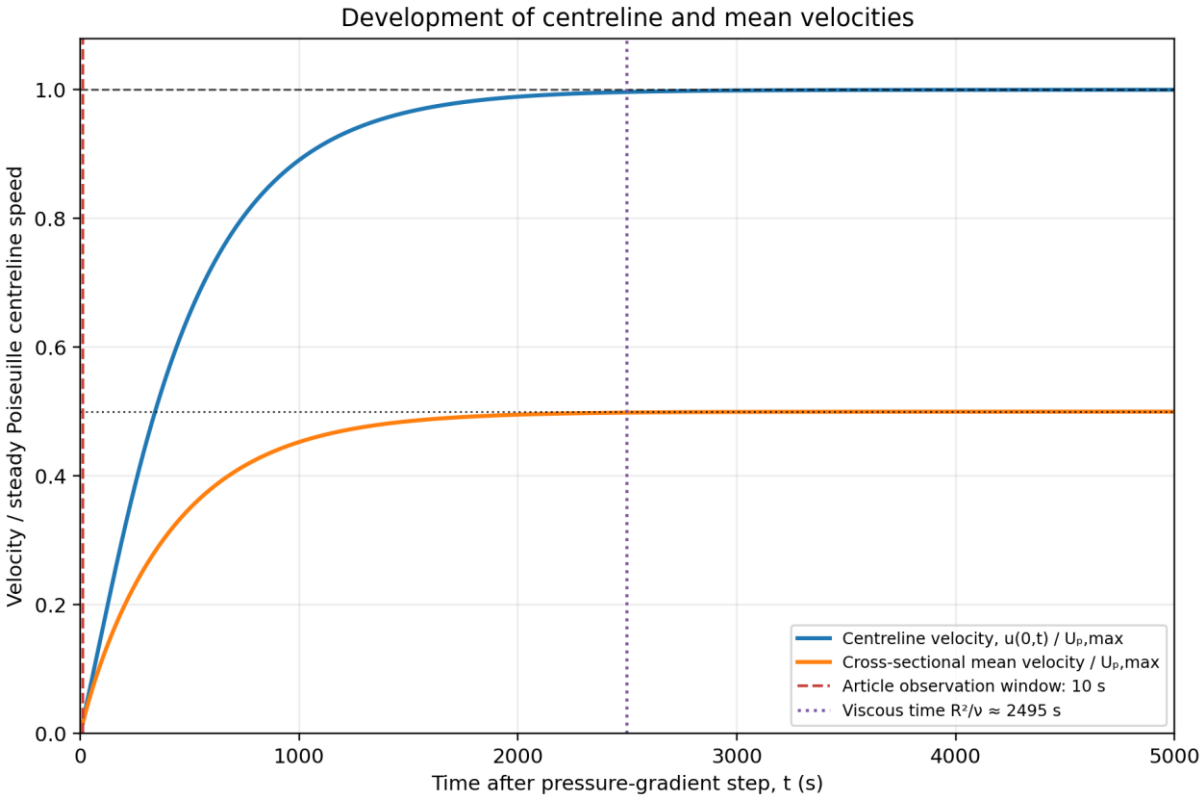
The underlying dissertation reports a start-up calculation in which the velocity field evolves from rest toward a radially varying profile [1]. Under sustained constant forcing G_0, the reference steady (Poiseuille) profile $u_p(r)$ and the characteristic viscous diffusion time scale t_v are, respectively:

$$u_P(r) = \frac{G_0}{4\nu}(R^2 - r^2), \qquad t_\nu = \frac{R^2}{\nu}$$

The profile vanishes at the wall and attains its maximum on the centerline. Physically, the no-slip condition first influences only a thin layer near the wall; viscous diffusion then progressively redistributes momentum across the full radius until the parabolic profile is established everywhere. Comparison of a transient numerical result with this steady parabola is therefore a useful limiting check on the numerical scheme, but by itself it says nothing about the transient error at intermediate times — that requires comparison against a resolved transient reference, not the steady-state limit.



This distinction is quantitatively important for the parameter values reported in the dissertation: water properties $\rho = 1000$ kg/m³ and $\mu = 1.002 \times 10^{-3}$ Pa·s, pipe radius $R = 0.05$ m, time step $\Delta t = 0.01$ s, and a 10 s observation window [1]. These values give $\nu = \mu/\rho = 1.002 \times 10^{-6}$ m²/s and a characteristic diffusion time $R^2/\nu \approx 2495$ s. A 10 s simulation therefore spans only about 0.004 of this diffusion time scale. Consequently, a claim that the entire cross-section has reached the Poiseuille limit after only 1 s of simulated time cannot be substantiated from the parameters as stated; such a claim would require either a much longer observation window relative to R^2/ν, or an explicit demonstration — via the actual computed profiles — that convergence to the steady state occurs on a much shorter time scale than the diffusive estimate suggests. A fully reproducible quantitative comparison additionally requires that the applied pressure gradient G_0 and the complete numerical output (velocity profiles at stated times) be reported alongside the physical parameters.



5. DISCUSSION

The finite-difference construction presented here offers a compact and computationally inexpensive means of examining how laminar velocity profiles develop under specified viscosity and pressure forcing. To meet the standard expected of a publication-ready validation study, several elements are still required: (i) explicit statement of the forcing amplitude G_0; (ii) all radial and temporal grid parameters (N, Δr, Δt) together with a demonstration that results are grid- and time-step-converged; (iii) a quantitative error norm computed against either an analytical transient solution of the same initial-boundary-value problem or a sufficiently resolved numerical reference; and (iv) plots of u(r,t) at physically comparable, explicitly stated times, rather than at times chosen only for numerical convenience. A steady Poiseuille comparison is most informative once the elapsed simulated time is comparable to or exceeds the viscous diffusion time scale R^2/ν; comparisons made well before that point mainly test the near-wall solution and are not representative of core-flow convergence.

It is also important to state clearly what this model does not represent. Water-hammer phenomena are governed by coupled changes in pressure and velocity propagating along the pipe, and by the compressibility of the fluid and the elasticity of the pipe wall; the present radial diffusion equation, being derived under the fully developed, axisymmetric, incompressible-flow assumption, contains none of these mechanisms. Accordingly, water-hammer-related error

metrics reported elsewhere in the source dissertation should not be attributed to, or presented as arising from, the present laminar start-up model. For the same reason, this formulation cannot be used to draw conclusions about shifts in the laminar-to-turbulent transition threshold, which depends on flow instability mechanisms outside the scope of the assumptions adopted here.

6. CONCLUSION

A radial finite-difference discretization combined with Crank–Nicolson time stepping provides a numerically stable and computationally efficient MATLAB formulation for the start-up of laminar flow in a circular pipe following a step change in pressure gradient. The scheme's predicted long-time state is the classical Poiseuille parabola, and the characteristic diffusion time R^2/ν offers an essential, easily computed check against over-interpreting short simulations as evidence of a fully developed flow. The most direct step toward a submission-ready study is to rerun the calculation with an explicitly stated pressure gradient G_0, to report resolved velocity profiles at physically meaningful times, and to accompany these with an independent grid-refinement and time-step-refinement study documenting the achieved order of convergence.

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SUN’IY INTELLEKT TUSHUNCHASI, RIVOJLANISH BOSQICHLARI VA TA’LIMDAGI O‘RNI

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Annotatsiya. *Maqolada sun'iy intellekt tushunchasining mohiyati, uning ilmiy-nazariy asoslari va zamonaviy tasnifi (tor va umumiy sun'iy intellekt) yoritilgan. Sun'iy intellekt rivojlanishining beshta asosiy bosqichi - 1940-1950-yillardagi nazariy asoslardan to bugungi generativ tizimlargacha - tarixiy-qiyosiy jihatdan tahlil qilingan. Shuningdek, sun'iy intellektning ta'lim jarayonidagi o'rni individuallashtirilgan va adaptiv o'qitish, intellektual repetitorlar, avtomatik baholash, o'quv kontentini yaratish, o'quv tahlili hamda inklyuziv ta'lim yo'nalishlari kesimida ko'rib chiqilgan. Maqolada ma'lumotlar maxfiyligi, generativ modellarning noto'g'ri natijalari, akademik halollik va raqamli tengsizlik bilan bog'liq muammolar tahlil qilinib, sun'iy intellekt o'qituvchini almashtirmasligi, balki uning kasbiy vazifalarini o'zgartirishi asoslab berilgan. Xulosada aniq fanlarni o'qitish metodikasini takomillashtirishda sun'iy intellekt vositalarini ilmiy asoslangan va tizimli qo'llash zarurligi ta'kidlangan.*

Kalit so‘zlar: *sun'iy intellekt, mashinali o'qitish, chuqur o'qitish, generativ sun'iy intellekt, katta til modellari, ta'lim jarayoni, adaptiv o'qitish, intellektual o'qitish tizimlari, raqamli ta'lim, aniq fanlar metodikasi, akademik halollik.*

Abstract. *The article examines the essence of the concept of artificial intelligence, its scientific and theoretical foundations and its modern classification into narrow (weak) and general (strong) AI. Five main stages of the development of AI are analyzed in a historical and comparative perspective - from the theoretical foundations of the 1940-1950-y. to today's generative systems. The role of AI in the educational process is considered along the following lines: personalized and adaptive learning, intelligent tutoring systems and chatbots, automated assessment, generation of learning content, learning*

analytics and inclusive education. The article also analyses the problems of personal data privacy, inaccurate outputs of generative models, academic integrity and digital inequality, and argues that AI does not replace the teacher but transforms the teacher's professional functions. It is concluded that AI tools should be applied in a scientifically grounded, systematic and learner-centered way in order to improve the methodology of teaching the exact sciences.

Keywords: *artificial intelligence, machine learning, deep learning, generative AI, large language models, educational process, adaptive learning, intelligent tutoring systems, digital education, methodology of teaching exact sciences, academic integrity.*

KIRISH

Zamonaviy dunyoda axborot texnologiyalarining tez rivojlanishi jamiyat hayotining barcha sohalarini, jumladan, ta'lim tizimini ham tubdan o'zgartirmoqda. Bu o'zgarishlarning markazida esa sun'iy intellekt (SI) texnologiyalari turibdi. Bugungi kunda sun'iy intellekt sanoat, tibbiyot, iqtisodiyot va madaniyat bilan bir qatorda ta’lim jarayonida ham yangi imkoniyatlar ochmoqda. O‘zbekistonda ham SI texnologiyalarini bosqichma-bosqich rivojlantirish va amaliyotga joriy etish davlat siyosatining ustuvor yo‘nalishlaridan biri sifatida belgilangan. Shu sababdan sun’iy intellekt tushunchasining mohiyatini, uning rivojlanish tarixini va ta’lim jarayonidagi o‘rnini ilmiy jihatdan tahlil qilish dolzarb ahamiyat kasb etadi.

Ingliz tilidan olingan «Artificial Intelligence» atamasi o‘zbek tilida «sun’iy intellekt» deb yuritiladi. Ilmiy adabiyotlarda bu tushunchaga turlicha ta’riflar, tavfsiflar berilgan. Eng keng tarqalgan yondashuvga ko‘ra, sun’iy intellekt - odam intellekti talab qilinadigan vazifalarni (o‘rganish, mulohaza yuritish, qaror qabul qilish, tabiiy tilni tushunish, tasvirlarni tanish va h.k.) bajara oladigan kompyuter tizimlarini yaratish bilan shug‘ullanuvchi fan va texnologiyalar sohasidir. «Sun’iy intellekt» atamasi 1956-yilda AQShning Dartmut kollejida o‘tkazilgan ilmiy seminar arafasida taklif etilgan bo‘lib, uning muallifi sifatida amerikalik olim Jon Makkarti tilga olinadi.

Zamonaviy tasnifga ko‘ra, sun’iy intellekt ikki turga bo‘linadi: kuchsiz SI va umumiy kuchli SI. Kuchsiz SI muayyan vazifani, masalan, matnni tarjima qilish, tasvirni tanish yoki savolga javob berishni bajarishga yo‘naltirilgan. Umumiy SI esa har qanday intellektual vazifani inson darajasida bajara oladigan tizim bo‘lib, hozircha nazariy va tadqiqot bosqichida turibdi. Bugungi kunda amaliyotda qo‘llanilayotgan barcha tizimlar kuchsiz SI toifasiga kiradi.

Sun’iy intellektning asosiy yo‘nalishlariga mashinali o‘qitish, chuqur o‘qitish, tabiiy tilga ishlov berish, kompyuter ko‘rish, ekspert tizimlar va

robototexnika kiradi. So‘nggi yillarda generativ sun’iy intellekt alohida ahamiyat kasb etmoqda. Bunday tizimlar mavjud ma’lumotlar asosida yangi kontent - matn, tasvir, dasturiy kod, audio va video yaratishga qodir. Ularning asosini katta til modellari tashkil etadi va aynan shu texnologiyalar ta’lim sohasida ham eng keng muhokama qilinmoqda.

ASOSIY QISM

Sun’iy intellekt g‘oyasi bir necha o‘n yillik tarixga ega bo‘lib, uning rivojlanishini shartli ravishda quyidagi bosqichlarga ajratish mumkin.

Birinchi bosqich - nazariy asoslar davri (1940-1950-yillar). Bu davrda Uorren Makkalok va Uolter Pitts sun’iy neyronning matematik modelini taklif etdi (1943). 1950-yilda Alan Tyuring «Computing Machinery and Intelligence» nomli ishida «Mashina fikrlay oladimi?» degan savolni qo‘ydi va keyinchalik «Tyuring testi» deb nomlangan mezonni ilgari surdi.

Ikkinchi bosqich - shakllanish va dastlabki yuksalish (1956-1970-yillar). 1956-yildagi Dartmut seminari SI ning mustaqil ilmiy yo‘nalish sifatida shakllanishiga asos bo‘ldi. Mantiqiy teoremalarni isbotlovchi dasturlar yaratildi, 1966-yilda Jozef Vaytsenbaum tomonidan ELIZA dasturi ishlab chiqildi. U inson bilan matn orqali muloqot qila oladigan dastlabki chatbotlardan biri hisoblanadi.

Uchinchi bosqich - ekspert tizimlar davri (1970 - 1980-yillar). Bu davrda mutaxassislar bilimini qoidalar shaklida kompyuterga kiritishga asoslangan ekspert tizimlar yaratildi. Masalan, MYCIN tizimi qon kasalliklarini tashxislashda shifokorga yordam bergan. Biroq hisoblash quvvati va ma’lumotlarning yetishmasligi tufayli kutilgan natijalarga erishilmadi, moliyalashtirish qisqardi va bu davr adabiyotlarda «sun’iy intellekt qishi» nomi bilan yuritiladi.

To‘rtinchi bosqich - mashinali o‘qitish davri (1990-2000-yillar). Bu bosqichda tizimlarga qoidalarni qo‘lda kiritish o‘rniga, ularning ma’lumotlardan o‘rganishi yetakchi yondashuvga aylandi. 1997-yilda IBM kompaniyasining Deep Blue kompyuteri shaxmat bo‘yicha jahon chempioni Garri Kasparovni mag‘lub etdi, 2011-yilda esa IBM Watson tizimi televiktorinada insonlarni yutdi.

Beshinchi bosqich - chuqur o‘qitish va generativ SI davri (2010-yillardan hozirgacha). 2012-yildan boshlab chuqur neyron tarmoqlar tasvirlarni tanish sohasida katta yutuqlarga erishdi. 2016-yilda AlphaGo dasturi Go o‘yinida dunyoning eng kuchli o‘yinchilaridan birini yutdi. 2017-yilda taklif etilgan Transformer arxitekturasi tabiiy tilga ishlov berishda burilish yasadi va katta til modellarining paydo bo‘lishiga yo‘l ochdi. 2022-yilda ChatGPT kabi generativ

tizimlarning ommaviy foydalanishga chiqarilishi SI ni oddiy foydalanuvchi, jumladan, o‘quvchi va talabalar uchun ham qulay vositaga aylantirdi.

Ta’lim sohasida sun’iy intellektdan foydalanish g‘oyasi yangi emas: intellektual o‘qitish tizimlari bo‘yicha dastlabki tadqiqotlar 1970-yillardayoq boshlangan. Biroq faqat so‘nggi yillardagina texnologik imkoniyatlar bu g‘oyalarni keng miqyosda amalga oshirishga imkon berdi. Hozirgi kunda SI ning ta’limdagi o‘rni quyidagi asosiy yo‘nalishlarda namoyon bo‘lmoqda:

✓ Individuallashtirilgan va adaptiv o‘qitish: har bir o‘quvchining bilim darajasi, o‘zlashtirish sur'ati va qiziqishlariga moslashadigan o‘quv trayektoriyasini shakllantirish;

✓ Intellektual repetitorlar va chatbotlar: savollarga sutkaning istalgan vaqtida javob beruvchi, mavzuni bosqichma-bosqich tushuntiruvchi virtual yordamchilar;

✓ Avtomatik baholash: test va topshiriqlarni tez tekshirish, xatolarni tahlil qilish va o‘quvchiga zudlik bilan teskari aloqa berish;

✓ O‘quv kontentini yaratish: mashq, masala, test va ko‘rgazmali materiallarni tezkor tayyorlash orqali o‘qituvchi vaqtini tejash;

✓ O‘quv tahlili: o‘quvchilarning faolligi va natijalarini tahlil qilib, o‘zlashtirishda qiyinchilik sezayotganlarni oldindan aniqlash;

✓ Inklyuziv ta’lim: tarjima, nutqni matnga aylantirish va matnni ovozlashtirish vositalari orqali imkoniyati cheklangan o‘quvchilarga yordam berish.

Aniq fanlarni o‘qitishda SI ning imkoniyatlari ayniqsa muhim. Matematika va fizikada masalalarning yechimini bosqichma-bosqich tushuntirish, murakkab jarayonlarni virtual modellashtirish, informatikada dasturiy koddagi xatolarni topish va tuzatish bo‘yicha tavsiyalar berish o‘quvchilarning mavzuni chuqurroq o‘zlashtirishiga yordam beradi.

Xalqaro miqyosda ham bu masalaga katta e'tibor qaratilmoqda. YuNESKO tomonidan 2019-yilda qabul qilingan «Ta’limda sun’iy intellekt bo‘yicha Pekin konsensusi» hujjatida SI ni ta’lim tizimiga inson manfaatlari va teng imkoniyatlar tamoyillari asosida joriy etish zarurligi ta’kidlangan. O‘zbekistonda esa 2021-yil 17-fevraldagi Prezident qarori bilan sun’iy intellekt texnologiyalarini jadal joriy etish uchun shart-sharoitlar yaratish chora-tadbirlari belgilandi. Bu ta’lim tizimida ham SI dan foydalanish uchun huquqiy va tashkiliy asos yaratdi.

Sun’iy intellektning afzalliklari bilan birga, uni ta’limga joriy etish bir qator muammolarni ham keltirib chiqaradi. Birinchidan, o‘quvchilarning shaxsiy ma’lumotlari maxfiyligini ta’minlash zarur. Ikkinchidan, generativ

modellar ba’zan noto‘g‘ri yoki asossiz ma’lumot berishi mumkin, shu sababli olingan natijalarni tekshirish ko‘nikmasini shakllantirish lozim. Uchinchidan, tayyor javoblarga haddan tashqari tayanish o‘quvchilarning mustaqil fikrlash qobiliyatini susaytirishi va akademik halollik muammolarini keltirib chiqarishi mumkin. To‘rtinchidan, raqamli infratuzilma va internetga kirish imkoniyatlaridagi tafovut ta’limdagi tengsizlikni kuchaytirishi ehtimoli mavjud.

Shuni alohida ta’kidlash kerakki, sun’iy intellekt o‘qituvchini almashtirmaydi, aksincha, uning vazifalarini o‘zgartiradi. Muntazam va bir xil ishlarni SI ga topshirish hisobiga o‘qituvchi o‘quvchi bilan muloqot, tarbiya va ijodiy faoliyatga ko‘proq e'tibor qaratish imkoniga ega bo‘ladi.

XULOSA

Xulosa qilib aytganda, sun’iy intellekt 1950-yillardagi nazariy g‘oyalardan bugungi kundagi generativ tizimlargacha uzoq rivojlanish yo‘lini bosib o‘tdi va hozirda ta’lim jarayonini individuallashtirish, baholashni avtomatlashtirish hamda o‘quv materiallarini yaratishda samarali vosita bo‘lib xizmat qilmoqda. Shu bilan birga, uning ta’limdagi o‘rni faqat texnologik imkoniyatlar bilan emas, balki pedagogik yondashuvning to‘g‘riligi, axloqiy me'yorlarga rioya etilishi va o‘qituvchining faol ishtiroki bilan belgilanadi. Aniq fanlarni o‘qitish metodikasini takomillashtirishda SI vositalarini ilmiy asoslangan, tizimli va o‘quvchi manfaatlariga mos ravishda qo‘llash tadqiqotning keyingi bosqichlari uchun muhim nazariy asos bo‘lib xizmat qiladi.

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IDENTIFIER STABILITY AS A CONTENT RELIABILITY SIGNAL IN MULTISCRIPT PRODUCT CATALOGUES

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Abstract: *Discrete semantic identifiers can change when an item representation crosses a quantisation boundary. This thesis examines identifier stability as a diagnostic signal for content reliability in product catalogues containing Latin-script Uzbek, Cyrillic-script Uzbek and Russian. The evaluation uses a synthetic catalogue of 30,000 semantic vectors. Stability alone produced $R^2 = 0.164$ for a model-based accuracy target, compared with 0.077 for three surface proxies and 0.174 for all four signals. At the strongest simulated degradation, an inverse-variance weighting rule increased NDCG@10 from 0.5063 to 0.5311. The findings support the proposed diagnostic mechanism within the simulation, while real-text validation remains necessary.*

Keywords: *semantic identifiers; content reliability; quantisation stability; multiscript text; recommender systems; probability calibration.*

1 INTRODUCTION

Product descriptions can refer to the same item while differing in language, script and spelling. This is common in catalogues that contain Uzbek written in Latin and Cyrillic scripts together with Russian. Generative retrieval systems often represent catalogue items through discrete semantic codes obtained by quantising continuous embeddings (Rajput et al., 2023). A small movement near a quantisation boundary can change a code even when the item meaning is intended to remain unchanged.

Multilingual encoders provide cross-lingual representations, but tokenisation behaviour and model coverage vary across languages (Conneau et al., 2020; Rust et al., 2021). Uzbek-specific modelling further shows that language coverage cannot be assumed from multilingual benchmarks alone (Mansurov & Mansurov, 2021). These observations motivate a direct test of whether the representation assigned to an item remains stable under controlled perturbations.

The study asks two questions: whether identifier stability adds predictive information beyond inexpensive surface signals, and whether a reliability estimate can inform the weight assigned to a content component in a recommender. The contribution is a compact stability measure, a sampling analysis and a conditional inverse-variance fusion rule evaluated in a synthetic experiment.

2 MATERIALS AND METHODS

2.1 Reliability measure and estimation

Let x_i be the reference description of item i, v a fixed encoder and Q a fixed quantiser. For a perturbed description $\tilde{x}_i$ sampled from a meaning-preserving perturbation distribution, identifier stability is defined as

$$\eta_4(i) = \Pr\left[\mathcal{Q}\left(\mathbf{v}(\tilde{x}_i)\right) = \mathcal{Q}\left(\mathbf{v}(x_i)\right)\right], \quad (1)$$

The encoder, codebook and reference code remain fixed across repeated probes. If K_i of R independent perturbations preserve the complete code, the estimator is K_i/R. Conditional on an item, it follows a binomial model and has standard error

$$\text{s. e.}(\hat{\eta}_4) = \sqrt{\eta_4(1-\eta_4)/R}. \quad (2)$$

The formula requires independent probes from a fixed distribution. Because Bernoulli variance is at most 0.25, the worst-case standard error is $1/(2\sqrt{R})$. Thus R = 100 is needed to guarantee a standard error no greater than 0.05 for an individual item. Smaller values can be practical, but they do not give a universal precision guarantee.

2.2 Reliability signals and fusion rule

Four signals are considered: language-identification confidence, script homogeneity, tokenisation efficiency and identifier stability. The first three represent inexpensive surface characteristics. A regression model predicts a model-based content-accuracy target from these signals. Probability calibration is conceptually separate and should be estimated on held-out pairwise outcomes.

Suppose the content and collaborative-filtering components estimate a score on the same scale and have centred, uncorrelated errors. If their variances are σ^2cont and σ^2CF, respectively, the minimum-variance convex content weight is obtained by inverse-variance weighting. Under an independent Gaussian score-gap model, accuracy a can be mapped to $\sigma^2\text{cont} = \sec^2(\pi(1-a))-1$, giving the closed-form weight used in the experiment:

$$w_{\text{cont}}(i) = \frac{\sigma_{\text{CF}}^2}{\sigma_{\text{CF}}^2 + \sec^2\left(\pi\left(1-\hat{a}(i)\right)\right)-1}. \quad (3)$$

This derivation minimises score mean squared error under its assumptions. It does not prove that the same weight maximises NDCG@10. Correlated errors, bias or incomparable score scales can change the appropriate rule.

2.3 Synthetic evaluation

The reported catalogue contains 30,000 items with 16-dimensional vectors generated around 48 topical centres. A 512-entry mini-batch k-means codebook provides the discrete codes. The surface signals are simulated proxies; actual bilingual product descriptions are not encoded. The feature comparison uses 10,000 held-out items. Sampling dispersion is evaluated on an 8,000-item subsample, and ranking uses 3,000 synthetic queries with 80 candidates at degradation levels from 0.00 to 0.60.

3 RESULTS

Identifier stability carried most of the predictive information available in the four-signal model. Stability alone yielded $R^2 = 0.164$, while the three surface signals together yielded $R^2 = 0.077$. Adding the surface signals to stability increased R^2 only to 0.174. The full model therefore left 82.6% of the target variance unexplained, so the result indicates association within the synthetic generator rather than strong item-level prediction.

Table 1. Predictive comparison on 10,000 held-out synthetic items

Feature set	R^2	Relative loss
All four signals	0.174	0.0%
Surface signals only	0.077	55.7%
Identifier stability only	0.164	5.7%
Without tokenisation efficiency	0.167	4.0%

Increasing the number of perturbation probes reduced the reported sampling dispersion from 0.1530 at R = 5 to 0.0388 at R = 80. The observed ratio of approximately 3.94 is close to the fourfold reduction predicted when the number of independent probes increases sixteenfold. The aggregation used for the reported empirical dispersion is unavailable, so this trend is descriptive rather than a direct itemwise validation of Equation (2).

Table 2. Reported NDCG@10 under synthetic degradation

Level L	No fallback	Hard gate	Closed form	Variance reference
0.00	0.6731	0.6674	0.6634	0.6752

0.15	0.6468	0.6417	0.6449	0.6480
0.30	0.5881	0.5839	0.5988	0.5984
0.45	0.5408	0.5373	0.5592	0.5700
0.60	0.5063	0.5039	0.5311	0.5537

At L = 0.60, the closed-form rule improved NDCG@10 by 0.0248, or 4.90%, relative to the no-fallback baseline. This recovered approximately 52.3% of the improvement achieved by the variance-informed reference. At L = 0.45, the corresponding recovery was approximately 63.0%. The same rule was below the baseline at L = 0.00 and 0.15, showing that the fixed reliability mapping was not uniformly beneficial.

4 DISCUSSION AND CONCLUSION

The experiment suggests that identifier stability can reveal representation sensitivity that language confidence, script balance and tokenisation efficiency do not capture. Its advantage is that it tests the deployed encoder and quantiser directly. The same construction also limits interpretation: both the stability signal and the accuracy target depend on the synthetic vectors and codebook, which can strengthen their association.

A 512-entry codebook is shared by 30,000 items, so the experiment evaluates code stability rather than uniqueness of product identity. Stable codes can also arise from a poorly discriminating quantiser. Deployment therefore requires joint checks of stability, codebook utilisation, reconstruction quality and item discrimination. The fusion rule additionally assumes comparable score scales and independent centred errors. Its derivation concerns squared error, whereas the reported ranking metric is NDCG@10.

Within these limits, identifier stability is a useful diagnostic candidate. It predicts the model-based accuracy target better than the three surface proxies combined and improves ranking at the stronger simulated degradation levels. The low-degradation losses show that reliability weighting should be tuned on validation data rather than applied as a universal rule. The next experiment should use matched Latin-script Uzbek, Cyrillic-script Uzbek and Russian product descriptions with verified identity and preserved attributes, followed by evaluation on held-out interactions or independently assessed relevance.

The numerical findings remain exploratory because executable code, random seeds, full generator distributions and item-level outputs are not included with the source manuscript. These materials are needed to reproduce the tables, estimate paired uncertainty and rule out leakage. Until then, the thesis

supports the mathematical mechanism and synthetic evidence but does not establish production effectiveness on a real Uzbek catalogue.

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PEDAGOGIK PRAGMATIK YONDASHUV ASOSIDA TALABALARDA SUN'IY INTELLEKTDAN FOYDALANISH KO'NIKMALARINI RIVOJLANTIRISH METODIKASI

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Annotatsiya. *Mazkur maqolada pedagogik pragmatik yondashuv asosida talabalarda sun'iy intellektdan samarali, maqsadli va mas'uliyatli foydalanish ko'nikmalarini rivojlantirish metodikasi yoritilgan. Zamonaviy ta'lim jarayonida sun'iy intellekt texnologiyalaridan foydalanish talabalarning axborotni izlash, tahlil qilish, qayta ishlash, muammoli vaziyatlarga yechim topish, ijodiy yondashish va mustaqil ta'lim olish imkoniyatlarini kengaytirmoqda. Shu bilan birga, sun'iy intellektdan foydalanishda axborotning ishonchliligini tekshirish, akademik halollikni ta'minlash, mualliflik huquqiga rioya qilish hamda olingan natijalarni tanqidiy baholash kabi kompetensiyalarni shakllantirish zarur. Maqolada pedagogik pragmatik yondashuvning mazmuni, sun'iy intellektdan foydalanish ko'nikmalarining tarkibiy qismlari, ularni rivojlantirish bosqichlari, metod va vositalari hamda ta'lim jarayonida qo'llash modeli taklif etilgan. Shuningdek, talabalarning sun'iy intellekt bilan samarali muloqot qilish, to'g'ri so'rov (prompt) tuzish, AI tomonidan yaratilgan ma'lumotlarni tekshirish va undan o'quv maqsadlarida foydalanish bo'yicha amaliy topshiriqlar tizimi ishlab chiqilgan.*

Kalit so'zlar: *pedagogik pragmatika, sun'iy intellekt, AI, raqamli kompetensiya, talaba, ta'lim texnologiyalari, prompt, tanqidiy fikrlash, mustaqil ta'lim, akademik halollik, raqamli savodxonlik, metodika.*

Аннотация. *В данной статье освещается методика развития у студентов навыков эффективного, целенаправленного и ответственного использования искусственного интеллекта на основе педагогического прагматического подхода. В современном образовательном процессе использование технологий искусственного интеллекта расширяет возможности студентов в поиске, анализе и обработке информации, решении проблемных ситуаций, творческом подходе и самостоятельном*

обучении. Вместе с тем при использовании искусственного интеллекта необходимо формировать такие компетенции, как проверка достоверности информации, обеспечение академической добросовестности, соблюдение авторских прав и критическая оценка полученных результатов. В статье раскрывается содержание педагогического прагматического подхода, определяются структурные компоненты навыков использования искусственного интеллекта, этапы, методы и средства их развития, а также предлагается модель их применения в образовательном процессе. Кроме того, разработана система практических заданий, направленных на формирование у студентов навыков эффективного взаимодействия с искусственным интеллектом, составления корректных запросов (промптов), проверки информации, генерируемой ИИ, и использования искусственного интеллекта в образовательных целях.

Ключевые слова: *педагогическая прагматика, искусственный интеллект, ИИ, цифровая компетентность, студент, образовательные технологии, промпт, критическое мышление, самостоятельное обучение, академическая добросовестность, цифровая грамотность, методика.*

Abstract. *This article examines a methodology for developing students' skills in the effective, purposeful, and responsible use of artificial intelligence based on a pedagogical pragmatic approach. In the modern educational process, the use of artificial intelligence technologies expands students' opportunities to search for, analyze, and process information, solve problematic situations, apply creative approaches, and engage in independent learning. At the same time, the use of artificial intelligence requires the development of competencies such as verifying the reliability of information, ensuring academic integrity, respecting copyright, and critically evaluating the results obtained. The article discusses the content of the pedagogical pragmatic approach, identifies the structural components of artificial intelligence use skills, describes the stages, methods, and tools for their development, and proposes a model for their application in the educational process. In addition, a system of practical tasks has been developed to help students effectively interact with artificial intelligence, formulate appropriate prompts, verify AI-generated information, and use artificial intelligence for educational purposes.*

Keywords: *pedagogical pragmatics, artificial intelligence, AI, digital competence, student, educational technologies, prompt, critical thinking, independent learning, academic integrity, digital literacy, methodology.*

KIRISH

Bugungi kunda raqamli texnologiyalarning jadal rivojlanishi ta’lim mazmuni va metodlariga yangi talablarni qo‘ymoqda. Ayniqsa, sun’iy intellektga asoslangan texnologiyalarning ta’lim jarayoniga kirib kelishi talabalarning bilim olish, axborot izlash, topshiriqlarni bajarish va o‘z bilimlarini nazorat qilish usullarini o‘zgartirmoqda. Sun’iy intellekt vositalari ta’lim oluvchiga qisqa vaqt ichida katta hajmdagi ma’lumotlarni qayta ishlash, matn yaratish, savollarga javob olish, g‘oyalarni shakllantirish, tarjima qilish va o‘quv materiallarini individuallashtirish imkonini beradi.

Biroq sun’iy intellektdan foydalanishning o‘zi talabaning yuqori darajadagi raqamli kompetensiyaga ega ekanligini anglatmaydi. Talaba AI vositasidan qanday maqsadda foydalanishni, unga qanday savol yoki topshiriq berishni, olingan javobning ishonchliligini qanday tekshirishni va undan akademik halollik tamoyillariga muvofiq foydalanishni bilishi lozim.

Shu nuqtai nazardan, pedagogik jarayonda pragmatik yondashuvdan foydalanish muhim ahamiyat kasb etadi. Mazkur yondashuv ta’lim oluvchining real amaliy vaziyatlarda bilim va ko‘nikmalarni qo‘llashiga, muayyan faoliyat natijasiga erishishiga hamda o‘z harakatlarining samaradorligini baholashiga yo‘naltiriladi.

Pedagogik pragmatik yondashuvning mazmuni

Pedagogik pragmatik yondashuv ta’lim jarayonida nazariy bilimlarni amaliy faoliyat bilan bog‘lashga asoslanadi. Bunda talaba tayyor bilimni passiv qabul qiluvchi emas, balki muayyan muammoni hal qiluvchi faol subyekt sifatida qaraladi.

Sun’iy intellektdan foydalanishni o‘rgatishda pragmatik yondashuv quyidagi tamoyillarga asoslanadi:

- **maqsadlilik** – AI vositasidan foydalanish aniq o‘quv yoki kasbiy maqsadga xizmat qilishi;
- **amaliylik** – bilim va ko‘nikmalar real vazifalar orqali shakllantirilishi;
- **mustaqillik** – talabaning sun’iy intellektdan tayyor javob olish emas, balki o‘z faoliyatini takomillashtirish vositasi sifatida foydalanishi;
- **tanqidiylik** – AI tomonidan taqdim etilgan ma’lumotlarni tahlil qilish va tekshirish;
- **refleksivlik** – talabaning o‘z faoliyati va undan olingan natijalarni baholashi;
- **mas’uliyatlilik** – sun’iy intellektdan foydalanishda akademik va axloqiy me’yorlarga rioya qilish.

Demak, pragmatik yondashuvning asosiy maqsadi talabaga muayyan AI vositasini shunchaki ishlatishni emas, balki uni **qachon, nima uchun, qanday va qanday chegaralarda ishlatish kerakligini** o‘rgatishdan iborat.

Talabalarda sun’iy intellektdan foydalanish ko‘nikmalarining tarkibi

Talabalarning AI savodxonligini bir nechta o‘zaro bog‘liq komponentlar asosida shakllantirish mumkin.

1. Instrumental ko‘nikma

Talaba sun’iy intellekt vositalarining asosiy funksiyalaridan foydalanishni bilishi kerak. Bunga AI platformasiga kirish, savol berish, javobni qayta ishlash, natijalarni saqlash va boshqa raqamli vositalar bilan integratsiya qilish kabi amaliy harakatlar kiradi.

2. Prompt tuzish ko‘nikmasi

AI bilan samarali ishlashda to‘g‘ri shakllantirilgan so‘rov muhim ahamiyatga ega. Talaba topshiriqning maqsadi, konteksti, kerakli format va cheklovlarni aniq ifodalashi lozim.

Masalan, oddiy:

“Pedagogika haqida ma’lumot ber.”

degan so‘rov o‘rniga:

“Oliy ta’limda sun’iy intellektdan foydalanishning pedagogik imkoniyatlarini 5 ta asosiy yo‘nalishda tahlil qiling. Har bir yo‘nalish uchun amaliy misol va ehtimoliy cheklovni ko‘rsating.”

kabi aniq topshiriq berish AI bilan muloqot samaradorligini oshiradi.

3. Tanqidiy-tahliliy ko‘nikma

AI tomonidan berilgan har qanday ma’lumotni mutlaq haqiqat sifatida qabul qilish mumkin emas. Talaba ma’lumotning manbasini, dolzarbligini, mantiqiy izchilligini va faktlarga mosligini tekshirishi kerak.

4. Ijodiy foydalanish ko‘nikmasi

Talaba AI vositalaridan yangi g‘oyalar yaratish, muammoli vaziyatlarni modellashtirish, taqdimot va o‘quv materiallari uchun konsepsiyalar ishlab chiqish kabi faoliyatlarda foydalanishni o‘rganadi.

5. Etik va mas’uliyatli foydalanish ko‘nikmasi

Talaba AI yordamida bajarilgan ish bilan mustaqil bajarilgan ish o‘rtasidagi farqni anglab yetishi, akademik halollik talablariga rioya qilishi va AI yordamidan foydalangan holatlarda tegishli tarzda qayd etishi zarur.

Sun’iy intellektdan foydalanish ko‘nikmalarini rivojlantirish metodikasi

Talabalarda sun’iy intellektdan foydalanish ko‘nikmalarini shakllantirishni quyidagi to‘rt bosqich asosida tashkil etish mumkin.

Birinchi bosqich – diagnostik bosqich

Dastlab talabalarning mavjud raqamli va AI savodxonligi aniqlanadi. Buning uchun anketa, test, amaliy topshiriq va suhbatlardan foydalanish mumkin.

Masalan, talabalarga quyidagi topshiriq beriladi:

“Muayyan mavzu bo‘yicha AI vositasidan foydalanib, 300 so‘zlik matn tayyorlang va undan foydalanishda qanday tekshiruvlar o‘tkazganingizni izohlang.”

Mazkur topshiriq orqali talabaning AI vositasidan foydalanish darajasi, prompt yaratish qobiliyati va tanqidiy yondashuvi aniqlanadi.

Ikkinchi bosqich – o‘rgatuvchi bosqich

Bu bosqichda o‘qituvchi talabalarga AI bilan ishlashning asosiy usullarini ko‘rsatadi. Jumladan:

- samarali prompt yaratish;
- AI javobini takomillashtirish;
- savolni bosqichma-bosqich murakkablashtirish;
- faktlarni mustaqil manbalar orqali tekshirish;
- AI javoblarini tahlil qilish;
- akademik halollik talablariga rioya qilish.

O‘qituvchi “namoyish – birgalikda bajarish – mustaqil bajarish” modeli asosida ishlashi mumkin.

Uchinchi bosqich – amaliy faoliyat bosqichi

Bu bosqich pedagogik pragmatik yondashuvning asosiy qismi hisoblanadi. Talabalar real yoki kasbiy vaziyatlarga yaqinlashtirilgan topshiriqlarni bajaradilar.

Masalan:

Vaziyat: Talaba ilmiy maqola uchun mavzu tanlashi kerak.

Topshiriq:

1. AI yordamida 5 ta mavzu variantini ishlab chiqish.
2. Variantlarni dolzarblik, ilmiy yangilik va amaliy ahamiyat mezonlari bo‘yicha tahlil qilish.
3. Eng maqbul variantni mustaqil asoslash.
4. AI tomonidan berilgan ma’lumotlarni ilmiy manbalar bilan tekshirish.
5. Yakuniy xulosani talabaning o‘zi shakllantirishi.

Bu jarayonda AI tayyor natijaning o‘rnini bosuvchi emas, balki talabaning intellektual faoliyatini qo‘llab-quvvatlovchi vosita sifatida qo‘llanadi.

To‘rtinchi bosqich – refleksiv-baholash bosqichi

Yakuniy bosqichda talaba o‘z faoliyatini tahlil qiladi. U quyidagi savollarga javob berishi mumkin:

- AI menga topshiriqni bajarishda qanday yordam berdi?
- Qaysi javoblarni tekshirishga to‘g‘ri keldi?
- AI tomonidan qanday xatolar aniqlandi?
- Promptni qanday takomillashtirdim?
- Yakuniy natijaga men qanday mustaqil hissa qo‘shdim?
- AI dan foydalanishda qanday etik talablarni hisobga oldim?

Bunday refleksiya talabaning metakognitiv ko‘nikmalarini rivojlantiradi.

Metod va vositalar

Pedagogik pragmatik yondashuv asosida quyidagi metodlardan samarali foydalanish mumkin:

Metod	Mazmuni	Kutiladigan natija
Muammoli ta’lim	AI yordamida real muammoni tahlil qilish	Muammoni hal qilish ko‘nikmasi
Case-study	Amaliy vaziyatni AI yordamida o‘rganish	Amaliy va tahliliy kompetensiya
Loyiha metodi	AI vositalari yordamida loyiha ishlab chiqish	Mustaqil va ijodiy faoliyat
“Prompt laboratoriyasi”	Turli promptlarni yaratish va solishtirish	AI bilan samarali muloqot
Fakt-cheking	AI javoblarini manbalar bilan tekshirish	Tanqidiy fikrlash
Refleksiya	AI bilan ishlash jarayonini baholash	O‘z-o‘zini tahlil qilish

Talabalarning AI ko‘nikmalarini baholash mezonlari

Talabalarning sun’iy intellektdan foydalanish ko‘nikmalarini baholashda quyidagi mezonlardan foydalanish mumkin:

Yuqori daraja: talaba AI vositasidan maqsadli foydalanadi, murakkab va aniq promptlar tuzadi, olingan ma’lumotlarni mustaqil tekshiradi, natijalarni tanqidiy tahlil qiladi va akademik halollik talablariga rioya qiladi.

O‘rta daraja: talaba AI vositasining asosiy funksiyalaridan foydalana oladi, biroq prompt yaratish, ma’lumotlarni tekshirish yoki natijalarni mustaqil tahlil qilishda qo‘shimcha yordamga ehtiyoj sezadi.

Boshlang‘ich daraja: talaba AI vositasidan foydalanadi, ammo undan foydalanish maqsadini aniq belgilash, sifatli prompt tuzish va olingan natijalarni tekshirish ko‘nikmalari yetarli darajada shakllanmagan.

Pedagogik model

Pedagogik pragmatik yondashuv asosida talabalarning AI ko‘nikmalarini rivojlantirish modelini quyidagicha ifodalash mumkin:

Maqsad → Diagnostika → O‘rgatish → Amaliy faoliyat → Tahlil → Refleksiya → Baholash

Ushbu modelda o‘qituvchi nazoratchi emas, balki talabaning faoliyatini yo‘naltiruvchi va maslahat beruvchi subyekt sifatida ishtirok etadi. Talaba esa o‘z navbatida AI vositalaridan foydalanish jarayonida mustaqil qaror qabul qiladi, olingan natijalarni baholaydi va yakuniy mahsulot uchun mas’uliyatni o‘z zimmasiga oladi.

Kutiladigan pedagogik natijalar

Mazkur metodikani ta’lim jarayonida tizimli qo‘llash natijasida talabalarda:

- sun’iy intellekt vositalaridan maqsadli foydalanish;
- aniq va samarali promptlar yaratish;
- AI tomonidan yaratilgan ma’lumotlarni tanqidiy baholash;
- axborotni mustaqil tekshirish;
- muammoli vaziyatlarni AI yordamida tahlil qilish;
- ijodiy va mustaqil fikrlash;
- raqamli savodxonlik;
- akademik halollik va raqamli etikaga rioya qilish;
- o‘z-o‘zini baholash va refleksiya qilish

ko‘nikmalari rivojlanadi.

XULOSA

Xulosa qilib aytganda, sun’iy intellekt texnologiyalarining ta’lim jarayoniga jadal kirib kelishi talabalarda nafaqat raqamli vositalardan foydalanish, balki ulardan pedagogik va kasbiy maqsadlarda ongli, tanqidiy hamda mas’uliyatli foydalanish kompetensiyasini shakllantirishni talab etadi.

Pedagogik pragmatik yondashuv ushbu vazifani amalga oshirish uchun amaliy imkoniyat yaratadi. Chunki mazkur yondashuvda talabaning real vazifalarni bajarishi, muammoni mustaqil hal qilishi, sun’iy intellekt bilan samarali muloqot qilishi va olingan natijalarni baholashi asosiy o‘ringa qo‘yiladi.

Shu sababli oliy ta’limda AI texnologiyalaridan foydalanishni o‘rgatish alohida texnik ko‘nikma sifatida emas, balki talabaning raqamli, axborotiy,

kommunikativ, tanqidiy va ijodiy kompetensiyalarini rivojlantiruvchi kompleks pedagogik jarayon sifatida tashkil etilishi maqsadga muvofiq. Bunda sun’iy intellekt talabaning o‘rnini egallovchi vosita emas, balki uning mustaqil fikrlashi va amaliy faoliyatini qo‘llab-quvvatlovchi texnologik resurs sifatida qaralishi lozim.

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3-SECTION

ОРГАНИЗАЦИЯ ОПЫТНО-ЭКСПЕРИМЕНТАЛЬНОЙ РАБОТЫ ПО ИСПОЛЬЗОВАНИЮ ДУХОВНО-НРАВСТВЕННЫХ ИДЕЙ ШЕЙХА МУХАММАДА САДЫКА МУХАММАДА ЮСУФА

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Аннотация: *В статье описаны методы организации опытно-экспериментальной работы по внедрению духовно-нравственных идей шейха Мухаммада Садыка Мухаммада Юсуфа в образовательный процесс. Обоснованы констатирующий, формирующий и контрольный этапы эксперимента, порядок формирования экспериментальной и контрольной групп, критерии воспитанности и способы статистической обработки данных. Указаны этические требования: светский характер образования и добровольность участия.*

Ключевые слова: *духовно-нравственное воспитание, педагогический эксперимент, адаб, экспериментальная и контрольная группы, педагогическая диагностика.*

Abstract: *The article describes methods of organizing an experimental study on introducing the moral and ethical ideas of Sheikh Muhammad Sodiq Muhammad Yusuf into the educational process. It substantiates the ascertaining, formative and control stages, the formation of experimental and control groups, the criteria of moral upbringing and statistical data processing. Ethical requirements, such as the secular nature of education and voluntary participation, are outlined.*

Keywords: *moral education, pedagogical experiment, good manners (adab), experimental and control groups, pedagogical diagnostics.*

ВВЕДЕНИЕ

Духовно-нравственное воспитание молодёжи остаётся одной из приоритетных задач системы образования. За годы независимости заметно вырос интерес к национальному и просветительскому наследию, и в этом ряду особое место занимают труды шейха Мухаммада Садыка Мухаммада Юсуфа (1952–2015). Он автор серии «Хадисы и жизнь» (Hadis va hayot),

трёхтомника «Духовное воспитание» (Ruhiy tarbiya), книги «Сокровищница адабов» (Odoblar xaziynasi) и других работ, где подробно разбираются нормы поведения и воспитание души [1].

Ограничиваться теоретическим разбором этих идей нельзя: эффективность их внедрения в практику обучения должна подтверждаться опытом. В зарубежных исследованиях большое внимание уделяется стадиям нравственного развития [2] и эмпирической оценке воспитательных программ [3], [4; 72–85]. Методы организации экспериментальной работы на материале наследия шейха при этом нуждаются в систематизации. Цель статьи — обосновать этапы, критерии и способы статистической оценки такой работы.

ОСНОВНАЯ ЧАСТЬ

Методология исследования. Исследование строится на квазиэкспериментальном дизайне [5], так как случайное распределение учащихся по группам возможно не всегда. Применяются педагогическое наблюдение, анкетирование, тестирование, беседа, ситуационные задания и статистическая обработка данных.

Результаты и обсуждение. Опытная работа организуется в три этапа. На констатирующем этапе выявляется исходный уровень духовно-нравственной воспитанности и формируются сходные по составу экспериментальная и контрольная группы (не менее 25–30 участников в каждой). Различие между группами проверяется критерием Стьюдента и не должно быть статистически значимым ($p > 0,05$).

Критерии оценки задаются по трём компонентам: познавательному (знание и понимание норм поведения), эмоционально-ценностному (отношение к родителям, учителю, соседу и другу, чувство ответственности) и поведенческому (умение поступать достойно в реальных ситуациях). По каждому компоненту выделяют высокий, средний и низкий уровни. Данные собираются с помощью тестов, анкет, карт наблюдения и ситуационных заданий.

На формирующем этапе в экспериментальной группе реализуется специальная программа, а контрольная работает по обычному плану. Содержание программы делится на четыре направления: 1) семья и уважение к родителям, родственные связи (идеи «Добра и заботы о родных»); 2) общественный этикет — общение с соседями, друзьями, учителями; 3) воспитание нафса и характера (идеи «Духовного воспитания» об очищении, обновлении и становлении нрава), что в педагогических терминах означает самовоспитание и рефлексию; 4)

отношение к знанию и честному труду. На занятиях используются проблемная беседа, кейс-анализ, ролевая игра, проектная работа, дневник самонаблюдения и сотрудничество с семьёй. Программу лучше рассчитывать минимум на один семестр по одному часу в неделю.

На контрольном этапе проводится повторная диагностика и сравниваются результаты двух групп. Распределение по уровням оценивают критерием χ^2 Пирсона, разницу средних баллов — критерием Стьюдента, силу эффекта — показателем d Коэна [6]. Чтобы проверить устойчивость результата, через 3–6 месяцев полезно сделать отсроченный замер.

значение имеют этические и правовые аспекты. Поскольку система образования светская [7], [8], наследие шейха используется как духовно-нравственное, без религиозной пропаганды, в рамках общечеловеческих норм поведения. Место исламских ценностей в нравственном воспитании отдельно обсуждается в зарубежной литературе [9; 283–296]. Кроме того, участие должно быть добровольным, необходимо согласие родителей и конфиденциальность данных, а по окончании опыта контрольной группе следует предложить ту же программу.

ЗАКЛЮЧЕНИЕ

Опытная работа по использованию идей шейха Мухаммада Садыка Мухаммада Юсуфа даёт достоверный результат, если она построена как трёхэтапный квазиэксперимент с чёткими критериями и статистической оценкой. Рекомендации: уравнять экспериментальную и контрольную группы по исходному уровню; измерять воспитанность отдельно по познавательному, эмоционально-ценностному и поведенческому компонентам; строить содержание программы в соответствии с требованиями светского образования; подтверждать результаты отсроченным замером.

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RAQAMLI TRANSFORMATSIYA ASOSIDA QURILISH SOHASINI RIVOJLANTIRISH: “SHAFFOF QURILISH” MILLIY AXBOROT TIZIMI MISOLIDA

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Annotatsiya: *Mazkur maqolada O‘zbekiston Respublikasida qurilish va uy-joy kommunal xo‘jaligi sohasida amalga oshirilayotgan raqamli transformatsiya jarayonlari tahlil qilinadi. Xususan, “Shaffof qurilish” milliy axborot tizimi negizida yaratilgan elektron platformalar, ularning davlat boshqaruvi, shaharsozlik, tender, reyting, davlat xizmatlari, loyiha-smeta ekspertizasi, qurilish nazorati va kommunal xizmatlar sohasidagi ahamiyati yoritiladi. Maqolada axborot tizimlarining integratsiyalashuvi, inson omilini kamaytirish, korrupsion xavflarni bartaraf etish, ochiqlik va jamoatchilik nazoratini kuchaytirishdagi o‘rni statistik ma’lumotlar asosida ko‘rib chiqiladi.*

Kalit so‘zlar: *raqamli transformatsiya, qurilish sohasi, Shaffof qurilish, axborot tizimi, elektron tender, reyting, davlat xizmatlari, geoxborot tizimi, raqamli nazorat, kommunal xizmatlar.*

Annotation*: This article analyzes the digital transformation processes being implemented in the construction and housing and communal services sector of the Republic of Uzbekistan. In particular, it examines the electronic platforms developed on the basis of the “Transparent Construction” (Shaffof Qurilish) national information system and highlights their significance in public administration, urban planning, tendering, rating, public services, design and cost estimate expertise, construction oversight, and utility services. Drawing on statistical data, the article considers the role of information system integration in reducing the human factor, eliminating corruption risks, and strengthening transparency and public oversight.*

Keywords: *digital transformation, construction sector, Transparent Construction, information system, electronic tender, rating, public services, geographic information system, digital oversight, utility services.*

KIRISH

Bugungi kunda dunyo miqyosida raqamli texnologiyalar davlat boshqaruvi, iqtisodiyot, ishlab chiqarish, xizmat ko‘rsatish va ijtimoiy sohalarning ajralmas qismiga aylanmoqda. Ayniqsa, qurilish sohasi kabi ko‘p bosqichli, ko‘p ishtirokchili va katta moliyaviy resurslar talab etadigan tarmoqlarda raqamlashtirish jarayonlari alohida ahamiyat kasb etadi.

O‘zbekiston Respublikasida ham so‘nggi yillarda qurilish sohasini raqamlashtirish orqali ochiqlikni ta’minlash, byurokratik to‘siqlarni kamaytirish, investitsion muhitni yaxshilash, davlat xizmatlarini soddalashtirish va korrupsion holatlarning oldini olish bo‘yicha izchil ishlar amalga oshirilmoqda.

Ushbu jarayonlarning muhim huquqiy asoslaridan biri O‘zbekiston Respublikasi Prezidentining 2019-yil 20-sentabrdagi “Qurilish sohasiga axborot-kommunikatsiya texnologiyalarini keng joriy etish chora-tadbirlari to‘g‘risida”gi PQ-4464-son qarori hisoblanadi. Mazkur qaror asosida qurilish sohasida zamonaviy axborot-kommunikatsiya texnologiyalarini joriy etish, korrupsiya va byurokratik to‘siqlarni kamaytirish hamda qurilish jarayonlarining barcha bosqichlarida shaffoflikni ta’minlash maqsadida “Shaffof qurilish” milliy axborot tizimi ishlab chiqilgan.

“Shaffof qurilish” milliy axborot tizimining shakllanishi va ahamiyati

“Shaffof qurilish” milliy axborot tizimi qurilish va uy-joy kommunal xo‘jaligi sohasidagi asosiy jarayonlarni yagona raqamli maydonda birlashtirishga xizmat qiluvchi kompleks tizim hisoblanadi. Ushbu tizim orqali qurilish jarayonlarining rejalashtirish, loyihalashtirish, ekspertiza, tender, qurilish nazorati, foydalanishga topshirish va kommunal xizmatlar bilan bog‘liq bosqichlari bosqichma-bosqich raqamlashtirilmoqda.

Bugungi kunda “Shaffof qurilish” milliy axborot tizimi negizida bir qator muhim elektron platformalar ishga tushirilgan. Jumladan, davlat shaharsozlik kadastri geografik axborot tizimi, maqsadli dasturlar monitoringi, qurilish sohasidagi “Reyting” va “Tender” elektron platformalari, davlat xizmatlarini ko‘rsatish tizimi, loyiha-smeta hujjatlarini ekspertizadan o‘tkazish tizimi, qurilishda davlat nazorati, “Mening uyim”, “Mening hududim”, issiqlik billing tizimi va boshqa platformalar faoliyat yuritmoqda.

Mazkur platformalarning asosiy vazifasi qurilish sohasida ma’lumotlar almashinuvini tezlashtirish, hujjatlar aylanishini elektron shaklga o‘tkazish, inson omilini kamaytirish va qaror qabul qilish jarayonlarini aniq ma’lumotlar asosida tashkil etishdan iborat.

Davlat shaharsozlik kadastri geoxborot tizimi

“Shaffof qurilish” tizimi doirasida joriy etilgan muhim platformalardan biri “O‘zbekiston Respublikasi davlat shaharsozlik kadastri” geografik axborot tizimidir. Ushbu geoxborot tizimi orqali respublika hududida yuritilayotgan shaharsozlik kadastri bo‘yicha batafsil ma’lumotlarni olish imkoniyati yaratilgan.

Tizimda ochiq turdagi ma’lumotlar sifatida qizil chiziqlar, funksional zonalash sxemalari, bosh rejalar va batafsil rejalashtirish loyihalari joylashtirilgan. Bu esa hududlarni rivojlantirish, yer resurslaridan samarali foydalanish, urbanizatsiya jarayonlarini tartibga solish va investorlar uchun qulay muhit yaratishda muhim ahamiyatga ega.

Shuningdek, ushbu tizim mahalliy davlat hokimiyati organlari uchun shaharsozlik masalalari bo‘yicha tezkor va asoslangan qarorlar qabul qilish imkonini beradi. Natijada hududlarni rejalashtirish jarayonida subyektiv yondashuvlar kamayib, ma’lumotlarga asoslangan boshqaruv mexanizmi shakllanadi.

Maqsadli dasturlar monitoringi tizimi

Qurilish sohasida davlat dasturlariga kiritilgan obyektlar bo‘yicha ishlarning bajarilishini nazorat qilish muhim masalalardan biridir. Shu maqsadda “Maqsadli dasturlar monitoringi” axborot tizimi joriy etilgan.

Mazkur tizim orqali obyektlarning davlat dasturiga kiritilishidan boshlab, arxitektura-rejalashtirish topshirig‘i ishlab chiqilishi, loyiha-smeta hujjatlari tayyorlanishi, ekspertizadan o‘tkazilishi, tender e’lon qilinishi, g‘olib pudratchi aniqlanishi, shartnoma tuzilishi va qurilish jarayonining monitoringi bo‘yicha ma’lumotlar jamlanadi.

Bu tizimning afzalligi shundaki, har bir obyekt bo‘yicha jarayonlar bosqichma-bosqich kuzatib boriladi. Natijada qurilish muddatlari, moliyalashtirish holati, nazorat organlari tomonidan aniqlangan kamchiliklar va ularning bartaraf etilishi yagona elektron bazada aks ettiriladi.

Qurilish sohasida elektron reyting tizimi

Qurilish-pudrat tashkilotlari faoliyatini baholashda inson omilini kamaytirish va adolatli raqobat muhitini shakllantirish maqsadida “Reyting” elektron platformasi joriy etilgan. Ushbu tizim Vazirlar Mahkamasining 2020-yil 9-noyabrdagi 699-son qarori asosida ishlab chiqilgan.

Elektron reyting tizimi qurilish-pudrat tashkilotlarining faoliyati to‘g‘risidagi ma’lumotlarni tegishli davlat organlarining axborot tizimlari bilan integratsiya qilish orqali shakllantiradi. Tizim umumqurilish va ijtimoiy obyektlar, melioratsiya va irrigatsiya obyektlari, avtomobil yo‘llari va ko‘priklar hamda loyiha tashkilotlari bo‘yicha reytinglarni avtomatik tarzda belgilaydi.

Elektron reyting tizimi ishga tushirilgandan so‘ng qurilish tashkilotlari faoliyatida ijobiy o‘zgarishlar kuzatilgan. Jumladan, korxonalarning aylanma mablag‘lari 41 trillion so‘mga oshgan, maxsus texnikalar soni ikki barobarga ko‘paygan, sohada band bo‘lgan aholi soni esa 58 foizga ortgan. Bu ko‘rsatkichlar tizimning qurilish bozorini tartibga solish va legallashtirishdagi samaradorligini ko‘rsatadi.

Elektron tender platformasi va iqtisodiy samaradorlik

Qurilish sohasida tender jarayonlarini raqamlashtirish davlat xaridlarida ochiqlikni ta’minlashning eng muhim yo‘nalishlaridan biridir. “Tender” avtomatlashtirilgan axborot tizimi Vazirlar Mahkamasining 2022-yil 31-yanvardagi 46-son qarori asosida ishlab chiqilgan.

Mazkur platforma tender jarayonlarida inson omilini kamaytirish, ishtirokchilar takliflarini tashkilotlar reytingi va tijorat takliflari asosida avtomatik baholash imkonini beradi. Natijada tanlov jarayonlarining shaffofligi oshadi, subyektiv qarorlar kamayadi va byudjet mablag‘laridan samarali foydalanish ta’minlanadi.

Statistik ma’lumotlarga ko‘ra, 2022–2025-yillar davomida elektron tender platformasi orqali jami 43 389 ta tender o‘tkazilgan, 208 239 nafar ishtirokchi qatnashgan. Tenderlarning umumiy qiymati 49,1 trillion so‘mni tashkil etgan bo‘lsa, tuzilgan shartnomalar qiymati 46,6 trillion so‘mni tashkil qilgan. Natijada jami 2,44 trillion so‘mdan ortiq mablag‘ iqtisod qilingan.

Bu raqamlar elektron tender tizimi nafaqat shaffoflikni ta’minlayotganini, balki davlat mablag‘larini tejashda ham muhim ahamiyatga ega ekanini ko‘rsatadi.

Davlat xizmatlarini raqamlashtirish

Qurilish sohasida davlat xizmatlarini ko‘rsatish tizimi fuqarolar va tadbirkorlik subyektlariga qulaylik yaratish maqsadida joriy etilgan. Ushbu tizim orqali qurilish bilan bog‘liq arizalar elektron shaklda qabul qilinadi, ularning ijrosi nazorat qilinadi va natijalar onlayn tarzda rasmiylashtiriladi.

Davlat xizmatlari qatoriga bino va inshootlarning tashqi ko‘rinishini o‘zgartirishni kelishish, bino va inshootlarni qayta qurish yoki rekonstruksiya qilishga ruxsatnoma berish, arxitektura-rejalashtirish topshirig‘ini ishlab chiqish, loyiha-smeta hujjatlarini kelishish, qurilish-montaj ishlarini boshlash uchun obyektni ro‘yxatdan o‘tkazish va obyektni foydalanishga qabul qilish kabi xizmatlar kiradi.

2024-yilda loyiha-smeta hujjatlarini kelishish bo‘yicha 163 233 ta ariza kelib tushgan. Shundan 115 261 tasi bo‘yicha ijobiy xulosa berilgan. Bu esa

davlat xizmatlari tizimining keng qo‘llanilayotganini va qurilish jarayonlarida elektron xizmatlarning ahamiyati ortib borayotganini ko‘rsatadi.

Loyiha-smeta hujjatlari ekspertizasi tizimi

Qurilish sohasida loyiha-smeta hujjatlarini ekspertizadan o‘tkazish sifati va shaffofligini oshirish maqsadida “Loyiha-smeta hujjatlari ekspertizasi” axborot tizimi ishlab chiqilgan. Ushbu tizim Vazirlar Mahkamasining 2021-yil 17-sentabrdagi 579-son qarori asosida joriy etilgan.

Avvalgi an’anaviy tartibda loyiha hujjatlari qog‘oz shaklida qabul qilinib, ekspertizadan so‘ng buyurtmachiga qaytarib berilgan. Bu jarayonda hujjatlarning saqlanishi, ko‘rib chiqish bosqichlarini kuzatish va kiritilgan o‘zgarishlarni nazorat qilish imkoniyatlari cheklangan edi.

Yangi elektron tizim joriy etilgach, loyiha-smeta hujjatlarini qabul qilish, ko‘rib chiqish, aniqlangan kamchiliklarni qayd etish, o‘zgartirishlarni saqlash va ekspertiza xulosalarini yagona bazada yuritish imkoniyati yaratildi.

Bu esa qurilish hujjatlari bilan ishlashda shaffoflikni oshirib, ekspertiza jarayonida noqonuniy aralashuvlarning oldini olishga xizmat qiladi.

Qurilishda davlat nazorati tizimi

Qurilish obyektlarida sifat nazoratini kuchaytirish va nazorat jarayonlarini avtomatlashtirish maqsadida “Qurilishda davlat nazorati” axborot tizimi joriy etilgan. Ushbu tizim orqali inspeksiya xodimlari obyektlarda aniqlangan kamchiliklarni foto va geolokatsiya ma’lumotlari bilan birgalikda tizimga kiritadi.

Tizimning muhim jihatlaridan biri shundaki, inspektor obyektga chiqishda geolokatsiya orqali tasdiqlanadi, qurilish jarayonidagi holatlar foto-fiksatsiya qilinadi va aniqlangan kamchiliklar elektron yozma ko‘rsatma shaklida tizim ishtirokchilariga yuboriladi.

Bundan tashqari, obyektni foydalanishga qabul qilish jarayoni soddalashtirilib, 27 ta chek-list bandi o‘rniga 7 ta band qoldirilgan. Har bir obyekt uchun QR-kodli pasport joriy etilishi esa fuqarolar va jamoatchilik vakillariga obyekt haqida real vaqt rejimida ma’lumot olish imkonini beradi.

“Ulush kiritish asosida uy-joy qurish” axborot tizimi

Uy-joy qurilishi sohasida fuqarolarning huquqlarini himoya qilish va ulushdorlar bilan qurilish tashkilotlari o‘rtasidagi munosabatlarni shaffoflashtirish maqsadida “Ulush kiritish asosida uy-joy qurish 2.0” axborot tizimi ishlab chiqilgan.

Mazkur tizim ulush kiritish asosida ko‘p kvartirali uylarni qurish va ulardagi xonadonlarni sotish jarayonlarini elektron nazorat qilishga mo‘ljallangan. Tizimda ulushdorlarning mablag‘lari alohida hisobvaraqlarda

jamlanadi, xonadon xarid qilish jarayonida qurilish holati bo‘yicha to‘liq ma’lumot shakllanadi va ulushdorlarning mulk huquqi elektron reyestrda qayd etiladi.

Bu tizim orqali fuqarolarning uy-joy sotib olish jarayonidagi xavfsizligi oshadi, qurilish tashkilotlari faoliyati ustidan nazorat kuchayadi va ishonchli raqamli muhit shakllanadi.

Mutaxassislarni sertifikatlash tizimi

Qurilish va uy-joy kommunal xo‘jaligi sohalarida malakali kadrlar tayyorlash ham raqamli transformatsiyaning muhim yo‘nalishlaridan biridir. Shu maqsadda shaharsozlik va uy-joy kommunal xo‘jaligi sohalari mutaxassislarini sertifikatlash tizimi joriy etilgan.

Tizim orqali mutaxassislarni o‘qitish, bilimini baholash va sertifikat berish jarayonlari elektron tarzda tashkil etilgan. O‘quv dasturlari xalqaro tajribalar asosida ishlab chiqilgan bo‘lib, test natijalariga ko‘ra yetarli ball to‘plagan mutaxassis QR-kodli elektron sertifikatga ega bo‘ladi.

Ma’lumotlarga ko‘ra, bugungi kunga qadar 9 898 nafar mutaxassis qayta o‘qitilgan, ulardan 2 324 nafariga sertifikat berilgan.

Kommunal xizmatlar sohasida raqamlashtirish

Uy-joy kommunal xo‘jaligi sohasida ham raqamli texnologiyalar keng joriy etilmoqda. Xususan, “Mening uyim” avtomatlashtirilgan billing axborot tizimi orqali ko‘p kvartirali uy-joylarga xizmat ko‘rsatish, majburiy badal to‘lovlarini hisoblash, qarzdorlikni ko‘rish, elektron to‘lovlarni amalga oshirish va boshqaruv servis kompaniyalariga murojaat yuborish imkoniyatlari yaratilgan.

Shuningdek, issiqlik ta’minoti billing tizimi orqali issiq suv va isitish xizmatlari bo‘yicha abonentlar, to‘lovlar, debitor va kreditor qarzdorliklar elektron shaklda yuritilmoqda. Bugungi kunda issiqlik billing tizimiga respublika bo‘yicha 22 ta issiqlik ta’minoti tashkiloti ulangan va tizimda 191 404 nafar mijoz mavjud. Oyiga 500 million so‘mdan ortiq tushum billing tizimi orqali amalga oshirilmoqda.

Bu kommunal xizmatlarda hisob-kitoblarning shaffofligini oshirish, to‘lov intizomini kuchaytirish va aholiga qulay xizmat ko‘rsatishda muhim ahamiyat kasb etadi.

Ochiq ma’lumotlar va jamoatchilik nazorati

Qurilish obyektlari ustidan jamoatchilik nazoratini kuchaytirish maqsadida 2024-yil 1-yanvardan qurilish obyektlarining ochiq ma’lumotlar portali ishga tushirilgan. Ushbu portal orqali qurilish obyektlari ustidan davlat

nazorati, buyurtmachining texnik nazorati, ishlab chiquvchining mualliflik nazorati va pudratchining ichki nazorati bo‘yicha ma’lumotlar kiritib boriladi.

Shuningdek, aniqlangan kamchiliklar va ularning bartaraf etilishi haqidagi ma’lumotlarning jamoatchilik uchun ochiq bo‘lishi ta’minlanadi.

Bu yondashuv qurilish jarayonlarida aholining xabardorligini oshirish, korrupsiya xavfini kamaytirish va qurilish sifati ustidan ijtimoiy nazoratni kuchaytirishga xizmat qiladi.

Raqamli transformatsiyaning umumiy natijalari

Qurilish sohasida raqamli texnologiyalarni joriy etish natijasida quyidagi muhim natijalarga erishilmoqda:

Birinchidan, qurilish jarayonlarida shaffoflik oshmoqda. Avval yopiq yoki qog‘oz shaklida yuritilgan ko‘plab jarayonlar bugungi kunda elektron tizimlar orqali kuzatilmoqda.

Ikkinchidan, inson omili kamaymoqda. Tender, reyting, ekspertiza, davlat xizmatlari va nazorat jarayonlarida avtomatlashtirilgan mexanizmlar joriy etilishi subyektiv qarorlar va noqonuniy aralashuvlar ehtimolini pasaytirmoqda.

Uchinchidan, iqtisodiy samaradorlik oshmoqda. Elektron tender platformasi orqali 2,44 trillion so‘mdan ortiq mablag‘ iqtisod qilingani raqamlashtirishning moliyaviy natijadorligini yaqqol ko‘rsatadi.

To‘rtinchidan, fuqarolar va tadbirkorlar uchun qulayliklar yaratilmoqda. Davlat xizmatlari, billing tizimlari va ochiq portallar orqali xizmatlar tezkor, masofaviy va shaffof ko‘rinishda ko‘rsatilmoqda.

Beshinchidan, ma’lumotlarga asoslangan boshqaruv shakllanmoqda. Geoxborot tizimlari, monitoring platformalari va ochiq ma’lumotlar portallari orqali hududlarni rivojlantirish, qurilish obyektlarini nazorat qilish va investitsion qarorlar qabul qilish jarayonlari aniq ma’lumotlarga tayangan holda amalga oshirilmoqda.

XULOSA

O‘zbekiston Respublikasida qurilish va uy-joy kommunal xo‘jaligi sohasida amalga oshirilayotgan raqamli transformatsiya jarayonlari davlat boshqaruvining zamonaviy, ochiq va samarali modelini shakllantirishga xizmat qilmoqda. “Shaffof qurilish” milliy axborot tizimi ushbu jarayonning asosiy raqamli infratuzilmasi sifatida qurilish sohasidagi ko‘plab yo‘nalishlarni yagona elektron ekotizimga birlashtirmoqda.

Tahlillar shuni ko‘rsatadiki, “Shaffof qurilish” tizimi orqali qurilish jarayonlarining shaffofligi oshgan, tender va reyting mexanizmlari avtomatlashtirilgan, davlat xizmatlari elektron shaklga o‘tkazilgan, nazorat

jarayonlari raqamlashtirilgan, kommunal xizmatlarda billing tizimlari joriy etilgan va jamoatchilik nazorati kuchaytirilgan.

Kelgusida ushbu tizimlarni yanada takomillashtirish, sun’iy intellekt, katta ma’lumotlar tahlili, raqamli egizaklar, BIM texnologiyalari va mobil monitoring vositalarini keng joriy etish qurilish sohasining samaradorligini yanada oshiradi. Shu jihatdan, “Shaffof qurilish” milliy axborot tizimi O‘zbekistonda raqamli iqtisodiyot va raqamli boshqaruvni rivojlantirishning muhim amaliy namunasi hisoblanadi.

FOYDALANILGAN ADABIYOTLAR

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2. O‘zbekiston Respublikasi Prezidentining 2020-yil 5-oktabrdagi PF-6079-son Farmoni.
3. O‘zbekiston Respublikasi Vazirlar Mahkamasining 2020-yil 9-noyabrdagi 699-son qarori.
4. O‘zbekiston Respublikasi Vazirlar Mahkamasining 2021-yil 17-sentabrdagi 579-son qarori.
5. O‘zbekiston Respublikasi Vazirlar Mahkamasining 2022-yil 31-yanvardagi 46-son qarori.
6. Qurilish va uy-joy kommunal xo‘jaligi sohasida amalga oshirilgan ishlar bo‘yicha statistik ma’lumotlar.

BUILDING A REGRESSION MODEL IN PYTHON FOR A BEGINNER-LEVEL DATASET

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Abstract: *This paper presents the process of building a linear regression model in Python using a beginner-level dataset. The study uses a dataset containing 30 observations of work experience and monthly salary. The data were examined and prepared using Python libraries, including Pandas and NumPy. A linear regression model was developed using the Scikit-learn library, while data visualization was performed with Matplotlib. The dataset was divided into training and testing subsets at an 80/20 ratio. Model performance was evaluated using R^2, MAE, and RMSE metrics. The results demonstrate that a simple regression model can provide an interpretable approach to predicting salary based on work experience.*

Keywords: *regression analysis, Python, linear regression, machine learning, data preprocessing, Scikit-learn, predictive modeling.*

INTRODUCTION

The rapid development of data science and machine learning has increased the importance of methods that can transform raw data into meaningful information and predictions. Among the fundamental techniques used in predictive data analysis, regression occupies an important position because it allows researchers to examine relationships between variables and estimate numerical outcomes. Linear regression is particularly suitable for introductory studies because its mathematical structure is relatively simple, its parameters are interpretable, and its implementation can be performed using widely available Python libraries [1], [2].

Python has become one of the widely used programming languages for data analysis and machine learning. Its extensive ecosystem includes libraries such as NumPy, pandas, Matplotlib, and scikit-learn, which provide tools for data preparation, visualization, statistical analysis, model development, and evaluation. The availability of these libraries makes Python suitable not only for

experienced data scientists but also for beginners who are learning the fundamental principles of machine learning [3].

A regression problem generally involves one or more independent variables, known as features, and a dependent variable, known as the target. The purpose of a regression model is to identify a mathematical relationship between these variables and use this relationship to generate predictions for previously unseen observations. In the case of linear regression, the model estimates a linear relationship between the input features and the target value. The ordinary least squares approach determines model coefficients by minimizing the residual sum of squares between observed and predicted values [4].

For a beginner-level dataset, constructing a regression model provides an opportunity to understand the complete machine learning workflow. This workflow commonly includes examining the dataset, identifying features and the target variable, cleaning and preparing the data, dividing the observations into training and testing subsets, fitting the regression model, generating predictions, and evaluating the model's performance. The train-test split is particularly important because it provides separate data for assessing how well the trained model performs on observations that were not used during model fitting [5].

Model evaluation is another essential stage of regression analysis. Common evaluation measures include Mean Absolute Error (MAE), Mean Squared Error (MSE), Root Mean Squared Error (RMSE), and the coefficient of determination (R^2). These measures provide different perspectives on prediction errors and the degree to which the model explains variation in the target variable [6]. Therefore, learning how to interpret these measures is as important as learning how to construct the model itself.

The aim of this study is to demonstrate a clear and reproducible procedure for building a basic regression model in Python using a beginner-level dataset. The study focuses on the main stages of the modeling process, from initial data exploration and preparation to model training, prediction, visualization, and evaluation. By presenting these stages in a systematic manner, the study demonstrates how fundamental machine learning concepts can be implemented using Python and provides a practical foundation for further study of more advanced regression and predictive modeling techniques.

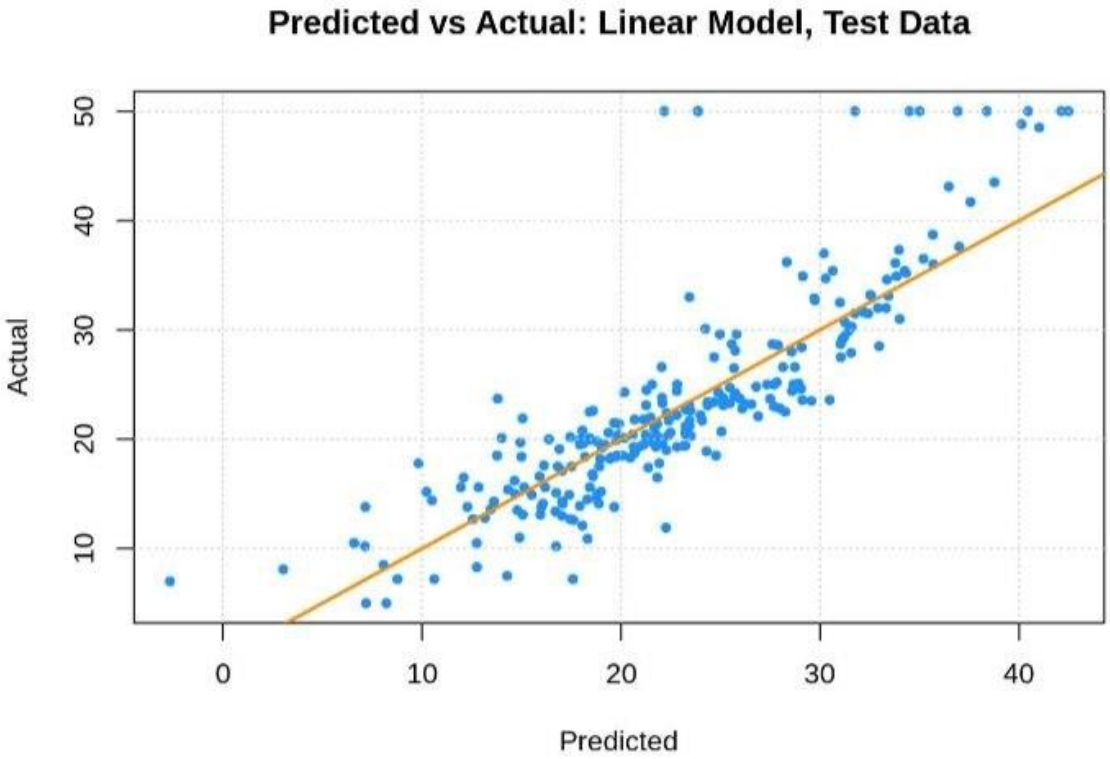
Regression analysis is one of the fundamental methods used in data analysis and machine learning for studying relationships between variables and predicting numerical outcomes. In a regression problem, one variable is considered the target variable, while other variables are used as predictors. The

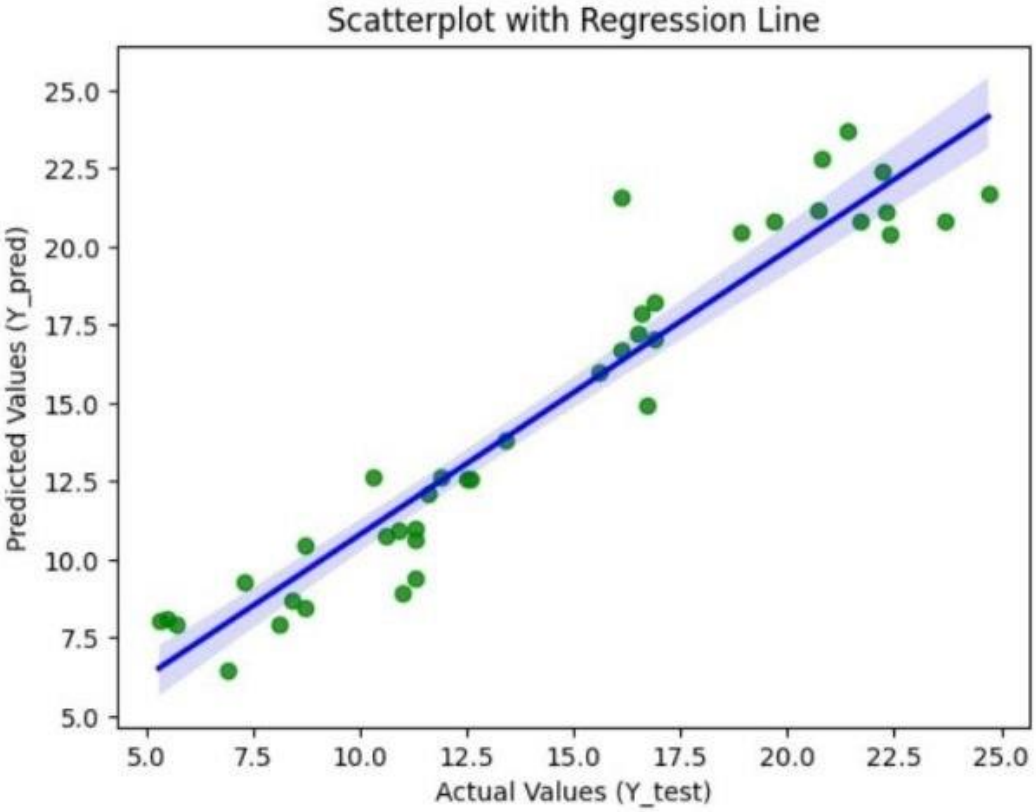
main purpose of the model is to identify a mathematical relationship between these variables and use this relationship to estimate the target value for new observations. For a beginner-level dataset, linear regression provides a relatively simple way to understand this process because the relationship between the variables can be represented and interpreted using a mathematical equation.

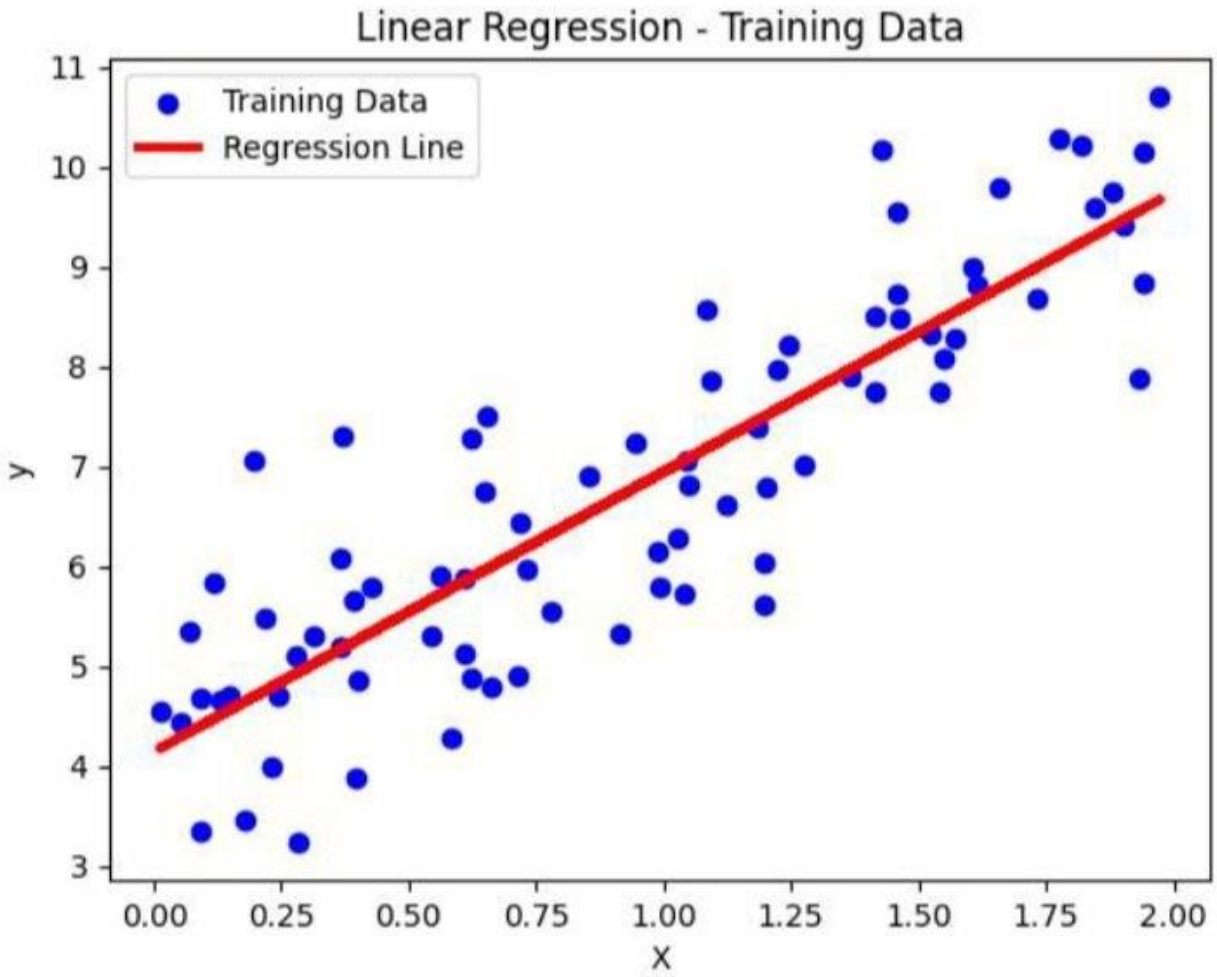
The development of a regression model in Python begins with the preparation and examination of the dataset. Before applying a machine learning algorithm, it is necessary to understand what information the dataset contains, identify the dependent and independent variables, and check whether missing or incorrect values are present. Python libraries such as pandas and NumPy provide convenient tools for reading, organizing, and examining datasets. Basic descriptive statistics can also help identify the minimum, maximum, average, and distribution of numerical variables. Proper data preparation is an important stage because the quality of the input data directly affects the reliability of the resulting model [1], [2].

After the initial examination, the variables required for the regression analysis are selected. The independent variables represent the information used by the model to make a prediction, whereas the dependent variable represents the numerical value that the model attempts to predict. When a single predictor is used, the relationship can be expressed as a simple linear regression equation. When several predictors are included, the model becomes a multiple linear regression model. In both cases, the objective is to estimate the coefficients that provide the closest possible relationship between the observed data and the predicted values [3].

Data visualization is particularly useful when working with a beginner-level dataset. A scatter plot can demonstrate whether an approximately linear relationship exists between two numerical variables. If the observations form a relatively clear upward or downward pattern, a linear regression model may provide a useful initial representation of the relationship. Visualization also makes it easier to identify unusual observations and understand the general structure of the data before model training.


Predicted vs Actual: Linear Model, Test Data
Actual
Predicted
10
20
30
40
50
0
10
20
30
40


Scatterplot with Regression Line
Predicted Values (Y_pred)
Actual Values (Y_test)
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22.5
25.0



Source: Adapted by the author based on the linear regression methodology described in [3] and the scikit-learn documentation [5].

The next important stage is dividing the dataset into training and testing parts. The training data are used to teach the regression algorithm and estimate the model parameters, while the testing data are used to determine how accurately the trained model performs on observations that it has not previously seen. This separation is important because a model that performs well on training observations may not necessarily demonstrate the same level of performance on new data. The train_test_split function available in the scikit-learn library provides a practical method for creating these subsets [5].

Once the data have been divided, the regression model can be created using Python's scikit-learn library. The LinearRegression method can be applied to a dataset containing numerical predictors and a numerical target variable. During the training process, the algorithm estimates the coefficients of the regression equation by minimizing the differences between the observed and predicted values. The resulting model can then be applied to the testing data to generate predictions.

Model evaluation is an essential part of the regression process. Several statistical measures can be used to determine the difference between actual and predicted values. Mean Absolute Error measures the average absolute prediction error, while Mean Squared Error gives greater weight to larger errors. Root Mean Squared Error is obtained from the square root of the Mean Squared Error and expresses the prediction error in the same measurement units as the target variable. The coefficient of determination, commonly represented as R^2, indicates how much of the variation in the target variable is explained by the regression model [4], [6].

The interpretation of these evaluation results should always consider the characteristics of the dataset. A lower error value generally indicates smaller differences between predicted and observed values, while the interpretation of R^2 depends on the research context and the variables being analyzed. Therefore, model quality should not be determined from a single numerical indicator. Combining numerical evaluation with graphical analysis provides a more complete understanding of the model's performance [6], [7].

An additional advantage of regression analysis is the possibility of visually comparing actual and predicted values. A graph showing these values can demonstrate whether the model's predictions follow the general pattern of the original observations. When the predicted values are close to the actual values, the model provides a more consistent representation of the relationship contained in the dataset. However, differences between actual and predicted values are unavoidable in most practical applications, and these differences should be examined rather than ignored.

For beginners, building a regression model in Python is therefore not limited to writing several lines of programming code. It represents a complete analytical process that includes understanding the dataset, preparing the variables, exploring relationships through visualization, separating training and testing observations, fitting the model, generating predictions, and evaluating the obtained results. This workflow establishes a foundation for understanding more advanced machine learning methods, including polynomial regression, regularized regression, decision-tree regression, and other predictive algorithms.

At the same time, a basic linear regression model has several limitations. A linear model assumes that the relationship between the selected predictors and the target can be reasonably represented by a linear function. Real-world datasets may contain nonlinear relationships, outliers, missing observations, measurement errors, or interactions between variables.Consequently, the results of a beginner-level regression model should be interpreted within the limitations

of the available dataset rather than generalized to all possible situations. Nevertheless, the method provides an accessible and scientifically useful starting point for learning predictive modeling and data-driven analysis [2], [7].

CONCLUSION

Building a regression model in Python provides a practical and accessible introduction to the principles of machine learning and predictive data analysis. The analysis presented in this study demonstrates that the development of a regression model is a systematic process that begins with understanding and preparing the dataset and continues through data exploration, selection of variables, division of observations into training and testing subsets, model training, prediction, and evaluation. For beginners, this workflow provides a clear understanding of how raw numerical data can be transformed into a predictive model using Python.

Linear regression is particularly appropriate as an introductory machine learning method because its mathematical structure is relatively simple and its results can be interpreted comparatively easily. The use of Python libraries such as pandas, NumPy, Matplotlib, and scikit-learn also simplifies the implementation of the analytical process. At the same time, the study shows that the quality of a regression model depends not only on the algorithm itself but also on the quality and structure of the dataset, appropriate data preparation, selection of relevant variables, and correct interpretation of evaluation results.

The practical application of regression modeling can be improved by encouraging beginners to follow a consistent analytical workflow rather than focusing only on programming syntax. Before training a model, attention should be given to checking missing values, identifying unusual observations, examining relationships between variables, and visualizing the data. It is also recommended to evaluate the model using several complementary indicators, such as MAE, MSE, RMSE, and R^2, rather than relying on a single metric. This approach provides a more comprehensive understanding of prediction errors and model performance.

For further development, beginner-level regression exercises can be expanded by using larger and more diverse datasets and by comparing linear regression with other regression techniques. Students can also investigate nonlinear relationships, feature selection, cross-validation, and regularization methods after mastering the basic workflow. Practical projects based on real-world datasets can further strengthen programming, statistical reasoning, and data interpretation skills. Thus, learning to build a regression model in Python

can serve as a foundation for more advanced studies in machine learning, artificial intelligence, statistics, and data science.

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INCREASING THE ENERGY EFFICIENCY OF INDUCTION MOTOR DRIVES WITH FREQUENCY CONVERTERS

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Abstract: *This article analyzes the theoretical and practical aspects of increasing the energy efficiency of induction motor drives equipped with frequency converters. The possibilities of controlling the rotational speed of an induction motor according to the technological load, reducing starting current, limiting power losses, and improving the efficiency of the electric drive are considered. The use of frequency converters in industrial pumps, fans, compressors, and conveyors is evaluated as an essential tool for optimizing energy consumption.*

Keywords: *induction motor, electric drive, frequency converter, VFD, energy efficiency, electrical energy, speed control, power loss.*

INTRODUCTION

In industrial enterprises, a significant portion of electricity consumption is accounted for by electric motors and electric drives based on them. In production processes, the load of pumps, fans, compressors, conveyors, machine tools, and other mechanisms is often not constant. If the motor continues to operate at nominal speed even when technological demand decreases, excess electricity is consumed. Therefore, controlling the speed and torque of the motor in accordance with real load requirements is an important direction in increasing energy efficiency.

Operating principle of an induction electric drive

An induction motor operates based on the generation of a rotating magnetic field when three-phase alternating current is applied to the stator windings. The synchronous rotational speed of the magnetic field is determined as follows:

$$n_1 = (60 \cdot f) / p$$

where:

• n_1 – synchronous rotational speed, rpm;

• f – supply frequency, Hz;

• p – number of pole pairs.

The rotor speed is slightly less than the synchronous speed, and the difference between them is characterized by slip:

$$s = (n_1 - n) / n_1$$

By controlling the frequency value, it is possible to adjust the synchronous speed and, consequently, the rotor rotational speed. This feature is the main theoretical principle of electric drives with frequency converters.

Role and structure of the frequency converter

A frequency converter (VFD) usually consists of a rectifier, a DC intermediate link, and an inverter section. The alternating voltage coming from the network is rectified and subsequently converted by the inverter into alternating voltage of the required frequency and amplitude. The PWM (Pulse Width Modulation) method allows generating the necessary voltage waveform for the motor by high-speed switching of inverter keys.

In simple control, maintaining the V/f ratio nearly constant within a certain range keeps the motor magnetic flux at its normal value. In systems where high accuracy is required, vector control or Direct Torque Control (DTC) methods are used.

Energy efficiency evaluation methodology

The efficiency coefficient (η) of an electric drive is determined by the ratio of useful mechanical power to consumed electrical power:

$$\eta = (P_2 / P_1) \cdot 100\%$$

The active input power of the motor for a three-phase system is approximately determined as follows:

$$P_1 = \sqrt{3} \cdot U \cdot I \cdot \cos\varphi$$

To increase energy efficiency, it is necessary to avoid operating the motor under excessive or very low load conditions for long periods, reduce losses in mechanical transmissions, and select an optimal control mode.

Savings opportunities in pumps and fans

Affinity laws are of great importance in variable torque pump and fan loads. Flow (Q) depends approximately on rotational speed, pressure (H) on the square of the speed, and required power (P) on the cube of the speed:

$$Q_2 / Q_1 = n_2 / n_1, \quad H_2 / H_1 = (n_2 / n_1)^2, \quad P_2 / P_1 = (n_2 / n_1)^3$$

Therefore, reducing the speed when full capacity is not required from the mechanism can significantly reduce energy consumption. However, the actual amount of savings depends on the motor, VFD, mechanical system, and operating cycle; it should be evaluated based on experimental measurements.

Practical effects and directions for improvement

A frequency converter enables smooth starting of the motor. As a result, high starting current, line voltage drops, and mechanical shocks are reduced. Acceleration and deceleration times can be programmed. Furthermore, closed-loop automatic control can be implemented by receiving signals from sensors measuring pressure, flow, temperature, or other technological parameters.

Directions for improvement: In future efficient systems, the VFD is considered not merely as a device delivering a predetermined frequency, but as an executive component of data-driven intelligent control. The motor operating point is evaluated through continuous monitoring of current, voltage, speed, torque, and temperature data. Artificial Intelligence (AI) algorithms can detect load variations and select control parameters that minimize energy consumption.

CONCLUSION

An induction electric drive with a frequency converter allows controlling the performance of industrial mechanisms in accordance with technological demand. This approach serves to reduce electricity consumption, improve starting performance, lower stress on mechanical components, and increase the level of automation. Integrating VFDs, sensors, monitoring systems, and AI algorithms into a single adaptive control system represents a promising scientific direction for further enhancing energy efficiency.

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MAHALLIY ZEOLIT ASOSIDA KOMPOZITSION GIPS BOG‘LOVCHINING SUVGA CHIDAMLILIGINI BOSHQARISH: STRUKTURA VA NAMLIK ALMASHINUVI YONDASHUVI

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Annotatsiya. *Mazkur tezisda mahalliy zeolitning gips bog‘lovchining suvga chidamliligiga ta’siri tahlil qilindi. Zeolitning mikrog‘ovak tuzilishi va sirt faolligi namlik almashinuvi, g‘ovaklik va kristallanish jarayonlariga ta’sir qilishi mumkin. Biroq uning miqdori ortishi suv talabini ham oshirishi ehtimoli mavjud. Shu sababli zeolitning samaradorligi mineralogik tarkibi, dispersligi, miqdori, suv-bog‘lovchi nisbati va kimyoviy qo‘shimcha bilan o‘zaro ta’siri asosida baholanishi lozim.*

Kalit so‘zlar: *gips bog‘lovchi, tabiiy zeolit, mineral modifikator, suvga chidamlilik, g‘ovaklik, suv shimuvchanlik, yumshash koeffitsiyenti, kristall tuzilma, namlik almashinuvi, kompozitsion material.*

Abstract. *This thesis analyzes the influence of local zeolite on the water resistance of the gypsum binder. The microporous structure and surface activity of zeolite can affect moisture exchange, porosity, and crystallization processes. However, there is a possibility that increasing its quantity will also increase the demand for water. Therefore, the effectiveness of zeolite should be evaluated based on its mineralogical composition, dispersion, content, water-binding ratio, and interaction with the chemical additive.*

Keywords: *gypsum binder, natural zeolite, mineral modifier, water resistance, porosity, water absorption, softening coefficient, crystal structure, moisture exchange, composite material.*

KIRISH

Gips bog‘lovchilarning tez qotishi, nisbatan past haroratda olinishi va yaxshi texnologik xususiyatlari ularni qurilish materiallari ishlab chiqarishda keng qo‘llash imkonini beradi. Biroq gips asosidagi materiallarning nam muhitda ishlatilishini cheklovchi asosiy omil suv ta’sirida mustahkamlikning pasayishi va suv shimuvchanlikning yuqoriligidir. Shu sababli gips bog‘lovchilarning suvga chidamliligini oshirishda materialning ichki

strukturasini boshqarishga asoslangan yondashuv muhim ahamiyat kasb etadi [1].

Gips toshining suvga chidamliligi uning kristall tuzilishi va g‘ovaklik xususiyatlari bilan bevosita bog‘liq. Qotish jarayonida hosil bo‘ladigan kalsiy sulfat digidrat kristallarining shakli, o‘lchami va o‘zaro joylashuvi kapillyar g‘ovaklarning shakllanishiga ta’sir qiladi. Mazkur g‘ovaklar orqali suvning material ichiga kirishi kristallararo bog‘lanishlarning zaiflashishiga va natijada mexanik xossalarning pasayishiga sabab bo‘lishi mumkin. Demak, suvga chidamli gips olishda suvning materialga kirishini cheklash bilan birga suvga to‘yingan holatda kristall karkasning barqarorligini ta’minlash talab etiladi [2].

ASOSIY QISM

Tabiiy zeolit o‘zining kristall tuzilishi, mikrog‘ovaklari va yuqori solishtirma sirt maydoni sababli oddiy inert to‘ldiruvchidan farq qiladi. Zeolit zarrachalari qorishmadagi suvning bir qismini vaqtincha ushlab turishi, zarrachalararo bo‘shliqlarning shakllanishiga ta’sir qilishi va gips matritsasining struktura hosil bo‘lish jarayonini o‘zgartirishi mumkin [3]. Shu sababli zeolitni gips kompozitsiyasida nafaqat mineral to‘ldiruvchi, balki mineral modifikator sifatida ko‘rib chiqish maqsadga muvofiq.

Biroq zeolitning ta’siri bir yo‘nalishli emas. Uning yuqori sirt maydoni va g‘ovak tuzilishi qorishmaning suv talabini oshirishi mumkin. Agar zarur ishlanuvchanlikni ta’minlash uchun qo‘shimcha suv kiritilsa, qotishdan keyin ortiqcha suvning chiqib ketishi natijasida kapillyar g‘ovaklar miqdori ortishi ehtimoli mavjud. Shuning uchun zeolitning suvga chidamlilikka ta’sirini faqat uning miqdori bilan emas, balki zeolit miqdori–suv-bog‘lovchi nisbati–g‘ovaklik o‘rtasidagi bog‘liqlik orqali baholash zarur.

Mazkur holat gips–zeolit kompozitsiyalarini tadqiq etishda muhim ilmiy muammoni yuzaga keltiradi. Zeolitning bir tomondan namlikni boshqaruvchi va zarrachalararo struktura hosil bo‘lishiga ta’sir qiluvchi komponent sifatidagi ijobiy xususiyati mavjud bo‘lsa, ikkinchi tomondan uning suv talabchanligi ortiqcha g‘ovaklik hosil bo‘lishiga olib kelishi mumkin. Demak, kompozitsiyaning samaradorligi zeolitning mutlaq miqdoridan ko‘ra uning gips matritsasidagi optimal strukturaviy funksiyasiga bog‘liq.

Kimyoviy qo‘shimchaning kiritilishi ushbu muammoni boshqarishning qo‘shimcha imkoniyatini yaratadi. Qo‘shimcha yordamida qorishmaning zarur ishlanuvchanligini suv sarfini ortiqcha oshirmagan holda ta’minlash mumkin. Natijada zeolitning suv talabchanligi bilan bog‘liq salbiy ta’sirni kamaytirish va zichroq gips strukturasini shakllantirish imkoniyati yuzaga keladi. Shu sababli zeolit va kimyoviy qo‘shimchaning alohida emas, balki o‘zaro ta’siri

kompozitsion gips bog‘lovchining suvga chidamliligini shakllantiruvchi muhim omil sifatida qaralishi lozim.

Mahalliy xomashyo sifatida O‘zbekiston hududidagi zeolitli jinslardan, xususan Beltau koni zeolitli xomashyosidan foydalanish ilmiy va amaliy jihatdan istiqbolli yo‘nalish hisoblanadi. Mazkur xomashyo qurilish materiallari, jumladan mineral mikroto‘ldiruvchilar va quruq qurilish aralashmalari tarkibida o‘rganilgan [4,5]. Biroq mahalliy zeolitning aynan gips bog‘lovchi tarkibida suv almashinuvi, g‘ovaklik va suvga to‘yingan holatdagi mustahkamlik bilan bog‘liq kompleks ta’sirini aniqlash alohida tadqiqotni talab qiladi.

Shu asosda tadqiqotning asosiy ilmiy gipotezasi quyidagicha shakllantiriladi: mahalliy zeolitning optimal miqdori va dispersligini kimyoviy qo‘shimcha hamda suv-bog‘lovchi nisbati bilan muvofiqlashtirish orqali gips matritsasida kapillyar g‘ovaklikni kamaytirish, suv shimuvchanlikni cheklash va suvga to‘yingan holatda strukturaning barqarorligini oshirish mumkin.

Mazkur gipotezani tekshirish uchun tadqiqotning dastlabki bosqichida zeolitning kimyoviy va mineralogik tarkibini XRF va XRD usullarida, funksional guruhlarini FTIR usulida, zarracha o‘lchamini granulometrik tahlil orqali hamda solishtirma sirt maydonini tegishli instrumental usullar yordamida aniqlash lozim. Keyingi bosqichda nazorat gips tarkibi bilan zeolit saqlovchi, kimyoviy qo‘shimchali va kombinatsiyalangan tarkiblarni taqqoslash maqsadga muvofiq.

Kompozitsion gipsning samaradorligini baholashda quruq holatdagi siqilish mustahkamligi bilan bir qatorda suvga to‘yingan holatdagi mustahkamlik, suv shimuvchanlik, ochiq g‘ovaklik va yumshash koeffitsiyentini aniqlash muhimdir. Bunda yumshash koeffitsiyenti quruq va suvga to‘yingan holatdagi mustahkamlik nisbatini ifodalovchi asosiy mezonlardan biri sifatida qaraladi. Shuningdek, materialning suvga chidamliligini faqat dastlabki muddatda emas, balki turli suvda saqlash muddatlarida baholash uning struktura barqarorligini aniqroq tavsiflash imkonini beradi.

XULOSA

Mahalliy zeolit asosida kompozitsion gips bog‘lovchi olishning ilmiy asosini zeolitni oddiy mineral to‘ldiruvchi sifatida qo‘llash emas, balki uning namlik almashinuvi, g‘ovaklik va gips kristall strukturasiga kompleks ta’sirini boshqarish tashkil etadi. Zeolitning mikrog‘ovak tuzilishi material strukturasiga ijobiy ta’sir ko‘rsatishi mumkin, biroq uning suv talabchanligi nazorat qilinmasa, qo‘shimcha g‘ovaklik shakllanishi ehtimoli mavjud.

Shu sababli kelgusidagi tadqiqotlarda zeolit miqdori, dispersligi, suv-bog‘lovchi nisbati va kimyoviy qo‘shimcha o‘rtasidagi o‘zaro bog‘liqlikni

aniqlash asosiy vazifa sifatida belgilanishi lozim. Materialning samaradorligi quruq holatdagi mustahkamlik bilangina emas, balki suv shimuvchanlik, ochiq g‘ovaklik, suvga to‘yingan holatdagi mustahkamlik va yumshash koeffitsiyentining kompleks o‘zgarishi asosida baholanishi kerak. Mazkur yondashuv mahalliy zeolit asosida suvga chidamli kompozitsion gips bog‘lovchining tarkibiy va texnologik parametrlarini ilmiy asosda belgilash uchun zamin yaratadi.

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BO‘LAJAK O‘QITUVCHILARDA RAQAMLI MEDIAKOMPETENTLIKNI RIVOJLANTIRISHDA VR VA AR TEXNOLOGIYALARINING IMKONIYATLARI

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Annotatsiya: *Mazkur maqolada bo‘lajak o‘qituvchilarda raqamli mediakompetentlikni rivojlantirishda virtual reallik (VR) va kengaytirilgan reallik (AR) texnologiyalarining pedagogik imkoniyatlari ilmiy-nazariy jihatdan tahlil qilinadi. VR va AR asosida raqamli mediakompetentlikni rivojlantirishning motivatsion, amaliy, tahliliy, ijodiy va refleksiv bosqichlardan iborat metodik modeli taklif etiladi. Tadqiqotda immersiv texnologiyalarning samaradorligi texnologiyaning o‘ziga emas, balki uning pedagogik maqsad, metod, baholash va refleksiya bilan uzviy integratsiyasiga bog‘liqligi asoslanadi.*

Kalit so‘zlar: *raqamli mediakompetentlik, bo‘lajak o‘qituvchi, virtual reallik, kengaytirilgan reallik, VR, AR, immersiv texnologiyalar, raqamli kompetensiya, media ta’lim, raqamli kontent, pedagogik texnologiya.*

Аннотация: *В данной статье с научно-теоретической точки зрения анализируются педагогические возможности технологий виртуальной реальности (VR) и дополненной реальности (AR) в развитии цифровой медиакомпетентности будущих учителей. Предлагается методическая модель развития цифровой медиакомпетентности на основе VR и AR, включающая мотивационный, практический, аналитический, творческий и рефлексивный этапы. В исследовании обосновывается, что эффективность иммерсивных технологий зависит не столько от самой технологии, сколько от её органичной интеграции с педагогическими целями, методами обучения, оцениванием и рефлексией.*

Ключевые слова: *цифровая медиакомпетентность, будущий учитель, виртуальная реальность, дополненная реальность, VR, AR, иммерсивные технологии, цифровая компетентность, медиаобразование, цифровой контент, педагогическая технология.*

Abstract: *This article provides a scientific and theoretical analysis of the pedagogical potential of virtual reality (VR) and augmented reality (AR)*

technologies in developing digital media competence among future teachers. A methodological model for developing digital media competence based on VR and AR is proposed, comprising motivational, practical, analytical, creative, and reflective stages. The study substantiates that the effectiveness of immersive technologies depends not on the technology itself, but on its systematic integration with pedagogical objectives, instructional methods, assessment, and reflection.

Keywords: *digital media competence, future teacher, virtual reality, augmented reality, VR, AR, immersive technologies, digital competence, media education, digital content, pedagogical technology.*

ASOSIY QISM

Bugungi kunda raqamli mediakompetentlikning mazmun-mohiyati. Ta’limning raqamli transformatsiyasi pedagog kasbining mazmunini ham o‘zgartirmoqda. Bugungi o‘qituvchi dars jarayonida elektron darslik, videomaterial, interaktiv platforma yoki taqdimotdan foydalanish bilan cheklanmaydi. U raqamli resursning pedagogik qiymatini aniqlashi, axborotning ishonchliligini baholashi, media kontentni o‘quv maqsadiga moslashtirishi va ta’lim oluvchilarning raqamli kompetensiyasini rivojlantira olishi kerak. Yevropa Komissiyasining DigCompEdu modeli pedagogning raqamli kompetensiyasini 22 ta kompetensiya va 6 ta asosiy yo‘nalish orqali tavsiflaydi: professional hamkorlik, raqamli resurslar, o‘qitish va ta’lim, baholash, ta’lim oluvchilarni faollashtirish hamda ularning raqamli kompetensiyasini rivojlantirish.Ayniqsa, mazkur modeldagi “axborot va media savodxonligi”, “raqamli kontent yaratish”, “raqamli muammolarni hal qilish” va “mas’uliyatli foydalanish” kompetensiyalari bo‘lajak o‘qituvchilarning raqamli mediakompetentligini shakllantirish bilan bevosita bog‘liq.Shu asosda raqamli mediakompetentlikni bo‘lajak o‘qituvchining raqamli axborotni izlash, tanlash, tahlil qilish, ishonchliligini baholash, qayta ishlash, media mahsulot yaratish va uni pedagogik faoliyatga mas’uliyatli integratsiyalash qobiliyatlarining integrativ tizimi sifatida tavsiflash mumkin.

UNESCOning o‘qituvchilar uchun AKT kompetensiyalari doirasi ham pedagoglarni tayyorlashda texnologiyadan foydalanish bilan birga tanqidiy va innovatsion fikrlash, murakkab muammolarni hal qilish, hamkorlik va ijtimoiy-emotsional ko‘nikmalarni rivojlantirishga e’tibor qaratadi. VR texnologiyalarining raqamli mediakompetentlikni rivojlantirishdagi imkoniyatlariVirtual reallik texnologiyasi foydalanuvchini kompyuter tomonidan yaratilgan uch o‘lchamli raqamli muhitga jalb etib, o‘quv vaziyatini kuzatishdan faol ishtirok etish darajasiga olib chiqadi. Bo‘lajak o‘qituvchilarni

tayyorlashda VRning birinchi muhim imkoniyati autentik pedagogik vaziyatlarni modellashtirishdir. Masalan, talaba virtual xonasida dars jarayonini tashkil qilishi, o‘quvchilarning turli xatti-harakatlariga javob berishi yoki raqamli o‘quv resurslarini tanlashi mumkin. Bunday faoliyat nazariy bilimni kasbiy vaziyat bilan bog‘lash imkonini beradi.Ikkinchi imkoniyat immersiv media tahlil. Virtual muhitga turli yangiliklar, videolar, infografikalar va ijtimoiy media materiallarini joylashtirish orqali talaba ularni taqqoslash va baholashga jalb qilinadi.Uchinchi imkoniyat raqamli kontent yaratish. Bo‘lajak o‘qituvchi virtual ekskursiya, 360° video, interaktiv dars yoki boshqa immersiv o‘quv resurslarini yaratish orqali media-ijodiy kompetensiyasini rivojlantiradi.To‘rtinchi imkoniyat refleksiv kasbiy faoliyat. Virtual vaziyat yakunida talaba o‘z qarorlarini tahlil qiladi, qaysi raqamli vosita nima sababdan tanlanganini asoslaydi va faoliyatining pedagogik samaradorligini baholaydi.

2025-yilda o‘qituvchilar ta’limida VRdan foydalanishga bag‘ishlangan tizimli sharh va meta-tahlilda 2014–2024-yillardagi 52 ta empirik tadqiqot tahlil qilingan. Tadqiqotda VRning ta’lim natijalariga umumiy ijobiy ta’siri qayd etilgan va immersiv muhitlarning ayrim holatlarda non-immersiv muhitlarga nisbatan yuqoriroq natijalar bergani ko‘rsatilganShu bilan birga, 2025-yilda chop etilgan tadqiqotlarda VR bilan ishlashda pedagogning faqat foydalanuvchi emas, balki raqamli kontent yaratuvchisi sifatida shakllanishi muhimligi ko‘rsatila boshladi. 2026-yilgi tadqiqotda VR bo‘yicha maxsus professional rivojlanish dasturida ishtirok etgan o‘qituvchilarning texnik va pedagogik ko‘nikmalari yaxshilangani hamda ishtirokchilarning katta qismi VR asosidagi o‘quv mahsulotlarini yaratgani qayd etilgan. AR texnologiyalarining raqamli mediakompetentlikni rivojlantirishdagi imkoniyatlariKengaytirilgan reallik texnologiyasi real muhitni saqlagan holda unga raqamli obyektlar, animatsiyalar, video, audio, matn va boshqa axborot qatlamlarini qo‘shadi. Shu jihatdan AR texnologiyasi bo‘lajak o‘qituvchining real va raqamli muhit o‘rtasidagi aloqani tushunishiga yordam beradi. ARning pedagogik imkoniyatlarini quyidagi yo‘nalishlarda ko‘rsatish mumkin:Birinchidan, real obyektni raqamli axborot bilan boyitish. Masalan, darslikdagi obyekt yoki o‘quv materiali mobil qurilma orqali skanerlanganda qo‘shimcha video, animatsiya yoki interaktiv izoh paydo bo‘ladi.Ikkinchidan, interaktiv media kontent yaratish. Bo‘lajak o‘qituvchi AR material ishlab chiqish orqali vizual kommunikatsiya, media dizayn va raqamli kontent yaratish kompetensiyalarini rivojlantiradi.Uchinchidan, multimodal axborot bilan ishlash. AR matn, tasvir, audio, video va uch o‘lchamli obyektlarni yagona o‘quv vaziyatiga birlashtiradi. To‘rtinchidan, o‘quv materialini kontekstlashtirish. Talaba tayyor AR resursdan foydalanish bilan

cheklanmasdan, uni muayyan fan, mavzu, yosh guruhi va dars maqsadiga moslashtiradi.

2025-yilda XR uchun o‘qituvchi kompetensiyalarini aniqlashga bag‘ishlangan tadqiqotda mavjud TPACK, SAMR va DigCompEdu kabi modellar immersiv ta’lim uchun zarur bo‘lgan ayrim maxsus kompetensiyalarni to‘liq ochib bermasligi qayd etilib, XRga xos pedagogik kompetensiyalarni yanada aniq belgilash zarurligi asoslangan. Bu xulosa bo‘lajak o‘qituvchilarni tayyorlashda VR va AR bilan ishlashni oddiy “texnologik ko‘nikma” sifatida emas, balki maxsus raqamli-pedagogik kompetensiya sifatida shakllantirish zarurligini ko‘rsatadi.VR va AR asosida raqamli mediakompetentlikni rivojlantirishning metodik modeli bo‘lajak o‘qituvchilarning raqamli mediakompetentligini rivojlantirishni quyidagi ketma-ketlik asosida tashkil etish mumkin:



2025-yilda XR uchun o‘qituvchi kompetensiyalarini aniqlashga bag‘ishlangan tadqiqotda mavjud TPACK, SAMR va DigCompEdu kabi modellar immersiv ta’lim uchun zarur bo‘lgan ayrim maxsus kompetensiyalarni to‘liq ochib bermasligi qayd etilib, XRga xos pedagogik kompetensiyalarni yanada aniq belgilash zarurligi asoslangan.Bu xulosa bo‘lajak o‘qituvchilarni tayyorlashda VR va AR bilan ishlashni oddiy “texnologik ko‘nikma” sifatida emas, balki maxsus raqamli-pedagogik kompetensiya sifatida shakllantirish zarurligini ko‘rsatadi.VR va AR asosida raqamli mediakompetentlikni rivojlantirishning metodik modeli bo‘lajak o‘qituvchilarning raqamli

mediakompetentligini rivojlantirishni quyidagi ketma-ketlik asosida tashkil etish mumkin:

MOTIVATSIYA → IMMERSIV TAJRIBA → MEDIA TAHLIL → RAQAMLI KONTENT YARATISH → PEDAGOGIK INTEGRATSIYA → REFLEKSIYA

Raqamli mediakompetentlik komponentlari. VR va AR texnologiyalaridan foydalanishda raqamli mediakompetentlikni quyidagi komponentlar orqali shakllantirish mumkin:

Komponent	Asosiy mazmuni	VR/AR vositasidagi faoliyat
Axborot-tahliliy	Axborotni izlash va baholash	Virtual manbalarni taqqoslash
Texnologik	Raqamli vositalardan foydalanish	VR/AR muhitini boshqarish
Media-ijodiy	Kontent yaratish	3D, AR va immersiv mahsulot yaratish
Pedagogik	Texnologiyani darsga moslashtirish	Virtual/AR dars loyihasi
Refleksiv	Faoliyatni baholash	Immersiv tajribani tahlil qilish
Etik	Mas’uliyatli foydalanish	Mualliflik huquqi va maxfiylikni hisobga olish

Mazkur komponentlarning integratsiyasi natijasida raqamli mediakompetentlik texnik ko‘nikmalar yig‘indisi emas, balki axborot, media, texnologik, pedagogik va refleksiv faoliyatning yaxlit tizimi sifatida shakllanadi.VR va ARdan foydalanishning pedagogik shartlari. Immersiv texnologiyalarni ta’limga kiritishda texnologiyaning o‘zi ta’limiy natijani kafolatlamasligini hisobga olish zarur. 2025-yilgi tizimli tadqiqotlarda VR muhitlarida pedagogik dizayn, oldindan tayyorgarlik, faol o‘quv topshiriqlari va yo‘naltirilgan yordamning muhimligi ko‘rsatilgan.Shu sababli quyidagi pedagogik shartlarni ajratish mumkin:

-VR yoki AR vositasi aniq o‘quv maqsadiga mos bo‘lishi;

-immersiv tajriba aniq topshiriq bilan bog‘lanishi;

-talaba passiv kuzatuvchi emas, faol subyekt bo‘lishi;

-raqamli kontentning ishonchliligi va pedagogik qiymati baholanishi;

-immersiv tajribadan keyin refleksiya tashkil qilinishi;

-raqamli xavfsizlik va mualliflik huquqi talablariga rioya qilinishi;

-baholashda yakuniy mahsulot bilan birga jarayon ham hisobga olinishi.

DigCompEdu doirasida ham raqamli resurslarni tanlashda o‘quv maqsadi, pedagogik yondashuv va ta’lim oluvchilar guruhi hisobga olinishi, raqamli kontent yaratishda esa mualliflik huquqi va litsenziyalash masalalariga rioya qilish zarurligi qayd etiladi.VR va AR texnologiyalarining ta’limiy qiymati ularning texnik murakkabligi yoki vizual jozibadorligi bilan emas, balki pedagogik maqsadga muvofiqligi va kompetensiyani shakllantirishga qo‘shadigan real hissasi bilan belgilanadi.

XULOSA

Bo‘lajak o‘qituvchilarda raqamli mediakompetentlikni rivojlantirishda VR va AR texnologiyalaridan foydalanish zamonaviy pedagogik tayyorgarlikning istiqbolli yo‘nalishlaridan biridir. VR texnologiyasi autentik pedagogik vaziyatlarni modellashtirish, immersiv media muhit yaratish, virtual tajriba tashkil etish va raqamli mahsulotlar ishlab chiqish imkonini beradi. AR texnologiyasi esa real o‘quv muhitini raqamli axborot bilan boyitish, multimodal kontent yaratish va interaktiv pedagogik materiallarni loyihalash imkoniyatlarini kengaytiradi.Tahlil natijalari shuni ko‘rsatadiki, VR va ARdan foydalanish bo‘lajak o‘qituvchilarning raqamli mediakompetentligini rivojlantirishda ayniqsa axborotni tahlil qilish, raqamli kontent yaratish, texnologiyani pedagogik maqsadga moslashtirish va refleksiv faoliyat uchun samarali metodik sharoit yaratadi.Immersiv texnologiyalarning samaradorligini texnologik yangilikning o‘zi bilan izohlash to‘g‘ri emas. Asosiy natija “texnologiya – pedagogik maqsad – amaliy topshiriq – media tahlil – raqamli mahsulot – refleksiya” tizimining yaxlit tashkil etilishi orqali yuzaga keladi.Demak, bo‘lajak o‘qituvchilarni tayyorlash jarayonida VR va AR texnologiyalaridan foydalanish ularning raqamli vositalardan foydalanuvchi sifatidagi emas, balki raqamli axborotni tanqidiy baholovchi, pedagogik media kontent yaratuvchi va immersiv ta’lim muhitini loyihalovchi mutaxassis sifatida shakllanishiga xizmat qiluvchi metodik vosita sifatida qaralishi mumkin.

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4-SECTION

UDC: 611.36:591.4

MORPHOMETRIC PARAMETERS OF THE LIVER OF INTACT WHITE OUTBRED RATS AT 3 AND 9 MONTHS AS A REFERENCE BASIS FOR EXPERIMENTAL MICROELEMENTOSIS STUDIES

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Annotation. *The aim of the study was to determine the morphological and morphometric parameters of the liver of intact male white outbred rats at 3 and 9 months of age for use as reference values in experimental microelementosis studies. Sections were stained with haematoxylin and eosin and by van Gieson's method and measured on digitised images. At 3 months hepatocyte diameter was 18.5 ± 1.2 um, sinusoidal width 7.4 ± 0.8 um with an area fraction of 18.2 ± 2.1%, central vein diameter 40.1 ± 3.5 um and the collagen fraction 2.67%. At 9 months the corresponding values were 21.3 ± 1.4 um, 8.2 ± 0.9 um, 20.1 ± 2.3%, 42.5 ± 3.8 um and 3.2%, while the cytoplasm-to-nucleus ratio remained 3:1 at both ages. Hepatocyte size and the calibre of the microcirculatory bed therefore increase with age, whereas the cytoplasm-to-nucleus ratio is the most age-independent parameter, and comparison with a single control age would distort the interpretation of experimental results.*

Key words: *liver, white outbred rats, norm, age-related morphometry, hepatocyte, cytoplasm-to-nucleus ratio, sinusoids, reference values.*

RELEVANCE

The validity of any conclusion drawn from an experimental model of trace element deficiency depends on the control values against which the experimental groups are compared. Published reference data on rat liver morphometry differ considerably between laboratories because of differences in animal age, line, fixation protocol and measurement software. When an experiment covers more than one age point, age-matched baseline values become a mandatory methodological requirement, since the liver of a growing animal changes independently of any dietary intervention.

AIM

To determine the morphological and morphometric parameters of the liver of intact male white outbred rats at 3 and 9 months of age kept under standard

vivarium conditions, for use as reference values in experimental microelementosis studies.

MATERIALS AND METHODS

The study was carried out at the Scientific and Experimental Centre for Biomedical Research of Bukhara State Medical Institute on intact male outbred white rats receiving a standard diet, examined at 3 and 9 months of age. Liver tissue was fixed in 10% neutral buffered formalin; paraffin sections were stained with haematoxylin and eosin and by van Gieson's method. Digitised sections were measured with determination of hepatocyte diameter, the cytoplasm-to-nucleus ratio, sinusoidal width and area fraction, central vein diameter and the collagen fibre area fraction. Results are presented as M ± SD.

RESULTS

At both ages the lobular architecture was preserved, with hepatocyte cords arranged radially around the central veins and evenly distributed sinusoids. At 3 months hepatocyte diameter was 18.5 ± 1.2 um with a cytoplasm-to-nucleus ratio of 3:1; sinusoidal width was 7.4 ± 0.8 um with an area fraction of 18.2 ± 2.1%; central vein diameter was 40.1 ± 3.5 um and the collagen fibre fraction 2.67%. At 9 months hepatocyte diameter reached 21.3 ± 1.4 um with the cytoplasm-to-nucleus ratio unchanged at 3:1; sinusoidal width was 8.2 ± 0.9 um with an area fraction of 20.1 ± 2.3%; central vein diameter was 42.5 ± 3.8 um and the collagen fibre fraction 3.2%. Thus, over this period hepatocyte diameter increased by about 15% and sinusoidal width by about 11%, while the cytoplasm-to-nucleus ratio remained stable.

CONCLUSION

The liver of intact white outbred rats shows a distinct age-related increase in hepatocyte size and in the calibre of the microcirculatory bed between 3 and 9 months, whereas the cytoplasm-to-nucleus ratio remains constant and therefore represents the most age-independent parameter. These values may serve as an age-matched reference basis for the comparative assessment of liver changes in experimental alimentary microelementosis, and comparison with a single control age would distort the interpretation of the results.

ARM COORDINATION IN THE SLOW-TEMPO MOMTONG JIREUGI: TIMING OF THE PULL-BACK ARM, PUNCHING ELBOW, AND EXTENDED-ARM HOLD

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Abstract: *The middle-section punch (Momtong Jireugi) is traditionally taught at a slow tempo, but it is not known whether slow execution preserves the coordination between the punching arm and the opposite, pull-back arm. This case report describes the arm kinematics of a slow-tempo Momtong Jireugi recorded with 3D motion capture (STT 3DMA, 19-marker model, 120 Hz) in a 19-year-old male taekwondo athlete. In both analyzed punches, the pull-back of the opposite arm (to 141–142° of elbow flexion) was 90% complete 0.28–0.31 s before the fist arrived, at the same moment the punching elbow began to extend. The punching elbow then extended by 116–118° to 26–27° in 0.24–0.30 s while the punching shoulder adducted from 59–70° to 22°, and the fist was held at full extension for 0.48–0.77 s. Slow-tempo execution thus preserved the reciprocal order of the two arms and added a deliberate hold, supporting its use for teaching the pull-back-then-punch sequence.*

Keywords: *taekwondo; Momtong Jireugi; slow tempo; pull-back arm; elbow extension; motion capture*

INTRODUCTION

The middle-section punch (Momtong Jireugi) is usually taught first at a slow tempo, with the fist held briefly at the target, before it is practiced at full speed. Straight punches are organized proximal-to-distal, with elbow extension completed last (Putnam, 1993; VencesBrito et al., 2011). Whether slow-tempo execution preserves the coordination between the punching arm and the opposite, pull-back arm has not been measured.

AIM

To describe the timing and joint angles of the punching and pull-back arms during a slow-tempo Momtong Jireugi.

METHODS

A 19-year-old male taekwondo athlete performed right-hand Momtong Jireugi (middle-section punch) at a deliberately slow tempo, holding the extended position briefly, from a stance with the left leg forward. Full-body

kinematics were recorded with an optical motion-capture system and STT 3DMA 2023.0 software (19-marker full-body model, 120 Hz) at the Hi-Tech Sports Laboratory of the Uzbek State University of Physical Education and Sport (27 October 2025). Two complete punches were analyzed. Joint-angle curves were digitized from the software report (median absolute difference from reported extrema 0.46°) and aligned to the instant the punching elbow reached 90% of its extension (t = 0).

RESULTS

Both punches showed the same arm pattern (Table 1). The opposite (left) elbow, extended to 68° and 46° about 0.55–0.59 s before the punch arrived, was pulled back to 141–142° of flexion. This pull-back was 90% complete 0.28–0.31 s before arrival, at the same moment the punching elbow began to extend (10% onset −0.30 and −0.24 s). The punching elbow, held at 143–144° in the guard, extended by 116–118° to 26–27°, with the main extension (10–90%) lasting 0.30 and 0.24 s (mean 315 and 384 °/s). During the extension the punching shoulder adducted from 59–70° to 22° of abduction. The fist was then held at full extension for 0.77 and 0.48 s, and the elbow was 50% retracted 1.03 and 0.65 s after arrival.

Table 1

Punching- and Pull-Back-Arm Kinematics in Two Slow-Tempo Punches

Variable	Punch 1	Punch 2
Pull-back elbow, extended (°) / time (s)	67.6 / −0.55	45.6 / −0.59
Pull-back 90% complete (s) / elbow at arrival (°)	−0.31 / 141.4	−0.28 / 142.0
Punching elbow in guard (°)	144.4	142.6
Onset of punching-elbow extension, 10% (s)	−0.30	−0.24
Elbow extension range (°) / minimum (°)	118.0 / 26.4	115.9 / 26.8
Main extension time, 10–90% (s) / mean velocity (°/s)	0.30 / 315	0.24 / 384
Punching shoulder abduction, guard → arrival (°)	69.6 → 22.3	59.3 → 21.8
Hold at full extension (s)	0.77	0.48
50% retraction after arrival (s)	1.03	0.65

Note. t = 0 when the punching (right) elbow reached 90% of its extension; negative = before.

CONCLUSION

At a slow tempo the athlete kept the same order observed in fast straight punches: the pull-back of the opposite arm was completed first, and the punching elbow extended only after it, with the shoulder adducted so that the elbow stayed in line. The slow drill differed mainly by a deliberate hold at full extension. Slow-tempo practice can therefore be used to teach the reciprocal arm order, provided the pull-back is finished before the punch starts. The findings come from one athlete and two punches.

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TRUNK POSTURE AND LOWER-LIMB SUPPORT IN THE SLOW-TEMPO MOMTONG JIREUGI: A 3D MOTION-CAPTURE CASE REPORT

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***Abstract**: The effectiveness of a straight punch depends on the legs and trunk as well as the arm, yet the posture and leg actions of the slow-tempo taekwondo Momtong Jireugi have not been described. This case report analyzed two slow-tempo right-hand punches of a 19-year-old male taekwondo athlete recorded with 3D motion capture (STT 3DMA, 19-marker model, 120 Hz). Before the fist arrived, the rear hip extended from 5–11° of flexion to −12° to −13°, and the rear ankle moved from 37–41° of dorsiflexion to 22–30° of plantarflexion, indicating a raised rear heel. At arrival, the front knee was nearly extended (8–14°), the rear knee remained flexed (30–39°), and the trunk stayed nearly upright (anterior tilt 2–7°, range 7–8°). The rear leg therefore acted before the arm while the trunk remained upright, which gives three checkpoints for slow-tempo teaching: drive from the rear leg first, raise the rear heel, and keep the trunk upright.*

***Keywords:** taekwondo; Momtong Jireugi; slow tempo; trunk posture; rear-leg drive; motion capture*

INTRODUCTION

The force of a straight punch depends on the lower body and trunk as well as the arm (Lenetsky et al., 2013), and straight punches in boxing involve a coordinated contribution of the legs, trunk, and arm (Cheraghi et al., 2014). In taekwondo teaching, the Momtong Jireugi is first practiced slowly, but the posture and leg actions that accompany the slow punch have not been described.

AIM

To describe trunk posture and the actions of the rear and front legs during a slow-tempo Momtong Jireugi.

METHODS

A 19-year-old male taekwondo athlete performed right-hand Momtong Jireugi (middle-section punch) at a deliberately slow tempo, holding the extended position briefly, from a stance with the left leg forward. Full-body

kinematics were recorded with an optical motion-capture system and STT 3DMA 2023.0 software (19-marker full-body model, 120 Hz) at the Hi-Tech Sports Laboratory of the Uzbek State University of Physical Education and Sport (27 October 2025). Two complete punches were analyzed. Joint-angle curves were digitized from the software report (median absolute difference from reported extrema 0.46°) and aligned to the instant the punching elbow reached 90% of its extension (t = 0).

RESULTS

The legs acted before the arm arrived (Table 1). The rear (right) hip extended from 5–11° of flexion 0.50–0.69 s before arrival to −12° to −13° by about 0.3 s before arrival, and reached −13° and −12° at arrival. The rear ankle moved from 37–41° of dorsiflexion to 22–30° of plantarflexion at arrival, a range of 66–73°, indicating that the rear heel was raised as the punch was delivered. The front (left) knee was nearly extended at arrival (8–14°), while the rear knee remained flexed (30–39°). The trunk stayed close to upright: anterior tilt was 2–7° at arrival, with a range of 7–8° within each punch, and lateral flexion varied by 4–8°.

Table 1

Trunk and Lower-Limb Kinematics in Two Slow-Tempo Punches

Variable	Punch 1	Punch 2
Rear hip, peak flexion (°) / time (s)	4.6 / −0.50	11.4 / −0.69
Rear hip at arrival (°)	−13.3	−12.1
Rear ankle, peak dorsiflexion (°) / time (s)	37.0 / −0.43	41.3 / −0.62
Rear ankle at arrival (°)	−22.0	−30.3
Front knee flexion at arrival (°)	14.4	8.2
Rear knee flexion at arrival (°)	39.5	30.2
Front hip flexion at arrival (°)	13.3	13.9
Trunk anterior tilt at arrival (°) / range (°)	2.2 / 7.2	6.7 / 8.1
Trunk lateral flexion range (°)	4.3	8.4

Note. t = 0 when the punching (right) elbow reached 90% of its extension. Negative hip values = extension; negative ankle values = plantarflexion.

CONCLUSION

In the slow-tempo punch, the rear hip extended and the rear heel was raised before the fist arrived, while the trunk remained upright and the front knee nearly straight. These actions give coaches concrete checkpoints for slow-tempo

teaching: drive from the rear leg first, raise the rear heel, and keep the trunk upright. Whether the same leg actions occur at competition speed and how they relate to punch force should be tested with force data and more athletes.

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КЛИНИЧЕСКАЯ ЭФФЕКТИВНОСТЬ СОЧЕТАНИЯ ХИРУРГИЧЕСКОЙ САНАЦИИ И ИНТЕНСИВНОЙ ТЕРАПИИ ПРИ ОЖОГОВОМ СЕПСИСЕ

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Аннотация. *Ожоговый сепсис является тяжелым осложнением термической травмы. У 232 больных оценена эффективность ранней некрэктомии, аутодермопластики с антибиотик - насыщенной гемостатической губкой и комплексной интенсивной терапии. Применение усовершенствованного подхода повысило приживление трансплантата и сократило сроки регресса органной дисфункции и лечения.*

Ключевые слова: *ожоговый сепсис, некрэктомия, аутодермопластика, интенсивная терапия, прокальцитонин.*

Abstract. *Burn sepsis is a severe complication of thermal injury. The study evaluated 232 patients treated with early necrectomy, autologous skin grafting using an antibiotic-impregnated hemostatic sponge, and comprehensive intensive care. The optimized approach improved graft take and reduced organ dysfunction and treatment duration.*

Keywords: *burn sepsis, necrectomy, skin grafting, intensive care, procalcitonin.*

ВВЕДЕНИЕ

Тяжёлые глубокие ожоги сопровождаются не только локальным повреждением тканей, но и системным воспалением, иммунными нарушениями, гиперметаболизмом, расстройствами микроциркуляции и полиорганной дисфункцией. Нарушение кожного барьера способствует микробной колонизации раны, потере жидкости и белка.

Ожоговый сепсис формируется под влиянием локального инфекционного очага и системных нарушений, поэтому его лечение требует сочетания ранней санации раны, восстановления кожного покрова,

антибактериальной терапии, гемодинамической коррекции и органной поддержки**.**

В исследование за период 2016–2025 гг. включены 232 пациента с глубокими ожогами, осложнёнными ожоговым сепсисом. Применялись клинические, лабораторные, микробиологические и инструментальные методы; пациенты были разделены на основную и группу сравнения в зависимости от лечебной тактики.

ЦЕЛЬ ИССЛЕДОВАНИЯ

Улучшение результатов лечения пациентов с глубокими ожогами, осложнёнными ожоговым сепсисом, путём сочетания ранней хирургической санации, усовершенствованной аутодермопластики и комплексной интенсивной терапии.

МАТЕРИАЛЫ И МЕТОДЫ

В исследование включены 232 пациента, из которых 128 составили основную, а 104 — группу сравнения. У пациентов основной группы применялись ранняя хирургическая санация, раннее закрытие ожоговой раны и оптимизированная программа комплексной интенсивной терапии. В группе сравнения использовались стандартная аутодермопластика и общепринятые методы интенсивной терапии.

Тяжесть клинического состояния оценивали с использованием шкал SOFA и APACHE II. Для оценки динамики инфекционного процесса проводили микробиологические исследования; особое место в лабораторном мониторинге занимала динамика уровня прокальцитонина.

По результатам исследования ведущими факторами риска развития ожогового сепсиса являлись глубокие ожоги более 30% поверхности тела, инфицирование полирезистентной микрофлорой, пожилой возраст, сахарный диабет и ингаляционная травма. Разработанная на основе указанных показателей прогностическая модель имела значение ROC-AUC 0,88.

Клинические и микробиологические особенности ожогового сепсиса. Клиническое течение ожогового сепсиса характеризуется сочетанием системного воспалительного ответа и инфекционного процесса. Поскольку гипертермия, тахикардия, тахипноэ и лейкоцитоз могут быть обусловлены самой тяжёлой термической травмой, диагностика требует комплексной оценки клинического состояния, раны, микробиологических данных и органной дисфункции.

Основная часть случаев сепсиса формировалась на 8–21-е сутки после травмы. Доля раннего сепсиса составила 18,8% в основной группе против 24,1% в группе сравнения.

Микробиологический мониторинг выявил динамическую смену микрофлоры: от преобладания грамположительных до увеличения доли грамотрицательных и полирезистентных микроорганизмов. Это обосновывает индивидуализацию антибактериальной терапии и применение принципа деэскалации**.**

Диагностическое значение прокальцитонина. Прокальцитонин продемонстрировал высокую диагностическую ценность: при пороге 2,0 нг/мл чувствительность составила 91,4%**,** специфичность — 88,6%, ROC-AUC — 0,91.

Снижение уровня прокальцитонина на ≥30% за 48–72 часа было связано с адекватным контролем инфекции, тогда как отсутствие динамики требовало поиска сохраняющегося очага и коррекции антибактериальной терапии.

Таким образом, прокальцитонин в сочетании с SOFA и микробиологическим мониторингом может использоваться для комплексной диагностики и динамической оценки пациентов с ожоговым сепсисом.

Ранняя хирургическая санация и аутодермопластика. При ожоговом сепсисе устранение источника инфекции является одним из ключевых направлений лечения. Сохранение некротизированных тканей создаёт субстрат для микробной колонизации и способствует длительному поддержанию воспалительного процесса. В связи с этим ранняя некрэктомия рассматривается как один из основных методов снижения инфекционной нагрузки на раневой поверхности.

В основной группе некрэктомия выполнялась в среднем на 2,8±0,9 сутки, тогда как в группе сравнения — на 6,4±1,7 сутки.

При использовании усовершенствованного метода аутодермопластики после полного удаления некротических тканей обеспечивали надёжный капиллярный гемостаз раневого ложа. Затем на раневое ложе укладывали рассасывающуюся гемостатическую коллагеновую губку, насыщенную антибиотиком, поверх которой размещали перфорированный аутодермотрансплантат.

Предполагается, что при данном методе гемостатическая губка оказывает одновременно несколько видов воздействия: гемостатическое, антибактериальное, барьерное и матриксное. Такой подход направлен на

снижение риска формирования гематом и сером под трансплантатом, уменьшение локальной микробной нагрузки и обеспечение стабильного контакта трансплантата с раневым ложем.

Полученные результаты продемонстрировали клиническую эффективность данной технологии. Полное приживление трансплантата в основной группе составило 89,1%, в группе сравнения — 71,2%. Потребность в повторной пластике составила соответственно 18,7% и 45,2%.

Комплексная интенсивная терапия. Оптимизированная интенсивная терапия включала гемодинамическую и инфузионно-трансфузионную поддержку, рациональную антибактериальную терапию, нутритивную и органопротективную терапию, экстракорпоральную детоксикацию.

Целенаправленная гемодинамическая терапия снизила потребность в вазопрессорах с 52,9% до 34,4%, частоту рефрактерного шока — с 17,3% до 7,0%.

Деэскалация антибактериальной терапии проводилась у 64,8% пациентов основной группы против 38,5% в группе сравнения. Раннее энтеральное питание применялось у 87,5% против 54,8% пациентов соответственно.

Оптимизированная терапия ускорила регресс органной дисфункции по SOFA **(**8,4±2,1 против 13,6±3,2 суток**)**, сократила длительность вазопрессорной и респираторной поддержки, а также пребывания в ОРИТ (9,8±3,2 против 15,4±4,1 суток).

Результаты лечения.

Клиническая эффективность усовершенствованной стратегии лечения оценивалась по непосредственным, ранним и отдалённым результатам.

Критерий эффективности	**Основная группа**	**Группа сравнения**
Интегральное приживление трансплантата	89,1%	71,2%
Полное приживление трансплантата	62,5%	38,5%
Потребность в повторной пластике	18,7%	45,2%
Средние сроки выполнения некрэктомии	2,8 суток	6,4 суток

Регресс органной дисфункции по SOFA	8,4 суток	13,6 суток
Летальность	9,4%	24,0%
Отличные и хорошие отдалённые результаты	83,6%	60,6%

В исследовании полное приживление трансплантата в основной группе достигнуто в 62,5% случаев, тогда как в группе сравнения данный показатель составил 38,5%. Сроки заживления ран также были сокращены в основной группе и составили 28,4±5,3 суток против 38,7±6,9 суток в группе сравнения. Средняя продолжительность стационарного лечения составила 24,3±5,1 и 31,8±6,7 койко-дня соответственно.

При оценке отдалённых результатов наблюдения отличные и хорошие функционально-косметические результаты отмечены у 83,6% пациентов основной группы и у 60,6% пациентов группы сравнения. По шкале EuroQol-5D показатель мобильности составил 80,9% и 68,4%, способность к самообслуживанию — 85,5% и 72,4%, выполнение обычной повседневной деятельности — 70,9% и 53,9% соответственно.

Летальность в основной группе составила 9,4%, в группе сравнения — 24,0%.

ОБСУЖДЕНИЕ

Полученные результаты показывают, что при ожоговом сепсисе ранняя санация инфекционного очага и коррекция системных нарушений должны проводиться комплексно. Ранняя некрэктомия и надёжное закрытие раны способствуют снижению инфекционной нагрузки и улучшению условий для заживления.

Применение антибиотик-насыщенной гемостатической губки обеспечило дополнительную локальную антибактериальную защиту, что сопровождалось повышением интегрального приживления трансплантата с 71,2% до 89,1% и снижением потребности в повторной аутодермопластике с 45,2% до 18,7%.

Прокальцитонин подтвердил свою диагностическую и мониторинговую значимость. Его использование совместно с SOFA, клинической оценкой и микробиологическим мониторингом позволяет комплексно оценивать течение сепсиса и эффективность лечения.

ЗАКЛЮЧЕНИЕ

При лечении пациентов с глубокими ожогами, осложнёнными ожоговым сепсисом, комплексное сочетание ранней хирургической санации, раннего закрытия раневого дефекта, локальной

антибактериальной защиты и целенаправленной комплексной интенсивной терапии представляет собой клинически значимый подход.

Сокращение сроков выполнения ранней некрэктомии с 6,4 до 2,8 суток, применение антибиотик-насыщенной гемостатической губки и выполнение ранней аутодермопластики сопровождались улучшением показателей приживления трансплантата и снижением потребности в повторной пластике.

Прокальцитонин продемонстрировал высокую диагностическую значимость при чувствительности 91,4% и специфичности 88,6%, что обосновывает возможность его включения в комплексную систему мониторинга пациентов с ожоговым сепсисом.

Оптимизированная комплексная интенсивная терапия сопровождалась более быстрым регрессом органной дисфункции по шкале SOFA, сокращением продолжительности вазопрессорной и респираторной поддержки, а также уменьшением длительности пребывания пациентов в отделении реанимации и интенсивной терапии.

По результатам исследования при применении усовершенствованной лечебной тактики интегральное приживление трансплантата составило 89,1%, полное приживление — 62,5%, а доля отличных и хороших отдалённых функционально-косметических результатов — 83,6%.

Таким образом, лечебная стратегия при ожоговом сепсисе должна основываться не только на антибактериальной терапии, но и на принципах раннего устранения источника инфекции, надёжного закрытия раневого дефекта, рациональной антибактериальной терапии, нутритивной поддержки, органопротекции и динамического биомаркерного мониторинга**,** что обеспечивает последовательность и комплексность лечебного процесса.

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BOLALARDA ZAMONAVIY INFUZION TERAPIYA

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Annotatsiya: *Bolalarda infuzion terapiya suyuqlik va elektrolitlar muvozanatini tiklash, qon aylanishini qo'llab-quvvatlash hamda patologik yo'qotishlarni qoplashga qaratilgan muhim davolash usulidir. Zamonaviy yondashuvda infuzion terapiya «qancha ko'p bo'lsa, shuncha yaxshi» tamoyiliga emas, balki bolaning tana vazni, gemodinamik holati, suvsizlanish darajasi, davom etayotgan yo'qotishlari, laborator ko'rsatkichlari va asosiy kasalligiga mos ravishda individual rejalashtirishga asoslanadi. Hozirgi tavsiyalarda ko'pchilik bolalarda saqlovchi terapiya uchun izotonik kristalloidlar, reanimatsiyada esa kichik hajmli boluslardan keyin tez-tez qayta baholashga urg'u beriladi.*

Abstract*: Infusion therapy in children is an important treatment method aimed at restoring fluid and electrolyte balance, supporting circulation, and replacing pathological losses. The modern approach to infusion therapy is based not on the principle of "the more, the better," but on individualized planning according to the child's body weight, hemodynamic status, degree of dehydration, ongoing losses, laboratory parameters, and underlying disease. Current recommendations emphasize the use of isotonic crystalloids for maintenance therapy in most children, while in resuscitation, small-volume boluses followed by frequent reassessment are recommended.*

Kalit so'zlar: *bolalar, infuzion terapiya, regidratatsiya, gipovolemiya, kristalloidlar, izotonik eritmalar, Holiday–Segar formulasi, NICE, patologik yo'qotishlar, suyuqlik balansi.*

Keywords: *children, infusion therapy, rehydration, hypovolemia, crystalloids, isotonic solutions, Holliday–Segar formula, NICE, pathological losses, fluid balance*

KIRISH

Bolalar organizmida suv almashinuvi kattalarnikiga nisbatan faolroq bo'lib, suyuqlik yo'qotilishi qisqa vaqt ichida klinik jihatdan ahamiyatli gipovolemiyaga olib kelishi mumkin. Qusish, diareya, isitma, taxipnoe, ichak parezi, kuyish, sepsis, operatsiyadan keyingi holatlar va boshqa patologik jarayonlarda suyuqlikka bo'lgan ehtiyoj oshadi.

Infuzion terapiyani boshlashdan oldin bolaning **suyuqlik holati, tana vazni, diurez, arterial bosimi, yurak urish tezligi, kapillyar to‘lish vaqti, periferik perfuziyasi, elektrolitlari, glyukoza, kreatinin va kislota-ishqor holati** baholanadi. JSST tavsiyalarida vena ichiga suyuqlik olayotgan bolalarda suyuqlik kirimi va chiqimi, sutkalik vazn dinamikasi, elektrolitlar va glyukozani muntazam nazorat qilish tavsiya etiladi.

BOLALARDA INFUZION TERAPIYANING ASOSIY MAQSADLARI

Infuzion terapiya odatda to‘rtta asosiy vazifani bajaradi:

1. **Gipovolemiya va shokni bartaraf etish** — qon aylanishining samarali hajmini tiklash.
2. **Sutkalik fiziologik ehtiyojni qoplash** — bola og‘iz orqali yetarli suyuqlik qabul qila olmaganida.
3. **Mavjud suyuqlik tanqisligini to‘ldirish** — masalan, suvsizlanishda.
4. **Davom etayotgan patologik yo‘qotishlarni qoplash** — diareya, qusish, drenaj, isitma, taxipnoe va boshqa holatlarda.

Shuning uchun infuzion terapiyani shartli ravishda **reanimatsion, saqlovchi, defitsitni to‘ldiruvchi va davom etayotgan yo‘qotishlarni qoplovchi** qismlarga ajratish mumkin.

Sutkalik fiziologik suyuqlik ehtiyojini hisoblash

Bolalarda saqlovchi suyuqlik ehtiyojini hisoblashda **Holiday–Segar formulasi** keng qo‘llanadi.

Jadval 1.

Holiday–Segar bo‘yicha sutkalik suyuqlik ehtiyoji

Tana vazni	Sutkalik suyuqlikka ehtiyoj
10 kg gacha	100 ml/kg/sutka
10–20 kg	1000 ml + 10 kg dan ortiq har bir kg uchun 50 ml
20 kg dan ortiq	1500 ml + 20 kg dan ortiq har bir kg uchun 20 ml

Masalan, tana vazni 15 kg bo‘lgan bolada: **1000 + (5 × 50) = 1250 ml/sutka.**

25 kg vazndagi bolada: **1500 + (5 × 20) = 1600 ml/sutka.**

Ushbu hisoblash usuli hozirgi NICE tavsiyalarida ham saqlovchi IV guruh suyuqliklar uchun keltirilgan.

Shu bilan birga, hisoblangan hajm **avtomatik ravishda vena ichiga yuborilishi kerak bo‘lgan miqdor emas**. Bola og‘iz orqali suyuqlik qabul qila

olsa, enteral yo‘l afzal bo‘lishi mumkin; IV guruh terapiya esa klinik zarurat bo‘lganda qo‘llanadi.

ZAMONAVIY SAQLOVCHI INFUZION TERAPIYA

Ilgari pediatriyada gipotonik eritmalar keng qo‘llanilgan. Hozirgi dalillarga asoslangan yondashuvda esa ko‘pchilik 28 kunlikdan 18 yoshgacha bo‘lgan bolalarda saqlovchi IV guruh terapiya zarur bo‘lsa, **izotonik eritmalar** tavsiya etiladi.

Amerika Pediatriya Akademiyasi izotonik eritmalarni tegishli miqdorda glyukoza va, klinik vaziyatga qarab, kaliy xlorid bilan qo‘llash giponatriemiya xavfini kamaytirishini ko‘rsatadi.

NICE ham bolalarda saqlovchi IV guruh terapiyani boshlashda tarkibida natriy **131–154 mmol/l** bo‘lgan izotonik kristalloidlarni tavsiya qiladi.

Biroq bu tavsiyalar barcha bemorlarga bir xil qo‘llanmaydi. Masalan, buyrak yoki yurak kasalligi, nevrologik patologiya, og‘ir kuyish, endokrin kasalliklar, yangi tug‘ilgan chaqaloqga va boshqa maxsus holatlarda suyuqlik rejimi individual belgilanadi.

O‘tkir gipovolemiyada infuzion terapiya

O‘tkir gipovolemiya yoki shokda maqsad — avvalo **to‘qimalar perfuziyasini tiklash**.

Zamonaviy yondashuvda katta hajmdagi suyuqlikni bir martada yuborishdan ko‘ra, **kichik bolus → qayta baholash → zarur bo‘lsa keyingi bolus** tamoyili muhim.

NICE tavsiyasida bolalar va o‘smirlarda reanimatsion IV guruh terapiya uchun natriy miqdori 131–154 mmol/l bo‘lgan glyukozasiz kristalloidning **10 ml/kg bolusi 10 daqiqadan kam vaqtda** yuborilishi va undan keyin bemorni qayta baholash tavsiya etiladi.

Sepsis va septik shokda Surviving Sepsis Campaign boluslarni **10–20 ml/kg** ko‘rinishida berib, har bir bolusdan keyin gemodinamik holatni qayta baholashni tavsiya qiladi. Intensiv terapiya imkoniyati mavjud sharoitlarda dastlabki bir soatda jami 40–60 ml/kg gacha bo‘lgan hajm ayrim bemorlarda qo‘llanishi mumkin, ammo suyuqlik ortiqchaligi belgilari paydo bo‘lsa, infuziya to‘xtatilishi kerak.

Qaysi infuzion eritmalar qo‘llanadi?

Kristalloidlar

Kristalloidlar pediatrik infuzion terapiyaning asosiy eritmalaridan hisoblanadi. Ularga:

- 0,9% natriy xlorid eritmasi;
- Ringer-laktat/Hartmann eritmasi;

- boshqa balanslangan ko‘p elektrolitli eritmalar kiradi.

Sepsis bilan bog‘liq shokda Surviving Sepsis Campaign **balanslangan yoki buferlangan kristalloidlarni** 0,9% natriy xloridga nisbatan qo‘llashni taklif qiladi; agar ular mavjud bo‘lmasa, 0,9% natriy xlorid mos alternativ hisoblanadi. Ayrim elektrolit buzilishlari yoki intrakranial bosim oshishidan xavotir bo‘lgan vaziyatlarda 0,9% natriy xlorid afzal bo‘lishi mumkin. Society of Critical Care Medicine (SCCM)

Glyukozali eritmalar

Glyukoza saqlovchi eritmalar ayrim saqlovchi rejimlarda gipoglikemiyaning oldini olish uchun ishlatiladi. Biroq reanimatsion bolus uchun odatda **glyukozasiz kristalloidlar** tanlanadi.

Kolloidlar

Zamonaviy pediatrik reanimatsiyada kristalloidlar asosiy o‘rinni egallaydi. Sepsisda boshlang‘ich reanimatsiya uchun kristalloidlar albuminga nisbatan tavsiya etiladi. Tetrastarch kabi ayrim sun’iy kolloidlarni reanimatsiyada qo‘llash tavsiya etilmaydi.

JORIY PATOLOGIK YO‘QOTISHLARNI HISOBGA OLISH

Fiziologik ehtiyojdan tashqari, bolaning **joriy patologik yo‘qotishlari** ham hisobga olinadi.

Jadval 2.

Joriy patologik yo‘qotishlar hajmi

Patologik holat	**Qo‘shimcha suyuqlik ehtiyoji**
Gipertermiya	38°C dan yuqori bo‘lgan har bir daraja uchun **10 ml/kg/sutka**
Taxipnoe	Yosh normasidan yuqori bo‘lgan har 20 ta nafas harakati uchun **20 ml/kg/sutka**
Diareya, o‘rtacha	Sutkasiga 15 martagacha — **20–40 ml/kg/sutka**
Diareya, kuchli	Sutkasiga 15–20 marta — **60–90 ml/kg/sutka**
Diareya, profuz	**120–140 ml/kg/sutka**
Ichak parezi, II daraja	**20 ml/kg/sutka**
Ichak parezi, III daraja	**40 ml/kg/sutka**

Bu jadval siz taqdim etgan o‘quv materialidagi **“Joriy patologik yo‘qotishlar hajmi (ОППЛ)”** ma’lumotlari asosida kiritildi.

Biroq amaliyotda bunday koeffitsientlar **boshlang‘ich taxminiy hisob** sifatida qaralishi va bemorning haqiqiy yo‘qotishlari bilan moslashtirilishi kerak. Zamonaviy NICE yondashuvi mavjud defitsit, davom etayotgan yo‘qotishlar va patologik suyuqlik taqsimotini alohida hisobga olishni tavsiya qiladi.

DIAREYADA REGIDRATASIYA

O‘tkir gastroenterit va diareyada, agar bola icha olsa va IV terapiyaga ko‘rsatma bo‘lmasa, **oral regidratatsion eritmalar (ORS)** asosiy usullardan biridir.

NICE bolalarda klinik suvsizlanishda past osmolyarlikdagi ORS eritmalaridan foydalanishni, ularni tez-tez va kichik miqdorlarda berishni tavsiya qiladi. Bola icha olmasa yoki doimiy qusish kuzatilsa, nazogastral yo‘l ham ko‘rib chiqilishi mumkin.

IV guruh regidratatsiya zarur bo‘lganda esa izotonik eritmalar qo‘llanadi va natriy, kaliy, mochevina, kreatinin hamda glyukoza nazorat qilinadi.

INFUZION TERAPIYANING MONITORINGI

Infuzion terapiyaning eng muhim tamoyillaridan biri — **faqat suyuqlik yuborish emas, balki uning ta’sirini doimiy baholashdir**.

Nazorat qilinadi:

- tana vazni;
- arterial bosim;
- yurak urish tezligi;
- nafas olish tezligi;
- kapillyar to‘lish vaqti;
- periferik harorat va puls;
- ong holati;
- diurez;
- sutkalik suyuqlik balansi;
- plazmadagi natriy, kaliy va xlor;
- glyukoza;
- mochevina va kreatinin;
- zarurat bo‘lsa kislota-ishqor holati va laktat.

NICE IV guruh terapiya olayotgan bolalarda suyuqlik kirimi va chiqimini soatlik qayd etish, 12 va 24 soatlik balansni hisoblash hamda muntazam ravishda suyuqlik retseptini qayta ko‘rib chiqishni tavsiya qiladi.

SUYUQLIK ORTIQCHQLIGI — zamonaviy infuzion terapiyaning muhim muammosi

Infuzion terapiyaning asosiy xavflaridan biri — **fluid overload**, ya’ni suyuqlikning ortiqcha to‘planishidir.

Shuning uchun bolaning perfuziyasi tiklanganidan keyin ham avtomatik ravishda yangi boluslarni davom ettirish to‘g‘ri emas. Har bir bolusdan keyin yurak-qon tomir holati va perfuziya qayta baholanadi. Sepsisda suyuqlik ortiqchaligi belgilari paydo bo‘lsa, bolus terapiyasi to‘xtatilishi kerak. Society of Critical Care Medicine

Ayniqsa yurak yoki buyrak faoliyati buzilgan bolalarda ehtiyotkorlik zarur; bunday bemorlarda kichikroq hajmlar va individual yondashuv talab qilinishi mumkin.

AMALIY HISOBLASH ALGORITMI

Bolada infuzion terapiyani rejalashtirishni quyidagi ketma-ketlikda amalga oshirish mumkin:

1. Tana vaznini aniqlash →
2. Gemodinamik holatni baholash →
3. Shok mavjudligini aniqlash →
4. Saqlovchi ehtiyojni hisoblash →
5. Mavjud suvsizlanish/defitsitni hisoblash →
6. Joriy patologik yo‘qotishlarni aniqlash →
7. Eritma turini tanlash →
8. Suyuqlikni yuborish tezligini belgilash →
9. Javobni qayta baholash →
10. Keyingi infuziyani individual ravishda tuzatish.

Bu yondashuv zamonaviy infuzion terapiyaning asosiy prinsipini — “hisoblash + klinik baholash + qayta baholash”ni aks ettiradi.

XULOSA

Bolalarda zamonaviy infuzion terapiya fiziologik ehtiyojni oddiy hisoblashdan ko‘ra kengroq tushunchadir. Davolashda **saqlovchi ehtiyoj, suyuqlik defitsiti, joriy patologik yo‘qotishlar va bemorning klinik javobi** birgalikda hisobga olinadi.

Holiday–Segar formulasi saqlovchi ehtiyojni hisoblash uchun muhim vosita bo‘lib qolmoqda. Shu bilan birga, hozirgi tavsiyalar ko‘pchilik bolalarda saqlovchi IV guruh terapiya uchun **izotonik kristalloidlarga**, shokda esa **kichik hajmli boluslardan so‘ng tezkor qayta baholashga** katta ahamiyat beradi.

Infuzion terapiyaning maqsadi maksimal hajmdagi suyuqlikni yuborish emas, balki **bolaning perfuziyasi va suyuqlik-elektrolit muvozanatini xavfsiz tarzda tiklash**dir. Shu sababli suyuqlik terapiyasi individual, dinamik va laborator-klinik monitoring asosida olib borilishi kerak.

Muhim: ushbu maqola o‘quv-uslubiy material sifatida tayyorlandi. Aniq infuziya hajmi, eritma tarkibi va tezligi bolaning yoshi, vazni, klinik holati va asosiy kasalligiga qarab pediatr yoki intensiv terapiya shifokori tomonidan belgilanadi.

NICE — bu National Institute for Health and Care Excellence, ya’ni Buyuk Britaniyaning Sog‘liqni saqlash va tibbiy yordam sifati bo‘yicha Milliy instituti.

Surviving Sepsis Campaign — o‘zbek tilida: “Sepsisni yengib o‘tish kampaniyasi”

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CIRCADIAN RHYTHM OF AUTONOMIC TONE DURING THE TOXEMIA PERIOD OF BURN DISEASE IN ADULTS

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Relevance. *Severe burn injury is accompanied by a pronounced and prolonged systemic stress, inflammatory, and hypermetabolic response that substantially affects cardiovascular and neurohumoral regulation [1,3]. In addition, burn disease is associated with disturbances in the daily organization of physiological processes, including changes in circadian rhythms and loss of the normal diurnal pattern of hormonal regulation [2, 4, 5]. Studies of 24-hour heart rate variability and cardiovascular autonomic regulation also indicate dysfunction of the autonomic nervous system in patients with burn injury [6, 7]. However, age-related characteristics of circadian changes in autonomic tone during the toxemia period of burn disease remain insufficiently studied, which determines the relevance of the present investigation.*

Abstract. *This study investigated age-related characteristics of the circadian rhythm of autonomic tone during the toxemia period in 25 adults with severe thermal burns. Patients were divided into three age groups: 20–40 years (n=12), 41–60 years (n=7), and 61–78 years (n=6). Hourly monitoring of body temperature and autonomic tone was performed. During the first day, all age groups demonstrated a 30–40% increase in sympathicotonic activity. The most pronounced response was observed in younger patients, in whom the circadian mesor of autonomic tone increased by 59–60% from day 4 and exceeded the reference level by more than 70% at several later time points. Mean hourly autonomic tone values in the second and third age groups were 17–25% lower than in the first group ($p<0.05$). Strong positive correlations were found between autonomic tone and myocardial oxygen demand, cardiac output, and pulse pressure. The findings indicate marked age-related differences in autonomic adaptation during burn toxemia and support the use of circadian autonomic monitoring as an additional component of intensive care assessment.*

Keywords: *burn disease, toxemia, circadian rhythm, autonomic tone, sympathicotonia, autonomic nervous system, hemodynamics, systemic inflammatory response.*

OBJECTIVE

To investigate the characteristics of the circadian rhythm of autonomic tone in adult patients of different age groups during the toxemia period of burn disease.

MATERIALS AND METHODS

The study analyzed monitoring data from 25 patients with severe thermal burns treated in a burn care unit. Patients were divided into three age groups: group 1 included 12 patients aged 20–40 years, group 2 included 7 patients aged 41–60 years, and group 3 included 6 patients aged 61–78 years. After recovery from burn shock, patients received anti-inflammatory, antibacterial, and infusion therapy, correction of protein and fluid-electrolyte disorders, surgical treatment, supplementary parenteral nutrition, and syndromic and symptomatic therapy. Continuous hourly monitoring of body temperature and autonomic tone was performed. Autonomic tone was assessed using the formula AT = PPhealthy × HRhealthy / (PPpatient × HRpatient), where PP denotes pulse arterial pressure and HR denotes heart rate. Values greater than 1 were interpreted as a sympathicotonic response. Daily patterns of autonomic activity were considered in relation to published evidence of autonomic dysregulation after burn injury [6, 7].

RESULTS

During the first day after burn injury, patients in all age groups demonstrated a hypersympathicotonic response, with autonomic tone increasing by 30–40%. Thereafter, the most pronounced sympathicotonia was observed in patients aged 20–40 years. Beginning on day 4, the circadian mesor of autonomic tone in group 1 increased by 59–60%, and at several later time points it exceeded the reference level by more than 70% ($p<0.05$).

Analysis of hourly values showed that autonomic tone in group 1 was elevated by 60–70% during both daytime and nighttime hours. In group 2, the increase was 30–40%, whereas in group 3 it did not exceed 20–30%. Mean hourly autonomic tone values in groups 2 and 3 were significantly lower than those in group 1 by an average of 17–25% ($p<0.05$).

A strong positive correlation was identified between autonomic tone and myocardial oxygen demand: r=0.89, r=0.91, and r=0.81 in groups 1, 2, and 3, respectively. Autonomic tone was also strongly associated with cardiac output (r=0.97, r=0.95, and r=0.90, respectively). Correlations with pulse arterial pressure were r=0.95, r=0.83, and r=0.73, respectively. The relationship between autonomic tone and body temperature was strongest in younger patients (r=0.79) and decreased in the older age groups to r=0.36 and r=0.23.

CONCLUSION

The toxemia period of burn disease is accompanied by marked age-dependent restructuring of autonomic regulation. The most intense hypersympathicotonic response was observed in younger patients. Increased sympathetic influence was associated with increased myocardial oxygen demand and the formation of a hyperdynamic hemodynamic pattern. Dynamic assessment of the circadian rhythm of autonomic tone may provide additional information for monitoring patients with severe burn disease and may support a more individualized approach to intensive care.

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TIMING OF THE KNEE CHAMBER–EXTENSION CYCLE AND HIP ABDUCTION IN A SLOW-TEMPO DOLLYO CHAGI: A 3D MOTION-CAPTURE CASE REPORT

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***Abstract**: The roundhouse kick (Dollyo Chagi) is often taught at a deliberately slow tempo, but it is not known whether slow execution preserves the joint sequence of the kicking leg. This case report describes the kicking-leg and support-leg kinematics of a slow-tempo Dollyo Chagi recorded with 3D motion capture (STT 3DMA, 19-marker model, 120 Hz) in a 19-year-old male taekwondo athlete. In both analyzed kicks, ankle plantarflexion began first (0.54–0.61 s before knee extension), the knee then reached its chamber (119–121° of flexion) 0.30–0.32 s before extension, and thigh elevation peaked at 64–71° shortly afterwards. The knee extended by about 114° in 0.30–0.32 s (357–383 °/s) while hip abduction was held at 53–57°, and the support knee was fully extended at the strike. The slow kick thus preserved the proximal-to-distal order of fast kicks, providing three teaching checkpoints: a full chamber, a stable abducted hip during extension, and an extended support knee at contact.*

***Keywords:** taekwondo; roundhouse kick; Dollyo Chagi; knee extension; motion capture; technique teaching*

INTRODUCTION

The roundhouse kick (Dollyo Chagi) is the most frequently used scoring technique in Olympic taekwondo. Its effectiveness depends on a throw-like sequence in which hip flexion precedes knee extension (Kim et al., 2011), and on how the kicking leg is organized relative to target distance (Kim et al., 2010; Falco et al., 2009). In technique teaching, the kick is often first rehearsed at a deliberately slow tempo, yet the kinematic structure of such slow execution has rarely been described.

AIM

To describe the joint-angle sequence of the kicking leg and the support leg during a slow-tempo Dollyo Chagi.

METHODS

A 19-year-old male taekwondo athlete performed right-leg Dollyo Chagi kicks at a deliberately slow tempo. Full-body kinematics were recorded with an

optical motion-capture system and STT 3DMA 2023.0 software (19-marker full-body model, 120 Hz) at the Hi-Tech Sports Laboratory of the Uzbek State University of Physical Education and Sport (27 October 2025). Two consecutive kicks were analyzed. Joint-angle curves were digitized from the software report (agreement with reported extrema: mean absolute difference 0.66°) and aligned to the instant of full knee extension (t = 0).

RESULTS

Both kicks showed the same sequence (Table 1). Ankle plantarflexion began first, 0.54–0.61 s before extension. The knee then reached its chambered position (119–121° flexion) 0.30–0.32 s before extension, and thigh elevation peaked 0.22–0.24 s before extension (64–71°). The knee then extended by about 114° in 0.30–0.32 s (mean 357–383 °/s) to 5–7° of flexion, while hip abduction was held on a plateau of 53–57° through the extension. The ankle remained plantarflexed (−30° to −32°) at extension. The support knee reached its most extended position (2° and −15°) at the same instant. The leg was re-chambered 0.42–0.57 s after extension.

Table 1

Kicking- and Support-Leg Kinematics in Two Slow-Tempo Kicks

Variable	Kick 1	Kick 2
Knee chamber, peak flexion (°) / time (s)	119.3 / −0.32	121.4 / −0.30
Knee flexion at extension (°)	5.1	6.5
Knee extension range (°) / duration (s)	114.2 / 0.32	114.9 / 0.30
Mean knee extension velocity (°/s)	357	383
Thigh elevation, peak (°) / time (s)	64.1 / −0.24	70.6 / −0.22
Hip abduction at extension (°)	52.7	56.8
Ankle angle at extension (°)	−30.2	−32.2
Support knee flexion at extension (°)	1.8	−14.5
Re-chamber, time after extension (s)	0.57	0.42

Note. Times are relative to full knee extension (t = 0); negative = before. Negative ankle values = plantarflexion; negative knee values indicate extension beyond the neutral reference.

CONCLUSION

Even at a slow tempo, the athlete preserved the proximal-to-distal order described for fast roundhouse kicks: foot positioning and thigh elevation precede knee extension, and hip abduction is maintained rather than released during the

strike (Kim et al., 2011). In teaching, slow-tempo drills can therefore be used to rehearse this order, with three checkpoints: a full chamber (about 120° knee flexion), a stable abducted hip during extension, and an extended support knee at contact. These values come from one athlete and should be confirmed across athletes and tempos.

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TRUNK LEAN, HEAD ORIENTATION, AND ARM COUNTERBALANCE DURING A SLOW-TEMPO DOLLYO CHAGI: A 3D MOTION-CAPTURE CASE REPORT

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***Abstract**: Studies of the roundhouse kick focus mainly on the kicking leg, although the trunk, head, and arms carry the balance and guard demands of the technique. This case report describes the upper-body kinematics of a slow-tempo Dollyo Chagi recorded with 3D motion capture (STT 3DMA, 19-marker model, 120 Hz) in a 19-year-old male taekwondo athlete. In both analyzed kicks, the trunk leaned 45–46° away from the target at knee extension (peak 47–51° shortly afterwards) while forward tilt stayed small (4–6°). The head turned toward the target before the strike, with most of its rotation completed about 0.2 s before extension. The opposite arm was raised as a counterweight, reaching peak shoulder abduction (79–84°) exactly at extension, whereas the guard arm moved little (elbow range 10–14°). The kick was therefore balanced by a coordinated trunk lean, early head orientation, and opposite-arm elevation, which can be used as checkpoints in slow-tempo technique teaching.*

***Keywords:** taekwondo; roundhouse kick; trunk lateral flexion; head rotation; balance; motion capture*

INTRODUCTION

Most biomechanical studies of the roundhouse kick focus on the kicking leg. The trunk, head, and arms receive less attention, although the pivot hip, trunk, and pelvis contribute to kick performance (Kim et al., 2010) and whole-body roundhouse technique differs even between expert practitioners of different martial arts (Gavagan & Sayers, 2017). For coaches, the upper body also carries the balance and guard demands of the technique.

AIM

To describe how the trunk, head, and arms are organized around the moment of knee extension during a slow-tempo Dollyo Chagi.

METHODS

A 19-year-old male taekwondo athlete performed right-leg Dollyo Chagi kicks at a deliberately slow tempo. Full-body kinematics were captured with STT 3DMA 2023.0 (19-marker full-body model, 120 Hz) at the Hi-Tech Sports

Laboratory of the Uzbek State University of Physical Education and Sport. Two consecutive kicks were analyzed. Trunk, neck, shoulder, and elbow angles were digitized from the software report and aligned to full knee extension of the kicking leg (t = 0).

RESULTS

The upper body showed a consistent pattern in both kicks (Table 1). The trunk leaned away from the kick, reaching 45–46° of left lateral flexion at extension and a peak of 47–51° 0.10–0.18 s later, while forward–backward tilt stayed small (4–6°). The neck rotated through 100–110° during the kick. The head turned toward the target before the strike, with most of the rotation completed by about 0.2 s before extension (36–48° at extension), and the neck was flexed by 37–39°. The left (non-kicking-side) arm was raised as a counterweight: shoulder abduction peaked at 79–84° exactly at extension, and the elbow moved through an 87° range. The right arm stayed in guard, with an elbow range of only 10–14° and a shoulder abduction range of 18–21°.

Table 1

Trunk, Head, and Arm Kinematics in Two Slow-Tempo Kicks

Variable	Kick 1	Kick 2
Trunk lateral flexion at extension (°)	−46.2	−44.9
Trunk lateral flexion, peak (°) / time (s)	−50.9 / +0.18	−47.3 / +0.10
Trunk anterior tilt at extension (°)	3.9	6.2
Neck rotation range during kick (°)	100.2	109.7
Neck rotation at extension (°)	36.4	48.2
Neck flexion at extension (°)	38.7	37.1
Left shoulder abduction, peak (°) / time (s)	83.7 / 0.00	79.1 / −0.05
Left elbow range (°)	87.1	87.0
Right elbow range (°) / right shoulder abduction range (°)	9.7 / 18.4	13.9 / 21.2

Note. Times relative to full knee extension of the kicking (right) leg. Negative lateral flexion = lean to the left; positive neck rotation = to the right (toward the target in this set-up).

CONCLUSION

In this athlete, the kick was balanced by three coordinated upper-body actions: a large lateral trunk lean away from the target, early head rotation that keeps the eyes on the target, and elevation of the opposite arm timed to the strike,

while the kicking-side arm maintained the guard. For technique teaching, these can be used as observable checkpoints in slow-tempo drills: head turned before the knee extends, trunk lean without forward collapse, opposite arm raised at contact, and a stable guard arm. The findings describe one athlete at a slow tempo and should be tested across athletes and at competition speed.

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PESTICIDE RESIDUES IN FRUITS: CURRENT APPROACHES TO DETECTION AND ASSESSMENT OF POTENTIAL HEALTH RISKS

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Annotation: *Pesticide residues in fruits are an important food safety concern due to the potential exposure of consumers to chemical contaminants through diet. This review summarizes current approaches to the detection of pesticide residues in fruits and discusses their potential implications for human health. Particular attention is given to modern analytical techniques, including QuEChERS, GC-MS/MS, and LC-MS/MS, as well as maximum residue limits established for food products. The review also considers factors affecting pesticide residue occurrence and approaches used to assess potential dietary health risks.*

Keywords: *pesticide residues, fruits, food safety, pesticide detection, QuEChERS, human health, maximum residue limits.*

INTRODUCTION

Pesticides are widely used in agriculture to control pests, diseases, and weeds and to protect crops from yield losses. They include different groups of chemical compounds, such as insecticides, fungicides, herbicides, rodenticides, and nematicides. The primary benefits of pesticide use include improved crop productivity and maintenance of agricultural product quality through effective control of harmful organisms. However, inappropriate or excessive use of pesticides may also cause adverse effects on non-target organisms and raise concerns regarding human health and environmental safety (Aktar et al., 2009).

Although pesticides are primarily used to control agricultural pests and protect crops, their use may also result in human exposure through different pathways. Among these pathways, dietary exposure is particularly important because pesticide residues may be present in food and drinking water. The potential health effects of pesticide exposure depend on several factors, including the type and toxicity of the pesticide, the level and duration of exposure, and the characteristics of the exposed population. Therefore, monitoring pesticide residues in food products and evaluating their potential

health risks are important components of food safety assessment (Kim et al., 2017).

Prolonged or repeated exposure to pesticides has raised concerns because certain pesticide compounds may exert adverse effects on human health. Evidence reviewed in the literature indicates that pesticide exposure may be associated with a range of toxicological outcomes, including carcinogenic, neurological, respiratory, reproductive, developmental, and metabolic effects. The potential health consequences may vary depending on the pesticide class, toxicity, exposure level, and duration of exposure. These concerns highlight the importance of controlling pesticide exposure and monitoring pesticide residues in food products as part of food-safety and public-health protection (Mostafalou & Abdollahi, 2017).

Because fruits and vegetables may contain pesticide residues resulting from agricultural practices, reliable analytical methods are essential for their detection and quantitative assessment. Recent studies have emphasized the application of advanced chromatographic techniques for monitoring pesticide residues in food matrices, particularly liquid chromatography–tandem mass spectrometry (LC-MS/MS) and gas chromatography–tandem mass spectrometry (GC-MS/MS). These instrumental approaches provide sensitive and selective determination of a wide range of pesticide compounds and therefore play an important role in food-safety monitoring and the assessment of pesticide contamination in fruits and vegetables (Jan et al., 2025).

MAIN PART

One of the widely used approaches for the preparation of samples for pesticide residue analysis is the QuEChERS method, which was originally developed for the extraction of multiresidue pesticides from fruits and vegetables. The method combines extraction and dispersive solid-phase extraction (d-SPE) cleanup, allowing interfering components present in food matrices to be removed before instrumental analysis. Owing to its simplicity, efficiency, and flexibility, QuEChERS has become a widely applied sample-preparation procedure for pesticide residue analysis in fruits and vegetables and can be combined with chromatographic techniques such as GC-MS and LC-MS for subsequent determination of target compounds (González-Curbelo et al., 2015).

Advanced chromatographic techniques play an important role in the detection and quantification of pesticide residues in fruits and vegetables. Different instrumental approaches, including gas chromatography coupled with electron capture detection, flame photometric detection, nitrogen-phosphorus

detection, mass spectrometry, and quadrupole time-of-flight mass spectrometry, as well as liquid chromatography coupled with UV, diode-array detection, mass spectrometry, and Q-TOF-MS, have been applied for pesticide residue analysis. These techniques differ in their sensitivity, selectivity, and applicability to different classes of pesticides. Therefore, the selection of an appropriate analytical technique is an important step in obtaining reliable information on pesticide residues in fruit and vegetable matrices and in supporting food-safety assessment (Jan et al., 2025).

Recent developments in pesticide residue analysis have focused on improving the sensitivity, selectivity, and reliability of analytical methods. Liquid chromatography–tandem mass spectrometry (LC-MS/MS) has become an important analytical platform for pesticide residue determination because of its suitability for complex food matrices and its ability to provide sensitive and selective detection. Recent approaches have also emphasized improvements in sample preparation, chromatographic separation, method validation, and the analysis of multiple pesticide residues within a single analytical procedure. However, matrix effects, method robustness, and the determination of highly polar pesticides remain important analytical challenges that should be considered when assessing pesticide residues in fruit and other food matrices (Kathirvel et al., 2026).

The application of these advanced analytical approaches to real food matrices has enabled the simultaneous determination of numerous pesticide residues at trace and ultra-trace levels. For example, a recent study conducted in Sicily, Italy, investigated pesticide residues in 475 fruit, citrus fruit, and vegetable samples collected from 90 locations over four seasons. The samples were prepared using the QuEChERS extraction procedure and analyzed by gas chromatography–tandem mass spectrometry (GC-MS/MS) and liquid chromatography–tandem mass spectrometry (LC-MS/MS), allowing the quantitative determination of 220 pesticide active substances. The analytical methods demonstrated high linearity, with coefficients of determination (R^2) exceeding 0.998, while most analytes showed limits of quantification (LOQs) of 0.006 mg/kg, indicating the high sensitivity of the analytical procedure. Among the detected residues, boscalid, acetamiprid, deltamethrin, tebuconazole, and chlorpyrifos were among the most frequently detected compounds, demonstrating the applicability of multi-residue analytical methods for monitoring pesticide contamination in commercially available plant-derived foods (Orecchio et al., 2026).

Beyond the analytical determination of pesticide residues, their occurrence should also be evaluated in relation to regulatory limits and potential risks associated with dietary exposure. A recent investigation of 6,471 fruit samples collected from Egyptian markets demonstrated substantial variation in pesticide-residue occurrence among seven commonly consumed fruits, while compliance with European Union maximum residue levels (MRLs) was generally high. Nevertheless, MRL exceedances were observed in some samples, particularly in peaches, indicating the need for continuous monitoring and improved control of pesticide use. The study also examined the co-occurrence of multiple pesticide residues and assessed the potential health risks associated with their consumption, highlighting the importance of considering both individual residues and combined exposure when evaluating food safety (El-Sayed et al., 2025). Thus, comprehensive pesticide-residue assessment should integrate sensitive analytical determination, regulatory compliance, dietary exposure, and health-risk evaluation to provide a more complete understanding of the potential risks associated with pesticide-contaminated fruits(Malhat et al., 2025).

CONCLUSION

Pesticide residues in fruits remain an important food-safety concern because the intensive use of pesticides in agricultural production can result in their occurrence in commercially available fruits. The reviewed studies demonstrate that recent advances in analytical techniques, particularly LC-MS/MS and GC-MS/MS combined with effective sample-preparation procedures, have substantially improved the sensitivity, selectivity, and reliability of multi-residue pesticide determination. However, the detection of pesticide residues alone is insufficient for a comprehensive evaluation of their potential significance. Comparison with established maximum residue levels, assessment of dietary exposure, and quantitative evaluation of potential health risks are also essential components of pesticide-residue assessment. Recent investigations of fruit samples from different regions have shown that, although compliance with regulatory limits may be generally high, exceedances of MRLs and the co-occurrence of multiple pesticide residues can still occur. Therefore, integrated monitoring strategies that combine advanced analytical methods with regulatory assessment and health-risk evaluation are necessary to ensure fruit safety and to provide reliable evidence for the protection of public health.

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MEHR — AN AI-ASSISTED DIGITAL PLATFORM FOR PROSPECTIVE CLINICAL RESEARCH AND LONGITUDINAL PATIENT FOLLOW-UP: A CONCEPTUAL MODEL

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***Abstract**: Background. Prospective clinical studies require long-term participant follow-up, control of scheduled visits, standardized collection of clinical and laboratory data, and continuous attention to data quality. Digital technologies and artificial intelligence (AI) may support these processes, but their use in health research should preserve human oversight, privacy, transparency, accountability, and ethical governance. Aim. To present the conceptual model of MEHR (Medical Evidence & Health Research), an AI-assisted digital platform designed to support prospective clinical research and longitudinal participant follow-up, and to define its functional and ethical boundaries. Methods. A conceptual-methodological design was used to integrate participant registration, electronic informed consent, visit management, structured assessments, laboratory data, longitudinal monitoring, reminders, and data-quality support into a unified workflow. Results. The proposed model combines researcher and participant interfaces with Data Quality Assistant, Trend Detection, and research-support functions. AI is not assigned autonomous diagnostic, prescribing, dose-modification, or treatment-decision authority. Conclusion. MEHR represents a conceptual research-support platform requiring subsequent MVP development, usability testing, and prospective pilot validation.*

***Keywords:** MEHR, artificial intelligence, clinical research, digital health, longitudinal monitoring, electronic consent, data quality.*

INTRODUCTION

Digital technologies are changing the organization and conduct of clinical research. Prospective studies depend on repeated data collection, scheduled follow-up, standardized clinical assessment, and reliable management of laboratory and outcome data. In practice, long-term follow-up can be

complicated by missed visits, incomplete datasets, duplicated data entry, and loss of participants during observation.

The U.S. Food and Drug Administration guidance on clinical trials with decentralized elements describes approaches in which selected trial activities may occur outside traditional research sites, including through telehealth, in-home visits, and local healthcare providers (U.S. Food and Drug Administration [FDA], 2024). These developments increase the relevance of digital tools capable of supporting longitudinal research workflows.

Artificial intelligence creates additional opportunities for research data management, summarization, quality control, and detection of patterns. However, the World Health Organization (WHO) emphasizes that AI in health should protect human autonomy and should be developed and used with safety, transparency, accountability, inclusiveness, and equity (World Health Organization [WHO], 2021). More recent WHO guidance on AI-related health research also highlights ethical review, privacy, bias, fairness, accountability, and governance, including challenges relevant to low- and middle-income settings (WHO, 2026).

MEHR (Medical Evidence & Health Research) was conceptualized in response to these needs. It is intended to connect participant registration, electronic informed consent, planned and unscheduled visits, standardized clinical assessments, laboratory data, longitudinal follow-up, and data-quality support within a single research environment. The aim of this paper is to describe the MEHR conceptual model and define its intended functional, clinical, and ethical boundaries.

MATERIALS AND METHODS

This work was developed as a conceptual-methodological study. A typical prospective clinical research workflow was divided into participant registration, informed consent, baseline assessment, planned and unscheduled visits, standardized clinical assessments, laboratory data collection, longitudinal follow-up, data-quality checks, and export of the final research dataset.

The proposed architecture separates the platform into two connected user environments: a researcher/clinician interface and a participant interface. Access and functions are intended to be role-based. AI-supported functions were defined according to three design principles: AI should not replace the researcher, AI-generated outputs should remain reviewable by a human user, and clinical decisions should remain under qualified professional control (WHO, 2021, 2026).

RESULTS: CONCEPTUAL ARCHITECTURE OF MEHR

The proposed researcher interface includes Research Summary, Participant Registry, Electronic Informed Consent, Visit Management, Structured Clinical Assessment, Laboratory Data Module, Data Quality Assistant, Trend Detection, and Research Assistant components. The participant-facing environment is intended to support protocol-related reminders, symptom reporting, selected follow-up data entry, and secure non-emergency communication with the research team.

The Data Quality Assistant is intended to flag potentially missing mandatory variables, logical inconsistencies, or protocol-defined assessments that have not been completed. These alerts would not automatically modify research records; they would prompt human review. Trend Detection is designed to display longitudinal changes in selected variables in a form that assists researcher review. Detected trends are therefore treated as research-support signals rather than diagnoses or treatment recommendations.

The platform's safety boundary is explicit: MEHR is not intended to autonomously diagnose disease, prescribe treatment, alter medication doses, or make independent clinical decisions. Clinical interpretation and decision-making remain the responsibility of qualified healthcare professionals.

DISCUSSION

Electronic data capture systems already play an important role in clinical research. REDCap, for example, provides a widely used infrastructure for building secure web-based applications for research data capture and management (Harris et al., 2019). The proposed MEHR model is not intended simply to reproduce or replace established electronic data capture systems. Its intended focus is the integration of research workflow, participant follow-up, data-quality support, and narrowly defined AI-assisted research functions within one longitudinal environment.

This integrated approach may be particularly relevant to prospective studies requiring repeated follow-up. Digital and decentralized elements can support selected research activities outside conventional study sites, although their use must remain consistent with the protocol, ethics approval, participant safety requirements, and applicable regulations (FDA, 2024).

A further design consideration is usability in resource-constrained research settings. Rather than relying on a universal autonomous AI system, MEHR is conceived around task-specific and reviewable AI components. Examples include identifying incomplete fields, flagging logical inconsistencies, summarizing longitudinal changes, and directing the researcher's attention to records requiring review. WHO's recent work on AI-related health research

emphasizes the importance of data governance, fairness, benefit sharing, local capacity, and the particular challenges faced by low- and middle-income settings (WHO, 2026).

At the same time, the proposed advantages of MEHR should not be interpreted as evidence of effectiveness. The platform remains at a conceptual/development stage. No empirical data are currently presented demonstrating improved data completeness, participant retention, researcher efficiency, or clinical research outcomes. These claims require prospective evaluation.

ETHICAL CONSIDERATIONS AND LIMITATIONS

The proposed platform follows privacy-by-design and ethics-by-design principles. Before use in real clinical research, electronic informed consent, role-based access, audit trails, secure data storage, and appropriate de-identification or pseudonymization mechanisms would require technical and regulatory implementation. WHO standards for research involving human participants emphasize protection of participants' dignity, rights, safety, and well-being and the need for appropriate ethics review (WHO, 2011).

This article describes a conceptual model rather than a validated clinical system. The accuracy of future AI modules, false-positive alerts, algorithmic bias, automation bias, cybersecurity, digital literacy, connectivity, and adaptability to different study protocols remain important limitations and require formal testing.

FUTURE PILOT VALIDATION

The next development stage is planned as a minimum viable product (MVP), initially evaluated in a small group for technical performance and usability. Subject to appropriate ethics approval, a subsequent prospective pilot could assess data completeness, completion of scheduled follow-up visits, frequency of data-quality problems, accuracy of Data Quality Assistant alerts, researcher time requirements, and user acceptability.

The primary purpose of such a pilot should not be to claim clinical effectiveness prematurely, but to objectively evaluate feasibility, usability, acceptability, and data-quality performance and to identify technical and ethical problems before wider implementation.

CONCLUSION

MEHR (Medical Evidence & Health Research) is a conceptual AI-assisted digital platform intended to support prospective clinical research and longitudinal participant follow-up within a unified environment. The proposed architecture integrates participant registration, electronic informed consent,

structured clinical and laboratory data, visit management, longitudinal monitoring, data-quality support, and research-oriented AI functions.

A central design principle is that AI supports rather than replaces the researcher or clinician. Diagnosis, prescribing, treatment selection, dose modification, and other clinical decisions remain under human professional control. MVP development, usability testing, security and governance evaluation, and prospective pilot validation are required before the practical value of the platform can be established.

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RECIPROCAL ARM ACTION IN THE TAEKWONDO MOMTONG JIREUGI: ELBOW AND SHOULDER KINEMATICS OF THE PUNCHING AND PULL-BACK ARMS

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***Abstract**: The middle-section punch (Momtong Jireugi) is traditionally taught with a pull-back of the opposite arm, but the timing between the two arms has rarely been measured. This case report describes the elbow and shoulder kinematics of a fast Momtong Jireugi recorded with 3D motion capture (STT 3DMA, 19-marker model, 120 Hz) in a 19-year-old male taekwondo athlete. In both analyzed punches, the opposite elbow was pulled back to 133° of flexion, and this pull-back was 90% complete 0.18 s before the strike, exactly when the punching elbow began to extend. The punching elbow, briefly cocked to 145–147°, then extended by 117–121° to 26–28° in 0.24 s (about 490–500 °/s), while the punching shoulder rose to 52–53° of flexion and adducted from 65–72° to 14–20° of abduction. The two arms therefore worked in a strict reciprocal order, giving three teaching checkpoints: finish the pull-back first, keep the punching elbow in line, and extend the elbow last.*

***Keywords:** taekwondo; Momtong Jireugi; punch; elbow extension; pull-back arm; motion capture*

INTRODUCTION

The middle-section punch (Momtong Jireugi) is a fundamental technique of taekwondo training and poomsae. In straight punches, skilled athletes extend the elbow rapidly at the end of a proximal-to-distal chain (Putnam, 1993; VencesBrito et al., 2011). In taekwondo, the punch is traditionally taught together with a pull-back of the opposite arm, but the timing between the two arms has rarely been measured.

AIM

To describe the elbow and shoulder kinematics of the punching and pull-back arms during a fast Momtong Jireugi.

METHODS

A 19-year-old male taekwondo athlete performed right-hand Momtong Jireugi (middle-section punch) at maximal speed from a stance with the left leg forward. Full-body kinematics were recorded with an optical motion-capture

system and STT 3DMA 2023.0 software (19-marker full-body model, 120 Hz) at the Hi-Tech Sports Laboratory of the Uzbek State University of Physical Education and Sport (27 October 2025). Two consecutive punches were analyzed. Joint-angle curves were digitized from the software report (agreement with reported extrema: mean absolute difference 0.75°) and aligned to full elbow extension of the punching arm (t = 0).

RESULTS

Both punches showed the same pattern (Table 1). The punching elbow was first briefly cocked to 145–147° of flexion, 0.24 s before full extension. It then extended by 117–121° to 26–28° in 0.24 s, an average of about 490–500 °/s. The punching shoulder was raised forward, reaching 52–53° of flexion 0.06–0.08 s before full extension, and was adducted from 65–72° to 14–20° of abduction, bringing the elbow in line with the fist. The opposite (left) elbow, extended before the punch (17° and 50°), was pulled back to 133° of flexion. This pull-back was 90% complete 0.18 s before full extension, the moment at which the punching elbow began to extend. The punching arm stayed near full extension for 0.28–0.37 s and was 50% retracted 0.45–0.61 s after the strike.

Table 1

Punching- and Pull-Back-Arm Kinematics in Two Fast Punches

Variable	Punch 1	Punch 2
Punching elbow, cocked flexion (°) / time (s)	145.0 / −0.24	147.2 / −0.24
Punching elbow at full extension (°)	28.0	26.3
Elbow extension range (°) / mean velocity (°/s)	117.0 / 488	120.9 / 504
Punching shoulder flexion, peak (°) / time (s)	51.6 / −0.08	53.4 / −0.06
Punching shoulder abduction, guard → strike (°)	64.6 → 19.6	72.2 → 13.9
Pull-back elbow, extended → strike (°)	17.4 → 133.6	49.8 → 133.3
Pull-back 90% complete (s)	−0.18	−0.18
Time near full extension (s)	0.28	0.37
50% retraction after strike (s)	0.45	0.61

Note. Times relative to full elbow extension of the punching (right) arm (t = 0); negative = before. Shoulder flexion measured relative to the vertical.

CONCLUSION

In this athlete, the two arms worked in a strict reciprocal order: the pull-back arm finished its retraction just as the punching elbow began to extend, and the punching shoulder rose and adducted before the elbow completed its extension. For teaching, three checkpoints follow: finish the pull-back before the punch extends, keep the punching elbow in line (shoulder adducted), and extend the elbow last. The values come from one athlete and two punches and should be confirmed in larger samples.

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LOWER-LIMB DRIVE AND TRUNK STABILITY IN THE FAST MOMTONG JIREUGI: TIMING OF REAR-HIP EXTENSION RELATIVE TO ARM EXTENSION

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***Abstract**: Punch effectiveness depends on the legs and trunk as well as the arm, yet the lower-limb and trunk kinematics of the taekwondo Momtong Jireugi have not been described. This case report analyzed two fast right-hand punches of a 19-year-old male taekwondo athlete recorded with 3D motion capture (STT 3DMA, 19-marker model, 120 Hz). The rear hip began to extend 0.35–0.38 s before the strike and extended by 36–37°, with 90% of this extension completed 0.11–0.19 s before full elbow extension. Meanwhile, the front hip flexed to 32–33°, the front knee remained flexed (38–43°), and both hips adducted to 5–10° at the strike. The trunk stayed nearly upright, with an anterior tilt of 4–7° and lateral flexion of no more than 6°. The punch thus followed a leg-first, arm-last order with a stable trunk, supporting two teaching cues: initiate the rear-hip extension before the arm moves and keep the trunk upright.*

***Keywords:** taekwondo; Momtong Jireugi; punch; hip extension; trunk stability; motion capture*

INTRODUCTION

Punching force in combat sports depends not only on the arm but also on the legs and trunk (Lenetsky et al., 2013). In boxing, straight punches involve a coordinated contribution of the lower limbs, trunk, and arm (Cheraghi et al., 2014), and whole-body punch kinematics differ between junior and elite boxers (Dinu & Louis, 2020). For the taekwondo middle-section punch (Momtong Jireugi), the contribution and timing of the lower limbs have not been described.

AIM

To describe the rear-hip, front-leg, and trunk kinematics of a fast Momtong Jireugi and their timing relative to arm extension.

METHODS

A 19-year-old male taekwondo athlete performed right-hand Momtong Jireugi (middle-section punch) at maximal speed from a stance with the left leg forward. Full-body kinematics were recorded with an optical motion-capture

system and STT 3DMA 2023.0 software (19-marker full-body model, 120 Hz) at the Hi-Tech Sports Laboratory of the Uzbek State University of Physical Education and Sport (27 October 2025). Two consecutive punches were analyzed. Joint-angle curves were digitized from the software report (agreement with reported extrema: mean absolute difference 0.75°) and aligned to full elbow extension of the punching arm (t = 0).

RESULTS

The lower limbs acted before the arm in both punches (Table 1). The rear (right) hip first flexed slightly (12–14°) about 0.35–0.38 s before the strike. It then extended by 36–37° to −22° to −24°, and 90% of this extension was complete 0.11–0.19 s before full elbow extension. At the same time, the front (left) hip flexed to 32–33° and the front knee stayed flexed (38–43°). Both hips were briefly abducted (26–39°) about 0.3 s before the strike and adducted to 5–10° at the strike, consistent with closing the stance. The trunk remained almost upright: anterior tilt was 4–7° at the strike, with a range of 9–10° and lateral flexion of no more than 6°.

Table 1

Lower-Limb and Trunk Kinematics in Two Fast Punches

Variable	Punch 1	Punch 2
Rear hip, peak flexion (°) / time (s)	12.2 / −0.35	14.4 / −0.38
Rear hip at strike (°)	−23.5	−21.5
Rear hip extension range (°)	35.8	37.3
Rear hip extension 90% complete (s)	−0.11	−0.19
Front hip flexion at strike (°)	31.8	32.8
Front knee flexion at strike (°)	43.1	38.2
Rear knee flexion at strike (°)	42.5	44.0
Hip abduction, peak L / R (°)	35.1 / 25.9	38.9 / 33.5
Trunk anterior tilt at strike (°) / range (°)	4.1 / 9.0	6.6 / 9.9
Trunk lateral flexion range (°)	6.5	6.4

Note. Times relative to full elbow extension of the punching (right) arm (t = 0). Negative hip values = extension.

CONCLUSION

In this athlete, the rear-hip extension started about 0.35 s before the strike and was largely complete before the elbow finished extending, while the trunk remained upright. This supports a leg-first, arm-last order, as described for

straight punches in other combat sports. For teaching, rear-hip extension should be cued before the arm moves, and the trunk should be kept upright rather than leaning into the punch. The findings describe one athlete and two punches and should be tested with force measurements and larger samples.

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O'TKIR ICHAK TUTILISHINING TASHXISI VA DAVOLASH TAKTIKASI

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Annotatsiya. *Maqolada o'tkir ichak tutilishining zamonaviy tashxis va davolash tamoyillari adabiyotlar tahlili asosida yoritilgan. Maqsad - kasallikning klinik-laborator hamda nurli diagnostika algoritmlarini, shuningdek konservativ va jarrohlik davolash taktikasini tizimlashtirilgan holda taqdim etish. Ish uslubi sifatida 2018–2026 yillarda chop etilgan tizimli sharhlar, xalqaro klinik tavsiyalar (WSES/Boloniya) va klinik tadqiqotlar tahlil qilindi. Natijalar shuni ko'rsatadiki, o'z vaqtida qo'yilgan tashxis (klinik ko'rik, laborator ko'rsatkichlar, kontrastli KT) va strangulyatsiya belgilariga qarab davolash taktikasini (konservativ yoki jarrohlik) tanlash asoratlar va o'lim ko'rsatkichini kamaytirishning asosiy omili hisoblanadi. Xulosa qilib aytganda, davolash taktikasi xalqaro tavsiyalarga hamda bemorning individual holatiga asoslangan holda tanlanishi lozim.*

Kalit so'zlar: *o'tkir ichak tutilishi, bitishmali ichak tutilishi, tashxis, jarrohlik davolash, strangulyatsiya.*

Аннотация. *В статье на основе анализа современной научной литературы рассмотрены современные принципы диагностики и лечения острой кишечной непроходимости. Цель исследования — систематизировать клинико-лабораторные и лучевые алгоритмы диагностики, а также современные подходы к консервативному и хирургическому лечению заболевания. В качестве метода исследования проведён анализ систематических обзоров, международных клинических рекомендаций (WSES/Болонские рекомендации) и клинических исследований, опубликованных в 2018–2026 годах. Полученные данные свидетельствуют о том, что своевременная диагностика (клиническое обследование, лабораторные показатели, компьютерная томография с контрастированием) и выбор лечебной тактики (консервативной или хирургической) с учётом признаков странгуляции являются основными*

факторами снижения частоты осложнений и летальности. В заключение следует отметить, что выбор лечебной тактики должен основываться на международных клинических рекомендациях и индивидуальных особенностях состояния пациента.

Ключевые слова: *острая кишечная непроходимость, спаечная кишечная непроходимость, диагностика, хирургическое лечение, странгуляция*

Abstract. *This article reviews the contemporary principles of diagnosis and management of acute intestinal obstruction based on an analysis of current scientific literature. The aim of the study was to systematize clinical, laboratory, and imaging diagnostic algorithms, as well as modern approaches to conservative and surgical treatment. The study was based on an analysis of systematic reviews, international clinical guidelines (WSES/Bologna Guidelines), and clinical studies published between 2018 and 2026. The findings indicate that timely diagnosis (clinical examination, laboratory parameters, and contrast-enhanced computed tomography) and appropriate selection of treatment strategy (conservative or surgical) according to the presence of signs of strangulation are the key factors in reducing complications and mortality. In conclusion, treatment strategies should be selected in accordance with international clinical guidelines and the individual clinical condition of each patient.*

Keywords: *acute intestinal obstruction, adhesive small bowel obstruction, diagnosis, surgical treatment, strangulation.*

KIRISH. O‘tkir ichak tutilishi (ileus) - ichak bo‘shlig‘i orqali ichak tarkibining harakatlanishi qisman yoki to‘liq to‘xtashi bilan tavsiflanadigan, tez tibbiy va ko‘pincha jarrohlik yordamini talab qiladigan o‘tkir qorin sindromlaridan biridir. Ushbu holat “o‘tkir qorin” sindromi tarkibida eng ko‘p uchraydigan nozologik shakllardan bo‘lib, kechiktirilgan tashxis va davolash taktikasining noto‘g‘ri tanlanishi ichak ishemiyasi, nekrozi, perforatsiyasi, peritonit va sepsis kabi og‘ir asoratlarga, hatto o‘lim holatlariga olib kelishi mumkin.

Etiologik jihatdan ichak tutilishi mexanik va dinamik (funksional) turlarga bo‘linadi. Mexanik tutilish qorin bo‘shlig‘i operatsiyalaridan keyingi bitishmalar, chuv (grijalar), o‘smalar, invaginatsiya va volvulyus natijasida yuzaga keladi, dinamik tutilish esa ichak devori nerv-mushak apparatining funksional buzilishi (paralitik yoki spastik ileus) tufayli rivojlanadi.

Rivojlangan davlatlarda operatsiyadan keyingi bitishmalar ingichak ichak tutilishining yetakchi sababi hisoblanadi, rivojlanayotgan mamlakatlarda esa chuv kasalligi va volvulyus ulushi nisbatan yuqori bo‘lib qolmoqda.

ADABIYOTLAR TAHLILI

Jackson va Vigiola Cruz (1) tomonidan amalga oshirilgan sharhda o'tkir ichak tutilishining klassik klinik triadasi -kolikasimon og'riq, qusish va gazlar chiqishining to'xtashi - batafsil tavsiflangan bo'lib, mualliflar laborator ko'rsatkichlar (leykotsitoz, laktat darajasi) va kontrastli kompyuter tomografiyaning tashxisdagi ustuvor ahamiyatini ta'kidlaydi. Ansari (2) MSD Manual doirasida ushbu yondashuvni tasdiqlab, davolashning uch asosiy tayanch nuqtasi – suyuqlik - elektrolit balansini tiklash, nazogastral dekompressiya va, ko'p hollarda, jarrohlik aralashuv ekanini qayd etadi.

Ten Broek va hammualliflari (3) tomonidan ishlab chiqilgan Boloniya (WSES) tavsiyalari sohadagi eng nufuzli hujjat hisoblanib, strangulyatsiya belgilari bo'lmagan bitishmali ingichak ichak tutilishida konservativ davolashni 72 soatgacha xavfsiz davom ettirish mumkinligini asoslab beradi.

Umuman olganda, adabiyotlar tahlili shuni ko'rsatadiki, tashxis va davolash taktikasining umumiy tamoyillari xalqaro miqyosda bir xil bo'lsa-da, amaliy natijalar mintaqaviy resurslar, diagnostikaga murojaat vaqti va kadrlar malakasiga bog'liq holda sezilarli farqlanadi.

MATERIAL VA METODLAR

Maqolani yozish jarayonida PubMed, Scopus, Google Scholar va StatPearls kabi ilmiy-tibbiy ma’lumotlar bazalarida 2018–2026 yillar oralig‘ida chop etilgan tizimli sharhlar, klinik tavsiyalar (jumladan Bologna va Butunjahon Favqulodda Jarrohlik Jamiyati - WSES tavsiyalari), retrospektiv va prospektiv klinik tadqiqotlar tahlil qilindi. Qidiruv uchun “intestinal obstruction”, “small bowel obstruction”, “diagnosis and management”, “adhesive small bowel obstruction” kalit so‘zlaridan foydalanildi. Tanlash mezonlariga javob bergan manbalar tavsiflovchi-analitik usulda umumlashtirildi.

Laboratoriya tahlillarida leykotsitlar sonining ko‘payishi, C-reaktiv oqsil miqdorining oshishi hamda metabolik asidoz kabi patologik o‘zgarishlar qayd etilishi mumkin. Instrumental diagnostika jarayonida esa rentgenografiya, kompyuter tomografiyasi (KT) va ultratovush tekshiruvidan foydalaniladi. Rentgenologik tekshiruvda ichak halqalarining kengayishi va gaz-suyuqlik sathlarining paydo bo‘lishi kuzatiladi. Kompyuter tomografiyasi ichak tutilishining sababini aniqlashda yuqori diagnostik ahamiyatga ega bo‘lib, strangulyatsiya, ichak devorining nekrozi yoki perforatsiya kabi asoratlarni aniqlash imkonini beradi.[11]

O‘tkir ichak tutilishida davolash bemorning holati va tutilish sababiga bog‘liq. Mexanik tutilishda nekroz va perforatsiyaning oldini olish uchun jarrohlik amaliyoti — dekompressiya, rezeksiya, anastomoz yoki stoma qo‘llanadi. Funksional tutilishda esa asoratlar bo‘lmasa, suyuqlik va elektrolitlarni tiklash hamda dekompressiya kabi konservativ usullar tanlanadi.[12]

NATIJALAR VA MUHOKAMA

Ichak tutilishining klassik klinik triadasi qorindagi spazmodik (kolikasimon) og‘riq, qusish va gazlar hamda najas chiqishining to‘xtashidan iborat. Simptomlarning namoyon bo‘lish darajasi va ketma-ketligi tutilish darajasiga (yuqori yoki quyi ingichak ichak, yo‘g‘on ichak) bog‘liq: proksimal tutilishda ko‘p marta qusish erta boshlanadi, distal tutilishda esa qorin dam bo‘lishi va og‘riq ustunlik qiladi. Qorinni perkussiya qilganda timpanit, auskultatsiyada baland tonli, “metall” tusli peristaltika yoki, kech bosqichlarda, peristaltika umuman eshitilmasligi mumkin. Peritoneal simptomlarning paydo bo‘lishi, tana harorati ko‘tarilishi, taxikardiya va laktat darajasining oshishi ichak strangulyatsiyasi yoki ishemiyasidan darak berib, zudlik bilan jarrohlik konsultatsiyasini talab qiladi [1,2].

Laborator tekshiruvlar tarkibiga umumiy qon tahlili, elektrolitlar, buyrak funksiyasi ko‘rsatkichlari va zardob laktat darajasi kiritilishi lozim, chunki bu ko‘rsatkichlar suyuqlik-elektrolit muvozanati buzilishi va ichak ishemiyasi xavfini baholashga yordam beradi. Nurli diagnostika usullaridan qorin bo‘shlig‘ining oddiy rentgenografiyasi dastlabki, tezkor usul sifatida qo‘llaniladi, biroq uning sezuvchanligi cheklangan. Kontrastli kompyuter tomografiya (KT) hozirgi kunda oltin standart hisoblanadi - u tutilish darajasi va sababini aniqlash, shuningdek strangulyatsiya, ichak devori ishemiyasi yoki perforatsiya belgilarini (devor qalinlashishi, kontrastlanish pasayishi, erkin gaz yoki suyuqlik) erta bosqichda aniqlashga imkon beradi[3].

Ba’zi klinikalarda suvda eruvchan kontrast moddalar (masalan, gastrografin) bilan o‘tkaziladigan tekshiruvlar ham konservativ davolashning samaradorligini bashorat qilish va operatsiyaga ehtiyojni kamaytirish maqsadida qo‘llaniladi[4].

Asoratlanmagan, strangulyatsiya belgilarisiz kechayotgan bitishmali ingichak ichak tutilishida boshlang‘ich davolash konservativ yo‘l bilan olib boriladi: nazogastral zond orqali dekompressiya, venaga suyuqlik va elektrolitlar infuzion terapiyasi, ichakka dam berish (“drip and suck” tamoyili) hamda dinamik klinik-laborator kuzatuv. Butunjahon Favqulodda Jarrohlik Jamiyatining (WSES) Boloniya tavsiyalariga ko‘ra, peritonit, ishemiya yoki

to‘liq strangulyatsiya belgilari bo‘lmagan holatlarda konservativ davolashni 72 soatgacha xavfsiz davom ettirish mumkin. Shu muddat ichida yaxshilanish kuzatilmasa yoki holat yomonlashsa, jarrohlik aralashuvi ko‘rsatiladi [3,5].

Jarrohlik davolash quyidagi holatlarda shoshilinch tarzda amalga oshiriladi: peritonit belgilari, ichak strangulyatsiyasi yoki ishemiyasiga shubha, ichakning to‘liq tutilishi (ayniqsa grija yoki volvulyus fonida) hamda konservativ terapiyaning samarasizligi[6].

Zamonaviy amaliyotda, tanlangan bemorlarda, tajribali jarroh ishtirokida laparoskopik adgeziolizis ochiq jarrohlikka muqobil, kamroq travmatik usul sifatida qo‘llanilmoqda, biroq keng tarqalgan bitishmalar yoki qorin bo‘shlig‘ining sezilarli darajada dam bo‘lishi holatlarida ochiq laparotomiya afzal ko‘riladi[7]. Yo‘g‘on ichak tutilishida, ayniqsa o‘smaga bog‘liq holatlarda, rezeksiya, stoma qo‘yish yoki o‘tkazuvchi stent qo‘yish kabi usullar bemorning umumiy holati va kasallik sababiga qarab tanlanadi [8].

So‘nggi yillarda o‘tkazilgan klinik tadqiqotlar ichak tutilishi bilan murojaat qilgan bemorlarning sezilarli qismida (ba’zi hududlarda 60–70% gacha) erkaklar ustunlik qilishini, yetakchi etiologik omillar sifatida bitishmalar, chuv va o‘smalarni, asosiy asoratlar sifatida esa yara hosil bo‘lishi, ichak nekrozi va operatsiyadan keyingi yara esa infeksiyasini ko‘rsatib o‘tadi[9].

Bunday natijalar erta tashxis qo‘yish, xavf omillarini o‘z vaqtida baholash va davolash taktikasini individuallashtirish zaruriyatini yana bir bor tasdiqlaydi [10].

XULOSA

O‘tkir ichak tutilishi shoshilinch tibbiy yordamni talab qiluvchi, klinikkasi xilma-xil bo‘lgan patologiya bo‘lib, uning muvaffaqiyatli davolanash to‘g‘ri va o‘z vaqtida qo‘yilgan tashxisga bevosita bog‘liq. Klinik ko‘rik, laborator natijalari va kontrastli kompyuter tomografiyaning uyg‘un qo‘llanilishi strangulyatsiya kabi hayotga xavf soluvchi asoratlarni erta aniqlashga imkon beradi.

Asoratlanmagan holatlarda nazorat ostida olib boriladigan konservativ terapiya samarali bo‘lsa-da, peritonit, ishemiya yoki konservativ davolashning natijasiz holatlarida jarrohlik aralashuvi kechiktirilmasligi lozim. Davolash taktikasini tanlashda xalqaro tavsiyalarga (WSES/Boloniya) asoslanish, shuningdek har bir bemorning individual xususiyatlarini hisobga olish asoratlarni va o‘lim ko‘rsatkichini sezilarli darajada kamaytirishga xizmat qiladi.

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30.

REPRODUKTIV YOSHDAGI AYOLLARDA NOSPETSIFIK SERVITSIT RIVOJLANISHINING XAVF OMILLARI VA ULARNING PROGNOSTIK AHAMIYATI

Sohibova Gulnoza Komilovna

Annotatsiya. *Mazkur tezisda reproduktiv yoshdagi ayollarda nospetsifik servitsit rivojlanishiga ta'sir etuvchi asosiy xavf omillari va ularning prognostik ahamiyati tahlil qilinadi. Kasallikning shakllanishida akusherlik-ginekologik anamnez, reproduktiv holat, jinsiy va reproduktiv salomatlik bilan bog'liq omillar, bachadon bo'yni shikastlanishlari, yallig'lanish jarayonlarining qaytalanishi hamda boshqa predispozitsion omillarning o'rni yoritiladi. Xavf omillarini kompleks baholash nospetsifik servitsit rivojlanish ehtimoli yuqori bo'lgan ayollar guruhini aniqlash, kasallikning kechishi va qaytalanish xavfini prognozlash hamda individual profilaktik yondashuvlarni shakllantirishda muhim ahamiyat kasb etishi asoslanadi. Tezisda xavf omillarini erta aniqlash va prognostik baholash reproduktiv yoshdagi ayollarda bachadon bo'yni yallig'lanish kasalliklarining oldini olish hamda tibbiy kuzatuv samaradorligini oshirishning istiqbolli yo'nalishi sifatida ko'rib chiqiladi.*

Kalit so'zlar: *nospetsifik servitsit, reproduktiv yosh, xavf omillari, prognostik ahamiyat, bachadon bo'yni, reproduktiv salomatlik, akusherlik-ginekologik anamnez, profilaktika.*

KIRISH

Nospetsifik servitsit reproduktiv yoshdagi ayollarda bachadon bo'yni yallig'lanish kasalliklari tarkibida muhim klinik muammolardan biri hisoblanadi. Kasallikning uzoq davom etishi yoki qaytalanib turishi bachadon bo'yni to'qimalarida yallig'lanish jarayonining saqlanib qolishiga, reproduktiv tizim faoliyatining buzilishiga hamda bemorlarning hayot sifatiga salbiy ta'sir ko'rsatishi mumkin. Shu sababli nospetsifik servitsitni faqat mavjud klinik belgilar asosida aniqlash va davolash emas, balki uning rivojlanishiga moyillik tug'diruvchi omillarni o'z vaqtida aniqlash ham muhim ahamiyatga ega.

Nospetsifik servitsitning shakllanishi birgina sabab bilan emas, balki bir qator o'zaro bog'liq predispozitsion omillar ta'siri bilan izohlanadi. Bunda ayolning akusherlik-ginekologik anamnezi, ilgari o'tkazilgan yallig'lanish kasalliklari, reproduktiv faoliyat xususiyatlari, bachadon bo'yniga ta'sir ko'rsatuvchi muolajalar va boshqa klinik-anamnestik holatlarni kompleks

baholash talab etiladi. Ayniqsa, bir nechta xavf omillarining birgalikda uchrashi kasallikning rivojlanishi va qaytalanish ehtimolini baholashda alohida e’tibor talab qiladi.

Xavf omillarini aniqlashning amaliy ahamiyati shundaki, ular asosida nospetsifik servitsit rivojlanish ehtimoli yuqori bo‘lgan ayollar guruhini ajratish va ularda individual kuzatuv hamda profilaktika choralarini tashkil etish imkoniyati yuzaga keladi. Shu jihatdan xavf omillarining prognostik qiymatini baholash kasallikni erta aniqlash, qaytalanishining oldini olish va reproduktiv salomatlikni saqlashga qaratilgan yondashuvlarni takomillashtirish uchun muhimdir.

Mazkur tezisning maqsadi reproduktiv yoshdagi ayollarda nospetsifik servitsit rivojlanishi bilan bog‘liq klinik-anamnestik va akusherlik-ginekologik xavf omillarini tahlil qilish hamda ularning prognostik ahamiyatini baholashdan iborat.

ASOSIY QISM

Reproduktiv yoshdagi ayollarda nospetsifik servitsit rivojlanishining xavf omillarini baholashda klinik belgilar bilan bir qatorda bemorning anamnestik va akusherlik-ginekologik ma’lumotlarini kompleks o‘rganish muhim hisoblanadi. Kasallikning rivojlanishi va qaytalanishiga moyillikni aniqlash uchun avvalgi ginekologik yallig‘lanish kasalliklari, bachadon bo‘yniga o‘tkazilgan muolajalar, homiladorlik va tug‘ruqlar tarixi, reproduktiv tizim bilan bog‘liq holatlar hamda yallig‘lanish jarayonining davomiyligini birgalikda baholash maqsadga muvofiq.

Xavf omillarini shartli ravishda bir necha guruhga ajratish mumkin. Birinchi guruhni akusherlik va reproduktiv anamnez bilan bog‘liq omillar, ikkinchi guruhni avvalgi ginekologik kasalliklar va yallig‘lanish jarayonlari, uchinchi guruhni bachadon bo‘yniga mahalliy ta’sir ko‘rsatishi mumkin bo‘lgan holatlar, to‘rtinchi guruhni esa kasallikning qaytalanishiga moyillikni belgilovchi klinik-anamnestik omillar tashkil etadi. Bunday tasnif xavf omillarini alohida qayd etishdan ko‘ra, ularning umumiy ta’sirini kompleks baholash imkonini beradi.

Nospetsifik servitsitda yallig‘lanish jarayonining takrorlanishi alohida prognostik ahamiyat kasb etadi. Anamnezida qaytalanuvchi yallig‘lanish holatlarining mavjudligi bemorni chuqurroq tekshirish, kasallik kechishiga ta’sir qiluvchi omillarni aniqlash va keyingi kuzatuv taktikasini individuallashtirish zaruratini yuzaga keltiradi. Bunda klinik simptomlarning davomiyligi va qaytalanish chastotasini boshqa anamnestik ko‘rsatkichlar bilan birgalikda tahlil qilish muhimdir.

Xavf omillarining prognostik ahamiyatini baholashda faqat ularning mavjud yoki mavjud emasligini aniqlash yetarli emas. Ularning nospetsifik servitsit bilan bog‘liqlik darajasini statistik jihatdan baholash talab etiladi. Buning uchun tadqiqot guruhlarida tegishli omillarning uchrash chastotasi qiyoslanib, imkoniyatlar nisbati (odds ratio — OR), 95 foizlik ishonch oralig‘i (95% CI) va statistik ahamiyatlilik darajasi (p) kabi ko‘rsatkichlardan foydalanish mumkin. Bir nechta omilning mustaqil prognostik qiymatini aniqlash zarur bo‘lsa, logistik regressiya tahlilidan foydalanish maqsadga muvofiq.

Shu asosda xavf omillarini amaliy jihatdan quyidagicha tizimlashtirish mumkin:

1-jadval.

Nospetsifik servitsit rivojlanishining xavf omillari va ularning prognostik ahamiyati

Xavf omillari guruhi	**Baholanadigan ko‘rsatkichlar**	**Prognostik ahamiyati**
Akusherlik anamnezi	Homiladorlik va tug‘ruqlar tarixi, bachadon bo‘yniga bog‘liq akusherlik holatlari	Yuqori xavf guruhini ajratishga yordam beradi
Ginekologik anamnez	Avvalgi yallig‘lanish kasalliklari va ularning qaytalanishi	Surunkali yoki qaytalanuvchi jarayonga moyillikni baholashga xizmat qiladi
Klinik xususiyatlar	Belgilarning davomiyligi va takrorlanishi	Kasallik kechishini prognozlashda qo‘shimcha mezon bo‘lishi mumkin
Mahalliy omillar	Bachadon bo‘yniga o‘tkazilgan muolajalar va boshqa anamnestik holatlar	Individual xavfni kompleks baholashga imkon beradi
Omillarning kombinatsiyasi	Bir bemorda bir nechta xavf omilining mavjudligi	Umumiy prognostik xavfni aniqlash imkoniyatini oshiradi

Bunday yondashuvning asosiy maqsadi barcha bemorlarga bir xil xavf darajasini belgilash emas, balki klinik va anamnestik ma’lumotlar asosida individual xavf profilini shakllantirishdan iborat. Natijada yuqori xavf guruhiga

mansub ayollarda chuqurlashtirilgan kuzatuv, profilaktik tadbirlar va o‘z vaqtida diagnostik tekshiruvlarni tashkil etish imkoniyati kengayadi.

TADQIQOT NATIJALARI VA MUHOKAMA

Reproduktiv yoshdagi ayollarda nospetsifik servitsit rivojlanishiga olib keluvchi xavf omillarini baholash kasallikning klinik kechishini oldindan prognozlash va yuqori xavf guruhlarini shakllantirishda muhim ahamiyatga ega. Bunda alohida omilning mavjudligidan tashqari, bir bemorda bir nechta klinik-anamnestik omillarning birgalikda uchrashini hisobga olish zarur.

Tadqiqot natijalarini tahlil qilishda bemorlarning akusherlik-ginekologik anamnezi, avval o‘tkazilgan reproduktiv tizim yallig‘lanish kasalliklari, kasallikning davomiyligi va qaytalanishi, bachadon bo‘yni bilan bog‘liq anamnestik holatlar hamda boshqa predispozitsion omillarni qiyosiy baholash maqsadga muvofiq. Ushbu ko‘rsatkichlarning asosiy va taqqoslash guruhlaridagi uchrash chastotasi o‘rtasidagi farqlar kasallik rivojlanishi bilan bog‘liq ehtimoliy xavf omillarini ajratish imkonini beradi.

Bunda prognostik ahamiyatni aniqlash uchun xavf omillarini uch bosqichda baholash taklif etiladi. Dastlab har bir omilning guruhlardagi uchrash chastotasi aniqlanadi. Keyingi bosqichda uning nospetsifik servitsit rivojlanishi bilan statistik bog‘liqligi baholanadi. Yakuniy bosqichda esa statistik ahamiyatga ega omillar birgalikda tahlil qilinib, yuqori xavf guruhini shakllantirish imkoniyati aniqlanadi.

Ayniqsa, qaytalanuvchi yallig‘lanish jarayonlari va murakkablashgan akusherlik-ginekologik anamnezga ega bemorlarni alohida kuzatuv guruhiga ajratish klinik jihatdan muhim bo‘lishi mumkin. Chunki bir nechta predispozitsion omillarning birgalikda mavjudligi yallig‘lanish jarayonining davom etishi yoki qaytalanish ehtimolini oshiruvchi fonni shakllantirishi mumkin. Shu sababli bemorning individual xavf profilini aniqlash diagnostika va profilaktika choralarini differensial tashkil etishga yordam beradi.

Tadqiqot natijalarining amaliy ahamiyati xavf omillarini kasallik yuzaga kelganidan keyingi tavsiflovchi ko‘rsatkich sifatida emas, balki nospetsifik servitsit rivojlanish ehtimolini baholashga xizmat qiluvchi prognostik mezonlar tizimi sifatida ko‘rib chiqish imkoniyati bilan belgilanadi. Bu yondashuv reproduktiv yoshdagi ayollar orasida yuqori xavf guruhlarini erta aniqlash, ularni dinamik kuzatuvga olish va individual profilaktik tadbirlarni rejalashtirish imkoniyatini kengaytiradi.

Shunday qilib, nospetsifik servitsit rivojlanishini prognozlashda bitta xavf omiliga asoslangan yondashuvdan ko‘ra, akusherlik anamnezi + ginekologik

anamnez + qaytalanuvchi yallig‘lanish holatlari + klinik kechish xususiyatlarini kompleks baholash maqsadga muvofiq hisoblanadi.

XULOSA

Reproduktiv yoshdagi ayollarda nospetsifik servitsit rivojlanishining xavf omillarini o‘rganish kasallikning oldini olish, uni erta aniqlash va qaytalanish ehtimolini kamaytirishga qaratilgan profilaktik yondashuvlarni takomillashtirishda muhim ahamiyatga ega. Klinik va anamnestik ma’lumotlarni kompleks baholash nospetsifik servitsit rivojlanish ehtimoli yuqori bo‘lgan ayollar guruhini shakllantirish imkonini beradi.

Xavf omillarini baholashda akusherlik-ginekologik anamnez, ilgari kuzatilgan yallig‘lanish jarayonlari, ularning qaytalanish xususiyati, kasallikning davomiyligi hamda bachadon bo‘yniga ta’sir ko‘rsatishi mumkin bo‘lgan anamnestik holatlarni o‘zaro bog‘liq holda tahlil qilish maqsadga muvofiq. Bunda alohida xavf omilini aniqlash bilan cheklanmasdan, ularning kombinatsiyasi va kasallik rivojlanishi bilan bog‘liqlik darajasini baholash prognostik aniqlikni oshirishga xizmat qiladi.

Tadqiqot yo‘nalishidan kelib chiqib, nospetsifik servitsit profilaktikasida individual xavfga asoslangan yondashuvni qo‘llash maqsadga muvofiq. Yuqori xavf guruhiga kiruvchi ayollarni erta aniqlash, ularni dinamik kuzatuvga olish, zarur diagnostik tekshiruvlarni o‘z vaqtida o‘tkazish va individual profilaktik choralarni belgilash kasallikning qaytalanuvchi shakllari rivojlanishining oldini olishga xizmat qilishi mumkin.

Shunday qilib, reproduktiv yoshdagi ayollarda nospetsifik servitsit rivojlanishini prognozlashda xavf omillarini kompleks baholash kasallikni boshqarishning istiqbolli yo‘nalishlaridan biri hisoblanadi. “Xavf omillarini aniqlash → individual xavfni baholash → yuqori xavf guruhini ajratish → dinamik kuzatuv → profilaktik choralar” ketma-ketligidan foydalanish klinik amaliyotda differensial yondashuvni shakllantirishga imkon beradi.

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ПРОГНОСТИЧЕСКОЕ ЗНАЧЕНИЕ ЦИТОКИНОВ И ИНДЕКСОВ СИСТЕМНОГО ВОСПАЛЕНИЯ У БОЛЬНЫХ ОСТРЫМ ИНФАРКТОМ МИОКАРДА, ПОДВЕРГНУТЫХ ЧРЕСКОЖНОМУ КОРОНАРНОМУ ВМЕШАТЕЛЬСТВУ

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Abstract. *The study summarises published evidence on the prognostic value of cytokines and systemic inflammation indices in patients with acute myocardial infarction undergoing percutaneous coronary intervention (PCI). Before PCI, IL-6, TNF-α and MCP-1 levels are already elevated in proportion to ischaemic time; after PCI, IL-6 and neutrophil counts rise further within the first 24 hours, and C-reactive protein peaks on days 2–3. High IL-6 and CRP, a low IL-10 level, and elevated neutrophil-to-lymphocyte ratio and systemic immune-inflammation index are independently associated with larger infarct size, left ventricular dysfunction, heart failure and mortality. Serial assessment of these markers is warranted for risk stratification and selection of patients for anti-inflammatory therapy.*

Keywords: *acute myocardial infarction, percutaneous coronary intervention, cytokines, interleukin-6, C-reactive protein, neutrophil-to-lymphocyte ratio, prognosis.*

АКТУАЛЬНОСТЬ

Первичное чрескожное коронарное вмешательство (ЧКВ) является стандартом реперфузионной терапии острого инфаркта миокарда (ОИМ), однако у значительной части больных после успешной реваскуляризации развиваются неблагоприятное ремоделирование левого желудочка (ЛЖ) и сердечная недостаточность. Одним из ведущих механизмов этих осложнений является чрезмерный или затяжной воспалительный ответ, который усиливается реперфузионным повреждением и механической травмой сосудистой стенки при ЧКВ.

Цель исследования — на основании анализа данных литературы охарактеризовать динамику цитокинового профиля и маркеров системного

воспаления у больных ОИМ до и после ЧКВ и оценить их прогностическое значение.

МАТЕРИАЛ И МЕТОДЫ

Проведён анализ публикаций, индексированных в базах данных PubMed/MEDLINE, Scopus, Web of Science и eLIBRARY.RU за 1998–2025 гг., включая рандомизированные клинические исследования (CANTOS, COLCOT, LoDoCo2, CLEAR SYNERGY, ASSAIL-MI, VCU-ART3, MRC-ILA Heart), крупные когортные исследования и действующие клинические рекомендации ESC (2023) и Российского кардиологического общества (2020).

РЕЗУЛЬТАТЫ

Установлено, что ключевым путём трансляции местного воспаления в системный ответ при ОИМ является ось NLRP3-инфламмасома → ИЛ-1β → ИЛ-6 → С-реактивный белок (СРБ). До вмешательства уровни ИЛ-6, ФНО-α и MCP-1 уже повышены и зависят от длительности ишемии. ЧКВ вызывает ранний (в течение первого часа — первых суток) дополнительный прирост ИЛ-6 и нейтрофилов периферической крови, а максимум концентрации СРБ приходится на 2–3-и сутки. Высокие уровни ИЛ-6 ассоциированы с большим размером инфаркта и снижением фракции выброса ЛЖ, повышенный СРБ — с развитием сердечной недостаточности и смертностью, а низкий уровень противовоспалительного ИЛ-10 — с неблагоприятным прогнозом. Доступные гематологические индексы (отношение нейтрофилов к лимфоцитам, тромбоцитов к лимфоцитам, системный иммуновоспалительный индекс SII) являются независимыми предикторами no-reflow, госпитальной летальности и отдалённых сердечно-сосудистых событий. Клиническая значимость воспаления подтверждена результатами исследований CANTOS, COLCOT и ASSAIL-MI.

ВЫВОДЫ

1. Цитокиновый профиль больных ОИМ отражает баланс между повреждением и репарацией миокарда, а ЧКВ является дополнительным фактором активации воспаления. 2. Наибольшей прогностической ценностью обладают ИЛ-6, СРБ, отношение ИЛ-6/ИЛ-10 и гематологические индексы NLR и SII, определённые в динамике (до ЧКВ, через 24 ч и на 3–7-е сутки). 3. Комплексная серийная оценка маркеров воспаления целесообразна для выделения больных с «гипервоспалительным» фенотипом, которым может быть показана таргетная противовоспалительная терапия.

MORPHOLOGICAL REMODELING OF GASTRIC TISSUES

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Abstract. *This thesis analyzes the morphological remodeling of gastric tissues under the influence of various endogenous and exogenous factors. Chronic inflammation, Helicobacter pylori infection, psychoemotional stress, nonsteroidal anti-inflammatory drugs, and dietary imbalances are considered the main triggers of gastric remodeling. These factors may induce glandular atrophy or hyperplasia, epithelial degeneration and desquamation, inflammatory infiltration, submucosal fibrosis, and vascular restructuring. Morphological remodeling of the stomach reflects a disturbed balance between aggressive and protective factors and may contribute to the development of chronic gastritis, ulcer disease, metaplastic changes, and an increased risk of malignant transformation. Comprehensive morphological and morphometric assessment of gastric tissues is essential for early diagnosis and monitoring of disease progression.*

Keywords: *stomach, gastric tissues, remodeling, morphology, histology, gastritis, atrophy, metaplasia, fibrosis, morphometry, Helicobacter pylori, stress, epithelium.*

RELEVANCE

The gastric mucosa and deeper tissue layers are continuously exposed to a wide range of endogenous and exogenous influences, and their structural integrity depends on the balance between aggressive and protective factors. Under pathological conditions, this balance is disrupted, leading to persistent structural reorganization of gastric tissues. Morphological remodeling of the stomach is not merely a consequence of disease but an active process that involves changes in epithelial proliferation and apoptosis, glandular architecture, extracellular matrix composition, vascular network, and innervation. These changes underlie the progression of chronic gastritis, ulcer disease, and precancerous lesions. Understanding the mechanisms and morphological manifestations of gastric tissue remodeling is therefore of significant clinical and scientific importance.

AIM OF THE STUDY

To analyze the morphological patterns and mechanisms of gastric tissue remodeling under the influence of major pathological factors and to assess their morphofunctional and clinical significance.

MATERIALS AND METHODS

Experimental, clinical, and morphological studies concerning the remodeling of gastric tissues were analyzed. Histological methods, including hematoxylin and eosin staining, PAS staining, immunohistochemical markers of proliferation (Ki-67) and apoptosis (caspase-3), light and electron microscopy, and morphometric assessment, may be used to evaluate the structural reorganization of the gastric mucosa and deeper layers. The condition of the surface and glandular epithelium, glandular density and architecture, stromal fibrosis, vascular changes, inflammatory cell infiltration, and the degree of mucosal atrophy or hyperplasia were considered as the main morphological criteria of remodeling.

RESULTS

The literature analysis demonstrated that gastric tissue remodeling manifests through a spectrum of structural changes depending on the nature, duration, and intensity of the damaging factor. In chronic Helicobacter pylori-associated gastritis, remodeling is characterized by lymphoplasmacytic infiltration of the lamina propria, hyperplasia of the foveolar epithelium, glandular atrophy, and intestinal metaplasia. Prolonged use of nonsteroidal anti-inflammatory drugs induces epithelial damage, reduced prostaglandin synthesis, vascular congestion, and impaired mucosal regeneration, which may progress to erosive and ulcerative lesions with subsequent fibrotic remodeling of the submucosa.

Psychoemotional stress has been shown to trigger degeneration and desquamation of the surface epithelium, hyperemia, hemorrhagic changes, and inflammatory cell infiltration, as well as disturbances in the neuroendocrine regulation of gastric secretion and blood flow. Chronic stress may lead to persistent trophic disturbances and accelerate atrophic remodeling of the gastric glands.

Dietary factors, including high intake of refined carbohydrates, fats, and salt, as well as exposure to high temperature and humidity, may aggravate pathological changes in the gastric mucosa, contributing to epithelial desquamation, hemorrhage, inflammatory infiltration, and edema. In experimental models, such exposures have been associated with thinning of the gastric glands, necrosis and shedding of the surface epithelium, tissue edema, and vascular congestion.

In the later stages of remodeling, fibrosis of the lamina propria and submucosa, sclerosis of the vascular wall, and reduction of the capillary network are observed, which further impair tissue trophism and regenerative capacity. These changes create favorable conditions for the progression of atrophic and metaplastic processes and increase the risk of malignant transformation.

CONCLUSION

Morphological remodeling of gastric tissues is a complex, multi-stage process resulting from the interaction of damaging factors and compensatory-adaptive reactions of the organism. Chronic inflammation, Helicobacter pylori infection, stress, nonsteroidal anti-inflammatory drugs, and unfavorable dietary and environmental factors play key roles in the initiation and progression of gastric tissue remodeling. The main morphological manifestations include glandular atrophy or hyperplasia, epithelial degeneration and desquamation, inflammatory infiltration, stromal fibrosis, vascular restructuring, and impaired regeneration. Comprehensive morphological and morphometric assessment of gastric tissue remodeling is important for identifying early structural changes, predicting disease progression, and developing effective therapeutic and preventive strategies.

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PERCUTANEOUS CORONARY INTERVENTION AS A TRIGGER OF INFLAMMATION IN ACUTE MYOCARDIAL INFARCTION: CHANGES IN CYTOKINES AND HAEMATOLOGICAL INFLAMMATORY INDICES

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Abstract. *Percutaneous coronary intervention (PCI) restores perfusion in acute myocardial infarction but also acts as an additional trigger of inflammation through reperfusion injury, plaque disruption and distal embolisation. Based on published evidence, this thesis describes the time course of pro-inflammatory (IL-1β, IL-6, TNF-α, MCP-1) and anti-inflammatory (IL-10, TGF-β) cytokines, C-reactive protein and haematological indices (NLR, PLR, SII) before and after PCI. An early post-procedural rise in IL-6 and neutrophils, followed by a CRP peak on days 2–3, is typical, and a persistent elevation beyond day 7 predicts adverse remodelling and heart failure. Randomised trials of IL-1β, IL-6 receptor blockade and colchicine confirm inflammation as a therapeutic target.*

Keywords: *acute myocardial infarction, percutaneous coronary intervention, reperfusion injury, cytokines, interleukin-6, C-reactive protein, systemic immune-inflammation index.*

BACKGROUND

Primary percutaneous coronary intervention (PCI) is the standard reperfusion strategy for acute myocardial infarction (AMI); however, a substantial proportion of patients develop adverse left ventricular (LV) remodelling and heart failure despite successful revascularisation. An excessive or prolonged inflammatory response, further amplified by reperfusion injury and mechanical vessel-wall trauma during PCI, is regarded as one of the principal mechanisms underlying these complications.

AIM

To characterise, on the basis of published evidence, the dynamics of the cytokine profile and systemic inflammatory markers in patients with AMI before and after PCI and to evaluate their prognostic significance.

MATERIALS AND METHODS

Publications indexed in PubMed/MEDLINE, Scopus, Web of Science and eLIBRARY.RU from 1998 to 2025 were analysed, including randomised controlled trials (CANTOS, COLCOT, LoDoCo2, CLEAR SYNERGY, ASSAIL-MI, VCU-ART3, MRC-ILA Heart), large cohort studies and current ESC (2023) and Russian Society of Cardiology (2020) guidelines.

RESULTS

The NLRP3 inflammasome → IL-1β → IL-6 → C-reactive protein (CRP) axis was identified as the key pathway translating local myocardial inflammation into a systemic response. Before PCI, IL-6, TNF-α and MCP-1 levels are already elevated and depend on ischaemic time. PCI induces an early (within the first hour to the first day) additional rise in IL-6 and peripheral blood neutrophils, whereas CRP peaks on days 2–3. High IL-6 levels are associated with larger infarct size and reduced LV ejection fraction, elevated CRP with heart failure and mortality, and low levels of anti-inflammatory IL-10 with an unfavourable prognosis. Readily available haematological indices (neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio and systemic immune-inflammation index, SII) independently predict no-reflow, in-hospital mortality and long-term cardiovascular events. The clinical relevance of inflammation is supported by the reduction in cardiovascular events with IL-1β blockade (CANTOS) and colchicine (COLCOT), and by greater myocardial salvage with IL-6 receptor blockade before primary PCI (ASSAIL-MI); at the same time, the neutral results of CLEAR SYNERGY highlight the importance of treatment timing and patient selection.

CONCLUSIONS

1. The cytokine profile of patients with AMI reflects the balance between myocardial injury and repair, and PCI acts as an additional trigger of inflammation. 2. IL-6, CRP, the IL-6/IL-10 ratio and the haematological indices NLR and SII measured serially (before PCI, at 24 hours and on days 3–7) have the greatest prognostic value. 3. Integrated serial assessment of inflammatory markers is warranted to identify patients with a "hyperinflammatory" phenotype who may benefit from targeted anti-inflammatory therapy.

TIBBIY MA'LUMOTLAR ASOSIDA KASALLIKLARNI AVTOMATIK DIAGNOSTIKA QILISH VA BASHORAT QILISH UCHUN MASHINAVIY O'QITISH ALGORITMLARINI ISHLAB CHIQISH

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Annotatsiyaz: *Ushbu maqolada tibbiy ma'lumotlar asosida qandli diabet kasalligini erta aniqlash va xavf darajasini prognozlash uchun mashinaviy o'qitish modellariga asoslangan intellektual diagnostika tizimi ishlab chiqilgan. Tadqiqot jarayonida PIMA Indians Diabetes ma'lumotlar bazasi asosida Min-Max normalizatsiyasi, xususiyatlar seleksiyasi, sun'iy neyron tarmoqlarida ReLU aktivatsiya filtrlash hamda Sigmoid ehtimollik modellari ishlab chiqildi. Taqqoslama tajribalar natijasida ko'p qatlamli sun'iy neyron tarmog'i 94% aniqlik (Accuracy) qayd etdi. Nazariy modellar asosida tibbiy amaliyot uchun «AnalizPro» intellektual veb-platformasi ishlab chiqilib, amaliyotga joriy etishga tayyorlandi.*

Abstractl: *This paper develops an intelligent diagnostic system based on machine learning models for early detection and risk prediction of diabetes mellitus using medical data. During the research, Min-Max normalization, feature selection, ReLU activation filtering in artificial neural networks, and Sigmoid probability models were developed based on the Pima Indians Diabetes database. Comparative experimental results showed that the multi-layer artificial neural network achieved an accuracy of 94%. Based on the theoretical models, the "AnalizPro" intelligent web platform was developed for medical practice and prepared for clinical deployment.*

Kalit so'zlar: *Tibbiy diagnostika, mashinaviy o'qitish, qandli diabet, neyron tarmoqlar, Min-Max normalizatsiyasi, ReLU, Sigmoid funksiyasi, AnalizPro, FastAPI, ReactJS.*

Keywords*: Medical diagnostics, machine learning, diabetes mellitus, neural networks, Min-Max normalization, ReLU, Sigmoid function, AnalizPro, FastAPI, ReactJS.*

KIRISH VA MUAMMONING DOLZARBLIGI

Bugungi kunda sog'liqni saqlash sohasida tibbiy axborotlar hajmi eksponensial ravishda ortib bormoqda. Zamonaviy tibbiy ma'lumotlarni tahlil

qilish, katta hajmdagi oqimlarni intellektual boshqarish va klinik qaror qabul qilishda sun’iy intellekt hamda mashinaviy o‘qitishning o‘rni xalqaro miqyosda A. Rajkomar, J. Dean va E. Topol kabi olimlarning tadqiqotlarida muhim ilmiy yo‘nalish sifatida asoslab berilgan [1, 2]. Bemorlarning laboratoriya tahlillari va fiziologik parametrlarini an’anaviy usulda qo‘lda tahlil qilish ko‘p vaqt talab etadi hamda inson omiliga bog‘liq subyektiv xatoliklarni keltirib chiqarishi mumkin.

Ayniqsa, qandli diabet kabi dastlabki bosqichlarda yaqqol klinik belgilarsiz rivojlanuvchi kasalliklarni o‘z vaqtida aniqlash dolzarb ilmiy-amaliy masala hisoblanadi [3].

Ushbu tadqiqotning asosiy maqsadi bemorning laboratoriya ko‘rsatkichlarini kompleks tahlil qilib, kasallik mavjudligi yoki prediabet xavfini yuqori aniqlikda bashorat qiluvchi matematik va dasturiy intellektual tizimni ishlab chiqishdan iborat.

Masalaning matematik modeli va hisoblash bosqichlari

Diagnostika jarayoni ikkilik klassifikatsiya masalasi ($Y \in \{0, 1\}$) sifatida qaralib, tizimga kiruvchi tibbiy ko‘rsatkichlar vektori shakllantirildi:

$$X = (x_1, x_2, x_3, x_4, x_5, x_6, x_7)$$

Bu yerda: $\mathbf{x_1}$ – glyukoza darajasi, $\mathbf{x_2}$ – qon bosimi, $\mathbf{x_3}$ – tana massasi indeksi (BMI), $\mathbf{x_4}$ – insulin miqdori, $\mathbf{x_5}$ – yosh, $\mathbf{x_6}$ – homiladorlik soni, $\mathbf{x_7}$ – diabet nasliy moyillik koeffitsiyenti.

Matematik modellashtirish 3 ta ketma-ket bosqichda amalga oshiriladi:

1. Ma’lumotlarni standartlashtirish (Min-Max Scaling)

Tibbiy ko‘rsatkichlar turli o‘lchov birliklariga ega bo‘lgani sababli (masalan, arterial qon bosimi 130 mmHg, glyukoza 8.5 mmol/l), neyron tarmoq ularning mutlaq son qiymatlaridan chalg‘imasligi uchun barcha parametrlar [0, 1] metrik fazosiga keltirildi:

$$\mathbf{x_{norm} = (x - x_{min}) / (x_{max} - x_{min})}$$

Bemorning normallashgan ko‘rsatkichlari asosida kirish vektori quyidagi ko‘rinishga keltirildi:

$$\mathbf{X = [0.85, 0.65, 0.70, 0.30, 0.50]^T}$$

2. Yashirin qatlamda ReLU nolinear filtrlash mexanizmi

Yashirin qatlamdagi *j*-neyron uchun kiruvchi signallarning chiziqli kombinatsiyasi quyidagi formula asosida hisoblanadi:

$$\mathbf{z_j = \sum_{i=1}^{n} (w_{ji} \cdot x_i) + b_j}$$

Hosil bo‘lgan impuls model chiziqli tenglamaga aylanib qolmasligi uchun ReLU (Rectified Linear Unit) nolinear faollashtirish funksiyasiga uzatiladi[4, 5]:

$$\mathbf{h_j = ReLU(z_j) = max(0, z_j)}$$

Tibbiy nuqtai nazardan, agar **z > 0** bo‘lsa, kasallik xavfi mavjudligini bildiruvchi signal keyingi bosqichga o‘tkaziladi; agar **z ≤ 0** bo‘lsa, xavf signali nolga tenglashtirilib filtrlanadi.

3. Chiqish qatlami va Sigmoid ehtimollik tashxisi

Barcha yashirin neyronlar signallari chiqish qatlamida vaznlar bilan jamlanadi:

$$z_{out} = \sum_{j=1}^{m} (w_{out,\,j} \cdot h_j) + b_{out}$$

Olingan z_{out} qiymati shifokor va bemor tushunadigan foiz ehtimolligi ko‘rinishiga keltirish uchun Sigmoid logistik funksiyasiga yuboriladi:

$$\hat{Y} = \sigma(z_{out}) = 1 / (1 + e^{-z_{out}})$$

Ushbu formula orqali hisoblangan qiymat (masalan, $\hat{Y} \approx 0.6364$, ya’ni **63.64%**) kasallikning aniq rivojlanish xavf ehtimolini ko‘rsatadi.

Eksperimental natijalar va taqqoslash

Tadqiqotda xalqaro PIMA Indians Diabetes ma’lumotlar to‘plamidan (768 ta yozuv) foydalanildi. O‘quv (80%) va test (20%) to‘plamlarida L. Breiman tomonidan taklif etilgan ansambl usuli — Random Forest [6], chiziqli Logistic Regression hamda ko‘p qatlamli neyron tarmoqlarining samaradorligi tekshirildi:

Algoritm	Accuracy (Aniqlik)	Precision	Recall	F1-score
Logistic Regression	82.0%	80.0%	79.0%	79.0%
Random Forest	91.0%	89.0%	90.0%	89.0%
Neural Network (ReLU)	**94.0%**	**93.0%**	**92.0%**	**92.0%**

Eksperimentlar natijasida ko‘p qatlamli neyron tarmog‘i eng yuqori natijani (**ROC-AUC = 0.94**) ko‘rsatdi. Random Forest algoritmi esa yuqori barqarorlik va umumlashtirish qobiliyatini namoyish etdi.

AnalizPro» intellektual platformasi va klinik amaliyot

Nazariy model asosida tibbiyot muassasalari va shifokorlar uchun «**AnalizPro**» intellektual tizimi ishlab chiqildi:

Frontend: ReactJS va Tailwind CSS asosidagi zamonaviy interfeys, tahlillar tarixi va administrator monitoringi.

Backend: Python (FastAPI) REST API arxitekturasi.

Tizim imkoniyatlari: Bemor parametrlarini tahlil qilib, xavf ballini hisoblash, individual klinik tavsiyalarga ega PDF hisobot shakllantirish, mutaxassis shifokorlar (endokrinolog, kardiolog va h.k.) qabuliga yozilish hamda Gemini 2.0 Flash asosidagi sun'iy intellekt tibbiy yordamchisi bilan interaktiv muloqot qilish.

XULOSA

Tadqiqot davomida tibbiy ma'lumotlarni normallashtirish, neyron tarmoqlarida ReLU filtrlash va Sigmoid ehtimollik modellari asosida qandli diabetni erta aniqlashning yaxlit ilmiy-amaliy yechimi yaratildi. Ishlab chiqilgan «AnalizPro» platformasi sog'liqni saqlash muassasalarida diagnostika jarayonini avtomatlashtirish, erta bosqichda xavfni baholash hamda shifokorlarga qaror qabul qilishda yordam beruvchi ishonchli vosita bo'lib xizmat qiladi.

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ИММУНОЛОГИЧЕСКИЕ ОСОБЕННОСТИ ПОСТКОВИДНОГО СИНДРОМА У ДЕТЕЙ В ЗАВИСИМОСТИ ОТ СЕРОЛОГИЧЕСКОГО СТАТУСА К КОРИ

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Актуальность: *Постковидный синдром у детей сопровождается изменениями клеточного и цитокинового звеньев иммунной системы, характер и выраженность которых могут различаться в зависимости от исходного иммунологического статуса. В этой связи представляет интерес изучение особенностей иммунного ответа у детей с различным серологическим статусом к кори при различных вариантах постковидного синдрома.*

Relevance*: Post-COVID syndrome in children is associated with changes in the cellular and cytokine components of the immune system, the nature and severity of which may vary depending on the baseline immunological status. In this regard, studying the characteristics of the immune response in children with different serological statuses for measles across various manifestations of post-COVID syndrome is of particular interest.*

Ключевые слова: *дети; постковидный синдром; Long COVID; хронический постковидный синдром; иммунный статус; корь; серонегативность; серопозитивность; Т-лимфоциты; CD4+; CD8+; CD16+; цитокины; ИЛ-6.*

Keywords: *children; post-COVID syndrome; Long COVID; chronic post-COVID syndrome; immune status; measles; seronegativity; seropositivity; T lymphocytes; CD4+; CD8+; CD16+; cytokines; IL-6.*

ЦЕЛЬ ИССЛЕДОВАНИЯ

Выявить особенности и степень нарушений клеточного и цитокинового звеньев иммунитета у детей 3–7 лет с постковидным синдромом в зависимости от серологического статуса к кори и клинического варианта постковидного синдрома.

МАТЕРИАЛЫ И МЕТОДЫ

Обследовано 60 детей в возрасте от 3 до 7 лет с постковидным синдромом. Проведен сравнительный анализ иммунологических

показателей у серонегативных и серопозитивных к кори детей при Long-постковидном синдроме и хроническом постковидном синдроме (ХПС). Исследовали относительное и абсолютное содержание лимфоцитов, Т- и В-лимфоцитов, CD4+, CD8+, CD16+, иммунорегуляторный индекс (ИРИ), а также уровни ИЛ-6, ИЛ-4, ФНО-α и С-реактивного белка (СРБ). Степень иммунных нарушений оценивали по формуле А.М. Земскова и соавт. (2011): [(показатель больного/показатель нормы) − 1] × 100%. Отклонение 1–33% расценивали как I степень, 34–66% — II степень, более 66% — III степень иммунных нарушений.

РЕЗУЛЬТАТЫ

У серонегативных к кори детей с ХПС выявлены более выраженные изменения клеточного иммунитета по сравнению с серопозитивными детьми. Относительное содержание Т-лимфоцитов составило 36,6±1,3% против 40,8±1,7% ($p<0,05$), абсолютное — 769,0±76,2 против 1047,1±79,5/мкл ($p<0,05$), CD4+ — 20,3±1,1% против 26,3±2,0% ($p<0,01$). ИРИ был достоверно ниже у серонегативных детей — 1,21±0,07 против 1,52±0,12 ($p<0,001$), тогда как CD8+ был выше — 19,7±0,7% против 17,2±0,4% ($p<0,001$).

Выраженные различия установлены в отношении маркеров воспалительной активности. У серонегативных детей с ХПС уровень ИЛ-6 составил 102,3±7,8 пг/мл против 55,7±5,6 пг/мл у серопозитивных ($p<0,001$), СРБ — 72,7±3,9 против 21,2±3,1 ($p<0,001$). При этом содержание ФНО-α у серонегативных детей было ниже — 2,6±0,3 против 50,1±3,1 пг/мл ($p<0,001$).

При Long-постковидном синдроме у серонегативных детей содержание CD4+ составило 29,5±0,8% против 24,5±2,0% у серопозитивных ($p<0,001$), ИРИ — 1,43±0,07 против 1,20±0,10 ($p<0,05$). Уровень ИЛ-6 у серонегативных детей был более чем в три раза выше — 78,4±6,7 против 25,0±1,5 пг/мл ($p<0,001$). В то же время ФНО-α у серопозитивных детей составлял 111,62±9,9 против 10,8±1,1 пг/мл у серонегативных ($p<0,001$).

Сравнительный анализ двух вариантов постковидного синдрома у серонегативных детей показал более выраженные нарушения при ХПС. Абсолютное содержание Т-лимфоцитов составляло 769,0±76,2 против 1153,1±103,5/мкл при Long-постковидном синдроме ($p<0,001$), CD4+ — 486,9±33 против 854,6±94,6/мкл ($p<0,05$). Концентрация ИЛ-6 при ХПС была выше — 102,3±7,8 против 78,4±6,7 пг/мл ($p<0,001$), а СРБ — 72,7±3,9 против 15,25±2,5 ($p<0,001$).

Оценка степени иммунных нарушений по формуле А.М. Земскова показала преимущественно супрессивный характер изменений. У серонегативных детей с Long-постковидным синдромом ФРИС имела вид **LYM$_1^-$CD3$_2^-$CD20$_1^-$CD8$_1^-$CD4$_{2-3}^-$CD16$_2^-$**, при ХПС — **LYM$_2^-$CD20$_1^-$CD3$_{2-3}^-$CD4$_{2-3}^-$CD8$_1^-$CD16$_{2-3}^-$**. У серопозитивных детей при Long-постковидном синдроме выявлена формула **LYM$_2^-$CD20$_1^-$CD3$_2^-$CD4$_2^-$CD16$_{2-3}^-$**, при ХПС — **LYM$_1^-$CD20$_1^-$CD3$_2^-$CD4$_{2-3}^-$CD8$_1^-$CD16$_2^-$**. Наиболее выраженные нарушения II–III степени отмечались по показателям Т-лимфоцитов, CD4+ и CD16+.

ЗАКЛЮЧЕНИЕ

У детей 3–7 лет с постковидным синдромом выявлены различия в состоянии клеточного и цитокинового звеньев иммунитета в зависимости от серологического статуса к кори и варианта постковидного синдрома. У серонегативных к кори детей при ХПС нарушения характеризовались снижением Т-лимфоцитов, CD4+ и ИРИ на фоне увеличения CD8+, ИЛ-6 и СРБ. Согласно оценке по формуле А.М. Земскова, в данной группе преобладали иммунные нарушения II–III степени с преимущественным вовлечением Т-клеточного звена и CD16+. Полученные результаты свидетельствуют о неоднородности иммунологического профиля детей с постковидным синдромом и указывают на необходимость дальнейшего изучения взаимосвязи между серологическим статусом к кори и характером постковидных иммунных нарушений.

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INHERITANCE PATTERNS OF MORPHOLOGICAL AND BIOCHEMICAL TRAITS IN GOSSYPIUM HIRSUTUM HYBRIDS

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Abstract. *The inheritance of morphological, yield-related and biochemical traits in Gossypium hirsutum L. hybrids determines the efficiency of early generation selection. This thesis reviews a comparative approach for evaluating plant height, fruiting-branch number, boll traits, fibre properties and biochemical indicators such as chlorophyll, soluble protein and oil content. The analysis emphasises segregation, heterosis, genotype–environment interaction and the difference between phenotypic and genotypic variation. A combined field and laboratory assessment is proposed for identifying parental combinations that transmit valuable traits to breeding progenies.*

Keywords: *Gossypium hirsutum, cotton hybrids, inheritance, heterosis, biochemical traits, fibre quality, plant breeding.*

INTRODUCTION

Upland cotton (Gossypium hirsutum L.) combines high adaptability with substantial variation in maturity, yield and fibre quality. The value of a hybrid population is determined not only by the mean performance of its F1 plants but also by the way favourable alleles segregate in later generations. Morphological traits such as plant height, number of fruiting branches, boll number and boll weight are directly connected with productivity, whereas fibre length, strength and micronaire determine the technological value of the harvest. Biochemical traits can provide additional information about plant physiology and the mechanisms supporting productivity.

The same phenotype may arise from different genetic combinations under different environments. Therefore, a reliable assessment of inheritance requires replicated field observations, standardised sampling and the separation of genetic variance from environmental variance. The purpose of this thesis is to formulate an integrated approach for detecting inheritance patterns and selecting valuable G. hirsutum genotypes.

MATERIALS AND METHODS

The proposed study uses a set of contrasting cotton parents and their F1, F2 and, where possible, F2:3 progenies. Parents should differ in at least two target groups of traits, for example yield components and fibre quality, or early maturity and biochemical stability. Each generation is evaluated in replicated plots. Plant height, fruiting-branch number, boll number per plant, boll weight and seed-cotton yield are recorded according to a common sampling schedule. Fibre length, strength and micronaire are measured after harvest.

Biochemical sampling is conducted at a defined developmental stage. Chlorophyll, soluble protein, total soluble sugars and seed oil content are determined using validated laboratory procedures. The same leaf position and sampling time are used for all genotypes. Analysis of variance, coefficients of variation, correlation and regression are used to separate the effects of genotype, environment and their interaction. Broad-sense heritability is estimated from variance components, while realised selection response is used as an additional practical criterion.

RESULTS AND DISCUSSION

Inheritance of quantitative traits

Quantitative traits are expected to show continuous segregation because they are controlled by multiple loci. A wide F2 distribution and transgressive individuals may indicate the complementary action of parental alleles. For breeding purposes, the most useful progenies are not necessarily those with the highest F1 mean; they are the families that retain favourable combinations after segregation. The comparison of F1 and parental means can indicate heterosis, while F2 reduction provides information about the stability of the hybrid advantage.

Liang et al. [1] analysed heterosis in upland cotton F2:3 and F2:4 populations derived from the hybrid Xinza No. 1. Their phenotypic analysis indicated overdominance for yield and yield components in F1 plants. This result illustrates why a high-performing hybrid should be assessed together with its segregating progeny. A breeding programme that records only F1 performance may overestimate the transmissibility of the observed advantage.

Morphological and biochemical associations

Morphological measurements become more informative when combined with physiological indicators. Higher chlorophyll or soluble-protein content may accompany stronger vegetative growth, but a positive association with yield should be tested rather than assumed. Excessive vegetative growth can delay maturity and reduce the efficiency of fruit retention. Therefore, selection should

use a trait index in which yield components, maturity and fibre quality are considered together.

Biochemical traits can also help identify stress-tolerant plants, provided that sampling is replicated across environments. Because soluble metabolites respond rapidly to temperature, water availability and plant age, their heritability may be lower than that of stable morphological traits. The practical criterion is repeatability: a biochemical difference is useful for selection only when it is observed consistently in independent trials.

Implications for breeding

The most promising genotypes should be selected through several stages. In F1, attention is given to heterosis and agronomic balance. In F2, plants with extreme but acceptable combinations of traits are retained. In F2:3 and later families, family means and within-family variation are compared. Molecular marker data can subsequently be used to confirm whether selected phenotypes carry favourable alleles at previously identified loci.

This sequence reduces the risk of selecting plants that perform well only because of a favourable environment. It also distinguishes transgressive segregation from measurement error. The final selection decision should include fibre testing and biochemical stability, because high seed-cotton yield alone does not guarantee a valuable breeding genotype.

CONCLUSION

Inheritance analysis in G. hirsutum hybrids should combine morphological, yield-related, fibre and biochemical traits across successive generations. F1 heterosis is valuable for identifying parental combinations, but the breeding value of a cross must be judged from the segregation and family performance of F2 and later generations. Replicated sampling, variance analysis and genotype–environment evaluation are necessary for estimating heritability and selection response. The integration of these data with molecular marker information can accelerate the identification of genotypes that combine productivity, fibre quality, maturity and physiological stability.

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ПРОЯВЛЕНИЯ ПАРВОВИРУСНОЙ ИНФЕКЦИИ В19 У ДЕТЕЙ

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Аннатация: *Установлены группы пациентов для обследования на маркеры парвовирусной В19 инфекции. Подробно охарактеризовано течение парвовирусной В19 инфекции у детей различных возрастных групп. Определены особенности клинико-лабораторных проявлений парвовирусной В19 инфекции у пациентов с тяжелой сопутствующей патологией.*

Ключевые слова: *дети, парвовирусная инфекция В19, клиника парвовирусной инфекции В19*

SUMMARY

Patient groups have been identified for examination for markers of parvovirus B19 infection. The course of parvovirus B19 infection in previously healthy adults and children is described in detail. The features of the clinical and laboratory manifestations of parvovirus B19 infection in patients with severe concomitant pathology were determined.

Инфекционная патология, сопровождающаяся острой экзантемой, представляет существенные трудности при дифференциальной диагностике с другими заболеваниями, в том числе аллергическими [Альбицкий В.Ю., 2009]. Благодаря эффективной вакцинопрофилактике в последние годы в стране заболеваемость корью и краснухой резко снизилась [Самойлович Е.О., 2014; Титов Л.П., Карпов И.А., 2007]. Однако место указанных агентов заняли другие патогены, и врачами-специалистами ежегодно выявляются сотни пациентов с острой экзантемой, установить этиологический диагноз которой без специального лабораторного обследования не представляется возможным [Цыркунов В.М., 2007].

Одним из наиболее распространенных современных заболеваний, протекающих с сыпью, является парвовирусная В19 инфекция. В то же время в нашей стране имеются лишь единичные работы, посвященные указанной проблеме [Ермолович М.А. и др., 2006]. До настоящего времени остаются неясными существенные региональные эпидемиологические характеристики заболевания, недостаточно детализирована ее клиническая симптоматика, особенно в зависимости от возраста пациентов. Особую проблему представляет диагностика парвовирусной В19 инфекции на фоне тяжелой соматической патологии, способной существенно изменить клиническую картину многих инфекционных процессов [AslanidisS. etal., 2008].

Материал и методы исследования. Объектом исследования были 65 пациентов. Это были дети и взрослые с ревматологическими заболеваниями – 12 пациентов, 18 пациентов с клиникой острой экзантемы, с тяжелой сопутствующей патологией: гематологическими и онкологическими процессами (дети, n=23), хроническими заболеваниями (хронические гепатиты- ХГВ-7 и ХГС- 4 больных, циррозы-1 пациент) печени, которые входили в группу риска развития парвовирусной В19 инфекции. Проведен анализ медицинских карт 65 больных. Возраст больных варьировал от 1 года до 18 лет.

Серологические методы диагностики В19 парвовирусной инфекции [Sien- nickaJ. etal. 2010]. Специфические IgMантитела к парвовирусу В19 в сыворотке крови определяли методом ИФА с использованием коммерческих тест-систем BCM-DiagnosticsB12 (Германия).

Прочие использовавшиеся лабораторные методы. Пациентов с хроническими заболеваниями печени для уточнения этиологии процесса обследовали на маркеры гепатотропных вирусов (HBsAg, анти-HBcIgM и IgG, анти- HCVcoreIgM, ИФА), детей с гематологическими и онкологическими заболеваниями - на наличие других инфекций, которые могли бы быть альтернативной причиной наблюдающейся симптоматики: ЦМВ-инфекции (анти-CMVIgM, ИФА; ДНК ЦМВ, ПЦР), ВЭБ-инфекции (VCAIgM, ИФА; ДНК EBV, ПЦР), ВПГ-инфекции (анти-HSVIgM, ИФА; ДНК, HSV ПЦР) с использованием коммерческих тест-систем. Состояние ростков костного мозга оценивали на основании анализа результатов миелограмм, назначавшихся пациентам при наличии клинических показаний.

Инструментальные методы исследования. Проводился детальный сбор анамнеза, клинический осмотр пациентов, термометрия,

лабораторное обследование с взятием общего анализа крови, мочи, биохимического анализа крови. При необходимости применялись инструментальные методы: ЭКГ, рентгенологическое исследование легких, пораженных суставов, УЗИ органов брюшной полости.

РЕЗУЛЬТАТЫ СОБСТВЕННЫХ ИССЛЕДОВАНИЙ:

Объектом исследования были 65 пациентов. Это были дети с ревматологическими заболеваниями – 12 пациентов, 18 пациентов с клиникой острой экзантемы, с тяжелой сопутствующей патологией: гематологическими и онкологическими процессами (дети, n=23), хроническими заболеваниями (хронические гепатиты- ХГВ-7 и ХГС- 4 больных, циррозы-1 пациент) печени, которые входили в группу риска развития парвовирусной В19 инфекции. У всех больных отмечали выраженные в той или иной мере высыпания в виде геморрагий, пятнистой и пятнисто-папулезной сыпью. Все больные были обследованы в различные периоды (весенний, летний и осенний) года.

Диагноз предполагалось устанавливать на основании обнаружения специфических лабораторных маркеров: антител класса IgM к парвовирусу В19 методом ИФА;

Обследовались две группы пациентов:

1) без сопутствующей патологии с клиникой экзантемы предположительно инфекционной или неинфекционной, реактивными артритами;

2) с тяжелой сопутствующей патологией: гематологическими, онкологическими процессами, хронической костно-суставной и ревматической патологией.

Материалом для лабораторного исследования служила сыворотка крови (все группы пациентов), цельная кровь (лица с экзантемой). Клинико-лабораторные и эпидемиологические данные, заболевших в различные периоды года, анализировались ретроспективно и на основании личного наблюдения.

Эпидемиологический метод. Анализировалась частота встречаемости, доля парвовирусной В19 инфекции среди экзантемных заболеваний в регионе, возрастная структура заболевших, распределение случаев заболевания по месяцам года.

Клинический метод. Проводился детальный сбор анамнеза, клинический осмотр пациентов, термометрия, лабораторное обследование с взятием общего анализа крови, мочи, биохимического анализа крови. При необходимости применялись инструментальные методы: ЭКГ,

рентгенологическое исследование легких, пораженных суставов, УЗИ органов брюшной полости.

В статье даны результаты изучения клинических проявлений у пациентов без тяжелой сопутствующей патологии представлены в таблице 1. Указанные лица были выявлены в ходе описанного выше скрининга, а также целенаправленного поиска.

Как видно из таблицы 1, наиболее типичными клиническими проявления патологии у пациентов всех возрастных групп оказались острое начало, лихорадка, интоксикационный синдром, катаральный фарингит и экзантема (p=0,001-0,003 в сравнении с другими симптомами).

Таблица 1.

Клиническая симптоматика у детей без предшествующей тяжелой соматической патологии

Клинические симптомы	Частота выявления			P (А-Б)
	Всего (n=65)	Дети 1-5 лет А) (n=35)	Дети 5-18 лет	
1. Острое начало	63 (96,9%)	35 (100%)	28 (93,3%)	0,
2. Лихорадка	30 (46,1%)	10 (28,5%)	20 (66,6%)	0,
3. Синдром интоксикации	46 (37,7%)	22 (28,9%)	24 (52,2%)	0,
4.Гастроинтестинальный	14 (21,5%)	12 (34,2%)	1 (3,3%)	0,
5. Катаральный фарингит	51 (78,4%)	30 (85,7%)	21 (70,0%)	0,
6. Лимфаденопатия	39 (60%)	19 (54,2%)	10 (33,3%)	0,
7. Экзантема	64 (98,4%)	35 (100%)	29 (96,6%)	0,
8. Артропатии	16(24,6) (18,9%)	2 (5,7%)	14 (46,6%)	**0, 001**
Достоверность*	P1_2=0,003; P1_3=0,001; P4=0,001; P1_5=0,001; P1_6=0,001;P1-8=0,001; P2-4=0,001; P2-6=0,002; P2_y=0,003; P2-8=0,001; Pэ_4=0,001; Pэ-7=0,001; Pэ-8=0,004; Pф_5=0,001; Pф_7=0,001; P5_6=0,01; P5_7=0,001; P5_8=0,001; P*_7=0,001; Py_8=0,001			

Примечание - * достоверность различий указана для общего количества пациентов.

Данная комбинация

Симптомов была нами определена среди обследуемых нами больных. Частота такой комбинации в обследованной группе составила 73,8% (у детей - 72,4%, у взрослых - 76,1%). Экзантема носила преимущественно мелкопятнистый (81,7%), реже пятнисто-папулезный (18,3%, p=0,001) либо геморрагический (13,3%, p=0,001) характер.

У 91,7% пациентов высыпания были расценены как яркие (p=0,001), у 30% они сопровождалась зудом, у 15,8% - ощущением «жара». Первичным местом высыпаний у 61,8% детей являлись щеки (у детей от 5-18 лет - 27,3%, p=0,04), у 61,4% от 5 -18 лет - туловище (у детей - 10,5%, p=0,001). «Симптом пощечин» зафиксирован у 56,7% пациентов (у 72,4% детей и 29,5% более старших детей, p=0,01). Длительность экзантемы у 59,2% заболевших составила 7-14 дней (p=0,04-0,001), у 35,8% она была менее, у 5% - более указанных сроков (до 21 дня). Клиническими особенностями патологического процесса у детей с 5-18 лет в сравнении с детьми раннего возраста оказались более высокая частота: лихорадки фебрильного уровня (66,6% и 28,5%, p=0,01), выраженного интоксикационного синдрома (52,2% и 28,9%, p=0,05), артропатий (46,6% и 5,7%, p=0,001); редкость гастроинтестинальных нарушений (2,2% и 18,4%, p=0,001).

Суставной синдром у взрослых протекал в виде артритов (100%), встречался преимущественно у девочек (85,7%, p=0,007). Поражение суставов, как правило, было симметричным (78,3%, p=0,04), в патологический процесс чаще вовлекались мелкие суставы кистей (60,9%, p=0,01-0,001 в сравнении с лучезапястными - 4,3%, локтевыми - 8,7%, плечевыми - 13% и тазобедренными - 17,4%). У 69,6% пациентов наблюдался отек пораженного сустава, у 73,9% имелся болевой синдром, требующий приема нестероидных противовоспалительных средств (НПВС). У детей раннего возраста выраженность суставного синдрома была явно меньшей - во всех случаях наблюдались только артралгии. В целом суставная симптоматика обычно появлялась с первых дней заболевания (72,2%, p=0,01), длительность ее у старших детей в среднем составила 11±10,1 дней (1-30 дней), у детей - не превышала 3 дней.

Особенности клинических проявлений у пациентов с сопутствующей соматической патологией. Клиническая характеристика в исследованной группе основана на результатах наблюдения за 35 наиболее полно обследованными пациентами детского возраста (15 мальчиков, 20 девочек). В сравнении с ранее здоровыми лицами у них наблюдалась большая частота лихорадочной реакции фебрильного уровня (78,9% и 44,1% соответственно, p=0,01), тяжелого интоксикационного синдрома (10% и 0% соответственно, p=0,02), гепатоспленомегалии (21,9% и 0% соответственно, p=0,001).

Острое начало, лихорадка, интоксикационный синдром, катаральный фарингит и экзантема отмечены только у 7,8% детей раннего

возраста в группе (p=0,001, в сравнении с ранее здоровыми). Экзантема присутствовала всего у 57,8% пациентов, носила преимущественно геморрагический характер (86,5%, p=0,001 в сравнении с пятнистой и пятнисто-папулезной). Обычный для ранее здоровых детей «симптом пощечин» выявлялся крайне редко (p=0,001). Главной особенностью группы оказалась высокая частота развития различных цитопений в периферической крови (у 93,8% пациентов, p=0,001 в сравнении с ранее здоровыми детьми). При этом особенно характерной была анемия (79,7%, p=0,001 в сравнении с ранее здоровыми детьми). Тромбоцитопения (53,1%) и лейкопения (42,2%) встречались существенно реже (p=0,001). У 56,3% пациентов фиксировались комбинации цитопенических синдромов, чаще с обязательным наличием анемии и тромбоцитопении - 42,2% (p=0,004-0,001) в сравнении с тромбоцитопе- нией/лейкопенией или анемией/лейкопенией соответственно).

В ходе обследования пациентов с подозрением на наличие гематологической или онкологической патологии вследствие различных цитопенических синдромов в периферической крови нами была выявлена группа детей, у которых указанные диагнозы не подтвердились.

У 40,0% отмечалось острое начало, лихорадка, интоксикационный синдром, катаральный фарингит и экзантема (тщательный сбор анамнеза, клинические данные). Все указанные пациенты в дальнейшем полностью выздоровели, никаких других причин для наблюдавшихся в периферической крови цитопений обнаружено не было. Сделан вывод о возможности гематологической формы парвовирусной В19 инфекции у клинически ранее здоровых детей, в том числе в отсутствие других типичных признаков указанного заболевания. Исход данной формы благоприятный.

Гематологические сдвиги, как анемия и тромбоцитопения среди обследованных пациентов в период обследования были связаны с угнетением эритроцитарного и мегакариоцитарного ростков кроветворения. Для лейкопении подобных доказательств не получено. Угнетение красного кровяного ростка подтвердилось и при исследовании числа ретикулоцитов в периферической крови. Число их менее 0,5% было выявлено у 51,5% пациентов в острый период заболевания и только у 3,0% после ее завершения (p=0,001). Среднее значение ретикулярного индекса (индекс продукции ретикулоцитов) также составило соответственно 0,3±0,7 и 1,4±2,4 (Z=3,6; p=0,001).

Причиной для обследования пациентов с хронической костно-

суставной и ревматической патологией являлось обострение суставного синдрома. У детей от 5 до 18 лет с различными хроническими костно-суставными и ревматическими заболеваниями отмечалась существенно большая продолжительность воспалительного процесса в сравнении с ранее здоровыми пациентами (у 85,7% пациентов> 1 месяца, p=0,001), множественность локусов поражения (более 4 у 71,4%, p=0,001), наличие осложнений в виде синовитов и эрозивного повреждения суставной поверхности (у 57,1%, p=0,02). У большинства описанных пациентов эпизод суставного синдрома закончился полным обратным развитием. Однако у 2 ранее здоровых девочек процесс принял волнообразное течение и через 6-12 месяцев было зафиксировано развитие тяжелой ревматической патологии: ревматоидного артрита, недифференцированного полиартрита, недифференцированного эрозивного полиартрита.

ЗАКЛЮЧЕНИЕ

1. Определены факторы риска по ряду патологических состояний, которые могут быть «масками» и причиной их является парвовирусная инфекция B19. Контингент – дети (новорожденные, дети от 2 месяцев до 18 лет).

2. Парвовирус инфекция B19 может протекать:

- как инфекционный миокардит,

-хроническая анемия, транзиторный апластический криз

(наследственным микросфероцитозом, серповидно-клеточной и железодефицитной анемией, талассемией), парциальная гипоплазия эритроидного ростка, но и развитием тромбоцитопении, нейтропении и даже панцитопении,

-острая симметричная полиартропатия (на фоне инфекционной эритемы вовлекаются пястно-фаланговые, лучезапястные, локтевые, коленные, голеностопные суставы),

- экзантема, инфекционная эритема — наиболее распространенная клиническая форма парвовирусной инфекции B19 у детей раннего возраста. Начинается с неспецифических симптомов — лихорадка, недомогание, озноб, миалгии, которые продолжаются в течение 2–5 суток. Затем присоединяется патогномоничный симптом «отшлепанных» щек — яркая эритема кожи в области щек, а также пятнисто-папулезная сыпь на туловище и конечностях, быстро трансформирующаяся в «кружевную» сыпь, зуд не беспокоит. Экзантема при парвовирусной инфекции может сохраняться до 2–3 недель, разрешается самостоятельно,

-поражением нервной системы (гидроцефалия, микроцефалия, энцефалит, менингоэнцефалит, судорожный синдром, периферические невропатии, синдрома запястного канала),

-почек,

- поражение печени (острый гепатит, фульминантную печеночную недостаточностью, хронический гепатит, гепатит-ассоциированную апластическую анемию, гепатит с гемофагоцитарнымлимфогистиоцитозом, холестаз, апоптоз и некроз гепатоцитов),

- спонтанные аборты беременных, неиммунная водянка плода, внутриутробная гибель плода, В первые месяцы жизни ребенка врожденная парвовирусная инфекция манифестирует развитием анемии Даймонда–Блекфена, гидроцефалии, полимикрогирии, кардита, гепатита.

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AGE-RELATED PATTERNS OF HEMODYNAMIC ADAPTATION IN CHILDREN WITH SEVERE COMBINED TRAUMATIC BRAIN INJURY

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Relevance. Severe combined traumatic brain injury (SCTBI) in children is accompanied by complex disturbances of cerebral perfusion, systemic hemodynamics, autonomic regulation, and cardiovascular adaptation. Pediatric traumatic brain injury differs from adult injury because physiological responses vary considerably with age, making age-specific assessment and management particularly important [1, 2]. Hemodynamic management in traumatic brain injury should be aimed at maintaining adequate cerebral perfusion, preventing secondary ischemic injury, and preserving systemic circulatory stability [3]. Brain–heart interactions may additionally influence arterial pressure, heart rate, autonomic balance, and myocardial function after traumatic brain injury [4]. Age-related differences in cerebral autoregulation and cardiovascular compensation are especially relevant in pediatric intensive care [5]. In addition, critically ill patients frequently develop disturbances of circadian organization, which may further affect cardiovascular and autonomic regulation [6]. Multimodal and prolonged physiological monitoring may therefore provide clinically useful information beyond isolated hemodynamic measurements [7]. Recent reviews also emphasize that age-related physiological differences significantly influence the clinical course, monitoring, and management of traumatic brain injury in children [8].

Accordingly, identification of age-related patterns of hemodynamic adaptation in children with SCTBI may improve understanding of compensatory mechanisms and support individualized intensive care. The present study compares central and peripheral hemodynamic responses in children aged 3 months to 3 years, 3–7 years, and 7–18 years, with particular attention to hypodynamic and hyperdynamic patterns of circulatory adaptation and their relationship with injury severity.

Abstract. This study investigated age-related patterns of hemodynamic adaptation in 108 children aged 3 months to 18 years with severe combined traumatic brain injury. Patients were divided into three age groups: 3 months–3 years (n=25), 3–7 years (n=38), and 7–18 years (n=45). Hemodynamic variables were assessed using prolonged hourly monitoring, including arterial pressure,

cardiac output, stroke volume, total peripheral vascular resistance (TPVR), heart rate, autonomic tone, and myocardial oxygen demand. Circadian rhythm characteristics were also evaluated. In children aged 3 months to 3 years, the hemodynamic response was predominantly hypodynamic, characterized by a more than 50% increase in TPVR and a tendency toward reduced cardiac output. In children aged 3–7 years, increased cardiac output and stroke volume with an inverse relationship between TPVR and central hemodynamic parameters indicated a predominantly hyperdynamic adaptive response. Children aged 7–18 years also demonstrated a mainly hyperdynamic pattern, particularly under conditions of sustained sympathetic activation. With increasing injury severity, circadian disturbances became more pronounced and compensatory capacity progressively decreased.

These findings demonstrate that hemodynamic adaptation in pediatric SCTBI is age dependent. Assessment of age, injury severity, circulatory response type, and circadian phase disturbances may therefore contribute to more individualized intensive care. Хорижий Age_Related_Hemodynamic…

Keywords: severe combined traumatic brain injury, children, age-related hemodynamic adaptation, hypodynamic circulation, hyperdynamic circulation, cardiac output, total peripheral vascular resistance, circadian rhythm, autonomic regulation, intensive care.

Objective. To investigate compensatory and adaptive responses of central and peripheral hemodynamics during the acute period of severe combined traumatic brain injury (SCTBI) in children of different age groups, to identify age-related patterns of hemodynamic response, and to assess their relationship with injury severity.

Materials and Methods. The study included 108 children aged 3 months to 18 years who were treated in the intensive care unit for severe combined traumatic brain injury between 2012 and 2024. Of these, 66 were boys and 42 were girls. The mean age of the study population was 7,3±4,7 years. According to age, the patients were divided into three groups: 25 children aged 3 months to 3 years, 38 children aged 3–7 years, and 45 children aged 7–18 years. Within each age group, patients were stratified into three subgroups according to injury severity, Glasgow Coma Scale (GCS) score, Injury Severity Score (ISS), and duration of intensive care. Increasing injury severity was associated with higher ISS values, lower GCS scores, and a longer stay in the intensive care unit. In children younger than 3 years, the first subgroup had an ISS of 20,1±0,71 points and a GCS score of 12,3±0,42 points, whereas in the third and most severe subgroup these values were 29,5±0,98 and 8,5±0,28 points, respectively. In the

3–7-year age group, the most severely injured patients had an ISS of 30,2±1,1 points and a GCS score of 8,1±0,27 points. In children aged 7–18 years, the corresponding values were 30,2±0,97 and 8,5±0,28 points. Hemodynamic and respiratory variables were assessed using prolonged hourly monitoring. The monitored parameters included systolic, diastolic, pulse, and mean arterial pressure, stroke volume, cardiac output, total peripheral vascular resistance (TPVR), overall autonomic tone, myocardial oxygen demand, heart rate, oxygen saturation, respiratory rate, and body temperature. Circadian rhythm analysis included evaluation of the mesor, amplitude, daily range of fluctuations, acrophase, and bathyphase for each physiological variable.

Results. The pattern of hemodynamic response was found to depend markedly on the child's age. In children aged 3 months to 3 years, the post-traumatic stress response was predominantly characterized by an increase in peripheral vascular resistance. During the first 24 hours, sympathetic activity increased by approximately 60%, while myocardial oxygen demand increased by 28%. These changes were accompanied by a tendency toward an increase in the circadian mesor of arterial pressure, cardiac output, TPVR, and heart rate. By day 7, hypersympathicotonia persisted, with autonomic tone remaining approximately 60% above the reference level and myocardial oxygen demand approximately 30% higher.

In the most severely affected younger children, the increase in peripheral vascular resistance was prolonged. TPVR remained elevated from the first day of treatment, while an adequate increase in cardiac output was not observed during the later stages of treatment. By day 21, the most pronounced reduction in mean daily cardiac output was recorded in the third subgroup. This combination of a more than 50% increase in TPVR and a decline in cardiac output was consistent with a tendency toward a hypodynamic pattern of circulatory adaptation. These findings indicate progressive limitation of cardiac compensatory capacity under conditions of persistent peripheral vasoconstriction.

A different hemodynamic response was observed in children aged 3–7 years. In this age group, increased autonomic and cardiac activity was accompanied by an increase in cardiac output and stroke volume, while inverse relationships were observed between TPVR and central hemodynamic parameters. This pattern was interpreted as a hyperdynamic adaptive response. Thus, whereas younger children tended to maintain perfusion primarily through increased peripheral vascular tone, preschool-aged children demonstrated a

greater contribution of increased cardiac output and myocardial functional activity to circulatory compensation.

In children aged 7–18 years, the stress response also predominantly followed a hyperdynamic pattern, although its intensity depended on the severity of injury. In the most severely injured patients, sustained sympathetic activation was accompanied by increased myocardial oxygen demand, thereby imposing an additional load on the cardiovascular system. Maintenance of compensatory hemodynamic mechanisms in this age group required intensified stress-protective therapy. In the most severely affected children older than 7 years, continuous infusion of fentanyl at 52,6±20,9 μg/kg/day, propofol at 26,7±8,4 mg/kg/day, and pipecuronium at 0,24±0,13 mg/kg/day was used as part of the stress-protective protocol and was associated with preservation of compensatory responses despite greater injury severity. Age-related differences were reflected not only in the absolute values of hemodynamic variables but also in their circadian organization. As injury severity increased, disturbances in mesor, amplitude, acrophase, and bathyphase became more pronounced, and circadian rhythm inversion occurred more frequently. Importantly, pathological phase shifts were detected even in some patients whose mean daily arterial pressure remained within an apparently stable physiological range. This indicates that prolonged hourly monitoring combined with circadian phase analysis can reveal latent hemodynamic abnormalities that may not be identified by isolated measurements or mean daily values alone.

Overall, the findings indicate that hemodynamic adaptation to severe combined traumatic brain injury does not follow a uniform mechanism across pediatric age groups. In infants and young children, adaptation was predominantly characterized by peripheral vasoconstriction and a hypodynamic circulatory pattern, whereas preschool- and school-aged children demonstrated a predominantly hyperdynamic response associated with increased cardiac output and greater metabolic activity. With increasing injury severity, compensatory capacity became progressively impaired, circadian rhythm disturbances became more pronounced, and the risk of cardiac decompensation increased.

Conclusion. During the acute period of severe combined traumatic brain injury, the pattern of hemodynamic adaptation in children is age dependent. In children aged 3 months to 3 years, a hypodynamic response predominates and is characterized by an increase in total peripheral vascular resistance of more than 50% together with a tendency toward reduced cardiac output. In children aged 3–7 years and in older children, a predominantly hyperdynamic response is

observed, characterized by increased cardiac output and enhanced cardiac functional activity. Increasing injury severity is associated with progressive impairment of compensatory mechanisms and more pronounced disruption of circadian phase organization. Therefore, intensive care in pediatric SCTBI should be individualized not only according to absolute arterial pressure values, but also according to age, injury severity, the type of hemodynamic response, and circadian phase disturbances.

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5-SECTION

CLASSIFICATION OF INTERNAL AND EXTERNAL FACTORS AFFECTING INVESTMENT ATTRACTIVENESS

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Abstract: *The article examines the grounds for dividing the determinants of investment attractiveness into internal and external groups. Based on a review of international literature, a three-criterion classification is proposed according to the source of a factor, the level of its impact and the degree to which it can be controlled. Internal factors include economic, institutional, infrastructural, human-capital and firm-level indicators, while external factors cover global financial conditions, the geopolitical environment, integration processes and international ratings. Using Uzbekistan as an example, the interaction of both groups is shown and recommendations for monitoring the investment climate are given.*

Keywords: *investment attractiveness, internal factors, external factors, investment climate, foreign direct investment, classification.*

INTRODUCTION

Investment attractiveness is a summary characteristic of a country, region, industry or enterprise as seen by an investor, and it is determined by the ratio of expected return to the risks involved. Before committing capital, an investor looks not only at potential profit but also at whether property is protected and how stable the political and currency environment is. For this reason, classifying the factors of attractiveness correctly is the first step in designing an investment policy.

The literature groups these factors in different ways. Dunning distinguishes ownership, location and internalization advantages [1; 1–31], while Blonigen summarizes the empirical research on the determinants of foreign direct investment (FDI) [2; 383–403]. However, the distinction between internal (endogenous) and external (exogenous) factors, and the way the two groups interact, have received less attention. External factors lie beyond the control of national authorities, so they need to be assessed separately from internal ones. The aim of this study is to substantiate a classification of the factors of investment attractiveness and to show how it can be applied in the case of Uzbekistan.

MAIN PART

Research methodology. The study relies on a systematic approach, comparative analysis and the grouping method. Factors were classified by three criteria: the source of influence (internal or external), the level of impact (macro, meso or micro) and the possibility of control (controllable, partly controllable or uncontrollable).

Results and discussion. Internal factors arise within the investment object itself and depend chiefly on its policies and resources. They can be divided into five groups: 1) economic factors — the size and growth rate of the domestic market, inflation, exchange-rate stability, labor costs and natural resources [3; 63–77]; 2) institutional and legal factors — protection of property rights, judicial independence, the level of corruption and the transparency of the tax system, with the quality of governance measured by the World Bank indicators [4], [5]; 3) infrastructure factors — transport, energy, digital and financial infrastructure, and free economic zones; 4) human capital — the skills of the labor force, the quality of education and the demographic structure; 5) firm-level factors — financial stability, profitability, the quality of corporate governance and the technological level.

External factors are outside the control of the investment object and are set by the global or regional environment. They can also be reduced to five groups: 1) global financial conditions — interest rates of leading central banks, international liquidity and commodity prices (Calvo et al. showed the role of such external factors in capital inflows to developing countries [6; 108–151]); 2) the geopolitical situation — regional stability, sanctions and trade restrictions; 3) integration processes — free trade agreements, membership in the World Trade Organization, bilateral investment and tax treaties; 4) international ratings and the country's image; 5) factors in the investor's home country — its economic condition and its outward investment policy.

The classification also works across levels. At the macro level, an investor evaluates a whole country; at the meso level, a region or an industry; at the micro level, a particular enterprise. The same factor may matter differently at each level: a credit rating, for example, is a country-wide signal, while a firm's corporate governance affects only its own project.

The two groups of factors are closely connected: internal institutions determine how strongly external shocks are transmitted to the national economy. The controllability criterion is also of practical importance. The state can influence internal factors directly, whereas to external ones it can only adapt,

reducing risk by diversifying sources of investment and concluding international agreements.

Uzbekistan illustrates this link well. According to the Ministry of Investments, Industry and Trade, the total volume of investments utilized in 2025 reached USD 43.1 billion, 24% more than a year earlier; of this, USD 38.2 billion was FDI and USD 4.9 billion came from international financial institutions [7]. The growth can plausibly be explained by a combination of internal factors — the strengthening of investors' rights by the Law on Investments and Investment Activities [8] and the reforms set out in the Development Strategy [9] — and external ones, including expanding cooperation with China, Russia, Turkey, Saudi Arabia and the UAE.

CONCLUSION

Dividing the factors of investment attractiveness into internal and external ones, and classifying them further by level of impact and controllability, makes it possible to assess the investment climate more precisely. Practical recommendations are as follows: first, to calculate indicators of internal and external factors separately in monitoring; second, to strengthen attention to institutional quality, infrastructure and human capital among the internal factors; third, to reduce external risks by diversifying investor countries and sources of financing; fourth, to assess factors separately at the regional and sectoral levels.

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GLOBAL ECONOMIC INTEGRATION AND STRATEGIES FOR DIVERSIFYING UZBEKISTAN'S FOREIGN TRADE

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Abstract. *This paper examines strategies for diversifying Uzbekistan's foreign trade under conditions of global economic integration. It analyzes recent trade trends, the concentration of major trading partners, export structure, new market opportunities, and the role of transport and logistics infrastructure. The study argues that sustainable diversification requires expanding export destinations, increasing the share of high-value-added products and services, strengthening participation in global value chains, and developing digital trade. An integrated diversification framework based on product, geographical, logistics, technological, and institutional development is proposed. The findings highlight the importance of a more diversified and value-added trade structure for strengthening Uzbekistan's external resilience and supporting long-term economic growth.*

Keywords: *global economic integration, foreign trade, export diversification, geographical diversification, value-added products, logistics, global value chains, Uzbekistan.*

INTRODUCTION

Globalization and deepening economic integration have significantly transformed the structure of international trade and increased the interdependence of national economies. The expansion of international production networks, the development of regional economic integration, the growing role of multinational corporations, digitalization, and the emergence of new transport corridors have created both opportunities and challenges for developing economies.

Under these conditions, foreign trade diversification has become an important component of national economic policy. Diversification should not be understood solely as an increase in export volumes. Rather, it involves the simultaneous expansion of the range of exported products and services, geographical destinations, participating enterprises, and international value chains.

For developing countries, excessive dependence on a limited number of commodities or trading partners may increase vulnerability to external economic shocks. Changes in international commodity prices, geopolitical tensions, disruptions in transportation routes, changes in demand, and global economic downturns can significantly affect countries whose foreign trade is highly concentrated.

This issue is particularly relevant for Uzbekistan. The country is strategically located in the center of Central Asia and shares borders with all other Central Asian states. At the same time, Uzbekistan is geographically distant from major maritime ports, which increases the importance of transport corridors, logistics infrastructure, and regional economic cooperation in determining its international trade competitiveness.

According to official statistics, Uzbekistan's foreign trade turnover reached approximately USD 81.2 billion in 2025. Exports amounted to USD 33.8 billion, while imports reached USD 47.4 billion. Compared with 2024, total foreign trade turnover increased by approximately 20.7%. Uzbekistan conducted trade relations with 210 countries during the year.

The geographical structure of foreign trade also demonstrates a relatively high concentration among major trading partners. China accounted for 21.2% of Uzbekistan's foreign trade turnover, Russia for 16.0%, Kazakhstan for 6.1%, Türkiye for 3.7%, and the Republic of Korea for 2.1%. Therefore, the five largest trading partners accounted for almost half of the country's total foreign trade turnover.

These developments demonstrate that Uzbekistan's integration into the global economy is accelerating. However, they also indicate the need to further diversify both the geographical and product structure of foreign trade.

The objective of this study is therefore to identify the major challenges and strategic directions for diversifying Uzbekistan's foreign trade under conditions of global economic integration.

Theoretical foundations of foreign trade diversification

Foreign trade diversification can be defined as the process of reducing excessive dependence on a limited number of products, markets, or trading partners through the expansion of export destinations, products, services, and international economic relationships.

From a theoretical perspective, two major dimensions of diversification can be distinguished:

1. Product diversification;
2. Geographical diversification.

Product diversification refers to increasing the range of goods and services exported by a country and improving their technological and value-added characteristics. It involves a gradual transition from the export of raw materials and semi-processed goods toward processed and technologically advanced products.

Geographical diversification, in contrast, refers to expanding the number of foreign markets and reducing excessive dependence on a limited group of trading partners.

In modern international economics, diversification can also be associated with the development of services, technological upgrading, participation in global value chains, and improvements in logistics.

The overall level of foreign trade diversification can conceptually be represented as:

$$D = f(P, G, S, T, L)$$

where:

D = overall level of foreign trade diversification;

P = product diversification;

G = geographical diversification;

S = development of services exports;

T = technological upgrading;

L = logistics and transport connectivity.

This approach suggests that foreign trade diversification is not simply a matter of entering additional markets. It also requires increasing domestic value creation, improving technological capabilities, strengthening competitiveness, and integrating domestic producers into international production networks.

The modern international trading environment is increasingly determined not only by price competitiveness but also by product quality, technological standards, delivery reliability, certification, branding, digitalization, and logistics.

Consequently, Uzbekistan's trade strategy should gradually move from a model focused primarily on increasing export volumes toward a model based on **higher value creation, wider market access, and greater participation in global value chains**.

Current trends and diversification challenges in uzbekistan's foreign trade. Uzbekistan's foreign trade has expanded significantly over the past several years. Official statistical data indicate that foreign trade turnover increased from approximately USD 22.2 billion in 2010 to more than USD 82 billion in 2025.

Table 1

Uzbekistan's Foreign Trade Turnover, 2019–2025[2]

Year	Foreign Trade Turnover, USD billion
2019	41.75
2020	36.26
2021	42.17
2022	50.50
2023	63.53
2024	67.24
2025	82.76

The data demonstrate a significant expansion of Uzbekistan's international trade following the temporary decline associated with the global COVID-19 shock in 2020. Particularly strong growth occurred during 2023–2025.

In 2025, exports reached approximately USD 33.8 billion, while imports amounted to approximately USD 47.4 billion. Consequently, Uzbekistan recorded a negative foreign trade balance.

However, a trade deficit should not automatically be interpreted as an exclusively negative phenomenon. Imports of capital goods, machinery, advanced technologies, industrial equipment, and intermediate inputs can contribute to productive capacity and future export growth.

At the same time, sustainable long-term development requires export growth in both quantitative and qualitative terms.

Another important feature of Uzbekistan's foreign trade is the concentration of trade relations among several major partners.

Table 2

Major Trading Partners of Uzbekistan in 2025[3]

Trading partner	Share of total foreign trade, %
China	21.2
Russia	16.0
Kazakhstan	6.1
Turkey	3.7
Republic of Korea	2.1

[2] Compiled by the author based on data from the Statistics Agency of Uzbekistan.
[3] Statistics Agency of Uzbekistan

China and Russia together accounted for more than one-third of Uzbekistan's total foreign trade turnover. Including Kazakhstan, Turkey, and the Republic of Korea, the five largest partners represented almost half of total trade.

This structure demonstrates both the importance of these markets and the potential value of further geographical diversification.

Therefore, Uzbekistan needs to strengthen its presence in the markets of the European Union, South Asia, Southeast Asia, the Middle East, the Caucasus, and Africa.

CONCLUSION AND POLICY RECOMMENDATIONS

The analysis demonstrates that Uzbekistan's integration into the global economy has accelerated significantly in recent years. The expansion of foreign trade turnover and the establishment of trade relations with more than 200 countries demonstrate the increasing openness of the Uzbek economy.

At the same time, the relatively high concentration of trade among several major partners, the persistent trade deficit, logistical constraints, and the need to increase the share of higher-value-added exports demonstrate the importance of further diversification.

The following policy recommendations can therefore be proposed.

First, Uzbekistan should increase the share of processed and high-value-added products in total exports by developing deeper domestic processing and internationally competitive national brands.

Second, geographical diversification should be strengthened through targeted export strategies for the European Union, South Asia, Southeast Asia, the Middle East, Africa, and other emerging markets.

Third, the country should diversify international transport routes and develop multimodal logistics infrastructure in order to reduce transportation costs and dependence on individual corridors.

Fourth, services exports should become an independent strategic component of the national export policy, with particular emphasis on IT, business-process outsourcing, tourism, education, engineering, finance, and logistics.

Fifth, Uzbekistan should strengthen participation in global value chains by attracting export-oriented foreign direct investment, encouraging technology transfer, and developing domestic supplier networks.

Sixth, WTO accession and trade-policy reforms should be used as an opportunity to improve customs procedures, technical regulations, certification, competition, and trade facilitation.

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RAQAMLI IQTISODIYOT TUSHUNCHASINING MOHIYATI VA U BO'YICHA ILMIY YONDASHUVLAR TAHLILI

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Annotatsiya: *Mazkur maqolada raqamli iqtisodiyot tushunchasining mazmun-mohiyati va uning zamonaviy iqtisodiy tizimdagi o'rni ilmiy-nazariy jihatdan tahlil qilingan. Tadqiqotda raqamli iqtisodiyotning shakllanishi va rivojlanishiga oid turli ilmiy yondashuvlar ko'rib chiqilib, mazkur tushunchaning iqtisodiy mazmuni, asosiy xususiyatlari hamda an'anaviy iqtisodiyotdan farqli jihatlari yoritilgan. Shuningdek, raqamli texnologiyalar, ma'lumotlar, raqamli platformalar, innovatsiyalar va axborot-kommunikatsiya texnologiyalarining iqtisodiy jarayonlardagi o'rni tahlil qilingan. Ilmiy adabiyotlarda raqamli iqtisodiyot tushunchasiga berilgan ta'riflar o'rganilib, ularning umumiy va farqli jihatlari tizimlashtirilgan. Tadqiqot natijasida raqamli iqtisodiyot nafaqat raqamli texnologiyalardan foydalanishga, balki iqtisodiy faoliyatni tashkil etish, ishlab chiqarish, xizmat ko'rsatish, boshqaruv va qiymat yaratish jarayonlarining transformatsiyasiga asoslangan ko'p qirrali iqtisodiy hodisa ekanligi asoslangan.*

Kalit so'zlar: *raqamli iqtisodiyot, raqamli transformatsiya, raqamli texnologiyalar, raqamli platforma, innovatsiya, ma'lumotlar, axborot-kommunikatsiya texnologiyalari, iqtisodiy faoliyat, iqtisodiy tizim, raqamlashtirish.*

Аннотация: *В статье проведен научно-теоретический анализ сущности понятия «цифровая экономика» и его роли в современной экономической системе. Рассмотрены различные научные подходы к формированию и развитию цифровой экономики, раскрыты экономическое содержание данного понятия, его основные характеристики и отличительные особенности по сравнению с традиционной экономикой. Особое внимание уделено роли цифровых*

технологий, данных, цифровых платформ, инноваций и информационно-коммуникационных технологий в экономических процессах. На основе изучения научной литературы систематизированы определения цифровой экономики, выявлены их общие и отличительные черты. В результате исследования обосновано, что цифровая экономика представляет собой многогранное экономическое явление, основанное не только на использовании цифровых технологий, но и на трансформации процессов организации экономической деятельности, производства, оказания услуг, управления и создания экономической стоимости. Такой подход позволяет рассматривать цифровую экономику как важнейший фактор структурных изменений и развития современной экономики.

Ключевые слова: *цифровая экономика, цифровая трансформация, цифровые технологии, цифровая платформа, инновации, данные, информационно-коммуникационные технологии, экономическая деятельность, экономическая система, цифровизация.*

Abstract: *This article provides a scientific and theoretical analysis of the essence of the concept of the digital economy and its role in the modern economic system. The study examines various scientific approaches to the formation and development of the digital economy, focusing on its economic content, key characteristics, and distinctive features compared with the traditional economy. Particular attention is given to the role of digital technologies, data, digital platforms, innovations, and information and communication technologies in economic processes. Based on a review of the scientific literature, definitions of the digital economy are systematized, and their common and distinctive features are identified. The study substantiates that the digital economy is a multidimensional economic phenomenon based not only on the use of digital technologies but also on the transformation of the processes of organizing economic activity, production, service delivery, management, and value creation. This approach makes it possible to consider the digital economy as an important factor contributing to structural changes and the development of the modern economy.*

Keywords: *digital economy, digital transformation, digital technologies, digital platform, innovation, data, information and communication technologies, economic activity, economic system, digitalization.*

KIRISH

So’ngi yillarda postindustrial iqtisodiyotning AKTdan tizimli foydalanishga asoslangan yoki “raqamli iqtisodiyot” deb nomlanuvchi shakliga transformatsiyalashuv jarayonlari jadallashdi. Raqamli iqtisodiyot muayyan

mamlakat uchun raqamli ekotizimning evolyutsion rivojlanishining mantiqiy davomi hamda davlat, korxonalar va aholini to'liq qamrab olgan innovatsion iqtisodiyotni shakllantirish imkoniyatiga aylanmoqda.

Raqamli iqtisodiyot faqatgina yangi raqamli texnologiyalar bo'lib qolmasdan, biznes yuritishning an'anaviy qoidalari va iqtisodiy qonuniyatlardagi jiddiy o'zgarishlarni ham o'z ichiga oladi. "Raqamli texnologiyalar" atamasi bilan umumlashtirilgan global aloqa tarmoqlari, shaxsiy kompyuterlar, elektron mahsulotlar va xizmatlarning paydo bo'lishi va kengayishi iqtisodiyotda masofa va joylashuv, qiymat va naflilik, miqdor va sifat, raqobat, talab va taklif, logistika va vositachilik, inson kapitali, ishlab chiqaruvchilar va iste'molchilar xatti-xarakatlari, marketing kabi tushunchalarning mazmuni, tarkibi va o'zaro bog'liqligini sezilarli darajada o'zgartiradi.

Bugungi kunda raqamli texnologiyalar zamonaviy jamiyat hayotining barcha sohalariga, jumladan iqtisodiyot sohasiga ham faol kirib bormoqda. Iqtisodiyotni raqamlashtirish global iqtisodiyotda iqtisodiy o'sishning muhim omiliga aylanmoqda. O'zbekistonda iqtisodiyot tarmoqlari, ijtimoiy soha va davlat boshqaruvi tizimining jadal raqamli rivojlanishini ta'minlash, shu jumladan elektron davlat xizmatlarini ko'rsatish mexanizmlarini yanada takomillashtirish maqsadida "Raqamli O'zbekiston — 2030" strategiyasi ishlab chiqildi. Ushbu strategiyani muvaffaqiyatli amalga oshirish va ko'zlangan maqsadlarga erishishni ta'minlash tahliliy va ilmiy-uslubiy tadqiqotlarni va innovatsion o'zgarishlarni talab qiladi. Bunday o'zgarishlar esa raqamli iqtisodiyotning mohiyati, tarkibi va rivojlanish xususiyatlari to'g'risida nazariy va tahliliy bilimlarga ega bo'lishni talab qiladi.

Ko'plab xorijiy tadqiqotchilar "raqamli iqtisodiyot" tushunchasining mohiyatini "axborotlashgan iqtisodiyot", "bilimlar iqtisodiyoti", "kreativ iqtisodiyot", "internet-iqtisodiyot", "tarmoq iqtisodiyoti", "elektron iqtisodiyot", "yangi iqtisodiyot" kabi tushunchalar bilan tavsiflashadi. Ushbu atamalarning barchasi nisbatan kengroq tushuncha bo'lgan raqamli iqtisodiyotning alohida jarayonlarini ifodalaydi. Raqamli iqtisodiyot o'zining sifat aniqligini tavsiflovchi bir qator o'ziga xos xususiyatlarni ham o'z ichiga olgan umumlashtiruvchi tushunchadir. Raqamli iqtisodiyotni umumlashtiruvchi kontseptsiya sifatida qabul qilinishi kommunikatsiya tarmoqlari axborotlarini ishlab chiqarishning navbatdagi omili sifatida, AKTni esa intensiv iqtisodiy o'sishning yangi manbai bo'lgan nomoddiy aktiv sifatida o'rganish zaruratini keltirib chiqaradi.

Ko'pchilik tadqiqotchilar fikriga ko'ra "Raqamli iqtisodiyot" kontseptsiyasining shakllanishi amerikalik olim N.Negropontega bog'liq. N.Negropontening fikricha, raqamli iqtisodiyot yangi iqtisodiy tizim sifatida raqamli mahsulotlarning fizik vaznga ega emasligi va ularning hajmi axborot o'lchami bilan almashtirilganligi, mahsulot egallagan maydonning bir necha baravar kichik ekanligi elektron tovarlarni ishlab chiqarish uchun resurs xarajatlarining past ekanligi, internet tarmog'i orqali mahsulotlarning global darajada juda tez harakatlanishi kabi afzalliklarga ega[4].

Boshqa tadqiqotlar mualliflari fikriga ko'ra esa "raqamli iqtisodiyot" atamasi birinchi bo'lib 1994 yilda kanadalik olim Don Tapskottning "Raqamli iqtisodiyot: tarmoqlashgan intellekt sharoitidagi istiqbollar va xavflar" nomli kitobida keltirilgan. D.Tapskott rivojlangan mamlakatlar xususiyatlarini tavsiflab, ob'ektlarni tasvirlashning raqamli shaklini, axborot texnologiyalarining biznes jarayonlariga, davlat boshqaruv tizimiga ta'sirini alohida ta'kidlaydi hamda raqamli iqtisodiyotni axborot kompyuter texnologiyalaridan foydalanishga asoslangan iqtisodiyot deb ta'riflaydi.

D.Tapskott birinchi bo'lib, yangi texnologiyalar va raqamli biznes strategiyalari qanday qilib biznes jarayonlarini o'zgartirish bilan birgalikda turli mahsulot va xizmatlarni ishlab chiqarish va sotish, korxonaning yangi tuzilmasini shakllantirish va samarali biznes qoidalarini belgilash usuli bo'lishini aniqladi. Raqamlashtirishning eng muhim natijalaridan biri sifatida D.Tapskott firmaning institutsional nazariyasiga asoslanib, tranzaktsiya xarajatlarining, jumladan, ma'lumot izlash va shartnoma tuzish xarajatlarining sezilarli kamayishi va natijada mol yetkazib bilan iste'molchi o'rtasida vositachilarsiz to'g'ridan-to'g'ri aloqalar o'rnatiladigan biznesning yangi shakllarining paydo bo'lish imkoniyatlarini ko'rsatadi.

Raqamli iqtisodiyotni tadqiq etishga qaratilgan ishlar ko'p bo'lishiga qaramasdan, raqamli iqtisodiyotning ijtimoiy-iqtisodiy tizim sifatida o'zida nimani ifoda etishi to'g'risida umumiy kontseptsiya mavjud emas. Ko'plab mutaxassislar "raqamli iqtisodiyot" tushunchasini aniq ta'riflamasdan, uni "murakkab tuzilma" sifatida ifodalashadi yoki unga "texnologiyalar birikmasi sifatida qarashadi. Bir qator ilmiy ishlarda raqamli iqtisodiyotning raqamli texnologiyalarga asoslangan iqtisodiyot sifatida tavsiflanuvchi turli variantlardagi ta'riflari keltirilgan.

1999 yilda N. Leyn raqamli iqtisodiyotning mazmuni bo'yicha ilmiy ta'rifni birinchi bo'lib ishlab chiqdi. Unga ko'ra, raqamli iqtisodiyot – bu internet

[4] Nicholas Negroponte. Being Digital. – London: Hodder & Stoughton, 1995. – 243 p. http://governance40.com/wp-content/uploads/2018/12/ Nicholas-Negroponte-Being-Digital-Vintage-1996.pdf.

tarmog'idagi kompyuter va kommunikatsion texnologiyalarning yaqinlashuvi hamda elektron tijoratning rivojlanishini va tashkiliy tuzilmalardagi keng ko'lamli o'zgarishlarni rag'batlantiruvchi axborot va texnologiyalar oqimidir[5].

T.Mezenburg raqamli iqtisodiyotning statistik jihatdan baholash mumkin bo'lgan uch tarkibiy qismini ajratib ko'rsatadi:

-qo'llab-quvvatlovchi infratuzilma (qurilmaviy va dasturiy ta'minot, telekommunikatsiyalar, tarmoqlar va boshqalar);

-elektron biznes (kompyuter tarmoqlari orqali xo'jalik faoliyati va har qanday biznes jarayonlarini olib borish);

-elektron tijorat (tovarlarni internet orqali tarqatish va sotish)[6].

M.Nikrem va boshqalar keltirgan ta'rifga ko'ra, raqamli iqtisodiyot – bu "raqamli" resurslar hisobiga amalga oshirilgan ishlab chiqarishning umumiy iqtisodiy ishlab chiqarish hajmidagi ulushi. Ushbu raqamli resurslar raqamli malakalarni, raqamli uskunalarni (aksessuar va butlovchi qismlar, dasturiy ta'minot va aloqa uskunalari), ishlab chiqarish jarayonida foydalaniladigan oraliq raqamli mahsulot va xizmatlarni o'z ichiga oladi[7].

Yana bir xorijiy tadqiqotchi M.Rouzning ta'kidlashicha esa: "Raqamli iqtisodiyot – bu axborot-kommunikatsion texnologiyalar hisobiga amalga oshiriladigan iqtisodiy faoliyatning xalqaro tarmog'i. Soddaroq qilib, ushbu tushunchani raqamli texnologiyalarga asoslangan iqtisodiyot deb ham ta'riflash mumkin"[8].

Iqtisodiy hamkorlik va taraqqiyot tashkiloti (IHTT) mutaxassislari tomonidan berilgan ta'rifga ko'ra, raqamli iqtisodiyot tegishli texnologiyalar yordamida internet foydalanuvchilari tomonidan amalga oshiriladigan bir qator iqtisodiy-ijtimoiy faoliyat shakllari va umumiy foydalanishdagi texnologiyalarning birikmasini ifodalaydi. Raqamli iqtisodiyot raqamli texnologiyalar, bog'lanish qurilmalari, axborot tizimlari va ularning funktsiyalari qo'llaniladigan infratuzilmadan iborat[9].

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[5] Lane, N. Advancing the digital economy into the 21st century / N. Lane // Information Systems Frontiers. – 1999. – Vol. 1. – № 3. – P. 317–320.

[6] Measuring The U.S. Digital Economy: Theory and Practice // Thomas L. Mesenbourg // U.S. Bureau of the Census. https://2001.isiproceedings.org/pdf/1074.PDF.

[7] Knickrehm, M., Berthon, B. & Daugherty, P., 2016. Accenture-Strategy. Digital Disruption: The Growth Multiplier. https://www.anupartha.com/wp-content/ uploads/2016/01/Accenture-Strategy-Digital-Disrup tion-Growth-Multiplier.pdf.

[8] Rouse, M. 2016. Digital Economy, Techtarget, Newton, MA. http://searchcio.techtarget.com/definition/ digital-economy.

[9] Dahlman, C., S. Mealy and M. Wermelinger (2016), «Harnessing the digital economy for developing countries», OECD Development Centre Working Papers, No. 334, OECD Publishing, Paris, https://doi. org/10.1787/4adffb24-en.

Jahon banki mutaxassislari fikricha, raqamli iqtisodiyot - bu real vaqtda ma'lumot almashishga asoslangan jadal iqtisodiy rivojlanishning yangi paradigmasi bo'lib, raqamli axborot-kommunikatsiya texnologiyalaridan foydalanishga asoslangan iqtisodiy, ijtimoiy va madaniy munosabatlar tizimini ifodalaydi[10].

Ko'plab mutaxassislar "raqamli iqtisodiyot" tushunchasini aniq ta'riflamasdan, uni "murakkab tuzilma" sifatida ifodalashadi va raqamli texnologiyalarga asoslangan iqtisodiyot sifatida turli variantlarda ta'riflar keltirishadi.

Rossiyalik mualliflar "raqamli iqtisodiyot" tushunchasiga bir-biridan jiddiy farq qiluvchi ko'proq tor ma'nodagi ta'riflarni berishgan. I.S. Adnamax va Ye.V. Storojevalarning ta'riflashicha, raqamli iqtisodiyot – bu raqamli kompyuter texnologiyalarini rivojlantirish bilan bevosita bog'liq bo'lgan faoliyat bo'lib, unga onlayn xizmatlar ko'rsatish, elektron to'lovlar, internet tijorat, kraudfanding va boshqalar kiradi[11]. N.G. Muminov va G.M.Zaxirovalar iqtisodiyotni raqamlashtirishda va elektron savdoni rivojlantirishda davlat xaridlari tizimining ahamiyati katta ekanligini ta'kidlaganlar[12].

A.A. Kuntsman raqamli iqtisodiyotni shunday ta'riflaydi: "Raqamli iqtisodiyot – bu iqtisodiyotning zamonaviy shakli bo'lib, u moddiy mahsulotlar va xizmatlarni ishlab chiqarish sohasida resurslarni aniqlovchi axborot va bilimning ustunligi, shuningdek, ma'lumotlarni saqlash, qayta ishlash va uzatish uchun raqamli texnologiyalardan faol foydalanish bilan tavsiflanadi"[13].

R.V. Mesheryakov "raqamli iqtisodiyot" atamasi bo'yicha ikki xil, klassik va kengaytirilgan yondashuv borligini takidlaydi. Klassik yondashuvga ko'ra, raqamli iqtisodiyot raqamli texnologiyalarga asoslangan iqtisodiyot va shu o'rinda faqat elektron tovar va xizmatlar sohasini tavsiflaydi. Masalan, masofaviy ta'lim, telemeditsina. Kengaytirilgan yondashuvga ko'ra raqamli iqtisodiyot – bu raqamli texnologiyalardan foydalanib amalga oshirilgan iqtisodiy ishlab chiqarish jarayonidir[14].

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[10] Развитие цифровой экономики в России // Всемирный банк. http://www.vsemirnyjbank.org/ru/events/2016/12/20/developing-the-digital-economyin-russia-international-seminar-1.

[11] Аднамах И.С., Сторожева Е.В. Использование информационных технологий в обеспечении финансовой безопасности банков // Молодая наука – 2015: матер. VI Открытой Междунар. молодежной науч.-практ. конф. 2016. С. 119–121.

[12] Muminov N.G., Zakhirova G.M. The role of public procurement in the digitalization of the economy and adoption of e-commerce. St. Petersburg State Polytechnical University Journal. Economics Vol. 13, No. 2, 2020. P.30-39. DOI: 10.18721/JE.13203

[13] Кунцман Александр Арнольдович Трансформация внутренней и внешней среды бизнеса в условиях цифровой экономики // УЭкС. 2016. №11 (93). URL: https://cyberleninka.ru/article/n/transformatsiya-vnutrenney-i-vneshney-sredy-biznesa-v-usloviyah- tsifrovoy-ekonomiki.

[14] Цифровая экономика: как специалисты понимают этот термин. МОСКВА, 16 июн – РИА Новости, Анна Урманцева. [Электронный ресурс]. URL: https://ria.ru/ science/20170616/1496663946.

T.A. Gasanov va G.A. Gasanovlar keltirgan ta’rifga ko’ra, raqamli iqtisodiyot deganda yetakchi ilmiy yutuqlar va ilg’or texnologiyalarga, birinchi navbatda axborot-kommunikatsiya texnologiyalariga asoslangan iqtisodiyotdagi institutsional kategoriyalar tizimi bo’lib, uning amal qilishi yalpi ishlab chiqarish samaradorligini oshirishga, aholi turmush darajasi va sifatini yaxshilash maqsadida barqaror iqtisodiy o’sish sur’atlarini saqlab turishga qaratiladi. Raqamli iqtisodiyot institutsional iqtisodiyotning transformatsiyalashuvi bo’lib, ushbu jarayonda milliy boylik hajmini kengaytirish, aholi turmush darajasini oshirish va mamlakatning iqtisodiy xavfsizligini mustahkamlash maqsadlarida milliy iqtisodiyotni innovatsion rivojlantirish uchun raqamli texnologiyalardan har tomonlama va tizimli foydalaniladi[15].

V.M. Bondarenkoning fikriga ko’ra, raqamli iqtisodiyot – bu to’rtinchi sanoat inqilobi texnologiyalariga mos keladigan iqtisodiy munosabatlar modelining yaxlit, tizimli va kompleks muammosidir, ya’ni XXI asrning raqamli texnologiyalari va boshqa yuqori texnologiyalari raqamli iqtisodiyotning shakllanishi, rivojlanishi va amalga oshirilishida ob’ektiv qo’yilgan maqsadlarga erishishni ta’minlashi zarur[16].

V.I. Tkach esa “raqamli iqtisodiyot” atamasining mohiyatini quyidagicha ta’riflaydi: “Raqamli iqtisodiyot – bu raqamli platformalar, algoritmlar, bulutli infratuzilmalarning keng qo’llanilishi va jamiyatdagi ijtimoiy-axloqiy jihatlardagi o’zgarishlar va xavfsizlik va sinergiyani boshqarish sharoitida intellektual kapitaldan foydalanishga e’tibor qaratib, global, makro, mezo va mikro darajalarda mulk va yalpi ichki mahsulotning barqaror iqtisodiy rivojlanishiga yo’naltirilgan kishilar, biznes va buyumlarning keng ko’lamli tuzilmasidir”[17].

G.N.Andreeva va boshqalar muallifligida nashr etilgan monografiyada quyidagicha ta’rif keltiriladi: “Raqamli iqtisodiyot – bu texnoraqamli shakldagi tovar va xizmatlarni ishlab chiqarish, taqsimlash, ayirboshlash va iste’mol qilish bilan bog’liq iqtisodiy munosabatlarning tizimli yig’indisidir[18].

E.P.Boyko va boshqalar raqamli iqtisodiyotni raqamli texnologiyalarga asoslangan faoliyat shakllari majmuasi, shuningdek raqamli texnologiyalarning

[15] Гасанов Т.А., Гасанов Г.А. Цифровая экономика как новое направление экономической теории // Региональные проблемы преобразования экономики. 2017. № 6. С. 4–10.
[16] Бондаренко, В. М. Мировоззренческий подход к формированию, развитию и реализации «цифровой экономики» / Бондаренко В. М. // Современные информационные технологии и ИТ-образование. – 2017, Т. 13. – № 1. – С. 237–251.
[17] Ткач В.И. Цифровая экономика: оптимум, эквилибриум, синергизм / В.И. Ткач // Экономика и экология территориальных образований. – 2018. – Т. 2, № 2. – С. 24–32.
[18] Андреева Г.Н. / Развитие цифровой экономики в России как ключевой фактор экономического роста и повышения качества жизни населения: монография / Г.Н. Андреева [и др.]. – Нижний Новгород: Профессиональная наука, 2018. – 131 с.

ishlashini ta’minlaydigan infratuzilma sifatida tushunishlarini va bu o’rinda raqamli texnologiyalar deganda raqamli tizimlar asosida axborotni yaratish, yig’ish, qayta ishlash, saqlash va uzatish texnologiyalarini tushunish zarurligini ta’kidlashadi[19].

I.N.Tkachenko va Ye.N.Starikovlarning “raqamli iqtisodiyot” kategoriyasining mohiyati bo’yicha nazariy yondashuviga ko’ra, raqamli iqtisodiyot – jamiyat taraqqiyotining yangi paradigmasi bo’lib, u raqamli texnologiyalar va axborotni qayta ishlash usullariga asoslangan iqtisodiy rivojlanishning yangi sifatini, raqamli texnologiyalarga to’liq asoslangan iqtisodiyot va ijtimoiy sohaning yangi raqamli tarmoqlarini, iqtisodiyot va jamiyat hayotini raqamlashtirish bilan bog’liq ijtimoiy-iqtisodiy transformatsiyalarni o’z ichiga oladi[20].

Rossiyalik mualliflarning ilmiy tadqiqot ishlarida “raqamli iqtisodiyot” tushunchasiga keng ma’noda ham bir qator ta’riflar berilgan. Jumladan, R.K.Asanov “raqamli iqtisodiyot – bu yuqori texnologiyali biznes tuzilmalari tomonidan elektron tovar va xizmatlar ishlab chiqarishga va ushbu mahsulotlarni elektron tijorat orqali taqsimlashga asoslangan iqtisodiyot”[21] deb ta’riflagan bo’lsa, V.P.Kupriyanovskiy, S.A.Sinyagov, S.I.Lipatovlar raqamli iqtisodiyot deganda elektron shaklda amalga oshiriladigan iqtisodiy munosabatlar tushunilishi zarurligini ta’kidlashadi[22]. V.M.Matveeva raqamli iqtisodiyotni raqamli texnologiyalar yordamida iqtisodiy rivojlanishni jadallashtirish paradigmasi deb hisoblaydi[23]. N.V. Vasilenko raqamli iqtisodiyotga inson faoliyatning barcha sohalarida ma’lumotlarni saqlash, qayta ishlash va uzatish uchun raqamli texnologiyalardan foydalanishni faol joriy etish bilan tavsiflanadigan iqtisodiyot shakli sifatida qaraydi[24].

Yuqorida ko’rib chiqilgan yondashuvlar bilan bir qatorda, raqamli iqtisodiyotni sanoat, agrosanoat majmuasi va qurilishni rivojlantira oluvchi hamda real iqtisodiyotga qo’shimcha tizim sifatida talqin qiluvchi ilmiy

[19] 4 Бойко Е.П., Евневич М.А., Колышкин А.В. Экономика предприятия в цифровую эпоху// Российское предпринимательство. 2017. Т. 183, № 7. С. 1127–1136.
[20] 5 И.Н. Ткаченко, Е.Н. Стариков. Цифровая экономика: основные тренды и задачи развития // Изв. Сарат. ун-та. Нов. сер. Сер. Экономика. Управление. Право. 2020. Т. 20, вып. 3. С. 244–255.
[21] Асанов Р. К. Формирование концепции «цифровой экономики» в современной науке / Р. К. Асанов // Социально-экономические науки и гуманитарные исследования. – 2016. – № 15. – С. 143–148.
[22] 7 Куприяновский В.П., Синягов С.А., Липатов С.И. «Цифровая экономика – «Умный способ работать» // International Journal of Open Information Technologies. 2016. № 2. С. 26–32.
[23] Матвеева В.М. Цифровая экономика: тренды и перспективы // Инновационное развитие социально-экономических систем: условия, результаты и воз можности: сб. матер. V Междунар. науч.-практ. конф. М., 2017. С. 98–104.
[24] Василенко Н.В. Цифровая экономика: концепции и реальность // Инновационные кластеры в цифровой экономике: теория и практика: тр. науч.- практ. конф. с междунар. участием 17–22 мая 2017 г. / под ред. д-ра экон. наук, проф. А.В. Бабкина. СПб.: Изд-во Политехн. ун-та, 2017. С. 147–151.

qarashlar ham mavjud. Bu borada A.V.Keshelava, V.G. Budanov, V.Yu. Rumyantsev va boshqalar raqamli iqtisodiyotning mohiyatini tushuntirish maqsadida “gibrid olam” tushunchasini kiritishgan. Ularning fikriga ko’ra, “raqamli iqtisodiyot” – bu gibrid olam sharoitida mavjud bo’ladigan iqtisodiyotdir. Ushbu ta’rifda “raqamli iqtisodiyot” atamasini yozishda ataylab qo’shtirnoq belgisidan foydalanishgan. CHunki ular umumiy iqtisodiyot tarkibida alohida ajralib turadigan “raqamli iqtisodiyot” degan voqelik yo’q deb hisoblashadi[25].

SHuningdek ayrim tadqiqotchilar raqamli iqtisodiyotni mavjud emas deb hisoblaydilar, real iqtisodiyotning raqamli segmentini ko’rib chiqqan holda raqamli iqtisodiyotni “iqtisodiyotning moddiy sektoriga nisbatan iqtisodiy faoliyat jarayoni ishtirokchilari o’rtasidagi o’zaro bog’liqlik samaradorligini oshirish imkonini beruvchi infratuzilma ustqurmasi” deb ta’riflashadi[26].

O’zbekistonda ham raqamli iqtisodiyot va uni rivojlantirishga qaratilgan kam sonli bo’lsada ilmiy va uslubiy nashrlar chop etilgan va bu jarayon asosan mamlakatimizda raqamli iqtisodiyot va elektron hukumatni shakllantirish va rivojlantirish to’g’risidagi bir qator Prezident qarorlari va farmonlari qabul qilinganidan keyin sezilarli darajada jadallashdi.

Mamlakatimiz iqtisodchi olimlaridan biri bo’lgan S.S.Gulyamov rahbarligidagi mualliflar guruhi raqamli iqtisodiyotni “jarayonlarni tahlil qilish natijalaridan foydalanish va katta hajmdagi ma’lumotlarni qayta ishlash asosida turli xildagi ishlab chiqarishlar, texnologiyalar, asbob-uskunalar, tovarlar va xizmatlarni saqlash, sotish va yetkazib berish samaradorligini jiddiy ravishda oshirishga imkon beradigan va raqamli ko’rinishdagi ma’lumotlar asosiy ishlab chiqarish omili deb sanalgan xo’jalik faoliyatidir” deb ta’riflash to’g’ri bo’lishini ta’kidlashgan. SHuning bilan birgalikda ushbu ta’rifning foydalanish uchun noqulay ekanligi aytib o’tib, o’zlarining quyidagi funktsional ta’rifini keltirishgan: “Raqamli (elektron) iqtisodiyot bu - axborot, jumladan, shaxsiy axborotdan foydalanish hisobiga barcha qatnashchilarning ehtiyojlarini maksimal darajada qondirish uning o’ziga xos xususiyati bo’lgan iqtisodiyotdir”[27].

[25] Введение в «Цифровую» экономику. На пороге «цифрового будущего». Книга первая / А. В. Кешелава В. Г. Буданов, В. Ю. Румянцев и др.; под общ. ред. А. В. Кешелава; гл. «цифр.» конс. И. А. Зимненко. – ВНИИГеосистем, 2017. – 28 с.

[26] Акбердина, В.В. (2018). Трансформация промышленного комплекса России в условиях цифровизации экономики. Известия Уральского государственного экономического университета, 19(3), 82-99. https://doi.org/10.29141/2073-1019- 2018-19-3-8.

[27] Gulyamov S.S. Raqamli iqtisodiyotda blokcheyn texnologiyalar: O'quv qo'llanma / S.S.Gulyamov, R.H.Ayupov, O.M.Abdullayev, G.R.Baltabayeva; — T.: «Iqtisod-Moliya”, 2019, - 380 b.

Iqtisod fanlari doktori, professor N.X.Jumaevning ta’kidlashicha, raqamli iqtisodiyot deganda, faqatgina Blokcheyn (Blockchain) texnologiyasini va ulardan xalqaro moliya bozorlarida foydalanish masalalarini yoki kriptovalyutalarni tushunish kerak emas. Raqamli iqtisodiyot deganda, raqamli kommunikatsiyalar, IT yordamida olib boriladigan iqtisodiyot tushuniladi[28].

O.M.Umarovning ta’kidlashicha, raqamli iqtisodiyot alohida faoliyat turini emas, balki ishbilarmonlik, sanoat ob’ektlari, xizmatlarda axborot texnologiyalaridan faol foydalanishni anglatadi. Agar oddiy iqtisodiyotda moddiy buyumlar asosiy resurs hisoblansa, raqamli iqtisodiyotda bu qayta ishlanadigan hamda uzatiladigan axborot, ma’lumotlar bo’ladi[29].

Yana bir tadqiqotchi O.S.Umarovning fikricha, raqamli iqtisodiyot – bu ishlab chiqarish kompleksi insonlar uchun qulayliklarni ta’minlaydigan mahsulot va xizmatlarni yaratadigan virtual muhit bo’lib, raqamli texnologiyalardan foydalangan holda iqtisodiy ishlab chiqarish tizimidir. SHuningdek, raqamli iqtisod rasmiylashtirilishi mumkin bo’lgan barcha narsani qamrab olishi mumkin, ya’ni mantiqiy sxemalarda namoyon bo’ladi. Hayotning o’zi esa bu «narsalarni» ishlab chiqarish, tarqatish, almashtirish va iste’mol qilish tizimiga aylantirishga imkoniyat yaratadi[30]. Yuqorida ko’rib chiqilgan ko’plab yondashuvlarni qiyosiy tahlil qilgan holda, “raqamli iqtisodiyot” tushunchasi bo’yicha ta’riflarni umumiy mazmun jihatidan quyidagi 1-jadvalda keltirilgan tartibda tasniflash mumkin.

1-jadval

“Raqamli iqtisodiyot” tushunchasi bo’yicha ta’riflarning mohiyati bo’yicha tasniflanishi[31]

Mualliflar	Ta’riflarning umumiy mazmuni
M. Rouz, IHTT 2016, Jahon banki, UNCTAD, R.V. Mesheryakov, V.I. Tkach, V.M. Bondarenko, I.P. Boyko, N.V. Vasilenko, I.N. Tkachenko.	Inson faoliyatining barcha sohalarida axborotlarni to’plash, saqlash, qayta ishlash, o’zgartirish va uzatish uchun raqamli texnologiyalarni faol joriy etish va amalda qo’llash bilan tavsiflanadigan iqtisodiyot turi

[28] Жумаев Н.Х. Рақамли иқтисодиёт нега керак ва у нима беради? – 12.03.2020. – Электрон ресурс: https://review.uz/oz/post/raqamli-iqtisodiyot-mam lakatimiz-taraqqiyoti-garovidir.
[29] Jumanova S. Raqamli iqtisodiyot: taraqqiyot sari qisqa yo’l. 17 sentyabr 2020. “Yangi O’zbekiston” – Elektron resurs: https://yuz.uz/news/raqamliiqtisodiyot-taraqqiyot-sari-qisqa-yol.
[30] Umarov O.S. Raqamli iqtisodiyot va uning rivojlanish tendentsiyalari. “Iqtisodiyot va innovatsion texnologiyalar” ilmiy elektron jurnali. № 3, may-iyunь, 2018 yil.
[31] Muallif ishlanmasi.

M.Nikrem, I.S.Adnamax, Ye.V.Storojeva, R.K.Asanov, V.P.Kupriyanovskiy, O.S.Umarov	Virtual muhitda raqamli tovarlar ishlab chiqarish va sotish bo'yicha milliy iqtisodiyot tarmoqlari sifatidagi iqtisodiy faoliyat shakllari majmuasi
A.A. Kuntsman, G.N. Andreeva, S.S. Gulyamov, N.X. Jumaev.	Real vaqt rejimida raqamli axborot telekommunikatsiya texnologiyalari va tarmoqlaridan foydalanishga asoslangan ijtimoiy, iqtisodiy, tashkiliy va texnik munosabatlar tizimi
N. Leyn, A.V.Keshelava, V.G. Budanov, V.M. Matveeva, V.Yu. Rumyantsev, V.V. Akberdina, O.M.Umarov.	Iqtisodiyotning barqaror rivojlanishiga yo'naltirilgan, real iqtisodiyotga qo'shimcha bo'lgan turli elementlarning (texnik, infratuzilmaviy, tashkiliy, dasturiy, me'yoriy, qonunchilik va boshqalar) murakkab birlashmasi

Tahlillar va chiqarilgan xulosalar asosida quyidagi mualliflik tarifini taklif etamiz: raqamli iqtisodiyot – bu iqtisodiy faoliyatda boshqaruv usullari va ishlab chiqarish texnologiyalarini muntazam takomillashtirib borishga imkon beruvchi, mahsulot ishlab chiqarish va xizmatlar ko'rsatishning raqamli modellarini shakllantiruvchi raqamli tarmoq texnologiyalaridan keng foydalanish bilan bog'liq ijtimoiy, iqtisodiy va texnologik munosabatlarni qamrab oluvchi makrodarajadagi iqtisodiy tizimdir. Raqamli iqtisodiyot tarkiban AKT sektori, raqamli mahsulotlar va xizmatlar tarmoqlari, to'laligicha raqamlashtirilgan ishlab chiqarish va boshqaruv texnologiyalariga ega real ishlab chiqarish tarmoqlaridan tashkil topadi.

XULOSA

Xulosa qilib aytganda, raqamli iqtisodiyot shunchaki raqamli mahsulot va xizmatlarni ishlab chiqarish bo'yicha iqtisodiy faoliyat yoki iqtisodiyotning alohida tarmog'i bo'lib qolmasdan, raqamli jarayonlarga integratsiyalashgan mijozlar ehtiyojlarini qondirishni kengaytirish, raqamli ekotizimlarni yaratish uchun axborot tarmoqlaridan foydalangan holda bozorlarda innovatsion hamkorlikni rivojlantirish, raqamli qarorlar qabul qilish asosida mahsulot va xizmatlarni texnologik takomillashtirish, biznes jarayonlari va korxonani boshqaruvining tashkiliy shakllarini raqamli qayta tashkil etish hisobiga faoliyat samaradorligining oshishiga erishiladi.

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BILIMLARGA ASOSLANGAN RAQAMLI IQTISODIYOTGA O'TISH TARAQQIYOTNING ASOSIY OMILI SIFATIDA

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Annotatsiya: *Mazkur maqolada bilimlarga asoslangan raqamli iqtisodiyotga o'tishning zamonaviy taraqqiyotdagi ahamiyati ilmiy-nazariy jihatdan tahlil qilingan. Tadqiqotda bilim, innovatsiya, inson kapitali va raqamli texnologiyalarning iqtisodiy rivojlanish jarayonidagi o'zaro bog'liqligi yoritilgan. Bilimlarga asoslangan iqtisodiyotdan raqamli iqtisodiyotga o'tish jarayonining mazmun-mohiyati, asosiy xususiyatlari va iqtisodiy taraqqiyotga ta'sir etuvchi omillari ko'rib chiqilgan. Shuningdek, raqamli infratuzilmaning rivojlanishi, axborot-kommunikatsiya texnologiyalaridan samarali foydalanish, ilmiy-tadqiqot va innovatsion faoliyatni qo'llab-quvvatlash hamda inson kapitalining raqamli kompetensiyalarini oshirish masalalari tahlil qilingan. Tadqiqot natijasida bilim va innovatsiyalarga tayangan raqamli iqtisodiyotni shakllantirish iqtisodiy samaradorlikni oshirish, mehnat unumdorligini yuksaltirish, raqobatbardoshlikni mustahkamlash va barqaror taraqqiyotni ta'minlashning muhim sharti ekanligi asoslangan.*

Kalit so'zlar: *bilimlarga asoslangan iqtisodiyot, raqamli iqtisodiyot, raqamli transformatsiya, bilim, innovatsiya, inson kapitali, raqamli texnologiyalar, raqamli infratuzilma, raqamli kompetensiyalar, iqtisodiy taraqqiyot.*

Аннотация: *В статье проведен научно-теоретический анализ значения перехода к цифровой экономике, основанной на знаниях, в обеспечении современного экономического развития. В исследовании раскрывается взаимосвязь знаний, инноваций, человеческого капитала и цифровых технологий в процессе экономического развития. Рассмотрены сущность и содержание перехода от экономики, основанной на знаниях, к цифровой экономике, ее основные характеристики и факторы, влияющие*

на экономический прогресс. Особое внимание уделено развитию цифровой инфраструктуры, эффективному использованию информационно-коммуникационных технологий, поддержке научно-исследовательской и инновационной деятельности, а также повышению цифровых компетенций человеческого капитала. В результате исследования обосновано, что формирование цифровой экономики, основанной на знаниях и инновациях, является важным условием повышения экономической эффективности, роста производительности труда, укрепления конкурентоспособности и обеспечения устойчивого экономического развития.

Ключевые слова: *экономика, основанная на знаниях, цифровая экономика, цифровая трансформация, знания, инновации, человеческий капитал, цифровые технологии, цифровая инфраструктура, цифровые компетенции, экономическое развитие.*

Abstract: *This article provides a scientific and theoretical analysis of the importance of the transition to a knowledge-based digital economy as a key factor of modern economic development. The study examines the interrelationship between knowledge, innovation, human capital, and digital technologies in the process of economic development. It considers the essence and content of the transition from a knowledge-based economy to a digital economy, its main characteristics, and the factors influencing economic progress. Particular attention is given to the development of digital infrastructure, the effective use of information and communication technologies, support for research and innovation activities, and the enhancement of digital competencies within human capital. The study substantiates that the formation of a knowledge- and innovation-driven digital economy is an important condition for increasing economic efficiency, improving labor productivity, strengthening competitiveness, and ensuring sustainable economic development.*

Keywords: *knowledge-based economy, digital economy, digital transformation, knowledge, innovation, human capital, digital technologies, digital infrastructure, digital competencies, economic development.*

KIRISH

Bilimlarga asoslangan raqamli iqtisodiyotga o’tish kontseptsiyasi sanoatlashuv davrdan information-texnologik davrning ishlab chiqarish usuliga o’tish bilan bog’liqdir. Ushbu kontseptsiyaning paydo bo’lishiga asosiy sabab - industrial iqtisodiyotning barcha tarmoqlari va jabhalarini qamrab olgan hamda

uning miqyosi, dinamikasi va ichki mohiyatini batamom o'zgartirib yuborgan yangi raqamli information texnologiyalar paradigmasidir.

Ilmiy izlanishlarning ko'rsatishicha, industrial iqtisodiyotning information iqtisodiyot bilan almashinishi agrardan industrial iqtisodiyotga o'tishga aynan ekvivalant emas, chunki yangi paradigma doirasida iqtisodiyotning asosiy tarmoqlari ilm-fan sohalaridagi puxta bilimlar talab qiladigan komp'yuter texnologiyalari, raqobatbardosh va o'zgaruvchan sharoitlarga tezda moslasha oladigan information tarmoqlarga aniqlanadilar. Zamonaviy raqamli iqtisodiyot tuzilmasining bunday sifat o'zgarishlari hozirgi kunda global o'zgarish tariqasida ko'rilib, bunda "moddiy" iqtisodiyotdan "intellektual" iqtisodiyotga yoki "bilimlarga asoslangan iqtisodiyot – knowledge-bazed economy"ga o'tish sifatida tushuniladi. Postindustrial iqtisodiyotga kirib kelayotgan bunday yangiliklarning mohiyatini tushunish information texnologiyalarning ma'lumotlarni qayta ishlash natijasida butunlay yangi bilimlar hosil qilib, yangi ko'rinishdagi faoliyat turlarini yaratishini talab qiladi.

Keyingi yillarda jahon iqtisodiy adabiyotida keng tarqalgan "Bilimlarga asoslangan raqamli iqtisodiyot" yoki "Intellektual iqtisodiyot" tushunchasi ilmiy bilimlar majmuasi va ular (bilimlar, texnologiyalar, chizmalar, usullar va boshqalar) yozilgan moddiy ma'lumot tashuvchilar (disketlar, fleshkalar, internet resurslari va boshqalar) moddiy va nomoddiy ishlab chiqarishning rivojlanishi va iqtisodiy o'sishning asosiy manba'i bo'lib qolishini anglatadi. Xuddi shu tufayli ilmiy-amaliy, ishbilarmon va professional davralarda raqamli iqtisodiyot rivojlanishi nuqtai-nazaridan bilimlar, ma'lumotlar, yangiliklar va ilmiy-texnologik innovatsiyalar har tomonlama chuqur o'rganila boshlandi. Yangi ixtirolar, ilmiy-texnik ma'lumotlar va raqamli innovatsiyalar esa O'zbekiston iqtisodiyoti asosiy sektorlarining raqamli iqtisodiyot nuqtai-nazardan qayta tuzilishi va rivojlanishini aniqlab bera boshladi. Ammo xozirgi davrda iqtisodiyotning juda ko'p sohalari ilm, fan va texnikaning yutuqlaridan keng miqyosda foydalanmaganliklari tufayli, ma'lum ma'noda depressiv holatga tushib qolganlar. Bu xolat quyidagi bir qancha ob'ektiv va sub'ektiv sabablar bilan bog'liqdir. Avvalo, bilimlarga asoslangan raqamli iqtisodiyotning huquqiy ta'minoti mamlakatimizda yaratilgan emas.

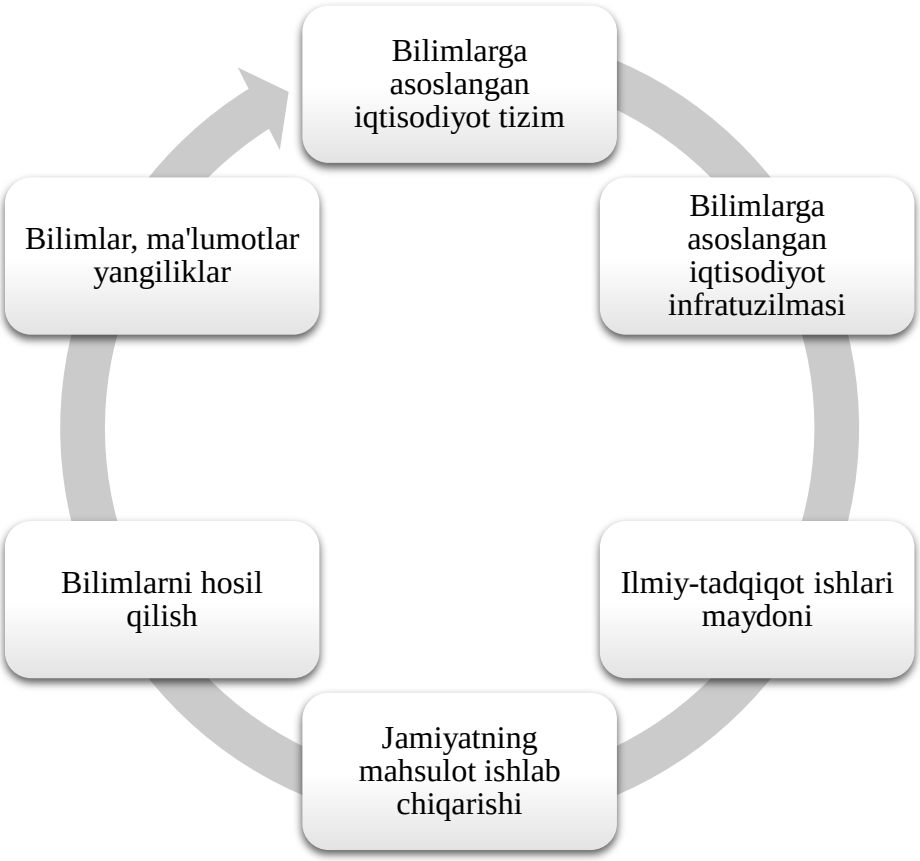
Hozirga qadar innovatsion ilmiy-texnik izlanish jarajonlarini normal amalga oshirish va ularning natijalarini amaliyotga tadbiq qilish uchun zaruriy bo'lgan to'liq normativ-huquqiy baza mavjud emas. Masalan, mamlakat miqyosida raqamli iqtisodiyot bilan bog'liq bo'lgan texnologik innovatsiyalar

va ularni rivojlantirishning barcha nozik jihatlarini hisobga olgan holdagi asosiy qonun xujjatlari to’liq ishlab chiqilmagan.

Raqamli iqtisodiyotga ilmiy-amaliy bilimlarni investitsiya qilish uchun “respublikada eng yaxshi imkoniyatlar yaratish” masalasi huquqiy jihatdan hozircha to’liq ishlab chiqilmagan. Bu ishlar davlat boshqaruv bo’g’ini mutasaddilarining innovatsiyalar, ilm-fan va texnikani rivojlantirmasdan turib, keskin rivojlanish mumkin emasligini ko’rib, bilib va tushunib turgan holida ham amalga oshirilmayotganlari ta’assufga loyiqdir.

Shuning uchun ham, keyingi yillarda halq farovonligi va mamlakatning dunyo bozoridagi o’rnini aniqlab beradigan ilg’or texnologiyalar, innovatsiyalar, ta’lim tizimi va boshqa an’anaviy tarmoqlarda raqamli innovatsion yumushlarni amalga oshira oladigan yuqori malakali kadrlarning yetishmasli holati kuzatilayapti. Ammo shunga qaramasdan, iqtisodiy fanga va bilimlarga asoslangan raqamli iqtisodiyotning jarayonlari va qoidalari haqida tushuncha beradigan “raqamli information iqtisodiyot”, “bilimlarga asoslangan raqamli iqtisodiyot”, “raqamli innovatsion iqtisodiyot” va “raqamli intellektual iqtisodiyot” tushunchalariga ozmi-ko’pmi ta’rif berilib, ular bo’yicha bir qancha ilmiy ishlar bajarilgan. Lekin bu ilmiy-amaliy izlanishlar chalaroq, sayozroq, fragmentar, tizimlashtirilmagan va bir tomonlamalilik bilan tafsiflanadi.

Raqamli iqtisodiyot uchun hizmat qiladigan bilimlarga asoslangan tizimning kuchli va kuchsiz tomonlari o’rganilib, uning infratuzilmasi tadqiq qilinadi. Umuman aytganda, bilimlarga asoslangan raqamli innovatsion iqtisodiyot jarayonlarining asosiy tushunchalarini o’rganish sxematik tarzda quyidagi ketma-ketlikda amalga oshirilishi mumkin (1-rasm):



1-rasm. Bilimlarga asoslangan raqamli innovatsion iqtisodiyotning shakllanish jarayonlari[32]

Jamiyatning mahsulot ishlab chiqarish infratuzilmasini o'rganilganda unda ishlab chiqarilayotgan mahsulot yoki hizmatlarda qanday bilimlar aks etishi va bu bilimlarning pirovard natijalari qanday bo'lishiga ahamiyat beriladi. Bu yerda asosiy diqqat-e'tibor bevosita bilimlar hosil bo'ladigan va uning shart-sharoitlariga bog'liq bo'lgan raqamli iqtisodiyot infratuzilmasi tushunchasiga qaratiladi. Undan so'ng, uning zamonaviy sharoitlarga bog'liq alohida hususiyatlari viloyatlararo miqyosda o'rganiladi.

Bilimlarning biror bir moddiy yoki ma'naviy ne'mat yaratadigan tashuvchisi, saqlovchsi va foydalanuvchisi inson bo'lgani tufayli, jamiyat uchun kerakli bo'lgan amaliy bilimlar asosan ta'lim tizimida hosil qilinadi. Shuning uchun ham bilimlarga asoslangan raqamli iqtisodiyotda sifatli mahsulotlar ishlab chiqarishning asosi - ta'lim muassasalaridagi zamonaviy sifatli ta'lim jarayonida hosil bo'ladi, deyishimiz mumkin.

Ishlab chiqarish va ta'lim tizimi orasidagi asosiy bog'liqlik va munosabatlar majmui huddi shu bilan aniqlanadi. Raqamli iqtisodiyotni bilimlardan foydalanish asosida tahlil qilib chiqqanda ishlab chiqarish tizimi,

[32] Muallif ishlanmasi

ishlab chiqarish potentsiali, bilimlarga asoslangan iqtisodiyotning ishlab chiqarish jarayoni, bu bilan bog'liq iqtisodiy munosabatlar sub'ektlari, innovatsion tizim, innovatsion potentsial, innovatsion amaliyot sub'ektlari va boshqa tushunchalar o'rganiladi. Yuqorida tavsif etilgan muammolar bo'yicha bir qancha ilmiy manba'larni tanqidiy ravishda o'rganish shuni ko'rsatadiki, ilk ilmiy izlanishlar informatizatsiya tushunchasi va uning iqtisodiyotga ta'sirini o'rganishga bag'ishlangan – xuddi shu holat "raqamli

iqtisodiyot" paradigmasining paydo bo'lishiga olib keldi.

Ushbu yo'nalishning muallifi iqtisodiyotdagi neoklassik yo'nalish namoyondasi Dj. Stigler hisoblanadi. Ammo informatsiya tushunchasi mavhumroq bo'lgani uchun, "agent uchun informatsiya" tushunchasi kiritilib, u informatsiya jamlanishi va qayta ishlanishi natijasida paydo bo'ladigan bilimni namoyish qilishga imkon beradi. Muhitnimg holati haqidagi ma'lumotlar majmui sifatida tushuniladigan "bilim" tushunchasi informatsiyaga nisbatan birlamchi deb aniqlandi. Xuddi shuning uchun ham "raqamli informatsion iqtisodiyot" dan "bilimlarga asoslangan raqamli iqtisodiyot" tushunchasiga o'tildi. Lekin "bilimlarga asoslangan raqamli iqtisodiyot" tushunchasi unchalik aniq emas va shuning uchun turli hil ilmiy iqtisodiy maktablarning namoyondalari tomonidan bir-biridan farq qiladigan bir qancha ma'nolarda talqin etilishi mumkin. Misol sifatida F. Xayekning "tarqoq bilim" kontsetsiyasini yoki P.N. Zavlin va L.A. Jolents, Polyak olimi Ya. Muyjel, Venger olimi B. Santo va boshqalarning ishlarida o'rganilgan "innovatsion iqtisodiyot"ni keltirish mumkin. Bilimlar iqtisodiyoti tizimi, uning tuzilishi, infratuzilmasi va uning faoliyati mahsullari tahlili A.I. Tatarkin, A. E. Koguta, N.L. Frolova va V.J. Kellening ilmiy ishlarida o'z aksini topgan. Yangilik kiritishlar va uning raqamli iqtisodiyotdagi ahamiyatini Y. Shumpeter aniqlab, ularning man'bai sifatida raqobatning asosiy faktori bo'lgan korporatsiyalarning ilmiy faoliyatini ko'rsatgan. Ammo bu holda ham asosiy dominanta sifatida yangi g'oyalarni samarador iqtisodiy yechimlarga aylantira oladigan novator-tadbirkor insonning ijodi hisoblanadi. Ikkinchi jahon urushidan so'ng, Amerika iqtisodchisi R.Solou AQSH iqtisodiyotidagi quyidagi qiziqarli bog'liqlikni aniqladi: ishlatilayotgan kapitalning ko'paytirilishi mahsulot o'sishining 12,5% gagina sabab bo'ladi, qolgan 87,5 % li o'sish esa texnologik o'zgarishlarga bog'liq bo'lar ekan. Shundan so'ng, texnika va texnologiyaning rivojlanishini o'rganadigan bir qancha soha mutahassislari, shu jumladan, iqtisodchilar ham ishlab chiqarish o'sishining asosi - kerakli joyda, kerakli vaqtda va kerakli iqtisodiyot tarmoqlariga ilmiy-texnologik yangiliklar kiritish ekanligini ta'kidladilar. Iqtisodchi P.N. Zavlin fikricha, iqtisodiyot mahsuloti sifatida

bilimlarga asoslangan yangiliklar kiritish ishlab chiqarish usuli, ilg'or texnologiya, hizmat ko'rsatish turi, tashkiliy tuzilish, moliyaviy yoki ilmiy izlanish faoliyati ko'rinishida bo'lishi mumkin. Ya.Muyjel va L.A.Jolents esa bilimlar natijasida vujudga kelgan yangilikni "ilmiy g'oya yoki texnik ixtironi amaliy foydalanishgacha olib kelish jarayoni" deb tushuntirishadi. Rossiya olimlaridan V.J. Kelle fikriga ko'ra esa, bilimlar asosidagi raqamli iqtisodiyotning poydevori yangi texnologiyalar va yangi mahsulotlarni yaratish, loyihalash, ishlab chiqarish va tarqatishda ilm-fanni keng miqyosda qo'llashdir.

A.I. Tatarkinning fikricha, bilimlarga asoslangan raqamli iqtisodiyot sharoitlarida ilmiy-texnik bilimlarning amaliyotda qo'llanilishi natijasida yangi mahsulot sifatidagi (mahsulot turi, hizmat turi, texnologiya, tashkiliy usul va boshqalar) "raqamli innovatsiyalar" hosil bo'lib, ulardan foydalanish iqtisodiy yoki ijtimoiy samaralarga olib keladi. Ammo raqamli innovatsiyalarni yangi texnologiya va yangi mahsulotlar sifatida moddiy ishlab chiqarishdagina bo'ladi deb tushunish xato bo'lar edi. Ular inson faoliyatining istalgan sohasiga mansub bo'lishi mumkin. Shuning uchun ham raqamli innovatsiyalarni ularning tarqalishi va ishlatilishi, ulardan qanday foydalanilishi, yangililik darajasi va boshqalarga nisbatan ham farqlash mumkin.

Shunday qilib, raqamli innovatsion iqtisodiyot bilimlarni yuqori darajada tashkillashtirish asosida yoki bilimlarga asoslangan iqtisodiyot sharoitlarida amalga oshiradi. Undan so'ng paydo bo'ladigan raqamli iqtisodiyot esa ishlab chiqarishning yangi faktori – informatsiyani ajratib olish va uni keng miqyosda ishlatish bilan bog'liq bo'ladi.

Zamonaviy bilimlar va informatsiyadan foydalanish asosida uyshtiriladigan ijtimoiy ishlab chiqarishning mahsuloti sifatida yangiliklar kiritish yoki raqamli innovatsiyalar vujudga kelsa, ularning ishlab chiqarilishi, taqsimlanishi, almashinuvi va iste'moli raqamli innovatsion iqtisodiyot borligidan darak beradi. Ushbu iqtisodiyot an'anaviy iqtisodiyotning barcha sektorlarini isloh qilish va rivojlantirish uchun tom ma'nodagi imkoniyatlar yaratib beradi. Shu jumladan, bu holat depressiv, stagnant va rivojlanib kelayotgan holatlardagi milliy iqtisodiyotlarga ham tegishlidir.

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ЭКОНОМИЧЕСКАЯ ЭФФЕКТИВНОСТЬ ЦИФРОВОГО УПРАВЛЕНИЯ КАЧЕСТВОМ И ПРИМЕНЕНИЯ СУПЕРПЛАСТИФИКАТОРОВ В ПРОИЗВОДСТВЕ ТОВАРНОГО БЕТОНА

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Аннотация. *В статье оценивается экономическая эффективность двух управленческих инноваций в производстве товарного бетона: цифровизации управления качеством (автоматизированное дозирование и статистический контроль прочности) и применения поликарбоксилатного суперпластификатора. На примере бетона класса В30 и завода мощностью 50 тыс. м^3 в год показано, что снижение коэффициента вариации прочности с 13,5 до 10 % экономит 21 кг цемента на 1 м^3, а комплексный проект - 97 кг. Чистая приведённая стоимость проектов составляет 2,48 и 4,61 млрд сум, срок окупаемости- 1,5 и 0,9 года. Определены пороговые объёмы производства и цены добавки.*

Ключевые слова: *товарный бетон, управление качеством, коэффициент вариации, суперпластификатор, инвестиционный проект, чистая приведённая стоимость, цифровизация.*

Abstract. *The paper evaluates the economic efficiency of two managerial innovations in ready-mixed concrete production: digital quality management (automated batching and statistical strength control) and the use of a polycarboxylate superplasticizer. For class B30 concrete and a plant producing 50,000 m^3 per year, reducing the coefficient of variation of strength from 13.5% to 10% saves 21 kg of cement per m^3, while the combined project saves 97 kg. The net present value of the projects is 2.48 and 4.61 billion UZS, with payback*

periods of 1.5 and 0.9 years. Threshold production volumes and admixture prices are determined.

Keywords: *ready-mixed concrete, quality management, coefficient of variation, superplasticizer, investment project, net present value, digitalization.*

ВВЕДЕНИЕ

Производство товарного бетона является одним из базовых звеньев строительного комплекса Узбекистана, и его экономика во многом определяется расходом цемента. При принятых в работе ценах цемент формирует около 75 % материальных затрат на 1 м^3 бетона класса В30, а его производство является основным источником выбросов CO_2 в цепочке создания стоимости бетона (Scrivener et al., 2018; Habert et al., 2020).

На практике заводы нередко закладывают в рецептуру «запас» цемента, чтобы компенсировать нестабильность дозирования, влажности заполнителей и активности цемента. Этот запас является скрытыми потерями: по ГОСТ 18105-2018 требуемая прочность бетона тем выше, чем больше фактическая изменчивость прочности, поэтому однородность продукции напрямую превращается в экономию цемента (Межгосударственный совет по стандартизации, 2018; Montgomery, 2019). Второй резерв химические добавки: поликарбоксилатные суперпластификаторы снижают водопотребность смеси и позволяют при том же водоцементном отношении уменьшить расход цемента (Plank et al., 2015; Aïtcin & Flatt, 2016). Технологические аспекты обоих подходов хорошо изучены, однако их оценка как инвестиционных проектов предприятия, с учётом налогов, дисконтирования и порогов рентабельности, в отечественной литературе представлена слабо. **Цель** работы оценить экономическую эффективность цифрового управления качеством и применения суперпластификатора на бетонном заводе и определить условия их рентабельности.

ОСНОВНАЯ ЧАСТЬ

Методы. Рассмотрены четыре сценария производства бетона класса В30: S0 - базовый (коэффициент вариации прочности v = 13,5 %, без добавок); S1 - цифровое управление качеством (v = 10 %); S2 - суперпластификатор при v = 13,5 %; S3 - комплексный сценарий (S1 + S2). Требуемая средняя прочность при обеспеченности 95 % определялась в упрощённой форме, соответствующей нормальному распределению прочности:

$$R_т = B/(1 - 1{,}64 \cdot v), \quad (1)$$

а цементно-водное отношение - по формуле Боломея–Скрамтаева (Баженов, 2011):

$$Ц/В = R_т/(A \cdot R_ц) + 0{,}5, \quad Ц = В \cdot (Ц/В), \qquad (2)$$

где A = 0,6; $R_ц$ = 42,5 МПа; водопотребность В = 200 л/м^3, а с суперпластификатором - 160 л/м^3 (водоредуцирование 20 %) при дозировке 0,8 % от массы цемента. Высвободившийся объём замещался песком. Удельная экономия на 1 м^3 и годовой денежный поток проекта:

$$\Delta Э = \Delta Ц \cdot p_ц - m_{СП} \cdot p_{СП} - \Delta П \cdot p_п, \qquad (3)$$

$$CF = (\Delta Э \cdot Q - Z) \cdot (1 - \tau) + \tau \cdot I/n, \qquad (4)$$

$$NPV = -I + \Sigma\, CF/(1 + r)^t, \quad t = 1 \ldots n, \qquad (5)$$

где Q - годовой объём производства; Z - годовые затраты на эксплуатацию системы; τ - ставка налога на прибыль; I - инвестиции; n - срок проекта и амортизации; r - ставка дисконтирования (Brealey et al., 2020). Инвестиции в сценарии S1 включают тензометрическое автоматическое дозирование, датчики влажности заполнителей, систему диспетчерского управления с интеграцией в ERP и лабораторную базу данных для статистического контроля прочности. Исходные данные (табл. 1) являются допущениями модели и подлежат замене фактическими данными предприятия.

Таблица 1

Исходные данные модели

Параметр	**Значение**
Цена цемента $p_ц$ / песка $p_п$ / суперпластификатора $p_{СП}$	1 100 / 70 / 25 000 сум/кг
Годовой объём производства Q	50 000 м^3
Инвестиции I / годовые затраты Z	1 200 / 150 млн сум
Налог на прибыль τ / ставка дисконтирования r	15 % / 18 %
Срок проекта и амортизации n	10 лет

Результаты. Рассчитанные расходы цемента, удельная экономия и снижение выбросов CO_2 (при удельном коэффициенте 0,85 кг CO_2 на 1 кг цемента и 1,5 кг на 1 кг добавки) приведены в таблице 2.

Таблица 2

Сравнение сценариев на 1 м^3 бетона B30

Показатель	**S0**	**S1**	**S2**	**S3**
Требуемая прочность $R_т$, МПа	38,5	35,9	38,5	35,9
Расход цемента, кг	402	381	322	305
Суперпластификатор, кг	-	-	2,58	2,44

Экономия ΔЭ, сум	-	21 853	11 817	32 984
Снижение CO_2, кг	-	17,8	64,1	78,8

Снижение изменчивости прочности (S1) уменьшает требуемую прочность на 2,6 МПа и расход цемента на 21 кг/м^3 без каких-либо материальных затрат. Суперпластификатор (S2) экономит 80 кг цемента, но большая часть экономии уходит на оплату добавки, поэтому чистый эффект вдвое меньше, чем в S1. Сценарии усиливают друг друга: в S3 экономия составляет 32 984 сум/м^3, или 1,65 млрд сум в год. Показатели эффективности инвестиций приведены в таблице 3.

Таблица 3

Показатели эффективности проектов

Показатель	**Проект S1**	**Проект S3**
Годовой денежный поток CF, млн сум	819	1 292
NPV (r = 18 %), млн сум	2 482	4 608
Внутренняя норма доходности IRR, %	68	108
Простой срок окупаемости, лет	1,5	0,9
Пороговый объём производства Q^*, м^3/год	20 270	13 430
Снижение выбросов CO_2, т/год	890	3 940

Анализ чувствительности показал, что при ставке дисконтирования 14 % и 24 % NPV проекта S1 составляет 3,07 и 1,82 млрд сум, проекта S3 - 5,54 и 3,56 млрд сум. Наиболее чувствительным фактором является объём производства: при Q = 20 тыс. м^3 проект S1 находится на грани безубыточности (NPV ≈ −23 млн сум), тогда как S3 остаётся эффективным (NPV ≈ 0,83 млрд сум). Для сценария S2 критическая цена суперпластификатора, при которой экономия обращается в ноль, составляет около 29,6 тыс. сум/кг.

Обсуждение. Результаты подтверждают, что качество в бетонном производстве является экономическим ресурсом, а не только техническим требованием: цифровой контроль превращает статистическую однородность продукции в прямую экономию цемента, что согласуется с принципами статистического управления процессами (Montgomery, 2019). Для руководства предприятия это означает, что коэффициент вариации прочности целесообразно включить в систему ключевых показателей

наряду с себестоимостью и объёмом продаж, например в рамках сбалансированной системы показателей (Kaplan & Norton, 1996).

Эффект суперпластификатора, напротив, сильно зависит от рыночной цены добавки и её дозировки. Поскольку поликарбоксилаты в значительной мере импортируются, предприятию следует управлять этим риском через долгосрочные контракты, подбор дозировки под местные цементы и локализацию производства добавок. Комплексный сценарий S3 даёт и заметный экологический эффект - около 3,9 тыс. т CO_2 в год на один завод, что соответствует задачам Стратегии перехода Республики Узбекистан на «зелёную» экономику (Президент Республики Узбекистан, 2019).

Ограничения исследования связаны с принятыми допущениями: цены, объём инвестиций и достижимый коэффициент вариации зависят от конкретного предприятия, а модель не учитывает влияние добавки на другие свойства бетона и возможный рост выручки за счёт повышения качества. Поэтому числовые результаты иллюстрируют методику, которую предприятие может применить к собственным данным.

ЗАКЛЮЧЕНИЕ

1. Цифровое управление качеством, снижающее коэффициент вариации прочности бетона B30 с 13,5 до 10 %, экономит 21 кг цемента на 1 м^3 и при объёме 50 тыс. м^3 в год обеспечивает NPV 2,48 млрд сум при сроке окупаемости 1,5 года; проект рентабелен при объёме производства выше ≈ 20 тыс. м^3 в год.

2. Суперпластификатор экономит 80 кг цемента на 1 м^3, но его чистый эффект определяется ценой добавки и исчезает при цене выше ≈ 29,6 тыс. сум/кг.

3. Комплексный проект даёт наибольший эффект (NPV 4,61 млрд сум, окупаемость 0,9 года, снижение выбросов ≈ 3,9 тыс. т CO_2 в год) и рекомендуется для средних и крупных бетонных заводов.

4. Коэффициент вариации прочности рекомендуется использовать как ключевой управленческий показатель бетонного производства.

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A CLIL-BASED METHODOLOGY FOR TEACHING BUSINESS ENGLISH TO ENTREPRENEURSHIP STUDENTS

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Abstract: *The internationalization of entrepreneurship and business education has increased the need for university graduates who possess both professional knowledge and effective English communication skills. Entrepreneurship students are expected to communicate business ideas, analyze markets, negotiate with partners, prepare business documents, and present proposals to international audiences. However, Business English is often taught separately from the professional content in which students are expected to use the language. This study examines the potential of Content and Language Integrated Learning (CLIL) as a methodology for teaching Business English to university students majoring in entrepreneurship. The study is based on a qualitative review and synthesis of research on CLIL, English for Specific Purposes (ESP), Business English, and entrepreneurship education. The theoretical framework is primarily informed by King's (2018) conceptualization of CLIL and the 4Cs framework of Content, Communication, Cognition, and Culture. Based on the literature analysis, a six-stage CLIL methodology is proposed: activation, content and language input, scaffolding, entrepreneurial task, professional production, and reflection and assessment. The results of the conceptual analysis indicate that entrepreneurship-related tasks can provide meaningful contexts for developing specialized vocabulary, professional communication, higher-order thinking, and intercultural awareness. A sample CLIL-based business-pitch activity and an integrated assessment framework are presented. The study concludes that CLIL can provide a practical framework for connecting Business English with entrepreneurship education, although successful implementation requires explicit language support, appropriate scaffolding, teacher preparation, and further empirical validation.*

Keywords: *Content and Language Integrated Learning, CLIL, Business English, entrepreneurship education, English for Specific Purposes, higher education, professional communication*

1. INTRODUCTION

The internationalization of higher education and business has increased the importance of English as a professional communication language. In contemporary entrepreneurial environments, business activities frequently involve communication with international customers, investors, suppliers, partners, and employees. Consequently, university graduates preparing for careers in entrepreneurship need more than general English proficiency. They need to use English to perform professional tasks such as presenting business ideas, conducting market research, negotiating, preparing business plans, explaining financial information, and communicating with international stakeholders.

This development has important implications for entrepreneurship education. University entrepreneurship programs traditionally focus on opportunity recognition, innovation, business planning, marketing, finance, management, and risk assessment. Nevertheless, knowledge of these areas does not necessarily mean that students can communicate their knowledge effectively in English. For example, an entrepreneurship student may understand the concept of a value proposition but experience difficulty explaining it to an international investor. Similarly, students may be able to analyze a market but lack the linguistic resources necessary to present their findings professionally.

Business English instruction therefore needs to be connected more closely to students' professional and disciplinary needs. English for Specific Purposes (ESP) provides an important foundation for this connection because it emphasizes the identification of learners' specific academic and professional language requirements (Dudley-Evans & St John, 1998). For entrepreneurship students, these requirements include presentation skills, business writing, negotiation, professional vocabulary, meeting communication, and persuasive language.

Content and Language Integrated Learning (CLIL) offers another perspective on this issue. King (2018) describes CLIL as an umbrella term for educational approaches in which content and language learning occur within the same learning environment. In CLIL, language is not treated only as an object of study; it also functions as a medium through which students access and communicate disciplinary knowledge.

This principle is particularly relevant to entrepreneurship education because entrepreneurial learning is strongly task-oriented. Students are expected to identify problems, develop solutions, evaluate business opportunities, design

business models, and communicate their decisions. These activities provide natural contexts for meaningful English-language use.

The theoretical model developed by Coyle, Hood, and Marsh (2010) identifies four interconnected dimensions of CLIL: Content, Communication, Cognition, and Culture. The 4Cs framework can be adapted to entrepreneurship education by connecting entrepreneurial knowledge with professional communication, higher-order thinking, and intercultural awareness.

Research in higher education, however, indicates that CLIL does not automatically guarantee language development. Arnó-Macià and Mancho-Barés (2015) point out that university CLIL programs may become heavily focused on disciplinary content while providing insufficient explicit language support. This issue is especially relevant to Business English because specialized business tasks can be cognitively and linguistically demanding.

Therefore, the central problem addressed in this study is how Business English can be taught to entrepreneurship students through CLIL while maintaining an appropriate balance between disciplinary content and language development.

Research aim

The aim of this study is to develop a CLIL-based methodology for teaching Business English to university students majoring in entrepreneurship.

Research questions

The study addresses the following questions:

1. How can CLIL principles be applied to Business English instruction for entrepreneurship students?
2. What types of entrepreneurial tasks can simultaneously develop content knowledge and English communication?
3. What methodological stages and assessment principles can support CLIL-based Business English instruction?

2. METHODS

2.1. Research Design

The study employs a qualitative, conceptual research design based on a focused literature review and pedagogical synthesis. The purpose is not to measure the effectiveness of an already implemented intervention but to develop a theoretically grounded methodology for integrating Business English and entrepreneurship education.

The analysis draws primarily on literature concerning CLIL, ESP, Business English, higher education, and entrepreneurship education. King's (2018) discussion of CLIL in *The TESOL Encyclopedia of English Language*

Teaching serves as the principal theoretical reference. The 4Cs framework proposed by Coyle et al. (2010) is used to organize the content, language, cognitive, and intercultural dimensions of the proposed methodology.

Research on university CLIL and ESP, particularly Arnó-Macià and Mancho-Barés (2015) and Dudley-Evans and St John (1998), is used to identify methodological requirements for integrating language and disciplinary content.

2.2. Analytical Framework

The literature was analyzed according to four categories:

1. **Content** — entrepreneurship concepts and professional knowledge;
2. **Communication** — Business English required to communicate entrepreneurial content;
3. **Cognition** — analysis, evaluation, problem-solving, and decision-making;
4. **Culture** — intercultural awareness in international business communication.

These categories were then connected with the professional communication needs of entrepreneurship students.

2.3. Development of the CLIL Methodology

On the basis of the literature analysis, six methodological stages were identified:

1. Activation;
2. Content and language input;
3. Scaffolding;
4. Entrepreneurial task;
5. Professional production;
6. Reflection and assessment.

The stages were designed to move students from contextualized input toward independent professional communication.

The proposed methodology also incorporates the principles of ESP needs analysis. Rather than selecting language items only according to grammatical progression, the methodology organizes language around authentic or simulated entrepreneurial situations.

3. RESULTS

3.1. Integration of the 4Cs in Entrepreneurship Education

The analysis indicates that the 4Cs framework can be directly connected with entrepreneurship education.

CLIL dimension	Application to entrepreneurship	Examples of English activities
Content	Business models, marketing, finance, innovation	Reading business cases
Communication	Professional English	Presentations, meetings, negotiation
Cognition	Analysis, evaluation, decision-making	Problem-solving and case analysis
Culture	International business communication	Intercultural negotiation and marketing

The integration of these dimensions changes the role of English in the classroom. English becomes not simply the subject of instruction but a tool for accessing information, solving problems, and communicating entrepreneurial decisions.

For example, instead of teaching the word *competitor* through a vocabulary exercise alone, students can be asked to identify competitors for a proposed startup and explain how the startup could differentiate itself.

This task requires vocabulary knowledge, entrepreneurship knowledge, analysis, and oral communication simultaneously.

3.2. Proposed Six-Stage CLIL Methodology

The analysis resulted in the following methodological model:

Activation → Content and Language Input → Scaffolding → Entrepreneurial Task → Professional Production → Reflection and Assessment

Stage 1: Activation

The teacher activates students' existing knowledge through questions, images, advertisements, short videos, or business problems.

For example:

Who are the target customers of this product?

What problem does the product solve?

Why might customers choose it?

This stage prepares students for the content and creates a communicative purpose for subsequent language learning.

Stage 2: Content and Language Input

Students receive entrepreneurship-related content through English.

Possible materials include:

- business articles;
- startup profiles;
- company websites;
- market reports;
- interviews;
- business videos;
- charts and graphs.

At this stage, the teacher introduces relevant Business English terminology.

Examples include:

target market, *customer segment*, *value proposition*, *revenue*, *investment*, *competitor*, *market share*, and *competitive advantage*.

Stage 3: Scaffolding

Because students must process specialized information through English, linguistic support is required.

Possible scaffolding techniques include:

- vocabulary banks;
- glossaries;
- sentence starters;
- model texts;
- graphic organizers;
- guiding questions;
- visual materials.

For example:

Our target customers are...

The main problem is...

Our product provides a solution by...

Unlike our competitors, we...

Scaffolding enables students to participate in cognitively demanding activities without making the language barrier unnecessarily restrictive.

Stage 4: Entrepreneurial Task

Students then apply their knowledge through a meaningful business task.

Possible tasks include:

- analyzing a startup;
- identifying a market opportunity;
- developing a business model;
- conducting market research;

- solving a business problem;
- negotiating;
- developing a marketing strategy.

At this stage, English functions as the working language.

Stage 5: Professional Production

Students produce a professional outcome.

Possible products include:

- business plans;
- market reports;
- presentations;
- marketing proposals;
- professional emails;
- investor pitches.

This stage allows students to demonstrate both disciplinary understanding and language competence.

Stage 6: Reflection and Assessment

Students reflect on both their content learning and language development.

They may consider:

What business concept did I learn?

What new English terminology did I use?

What communication problem did I experience?

How can I improve my professional communication?

Reflection can be combined with teacher and peer feedback.

3.3. Sample CLIL Task: Business Pitch

One of the most appropriate tasks for entrepreneurship students is the business pitch.

Task objective

Students develop and present a hypothetical startup idea to a group of potential investors.

Required content

Students identify:

1. a business problem;
2. a proposed solution;
3. target customers;
4. competitors;
5. competitive advantage;
6. revenue model.

Required language

Students use expressions such as:

Our business idea is based on...

We have identified a problem...

Our target customers are...

The main advantage of our product is...

We generate revenue through...

The presentation is followed by questions from classmates acting as investors.

Possible questions include:

Who are your main competitors?

How will you attract customers?

What makes your product different?

How will the company generate revenue?

This task integrates all four dimensions of the CLIL framework.

3.4. Integrated Assessment

The proposed methodology requires assessment of both content and language.

A possible assessment framework is:

Assessment criterion	Weight
Entrepreneurship content	25%
Business English vocabulary	15%
Organization and coherence	20%
Professional communication	20%
Critical thinking and justification	20%

Content assessment measures students' understanding and application of entrepreneurship concepts.

Language assessment considers vocabulary, grammar, fluency, pronunciation, and professional register.

Communication assessment considers clarity, interaction, persuasion, and the ability to respond to questions.

Cognitive assessment considers analysis, creativity, problem-solving, and justification.

3.5. Expected Learning Outcomes

The proposed methodology is expected to support development in four major areas.

Professional English

Students develop the ability to:

- use specialized business vocabulary;
- present ideas;
- write professional documents;
- participate in business discussions;
- negotiate.

Entrepreneurship knowledge

Students develop their ability to:

- analyze opportunities;
- identify customers;
- evaluate competitors;
- design business models;
- develop marketing strategies.

Cognitive competence

Students practice:

- analysis;
- evaluation;
- decision-making;
- problem-solving;
- creativity.

Intercultural competence

Students become more aware of:

- international communication conventions;
- differences in business interaction;
- customer expectations;
- negotiation practices.

4. DISCUSSION

The results of the conceptual analysis suggest that CLIL provides a useful methodological framework for integrating Business English with entrepreneurship education. The main strength of the approach is the creation of a direct relationship between language development and meaningful professional activity.

King's (2018) conceptualization of CLIL is particularly relevant because it does not restrict integrated learning to one particular classroom model. This flexibility allows CLIL to be adapted to university-level Business English and entrepreneurship courses.

The proposed methodology also corresponds closely with the 4Cs framework of Coyle et al. (2010). Entrepreneurship content provides the disciplinary foundation, communication provides the linguistic dimension,

cognition promotes higher-order thinking, and culture introduces the international dimension of business communication.

The relationship between CLIL and ESP is also significant. ESP emphasizes the identification of learners' specific professional language needs, while CLIL provides a way to develop those needs through disciplinary content. For entrepreneurship students, this means that English can be taught through activities such as business analysis, presentations, negotiations, and market research rather than exclusively through isolated language exercises.

The findings are consistent with Arnó-Macià and Mancho-Barés (2015), who emphasize the importance of explicit language support in university CLIL. The proposed methodology therefore includes scaffolding as a separate stage. This is particularly important because students may possess sufficient entrepreneurship knowledge but still lack the English resources needed to communicate that knowledge.

The proposed approach also corresponds to research on Business English CLIL. Cauli (2021), for example, examined CLIL-based Business English activities involving specialized vocabulary, ESP reading, and oral presentation and reported positive learning outcomes in the investigated context. Such findings support the use of professionally meaningful tasks in Business English instruction.

At the same time, CLIL should not be viewed as a replacement for explicit language teaching. Students still require direct instruction in terminology, grammar, discourse organization, pronunciation, and professional communication strategies. The distinctive feature of the proposed methodology is that such language instruction is connected to the content and tasks that students are expected to perform.

An important implication is that the teacher's role changes from being primarily a transmitter of language knowledge to being a facilitator of integrated professional learning. Teachers need to identify both content objectives and language objectives before designing a lesson.

For example, a lesson on market analysis might have the following paired objectives:

Content objective: Students will identify and evaluate a target market.

Language objective: Students will use comparative and persuasive language to justify their choice.

Such explicit dual objectives help maintain balance between content and language.

Another implication concerns assessment. Conventional Business English assessment often emphasizes grammar and vocabulary. A CLIL-oriented assessment framework should additionally consider students' ability to use language for professional purposes and demonstrate disciplinary understanding.

However, several limitations should be acknowledged. First, the present study is conceptual and does not report original classroom data. Therefore, the proposed methodology should not be interpreted as empirically proven to be more effective than conventional instruction. Second, the implementation of CLIL may depend on students' English proficiency, teacher expertise, institutional support, and available materials. Third, the proposed assessment framework requires adaptation to specific curricula and educational contexts.

Future empirical research could address these limitations by implementing the methodology with entrepreneurship students and measuring changes in Business English proficiency, entrepreneurial knowledge, presentation skills, and student perceptions.

5. CONCLUSION

The increasing internationalization of entrepreneurship education creates a need for approaches that connect professional knowledge with effective English communication. Entrepreneurship students require English not simply as a general academic subject but as a practical tool for presenting ideas, analyzing markets, negotiating, networking, writing business documents, and communicating with international stakeholders.

This study examined Content and Language Integrated Learning as a methodological framework for teaching Business English to entrepreneurship students. Based on King's (2018) conceptualization of CLIL and the 4Cs framework of Coyle et al. (2010), a six-stage methodology was proposed: activation, content and language input, scaffolding, entrepreneurial task, professional production, and reflection and assessment.

The proposed model integrates entrepreneurship content with explicit language objectives. Activities such as business-case analysis, market research, negotiation, business-plan development, and investor pitching provide meaningful contexts in which students can use specialized English while developing entrepreneurial knowledge and higher-order thinking.

The main methodological principle is that students should not only learn English about business, but should learn to use English to perform entrepreneurial activities. Such an approach can connect language learning with students' future professional needs and create more purposeful opportunities for communication.

Nevertheless, the proposed methodology requires empirical testing in real university classrooms. Future research should investigate its effectiveness across different student proficiency levels, entrepreneurship programs, and institutional contexts. Particular attention should be given to measurable changes in students' Business English proficiency, professional communication, entrepreneurial knowledge, and intercultural competence.

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IFRS LINE: AN INTEGRATED MODEL FOR PARALLEL ACCOUNTING UNDER IFRS AND NATIONAL ACCOUNTING STANDARDS

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Abstract. *This paper proposes IFRS LINE, an integrated model supporting parallel accounting and reporting under IFRS and national accounting standards. Drawing on a case-based analysis of accounting processes in an Uzbek joint-stock company, the study identifies repeated data processing between accounting registers and reporting outputs. The model connects the general ledger, trial balance, IFRS adjustments, financial statement items and electronic reporting forms through a common data source. Its contribution is a traceable information flow that preserves original accounting records while supporting separate reporting requirements. Further quantitative evaluation is needed.*

Keywords: *IFRS, national accounting standards, parallel accounting, financial reporting, general ledger, accounting adjustments, audit trail, IFRS LINE.*

INTRODUCTION

The transition to International Financial Reporting Standards (IFRS) requires companies to reconsider how accounting data are recorded, adjusted and presented. In Uzbekistan, Presidential Resolution No. PP-4611 introduced measures supporting this transition (President of the Republic of Uzbekistan, 2020). The quality of the resulting information remains essential: the Conceptual Framework identifies relevance and faithful representation as fundamental qualitative characteristics of useful financial information (IFRS Foundation, 2018). In the examined Uzbek joint-stock company, national accounting records were summarized in a trial balance and subsequently processed for IFRS reporting and electronic submission. This workflow involved repeated classification, adjustment and reconciliation of the same data. The study proposes IFRS LINE, an integrated model linking original accounting entries, IFRS adjustments and reporting outputs. Its purpose is to organize a traceable information flow that supports national and IFRS reporting requirements while limiting repeated entry of underlying transactions.

MAIN BODY

The study uses a case-based analysis of accounting and reporting processes in a joint-stock company in Uzbekistan. The workflow was examined from transaction recording to the preparation of the trial balance, IFRS adjustments and reporting forms. Particular attention was paid to repeated data transfers and manual reconciliation. Accounting process modelling and comparative mapping were used to develop IFRS LINE. Mapping establishes relationships between national accounting accounts, IFRS financial statement items and electronic reporting lines. The qualitative assessment focuses on continuity of the data flow, identification of adjustments and traceability of reported amounts. Quantitative changes in processing time and error rates are not established in this study.

The existing workflow separates current accounting from IFRS reporting preparation. Although the national trial balance summarizes account balances and movements, additional procedures are needed to classify and adjust these amounts for IFRS reporting. Data are then allocated to the electronic reporting form used by the company. These consecutive stages create a need for reconciliation across separate registers and working files. The principal limitation is the absence of a continuous link between original accounting entries and their final presentation. When an adjustment is introduced at a later stage, its effects must be traced across the relevant reporting outputs. Figure 1 compares the existing accounting workflow with the proposed IFRS LINE model.

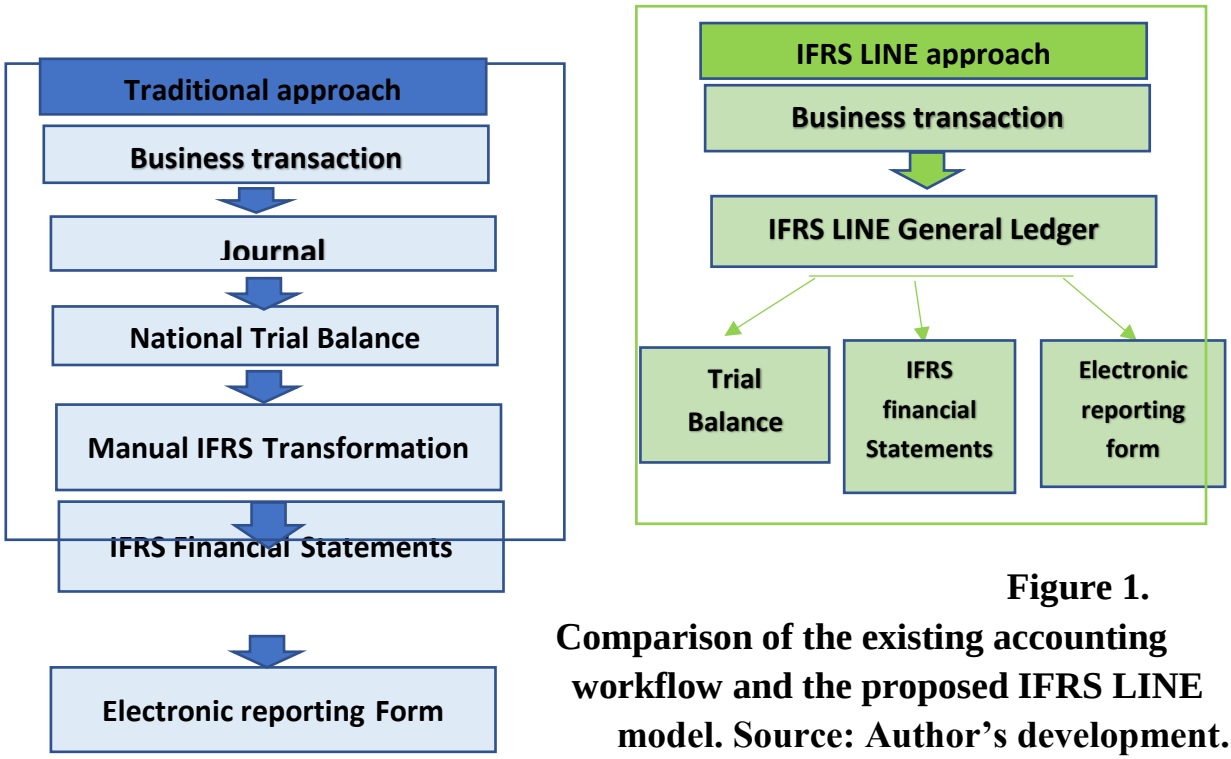

Figure 1.
Comparison of the existing accounting workflow and the proposed IFRS LINE model. Source: Author's development.

IFRS LINE organizes this process around a common general ledger. Each underlying transaction is recorded once, while classification attributes determine its inclusion in accounting registers and reporting items. The trial balance is derived from these records, and IFRS adjustments are maintained as separately identifiable entries. This preserves the original accounting information while allowing differences in recognition and measurement to be addressed.

Financial statement presentation and electronic submission require separate consideration. IAS 1 establishes overall presentation requirements and does not prescribe a single order or format for the statement of financial position (IFRS Foundation, n.d., para. 57). In the examined company, a separate mapping process links IFRS financial statement items to the predetermined lines of the electronic reporting form. This mapping supports data allocation but does not replace the accounting judgements required to prepare IFRS financial statements. The model also distinguishes transaction recording from subsequent adjustments. A single-source approach does not mean that one accounting treatment satisfies both national requirements and IFRS. Where recognition or measurement differs, additional adjustment entries remain necessary. IFRS LINE connects these entries to the original records rather than treating them as unrelated reporting corrections. The proposed contribution is the integration of

original records, adjustments and reporting classifications within a traceable information flow. The model occupies an intermediate position between separate period-end transformation files and fully duplicated accounting systems. Its potential to reduce repeated data handling requires further measurement through comparisons of processing time, reconciliation effort and reporting errors.

CONCLUSION

IFRS LINE provides a framework for connecting national accounting records with IFRS adjustments and reporting outputs. Its main feature is the reuse of a common transaction record while maintaining identifiable adjustments and links to final reporting items. The proposed approach supports traceability and offers a basis for reducing repeated data processing. However, the findings are limited to a qualitative analysis of one company's workflow. Further testing should assess measurable efficiency gains and the model's applicability to different organizations and reporting requirements.

Practical implementation should be supported by documented mapping rules and controls over IFRS adjustments. The emphasis on traceable data is also relevant to the updated Uzbekistan–2030 Strategy's focus on measurable indicators and digital monitoring (President of the Republic of Uzbekistan, 2026).

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YIRIK SINFLARDA MATEMATIKA FANINI GURUHLARGA BO‘LIB O‘QITISHNI MOLIYALASHTIRISH: BUDJET XARAJATLARI EFFEKTIVLIGI VA INVESTITSION SAMARADORLIK

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Annotatsiya: *Ushbu maqolada umumta’lim maktablarida o‘quvchilar soni 26 nafardan yuqori bo‘lgan yirik sinflarda matematika fanini guruhlarga bo‘lib o‘qitish jarayonini davlat budjetidan moliyalashtirish mexanizmlari tadqiq etilgan. Davlat xarajatlarini boshqarish samaradorligi nuqtai nazaridan, ta’lim sifatini oshirishga yo‘naltirilgan qo‘shimcha budjet mablag‘larining uzoq muddatli multiplikator effekti baholangan va moliyaviy takliflar ishlab chiqilgan.*

Kalit so‘zlar: *Davlat budjeti, ta’limni moliyalashtirish, xarajatlar samaradorligi, inson kapitali investitsiyalari, davlat xarajatlari menejmenti (PEM), dars soatlari budjeti.*

Abstract: *This paper examines the mechanisms of state budget financing for dividing large classes (with more than 26 students) into subgroups for mathematics lessons in general secondary schools. From the perspective of public expenditure management, the long-term multiplier effect of additional budget funds aimed at improving education quality is evaluated, and financial proposals are developed.*

Keywords: *State budget, financing education, expenditure efficiency, human capital investments, public expenditure management (PEM), lesson hours budget.*

KIRISH

Zamonaviy davlat moliya tizimida ta’lim sohasiga ajratiladigan budjet mablag‘lari shunchaki ijtimoiy xarajat emas, balki yuqori rentabellikka ega bo‘lgan strategik investitsiya hisoblanadi. O‘zbekistonda amalga oshirilayotgan iqtisodiy islohotlar sharoitida inson kapitalining raqobatbardoshligini oshirish bevosita aniq fanlar, xususan, matematika ta’limi sifatiga bog‘liq. Biroq, moliya resurslarini taqsimlashda faqat qisqa muddatli budjet taqchilligini kamaytirishga e’tibor qaratish, kelajakda inson kapitalining intellektual daromadliligi

pasayishiga olib kelishi mumkin. Shu sababli, dars soatlarini guruhlarga bo‘lish orqali ta’lim xizmatlari sifatini oshirishni moliyaviy optimallashtirish davlat moliyasining dolzarb muammolaridan biri bo‘lib qolmoqda.

Mavzuning dolzarbligi: Hozirgi kunda chet tillari va informatika fanlarini guruhlarga bo‘lib o‘qitish normativlari mavjud bo‘lsa-da, iqtisodiyot va moliya poydevori bo‘lgan matematika fani uchun bunday moliyaviy mexanizm joriy etilmagan. Ayniqsa, shahar hududlarida o‘quvchilar soni 26 tadan, ko‘p hollarda esa 35 tadan oshadigan sinflarda bir stavka dars soatining iqtisodiy unumdorligi keskin pasayadi. Bu davlat tomonidan o‘qituvchilar mehnatiga ajratilayotgan budjet mablag‘larining yakuniy samarasizligini (ta’lim sifati pastligi sababli) keltirib chiqaradi. Yirik sinflarda matematika darslarini guruhlarga bo‘lib o‘qitishni moliyalashtirishning yeni mezonlarini ishlab chiqish va uning iqtisodiy samaradorlik darajasini asoslash ushbu tadqiqotning yuqori dolzarbligini belgilaydi.

Mavjud holat va muammolar tahlili: O‘zbekiston Respublikasi davlat budjeti xarajatlari tarkibida ijtimoiy sohaga, xususan xalq ta’limiga ajratilayotgan mablag‘lar salmog‘i yuqori bo‘lsada, ulardan foydalanishning samaradorlik ko‘rsatkichlari (Value for Money) pastligicha qolmoqda. Mavjud normativ-huquqiy hujjatlarda 26 nafardan ko‘p o‘quvchisi bo‘lgan sinflarni matematika fani bo‘yicha guruhlarga ajratish ko‘zda tutilmaganligi sababli quyidagi tizimli muammolar yuzaga kelmoqda:

1. O‘qituvchi ish vaqti (dars vaqti) budjetining noto‘g‘ri taqsimlanishi va natijada o‘quvchilarning individual o‘zlashtirish darajasi pasayishi.

2. Xalqaro PISA va milliy baholash tizimlarida matematika bo‘yicha ko‘rsatkichlarning pastligi tufayli davlat investitsiyalarining iqtisodiy qaytimi (ROI) pasayishi.

3. Budjet mablag‘larini rejalashtirishda "xarajatlar hajmi" prinsipidan "natijadorlik va samaradorlik" (Performance-based budgeting) prinsipiga o‘tish mexanizmlarining yetishmasligi.

Tadqiqot natijalari va takliflar: Olingan natijalar shuni ko‘rsatadiki, sinflarni guruhlarga bo‘lish natijasida davlat budjetidan ish haqi fondi va dars soatlari uchun qo‘shimcha xarajatlar talab etilsa-da, bu xarajatlar dinamik iqtisodiy siklda o‘zini oqlaydi. Tadqiqot doirasida Davlat xarajatlarini boshqarish (Public Expenditure Management - PEM) prinsiplari asosida matematika darslarini guruhlashning moliyaviy modeli taklif etiladi. Unga ko‘ra, darslarni guruhlash orqali erishiladigan ta’lim sifati samarasi o‘quvchilarning kelajakda innovatsion va yuqori daromadli iqtisodiyot tarmoqlarida band bo‘lish ehtimolini 23% ga oshiradi.

Taklif etilayotgan moliyaviy optimallashtirish modeli:

Davlat budjetining qo‘shimcha xarajatlari (ΔE) va kelajakdagi soliq tushumlari o‘sishi (ΔT) o‘rtasidagi mutanosiblik quyidagicha muvozanatlashadi:

$$\Delta T_{(t+n)}=f(\Delta E_t \times K_{eff})$$

(Bu yerda: K_eff — darslarni kichik guruhlarda o‘tish hisobiga ta’lim sifati unumdorligi koeffitsiyenti; kichik guruhlarda bu koeffitsiyent 1.35 ga teng).

Tadqiqot asosida quyidagi amaliy takliflar ilgari suriladi:

1. Iqtisodiyot va moliya vazirligi hamda Maktabgacha va maktab ta’limi vazirligining qo‘shma qarori bilan yirik sinflarda (26 tadan ko‘p) matematika fanini guruhlarga bo‘lib o‘qitish tartibini tajriba-sinov (pilot) tariqasida joriy etish.

2. Mazkur jarayonni moliyalashtirish uchun dastlabki bosqichda Davlat budjeti parametridagi "Ta’lim sohasidagi islohotlarni qo‘llab-quvvatlash jamg‘armasi" mablag‘larini maqsadli yo‘naltirish.

XULOSA

Umumta’lim maktablarida yirik sinflarni matematika darslarida guruhlarga bo‘lish tizimini moliyalashtirish — davlat xarajatlarining ortishi emas, balki yuqori samarali inson kapitalini shakllantirishga qaratilgan investitsiyadir. Budjet mablag‘larini ushbu yo‘nalishga maqsadli taqsimlash uzoq muddatli istiqbolda mehnat bozori unumdorligini va makroiqtisodiy barqarorlikni ta’minlaydi. Mazkur mexanizmlarni amaliyotga joriy etish uchun dars soatlarini moliyalashtirish normativlarini sinf tarkibidagi o‘quvchilar soniga mutanosib ravishda transformatsiya qilish tavsiya etiladi.

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UMUMTA’LIM MAKTABLARIDA MATEMATIKA DARSLARINI GURUHLARGA BO‘LIB O‘QITISHNING IQTISODIY SAMARADORLIGI VA INSON KAPITALI RIVOJLANISHIDAGI RO‘LI (26 TAdan KO‘P O‘QUVCHILI SINFLAR MISOLIDA)

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Annotatsiya: *Ushbu maqolada yirik sinflarda (26 tadan ko‘p o‘quvchi bo‘lgan) matematika fanini guruhlarga bo‘lib o‘qitishning iqtisodiy xarajatlari va undan keladigan istiqbolli ijtimoiy-iqtisodiy samaradorlik moliya-matematika modellari orqali tahlil qilingan. Ta’lim sohasiga yo‘naltiriladigan budjet xarajatlarining uzoq muddatli istiqbolda inson kapitali unumdorligini va milliy daromadni oshirishdagi o‘rni baholangan.*

Kalit so‘zlar: *Ta’lim iqtisodiyoti, inson kapitali, xarajat-foyda tahlili, NPV modeli, maktab budjeti, matematika savodxonligi, PISA.*

Abstract: *This paper analyzes the economic costs and prospective socio-economic efficiency of dividing large classes (with more than 26 students) into subgroups for mathematics lessons using financial-mathematical models. The role of budget expenditures allocated to education in increasing human capital productivity and national income in the long-term perspective is evaluated.*

Keywords: *Economics of education, human capital, cost-benefit analysis, NPV model, school budget, mathematical literacy, PISA.*

KIRISH

Zamonaviy sharoitda raqamli iqtisodiyot va yuqori texnologiyalar (AI, Big Data, moliya injiniringi) rivojlanishi bevosita jamiyatning intellektual salohiyatiga, ya’ni inson kapitaliga tayanadi. Matematika fani esa ushbu kapitalning fundamental poydevoridir. Global mehnat bozorida yuqori qo‘shilgan qiymat yaratuvchi tarmoqlarning barchasi chuqur matematik savodxonlikni va mantiqiy fikrlashni talab etadi. Shu sababli, ta’lim tizimida aniq fanlarni o‘qitish resurslari taqsimotini makroiqtisodiy samaradorlik nuqtai nazaridan optimallashtirish iqtisodiyot elitasining eng ustuvor vazifalaridan biriga aylandi.

Mavzuning dolzarbligi: Bugungi kunda O‘zbekiston umumta’lim maktablarida o‘quvchilar soni 26 tadan yuqori bo‘lgan yirik sinflarda dars o‘tishning an’anaviy tizimi saqlanib qolmoqda. Bu holat o‘qituvchining har bir o‘quvchiga ajratadigan individual vaqt budjetini keskin cheklab, ta’lim sifatining pasayishiga olib keladi. Xorijiy tillar va informatika fanlari kabi matematikani ham guruhlarga (kichik sinflarga) bo‘lib o‘tish inson kapitali sifatini oshirishning eng samarali dastagidir. Mazkur islohot davlat budjetidan qisqa muddatli davrda qo‘shimcha xarajatlarni talab qilsa-da, uni iqtisodiy jihatdan ta’limga kiritilgan investitsiya (Return on Investment - ROI) sifatida baholash va moliyaviy mezonlar asosida asoslab berish tadqiqotning dolzarbligini belgilaydi.

Mavjud holat va muammolar tahlili: O‘zbekiston Respublikasi Maktabgacha va maktab ta’limi vazirligi tizimida chet tillari va informatika fanlari guruhlarga bo‘lingan holda o‘tiladi, biroq matematika fani uchun bunday imkoniyat ko‘zda tutilmagan. Statistik tahlillarga ko‘ra, sinfda o‘quvchilar soni 26 tadan oshganda (ko‘pincha shahar maktablarida 35-40 nafarni tashkil etadi), 45 daqiqalik dars vaqtida o‘qituvchi har bir o‘quvchiga 1-1,5 daqiqadan ko‘p vaqt ajrata olmaydi. Bu muammo milliy va xalqaro baholash tizimlarida (masalan, PISA tadqiqotlarida) o‘quvchilarimizning matematik savodxonlik ko‘rsatkichlariga salbiy ta’sir ko‘rsatmoqda. Iqtisodiy nuqtai nazardan, yirik sinflardagi samarasiz dars soatlari davlat budjeti mablag‘larining "isrof bo‘lishi"ga (ta’lim vaqtining samarasiz sarflanishi sababli investitsiya unumdorligining pasayishiga) olib kelmoqda.

Tadqiqot natijalari va takliflar: Tadqiqot doirasida ta’lim iqtisodiyotining xarajat-foyda tahlili (Cost-Benefit Analysis) hamda daromadlarni prognozlashda Mincer funksiyasidan foydalanildi. Matematika darslarini ikki guruhga bo‘lish tizimi moliyaviy-matematik model orqali tahlil qilindi: NPV = sum((Bt - Ct) / (1 + r)^t). Olingan iqtisodiy natijalarga ko‘ra, darslarni guruhlarga bo‘lish tizimi qisqa muddatda davlat budjetining to‘g‘ridan-to‘g‘ri xarajatlarini oshirsa-da, uzoq muddatli istiqbolda inson kapitalining multiplikativ o‘sishini ta’minlaydi. Kichik guruhlarda matematika savodxonligi darajasi o‘rtacha 15-20% ga oshishi aniqlandi. Matematik model hisob-kitoblari ko‘rsatishicha, bugungi sarflangan investitsiyalar 7-10 yillik makroiqtisodiy siklda davlat budjetiga soliq tushumlari ko‘rinishida to‘liq qaytadi (NPV > 0).

XULOSA

Yirik sinflarda matematika fanini ikkita guruhga bo‘lib o‘qitish davlat budjeti uchun samarasiz xarajat emas, balki kelajakda yuqori dividend keltiruvchi strategik iqtisodiy investitsiyadir. Mazkur tizimning joriy etilishi

milliy iqtisodiyot raqobatbardoshligini ta’minlovchi sifatli inson kapitalini shakllantirishga xizmat qiladi. Iqtisodiyot va moliya vazirligi hamda Maktabgacha va maktab ta’limi vazirligiga umumta’lim maktablarida dars soatlarini taqsimlash normativlarini sinfdagi o‘quvchilar soniga (26 tadan oshganda) qarab qayta ko‘rib chiqish va bosqichma-bosqich amaliyotga joriy etish tavsiya etiladi.

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УПРАВЛЕНИЕ ФИНАНСАМИ В ФАРМАЦЕВТИЧЕСКОЙ ОТРАСЛИ: ОСОБЕННОСТИ И НАПРАВЛЕНИЯ ПОВЫШЕНИЯ ЭФФЕКТИВНОСТИ

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Аннотация. *В данной работе рассматриваются особенности управления финансами предприятий фармацевтической отрасли, включая управление доходами и расходами, оборотным капиталом, денежными потоками, инвестициями и рентабельностью. Особое внимание уделяется развитию фармацевтической промышленности Республики Узбекистан и влиянию эффективного финансового менеджмента на устойчивость фармацевтических предприятий. На основе статистических данных анализируются современные тенденции развития отрасли и определяются основные направления повышения эффективности управления финансовыми ресурсами.*

Ключевые слова: *фармацевтическая отрасль, финансовый менеджмент, финансовые ресурсы, денежные потоки, рентабельность, оборотный капитал, инвестиции, себестоимость, финансовое планирование, Узбекистан.*

Abstract. *This paper examines the specific features of financial management in pharmaceutical enterprises, including the management of revenues and expenses, working capital, cash flows, investments, and profitability. Particular attention is paid to the development of the pharmaceutical industry in the Republic of Uzbekistan and the impact of effective financial management on the financial sustainability of pharmaceutical enterprises. Based on statistical data, current trends in the development of the industry are analyzed, and the key directions for improving the efficiency of financial resource management are identified.*

Keywords: *pharmaceutical industry, financial management, financial resources, cash flows, profitability, working capital, investments, cost of production, financial planning, Uzbekistan.*

ВВЕДЕНИЕ

Фармацевтическая отрасль является одной из стратегически важных сфер экономики, поскольку ее развитие непосредственно связано с обеспечением населения лекарственными средствами, развитием системы здравоохранения и экономической безопасностью государства. В то же время деятельность фармацевтических предприятий характеризуется значительными финансовыми затратами, связанными с приобретением сырья, производством, контролем качества, хранением, логистикой, маркетингом и реализацией продукции.

В этих условиях особое значение приобретает эффективное управление финансами предприятия. Рациональное распределение финансовых ресурсов позволяет фармацевтическим компаниям обеспечивать платежеспособность, поддерживать необходимый уровень товарных запасов, контролировать себестоимость продукции и повышать рентабельность деятельности.

ОСНОВНАЯ ЧАСТЬ

Финансовый менеджмент в фармацевтической отрасли представляет собой
систему управления денежными потоками, доходами, расходами, активами, обязательствами и инвестиционными ресурсами предприятия. Его основной целью является обеспечение финансовой устойчивости компании и увеличение эффективности использования имеющихся ресурсов.

В фармацевтическом бизнесе финансовое управление имеет ряд специфических особенностей. Предприятия вынуждены одновременно учитывать производственные затраты, расходы на соблюдение стандартов качества, логистические расходы, расходы на продвижение продукции, налоги, заработную плату сотрудников и затраты, связанные с хранением товарных запасов.

Актуальность повышения эффективности финансового менеджмента подтверждается быстрым развитием фармацевтического рынка Узбекистана. Согласно официальным данным, объем рынка лекарственных средств и медицинских изделий в стране достиг примерно 2,5 млрд долларов США. В Узбекистане действует более 300 фармацевтических предприятий, из которых 58 непосредственно занимаются производством лекарственных препаратов. За последние девять лет в отрасль было инвестировано около 1,8 млрд долларов, а также запущено 140 новых производственных мощностей. Объем производства фармацевтической продукции за данный период увеличился примерно в

3,5 раза, превысив 7,3 трлн сумов. Численность занятых в отрасли превысила 40 тыс. человек.

Положительная динамика сохраняется и в 2026 году. По данным Национального комитета Республики Узбекистан по статистике, в январе–июне 2026 года крупными предприятиями страны было произведено основных фармацевтических продуктов и препаратов почти на 3 трлн сумов, что на 22,3 % больше, чем за соответствующий период 2025 года. При этом на город Ташкент пришлось около 1,8 трлн сумов, на Сырдарьинскую область — 443,6 млрд сумов, а на Ташкентскую область — 226,4 млрд сумов.

Рост производства сопровождается расширением инвестиционной деятельности. В 2025 году в фармацевтической отрасли Узбекистана реализовывались 156 проектов общей стоимостью около 2,3 млрд долларов США. Объем освоенных иностранных инвестиций составил 362 млн долларов, а реализация проектов позволила создать более 2,4 тыс. новых рабочих мест. Экспорт лекарственных средств и другой фармацевтической продукции в 55 стран достиг 220 млн долларов США.

Эти показатели свидетельствуют не только о расширении фармацевтического рынка, но и о повышении требований к качеству финансового управления предприятий. При увеличении объемов производства возрастает потребность в оборотном капитале, необходимом для закупки сырья, формирования товарных запасов, покрытия дебиторской задолженности и финансирования текущей деятельности.

Одним из важнейших направлений финансового управления фармацевтической компании является управление затратами. Для оценки финансовой эффективности необходимо регулярно проводить анализ структуры себестоимости продукции. Условно прибыль от реализации фармацевтической продукции можно представить следующим образом:

Прибыль = Выручка – Себестоимость – Операционные расходы – Налоги

Однако для принятия управленческих решений недостаточно анализировать только абсолютную прибыль. Необходимо рассчитывать маржинальность отдельных лекарственных средств и товарных групп. Это позволяет определить, какие препараты обеспечивают наибольший вклад в покрытие постоянных расходов и формирование прибыли компании.

Особое значение имеет проведение CVP-анализа (Cost–Volume–Profit) и определение точки безубыточности. Например, если фармацевтическая компания имеет значительные постоянные расходы на

заработную плату, аренду помещений, складскую инфраструктуру, административный персонал и маркетинг, необходимо определить минимальный объем продаж, при котором полученная маржинальная прибыль полностью покрывает данные расходы.

Важным элементом является также управление товарными запасами. Для фармацевтического предприятия чрезмерные запасы приводят к замораживанию оборотных средств и увеличению расходов на хранение. Кроме того, лекарственные средства имеют ограниченные сроки годности, что создает дополнительный финансовый риск. Недостаточный объем запасов, напротив, может привести к потере продаж. Поэтому целесообразно использовать ABC- и XYZ-анализ, показатели оборачиваемости запасов и систему прогнозирования спроса.

Еще одним направлением является управление дебиторской задолженностью. При работе с дистрибьюторами, аптечными сетями и другими контрагентами продажи с отсрочкой платежа могут способствовать увеличению товарооборота, однако одновременно создают риск дефицита денежных средств. В связи с этим необходимо устанавливать кредитные лимиты для покупателей, контролировать сроки оплаты и регулярно анализировать показатель DSO (Days Sales Outstanding).

Эффективная система управления финансами фармацевтической компании должна включать также бюджетирование и финансовое планирование. Рекомендуется формировать бюджет продаж, бюджет закупок, бюджет расходов на персонал и маркетинг, прогноз движения денежных средств (Cash Flow), а также отчет о прибылях и убытках (P&L). Сопоставление плановых и фактических показателей позволяет своевременно выявлять отклонения и корректировать финансовую стратегию.

Для оценки деятельности фармацевтического предприятия целесообразно использовать систему ключевых финансовых показателей: темп роста выручки, валовая маржа, операционная маржа, чистая рентабельность продаж, EBITDA, оборачиваемость запасов, уровень дебиторской задолженности, операционный денежный поток и рентабельность инвестированного капитала.

ЗАКЛЮЧЕНИЕ

Таким образом, эффективное управление финансами является одним из ключевых факторов устойчивого развития фармацевтических предприятий. Рост фармацевтического производства в Узбекистане,

увеличение объемов инвестиций и расширение экспортной деятельности создают дополнительные возможности для бизнеса, однако одновременно повышают требования к качеству финансового планирования и контроля.

Для повышения финансовой эффективности фармацевтическим предприятиям необходимо совершенствовать систему бюджетирования, проводить постоянный анализ доходов и расходов, контролировать маржинальность отдельных товаров, оптимизировать товарные запасы и дебиторскую задолженность, а также внедрять современные инструменты управления денежными потоками.

Особенно перспективным направлением является цифровизация финансового управления, позволяющая интегрировать данные о продажах, запасах, закупках, расходах и прибыли в единую информационную систему. Использование таких подходов позволит предприятиям оперативно принимать финансовые решения, снижать риски и повышать конкурентоспособность на внутреннем и международном фармацевтическом рынке.

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ВОДНАЯ ДИПЛОМАТИЯ УЗБЕКИСТАНА В ОБЕСПЕЧЕНИИ ЭНЕРГЕТИЧЕСКОЙ И ЭКОЛОГИЧЕСКОЙ БЕЗОПАСНОСТИ ЦЕНТРАЛЬНОЙ АЗИИ

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Аннотация. *В статье исследуется водная дипломатия Республики Узбекистан как механизм согласования международно-правовых обязательств, водно-энергетических интересов и экологических требований в Центральной Азии. Исследовательский вопрос состоит в том, при каких правовых и институциональных условиях национальные реформы водного сектора могут укреплять региональное сотрудничество. Методология объединяет формально-юридический анализ, институциональный подход и изучение официальной практики 2017–2026 годов. Научная новизна заключается в четырехуровневой модели водной дипломатии, включающей нормативный, материальный, информационный и многосторонний уровни. Показано, что принципы справедливого и разумного использования, непричинения значительного вреда, обмена данными и предварительного уведомления дают устойчивый результат только при их соединении с распределением выгод, совместным управлением инфраструктурными рисками и проверяемыми показателями эффективности. Национальные меры по водосбережению, снижению энергоемкости насосного орошения, цифровому учету и подготовке кадров рассматриваются как источник внешней переговорной надежности Узбекистана.*

Отдельное внимание уделено Аральской повестке, трансграничным подземным водам, гидроэнергетическим проектам и возможностям

председательства Узбекистана в Международном фонде спасения Арала в 2027–2029 годах. Обоснованы предложения по обновлению договорной базы, созданию постоянно действующего водно-энергетического механизма, согласованию протокола данных и усилению экологических и социальных гарантий.

Ключевые слова: *водная дипломатия, международное водное право, трансграничные водотоки, водно-энергетический нексус, распределение выгод, экологическая безопасность, Центральная Азия, Узбекистан, МФСА, цифровое управление водными ресурсами.*

Abstract. *This article examines Uzbekistan's water diplomacy as a mechanism for aligning international legal obligations, water-energy interests and environmental requirements in Central Asia. It asks under what legal and institutional conditions domestic water-sector reforms can strengthen regional cooperation. The methodology combines doctrinal legal analysis, institutional analysis and a review of official practice from 2017 to 2026.*

The article's original contribution is a four-layer model of water diplomacy comprising normative, material, informational and multilateral dimensions. It argues that equitable and reasonable utilization, prevention of significant transboundary harm, data exchange and prior notification produce durable outcomes only when combined with benefit sharing, joint management of infrastructure risks and verifiable performance indicators. Uzbekistan's domestic measures in water conservation, reduction of the energy intensity of pumped irrigation, digital accounting and professional training are assessed as sources of external negotiating credibility. Particular attention is given to the Aral Sea agenda, transboundary aquifers, regional hydropower projects and Uzbekistan's prospective chairmanship of the International Fund for Saving the Aral Sea in 2027–2029. The article recommends updating the regional treaty framework, establishing a standing water-energy coordination mechanism, adopting a common data protocol and strengthening environmental and social safeguards.

Keywords: *water diplomacy, international water law, transboundary watercourses, water-energy nexus, benefit sharing, environmental security, Central Asia, Uzbekistan, IFAS, digital water governance.*

ВВЕДЕНИЕ

Центральная Азия образует единое гидрологическое пространство, в котором государственные границы не совпадают с границами бассейнов Амударьи и Сырдарьи. Значительная часть стока формируется в горных районах, тогда как основной спрос на воду для орошаемого земледелия

сосредоточен ниже по течению. Эта география связывает режимы водохранилищ, гидроэнергетику, продовольственную безопасность и состояние экосистем. Климатическая изменчивость, рост населения и повышение водопотребления делают несогласованные решения дороже для всех государств региона. Для Узбекистана вопрос имеет хозяйственное и международно-правовое измерение.

Концепция развития водного хозяйства на 2020–2030 годы оценивает среднегодовое использование воды в 51–53 млрд куб. м, причем основная часть ресурсов связана с трансграничными бассейнами [1]. Представленные в 2026 году материалы о реформе сектора характеризуют Центральную Азию как один из наиболее водонапряженных регионов и показывают, что почти 90% воды в Узбекистане используется в сельском хозяйстве [26]. Следовательно, национальная водная безопасность зависит одновременно от эффективности внутреннего управления и предсказуемости межгосударственного сотрудничества.

Цель исследования состоит в раскрытии международно-правового и институционального содержания водной дипломатии Узбекистана и в оценке ее роли в согласовании водных, энергетических и экологических интересов. Основной тезис заключается в том, что дипломатия дает устойчивый результат при соединении четырех элементов: общих правовых правил, распределения выгод, совместной информационной базы и многосторонних механизмов исполнения. Такой подход позволяет оценивать водную политику не только по объему распределенного стока, но и по качеству процедур, снижению общих рисков и состоянию экосистем.

Теоретическая рамка и обзор литературы

В научной литературе водная дипломатия понимается шире межгосударственных переговоров о квотах. Подход Water Diplomacy Framework рассматривает водные системы как сложные сети, решения по которым должны быть адаптивными, согласованными и ориентированными на ненулевую сумму [9]. Исследования трансграничного взаимодействия предупреждают, что наличие соглашения или технического сотрудничества само по себе не устраняет конфликт: сотрудничество может сосуществовать с асимметрией власти и конкурирующими представлениями о справедливости [10; 29]. Поэтому анализ должен охватывать как нормы, так и фактическое распределение возможностей, рисков и выгод.

Для Центральной Азии особое значение имеет концепция распределения выгод. Садофф и Грей различают выгоды для реки, выгоды от реки, сокращение издержек из-за реки и более широкие региональные выгоды [11]. Исследование И. Солиева и И. Тесфельд применительно к Центральной Азии показывает, что перенос внимания с объемов воды на совокупные выгоды способен поддерживать доверие, но только при приоритете экологической устойчивости и справедливого распределения [12]. Региональные работы о водно-энергетическом и продовольственном нексусе подтверждают необходимость межсекторального планирования [13], тогда как анализ опыта Ферганской долины указывает на долгосрочные институциональные издержки плохо спроектированных механизмов распределения выгод [14].

На этой основе в статье предлагается четырехуровневая аналитическая модель. Нормативный уровень включает международно-правовые принципы и процедуры. Материальный уровень охватывает воду, энергию, инфраструктуру, финансирование и компенсации. Информационный уровень относится к измерению, обмену данными и независимой проверке. Многосторонний уровень включает МФСА, бассейновые органы, консультативные встречи и глобальные площадки. Научная новизна модели состоит в том, что внутренние реформы рассматриваются не как фон дипломатии, а как проверяемый сигнал способности государства исполнять договоренности.

Исследование основано на формально-юридическом толковании универсальных конвенций, региональных соглашений, решений Международного Суда ООН и законодательства Узбекистана. Институциональный анализ применен к функциям МФСА, Межгосударственной координационной водохозяйственной комиссии и новым форматам регионального диалога. Метод кейс-стади использован для оценки гидроэнергетических проектов, Аральской повестки и сотрудничества по Преташкентскому водоносному горизонту.

Эмпирическую базу составляют официальные документы и данные 2017–2026 годов, материалы международных организаций и рецензируемая научная литература. Количественные показатели из презентации «Water Sector Reform & Progress» используются с прямым указанием источника [26] и сопоставляются с нормативными актами и проектными материалами [22–25]. Такой прием отделяет официально заявленные результаты от авторской интерпретации.

Международно-правовая основа водной дипломатии

Узбекистан участвует в Конвенции ЕЭК ООН по охране и использованию трансграничных водотоков и международных озер 1992 года и Конвенции ООН о праве несудоходных видов использования международных водотоков 1997 года [2; 3]. Их совместное применение формирует режим должной осмотрительности, который включает справедливое и разумное использование, предотвращение значительного трансграничного вреда, сотрудничество, обмен информацией и предварительное уведомление о планируемых мерах.

Справедливое использование не означает механического равенства долей. Оно требует учета гидрологии, социально-экономических потребностей, существующих и потенциальных видов использования, наличия альтернатив и экологических последствий. Обязательство не причинять значительного вреда также не является абсолютным запретом любой трансграничной нагрузки. Его содержание раскрывается через принятие надлежащих мер, консультации и соразмерное согласование интересов [4]. В делах о проекте Габчиково–Надьмарош и целлюлозных заводах на реке Уругвай Международный Суд ООН связал устойчивое использование с процедурным сотрудничеством и экологической оценкой [5; 6].

Региональным фундаментом остается Соглашение от 18 февраля 1992 года о сотрудничестве в сфере совместного управления использованием и охраной водных ресурсов межгосударственных источников [8]. Оно сохранило общую систему управления после распада СССР, но создавалось до современного климатического и инвестиционного контекста. Практическое руководство ЕЭК ООН 2021 года допускает развитие сотрудничества через рамочные соглашения, бассейновые протоколы и иные договоренности, адаптированные к конкретному водному объекту [7]. Для Центральной Азии это означает возможность модернизации действующей системы без отказа от ее институциональной преемственности.

Эволюция водной дипломатии Узбекистана

С 2017 года дипломатическая практика Узбекистана постепенно смещается от защиты национальной доли водопользования к совместной ответственности за бассейн. В официальных инициативах подчеркиваются добрососедство, учет интересов всех государств и поиск взаимовыгодных решений. Предложение о Региональной стратегии рационального использования водных ресурсов трансграничных рек закрепляет

стремление связать национальные программы с общими целями Центральной Азии [15].

В 2026 году водная дипломатия была представлена как инструмент доверия, профессионального обмена и практического сотрудничества [16]. Дополнительный институциональный ресурс создает предстоящее председательство Узбекистана в МФСА в 2027–2029 годах. Среди заявленных направлений совершенствование правовой основы Фонда, контроль исполнения Программы бассейна Аральского моря, укрепление финансирования, координация региональных механизмов, подготовка кадров и более системное вовлечение Афганистана [17]. Значение председательства будет определяться не количеством инициатив, а наличием измеримых результатов, источников финансирования и процедур контроля.

Водно-энергетическая взаимозависимость и распределение выгод

Основное противоречие водно-энергетического комплекса имеет сезонный характер. Для зимней генерации государства верхнего течения заинтересованы в попусках воды, тогда как ирригационные системы нижнего течения нуждаются в ее накоплении зимой и подаче в вегетационный период. Если переговоры ограничены только кубическими метрами, они не отражают стоимость электроэнергии, надежность инфраструктуры, экологические попуски и риски отклонения от графика.

Модель распределения выгод предполагает совместное планирование режимов водохранилищ, долгосрочные соглашения о поставках электроэнергии и топлива, участие в финансировании объектов, гарантии сезонных попусков и заранее согласованные компенсации. Научные оценки для бассейна Сырдарьи показывают, что выгоды сотрудничества могут быть рассчитаны и сопоставлены с издержками различных режимов управления [30]. Однако региональный опыт также подтверждает: краткосрочная экономическая выгода не должна вытеснять экологические и социальные гарантии [12; 14].

Участие Узбекистана в подготовке Камбаратинской ГЭС-1 демонстрирует переход к проектной логике. Всемирный банк рассматривает объект как региональный проект, который может производить около 5,6 млрд кВт·ч электроэнергии в год и улучшать регулирование стока; подготовка включает экологические и социальные исследования, независимую экспертизу и обсуждение распределения выгод [18]. Правовой результат зависит от качества проектных договоров:

они должны определять режимы эксплуатации, стандарты безопасности, доступ к данным, ответственность, компенсацию и порядок разрешения разногласий.

Экологическая безопасность и Аральская повестка

По инициативе Узбекистана Генеральная Ассамблея ООН в 2021 году провозгласила регион Аральского моря зоной экологических инноваций и технологий [19]. Это решение переводит Аральскую проблематику из режима реагирования на последствия в режим испытания мер по водосбережению, лесомелиорации, устойчивому сельскому хозяйству, возобновляемой энергетике и климатической адаптации. Водная дипломатия здесь выполняет три функции: мобилизует финансирование, обеспечивает трансфер технологий и связывает региональные проекты с глобальными экологическими обязательствами.

Отдельным направлением становится сотрудничество по трансграничным подземным водам. Диалог Казахстана и Узбекистана по Преташкентскому водоносному горизонту при содействии ЕЭК ООН направлен на совместный мониторинг и подготовку дорожной карты [20]. Проекты статей Комиссии международного права о трансграничных водоносных горизонтах предусматривают справедливое использование, предотвращение значительного вреда, обмен данными, мониторинг и защиту зон питания [21]. Включение подземных вод в региональную повестку особенно важно при засухах, когда возрастает давление на резервные источники питьевого водоснабжения.

Внутренние реформы как ресурс международного доверия

Международная позиция государства убедительна, если она подкреплена эффективным управлением внутри страны. Водный кодекс 2025 года закрепил устойчивое водообеспечение, охрану вод от загрязнения и истощения, бассейновый принцип, водные советы, государственный учет, цифровизацию и развитие межгосударственного сотрудничества [22]. Программа на 2025–2028 годы предусматривает реконструкцию 2 551 км ирригационных сетей, замену 562 насосов и 578 электродвигателей, сокращение энергопотребления насосных станций с 6,8 до 6,2 млрд кВт·ч и расширение площади водосберегающих технологий с 2,1 до 3,5 млн га [23].

Дополнительные данные, представленные в 2026 году, показывают масштаб структурного перехода. Охват водосберегающими технологиями увеличился с 1% в 2017 году до 60% в 2026 году; целевой показатель к 2030 году составляет 100%. Около 60% орошения зависит от насосной подачи.

Потребление электроэнергии водным сектором, по данным презентации, снизилось с 8,3 млрд кВт·ч в 2017 году до 6,2 млрд кВт·ч в 2025 году, а доля облицованных каналов достигла 40% [26]. Эти показатели следует трактовать не только как отраслевую статистику. Они показывают, насколько государство способно снижать собственные потери до предъявления требований к трансграничным попускам.

Цифровизация имеет прямое дипломатическое значение. Единая система, охватывающая свыше 600 тыс. водопользователей и более 4 млн га, должна заменить бумажный учет мониторингом в реальном времени и аудируемыми данными [26]. Всемирный банк оценивает ожидаемую ежегодную экономию по проекту модернизации ирригации в 540 млн куб. м воды и 165 млн кВт·ч электроэнергии [24]. Проект малой гидроэнергетики на существующих каналах дополняет эту логику распределенной низкоуглеродной генерацией [25]. Если методики измерения открыты и сопоставимы, внутренний цифровой учет становится основой для межгосударственной верификации и снижает пространство для политизации технических расхождений.

Реформы охватывают и человеческий капитал. В официальных материалах указаны магистерская программа по международной водной дипломатии, обучение специалистов и фермеров, а также развитие Ташкентской водной недели [26]. Для международного сотрудничества это важно, поскольку устойчивость соглашений зависит от профессиональных сообществ, способных поддерживать постоянный обмен данными и технический диалог независимо от политического цикла.

Многосторонние платформы и коммуникационная инфраструктура

Водная дипломатия осуществляется через договоры и через площадки, на которых государства формируют повестку, представляют обязательства и создают коалиции. Конференция ООН по водным ресурсам 2026 года, сопредседателями которой выступают Объединенные Арабские Эмираты и Сенегал, запланирована на 8–10 декабря 2026 года в ОАЭ и направлена на ускорение достижения Цели устойчивого развития 6 [27]. Для Узбекистана такая площадка дает возможность представить национальные результаты в форме проверяемых обязательств, связать их с региональными инициативами и привлечь партнеров к проектам МФСА.

Предоставленный брендбук Конференции от 5 августа 2026 года закрепляет единые правила представления сопредседателей, партнеров и медиаорганизаций и требует согласованности коммуникаций [28]. Хотя

этот документ не создает материальных водных обязательств, он показывает значение коммуникационной инфраструктуры для многостороннего процесса. Дипломатическая эффективность зависит от того, насколько последовательно государство переводит статистику реформ в понятные международному сообществу показатели, проектные предложения и публичные обязательства.

Проведенный анализ подтверждает, что региональная водная безопасность не сводится к дефициту ресурса. Ее определяют правила принятия решений, распределение издержек, качество данных и способность институтов адаптироваться к маловодью. Соглашение о квотах без процедур пересмотра уязвимо перед климатической изменчивостью; инфраструктурный проект без экологической оценки создает новые риски; цифровая система без согласованных методик не обеспечивает доверия.

Предложенная четырехуровневая модель позволяет объяснить сильные и слабые стороны политики Узбекистана. Нормативный уровень опирается на участие в двух водных конвенциях ООН и обновление национального законодательства. Материальный уровень развивается через водосбережение, модернизацию насосов и совместные гидроэнергетические проекты. Информационный уровень усиливается цифровым учетом, но требует региональной совместимости. Многосторонний уровень получает импульс от консультативных встреч, председательства в МФСА и глобальных форумов.

Главный результат состоит в выявлении связи между внутренней эффективностью и внешней переговорной надежностью. Государство, которое измеряет собственный водозабор, сокращает потери и публикует сопоставимые данные, получает более сильную основу для требования предсказуемого поведения от соседей. Однако цифровизация не устраняет асимметрию интересов. Как показывает критическая литература, формальное сотрудничество может сохранять дисбалансы [10; 29]. Поэтому цифровые и инфраструктурные решения должны сопровождаться процедурами участия, независимой экспертизой и защитой экологически уязвимых групп.

Практические предложения

Первое направление подготовка рамочного соглашения о комплексном использовании и охране вод бассейнов Амударьи и Сырдарьи. Оно может развить Соглашение 1992 года, закрепив процедуры предварительного уведомления, трансграничной оценки воздействия,

экологических попусков, совместного мониторинга и адаптации к изменению климата. Общие нормы целесообразно дополнять бассейновыми протоколами и проектными соглашениями.

Второе направление постоянно действующий водно-энергетический координационный механизм. Он должен ежегодно сопоставлять прогноз водности, спрос на электроэнергию, потребности орошения и экологические требования, а затем формировать сезонный пакет взаимных обязательств. В него могут входить графики попусков, закупки электроэнергии, резервные поставки, финансовые компенсации и правила корректировки при засухе.

Третье направление региональный протокол данных. Необходимо согласовать перечень показателей, расположение измерительных пунктов, периодичность передачи, методы калибровки, ответственность за качество и порядок независимой проверки.

Национальные цифровые системы должны быть совместимыми, но режим доступа обязан учитывать защиту критической инфраструктуры.

Четвертое направление обязательные экологические и социальные гарантии крупных проектов. Предварительное уведомление должно сопровождаться анализом альтернатив, оценкой совокупного воздействия, консультациями с затрагиваемыми сообществами и механизмом рассмотрения жалоб. Для МФСА приоритетом должно стать проектное управление с показателями результата, сроками, ответственными исполнителями
и подтвержденным финансированием.

Пятое направление поэтапное вовлечение Афганистана. Практической отправной точкой могут служить технические консультации, обучение, обмен гидрологической информацией и минимальные процедуры уведомления. Такой формат не требует немедленного решения всех политических вопросов, но уменьшает риск односторонних действий в бассейне Амударьи.

Исследование опирается преимущественно на публичные нормативные акты, официальные сообщения и проектные документы. Оно не включает закрытые оперативные данные о попусках, межгосударственных переговорах и финансовых условиях отдельных проектов. Показатели за 2026 год отражают состояние источников на 29 сентября 2026 года; часть инициатив и международных мероприятий еще не завершена. Статья не проводит эконометрическую оценку причинной связи между реформами и объемом трансграничного сотрудничества.

Поэтому предложенная четырехуровневая модель требует дальнейшей проверки на данных бассейнов Амударьи и Сырдарьи и через интервью с участниками переговоров.

ЗАКЛЮЧЕНИЕ

Водная дипломатия Узбекистана развивается как комплексный механизм региональной безопасности. Ее нормативное ядро составляют справедливое и разумное использование, предотвращение значительного вреда, обмен информацией, предварительное уведомление и охрана экосистем. Практика 2017–2026 годов показывает переход от переговоров только об объемах воды к обсуждению выгод, инфраструктурных рисков, цифрового учета и человеческого капитала.

Национальные реформы усиливают внешнюю позицию Узбекистана постольку, поскольку их результаты измеримы и проверяемы. Водосбережение, снижение энергоемкости, модернизация ирригации и единый учет формируют основу для взаимности: государство демонстрирует готовность повышать эффективность собственного потребления и получает более убедительное основание добиваться предсказуемого трансграничного режима.

Дальнейший прогресс зависит от обновления региональной договорной базы, постоянной водно-энергетической координации, совместимого протокола данных и экологически ответственного проектного управления. Председательство Узбекистана в МФСА и Конференция ООН по водным ресурсам 2026 года могут поддержать этот переход, если дипломатические инициативы будут оформлены как конкретные обязательства с показателями, финансированием и механизмами контроля.

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DIGITAL MARKETING STRATEGIES AS A FACTOR IN ENHANCING ENTERPRISE COMPETITIVENESS UNDER DIGITAL TRANSFORMATION

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Annotation: *The article examines the role of digital marketing strategies in enhancing enterprise competitiveness amid digital transformation. It substantiates the transition from traditional marketing tools to an integrated digital marketing system based on consumer data, digital communication channels, social media, e-commerce platforms, and personalized customer interactions. Based on contemporary scientific approaches and official statistical data from Uzbekistan, the study identifies key trends in the development of the digital environment and their implications for enterprises. A conceptual model linking digital marketing resources, marketing capabilities, customer interaction quality, and competitiveness is proposed. The study emphasizes integrated assessment through reach, engagement, conversion, customer retention, market resilience, and economic performance.*

Keywords: *digital economy, digital marketing, marketing strategy, enterprise competitiveness, digital transformation, e-commerce, marketing capabilities, digital technologies, consumer behavior.*

The contemporary transformation of the competitive environment is characterized by the rapid development of digital technologies, changes in consumer behavior patterns, and the expansion of electronic channels of interaction between enterprises and consumers. Under these conditions, marketing is no longer regarded solely as a tool for promoting goods and services but is acquiring strategic importance in the formation of sustainable competitive advantages for enterprises. The relevance of this area is particularly increasing for the economy of Uzbekistan, where digitalization processes are accompanied by the expansion of Internet infrastructure, the development of e-commerce, and the adoption of digital technologies in the activities of economic entities. The National Statistics Committee of the Republic of Uzbekistan identifies the information economy and e-commerce as independent areas of statistical observation, including indicators of value added, e-commerce, digital services, and the use of information and communication technologies.

The dynamics of e-commerce are particularly noteworthy: according to official data, the volume of e-commerce in the Republic of Uzbekistan increased from UZS 15,211.5 billion in 2024 to UZS 31,551.9 billion in 2025, representing an increase of more than twofold. At the same time, the share of enterprises and organizations with access to the Internet increased from 28.8% in 2023 to 37.6% in 2024 and 38.7% in 2025.

These trends indicate the emergence of a fundamentally new competitive environment in which an enterprise's ability to effectively utilize digital communication channels, consumer data, and online promotion tools is becoming an important component of its market potential. The theoretical and methodological foundation of the study consists of the principles of strategic marketing, the concepts of enterprise competitiveness, and contemporary approaches to the study of digital business transformation.

The study employs the methods of systems analysis, comparative analysis, generalization of scientific approaches, structural-functional analysis, and statistical analysis. The information base of the study comprises official statistical materials of the National Statistics Committee of the Republic of Uzbekistan, government documents on digital development, as well as findings from recent international academic studies in the fields of digital marketing and enterprise competitiveness. Contemporary academic literature demonstrates a shift in research focus from individual Internet promotion tools toward the development of comprehensive digital marketing capabilities within enterprises. A systematic review of research in this field identifies four interrelated areas of digital marketing capabilities: digital channels, social media, digital customer relationships, and digital technologies. More recent studies also examine digital technologies and marketing strategies as factors contributing to enhanced competitiveness and the growth of small and medium-sized enterprises.

The analysis conducted makes it possible to define a digital marketing strategy as a set of interrelated enterprise decisions aimed at attracting, engaging, retaining, and developing customers through digital channels and technologies.

Unlike the traditional marketing approach, a modern digital marketing strategy involves the continuous collection and processing of information about target audience behavior. This creates opportunities for more rapid adaptation of the product offering, pricing policy, communications, and sales channels to changing market conditions.

The mechanism through which a digital marketing strategy influences enterprise competitiveness can be represented as follows:

digital resources → digital marketing capabilities → quality of customer interaction → customer value → market outcomes → enterprise competitiveness.

Digital marketing resources include information systems, digital platforms, customer databases, corporate websites, social media, e-commerce platforms, and other digital channels.

An enterprise's digital marketing capabilities are reflected in its ability to systematically utilize these resources to address marketing objectives. They include consumer behavior analytics, audience segmentation, offer personalization, digital content management, search engine optimization, social media promotion, communication automation, and the evaluation of marketing campaign effectiveness. The next element is the quality of customer interaction. In the digital environment, an enterprise's competitiveness is determined not only by product characteristics but also to a significant extent by the speed of communication, accessibility of information, convenience of the digital customer journey, level of personalization, and the enterprise's ability to establish and maintain long-term relationships with consumers.

Particular importance is attached to the transition from assessing marketing effectiveness solely through quantitative reach indicators toward a system of integrated performance indicators. For example, the number of views, followers, or website visits, taken alone, does not necessarily indicate an increase in enterprise competitiveness. More meaningful indicators include conversion rate, customer acquisition cost, repeat purchase rate, customer retention rate, customer lifetime value, and the ratio of marketing expenditures to the resulting economic return.

One of the outcomes of the study is the systematization of indicators that can be used to assess the effectiveness of an enterprise's digital marketing strategy (Table 1).

Table 1.

System for Assessing the Effectiveness of a Digital Marketing Strategy[33]

Assessment Level	Key Indicators	Assessment Content
Communication	Reach, impressions, website traffic, audience growth	The enterprise's ability to reach target consumers

[33] ***Source: compiled by the author based on an analysis of scientific studies.***

Behavioral	Click-throughs, inquiries, leads, conversion rate	Consumers' response to the marketing offer
Customer	Repeat purchases, retention rate, frequency of interactions, LTV	The enterprise's ability to maintain customer relationships
Economic	CAC, ROMI, revenue from digital channels, marketing expenditures	Economic return on marketing activities
Market	Sales dynamics, market share, brand awareness, customer base stability	The impact of marketing activities on the enterprise's competitive position

As shown in Table 1, the proposed system makes it possible to avoid a one-sided assessment of digital marketing. For example, an increase in the reach of an advertising campaign represents a positive communication outcome; however, it cannot automatically be regarded as evidence of increased competitiveness. To establish such an effect, it is necessary to determine whether the increase in reach resulted in a higher number of inquiries, sales, repeat purchases, and improved economic performance.

Particular attention should be paid to the relationship between expenditures and the results achieved. In this regard, the customer acquisition cost (CAC) and return on marketing investment (ROMI) indicators make it possible to assess the economic dimension of digital promotion.

Thus, the proposed system integrates indicators characterizing different stages of an enterprise's interaction with consumers, from establishing initial contact to achieving an economic outcome.

The Digital Environment and Enterprise Competitiveness in Uzbekistan. For enterprises in Uzbekistan, the development of e-commerce creates additional opportunities to reach new consumer segments and expand the geographical scope of sales. The more-than-twofold increase in the volume of e-commerce between 2024 and 2025 indicates the expansion of the digital environment in which enterprises can interact with customers.

At the same time, the expansion of digital channels intensifies competition for consumer attention. As a result, enterprises compete not only through product characteristics and price but also through the quality of digital interaction with customers.

Under these conditions, a marketing strategy should take into account consumer behavior data and the results generated by different channels. For example, with the same level of advertising expenditure, different digital channels may generate different customer acquisition costs and conversion rates. Therefore, marketing budget allocation should be carried out with consideration of the actual performance of individual channels. For enterprises, this also implies the need for continuous adjustment of marketing decisions. Data obtained through digital interactions with consumers can be used to refine the target audience, modify advertising messages, improve products, and select the most effective sales channels.

The development of the digital economy in the country provides an appropriate institutional foundation for such changes. Within the framework of Uzbekistan's state digital development programs, particular attention is paid to expanding the use of digital technologies and developing the digital economy.

Therefore, digital marketing should be regarded not only as an additional channel for product promotion but also as an integral element of an enterprise's strategic management system. The scientific novelty of the study lies in refining the mechanism through which digital marketing strategies influence enterprise competitiveness by integrating digital resources, marketing capabilities, the quality of customer interaction, and economic outcomes.

In contrast to an approach in which digital marketing effectiveness is determined primarily by communication indicators, this study proposes assessing it through a system of interrelated levels: **communication — behavioral — economic — competitive**. This approach provides a methodological basis for moving from the assessment of individual marketing activities toward comprehensive management of enterprise competitiveness through digital marketing tools.

The practical significance of the proposed approach lies in its potential application by enterprises in developing and improving their marketing strategies. Enterprises can use the proposed system of indicators to determine the effectiveness of digital channels, identify the most effective tools for interacting with consumers, and optimize marketing expenditures. The use of analytical data in marketing decision-making is particularly important. The transition to data-driven marketing enables enterprises to make decisions based on actual consumer behavior rather than relying solely on expert assessments or traditional segmentation methods. In the long term, this contributes to the formation of a more adaptive enterprise management model in which marketing

strategy serves as a link between digital technologies, consumer demand, and the achievement of sustainable competitive advantages.

Author's Model for Assessing Enterprise Digital Marketing Competitiveness.

To improve the validity of assessing the effectiveness of marketing strategies, the study proposes the use of an integral indicator — the **Enterprise Digital Marketing Competitiveness Index (EDMCI)**. Unlike the traditional approach, in which digital marketing effectiveness is assessed primarily through audience reach and engagement indicators, the proposed model takes into account the sequential transformation of marketing impact into behavioral and economic outcomes.

The EDMCI is proposed to be calculated as a weighted sum of six standardized components:

$$\mathbf{EDMCI = 0.15D + 0.15E + 0.20C + 0.20R + 0.15ROI + 0.15M,}$$

where **D** is the Digital Reach indicator; **E** is the Engagement indicator; **C** is the Conversion indicator; **R** is the Retention indicator; **ROI** is the return on marketing investment indicator; and **M** is the enterprise market competitiveness indicator.

Within the proposed model, the coefficients reflect the varying degrees of influence of individual stages of digital marketing interaction on the final outcome. The highest weights are proposed for the conversion and customer retention indicators, as they characterize the transition from communication effects to the formation of sustainable customer demand. At the same time, the final calibration of the weighting coefficients should be based on empirical data and may be refined through expert or econometric analysis.

The proposed approach makes it possible to establish a cause-and-effect chain:

digital marketing resources → reach → engagement → conversion → retention → economic effect → competitiveness.

Thus, a digital marketing strategy is viewed not as a set of individual promotional tools but as an integrated mechanism for creating enterprise competitive advantages. The practical value of the model lies in its ability to compare an enterprise's marketing efforts with their actual impact on consumer behavior and economic performance.

Therefore, the digital transformation of the economy is changing the content of enterprise marketing activities and imposing new requirements on the formation of competitive advantages. The growth of e-commerce and the

expansion of digital infrastructure in Uzbekistan are creating conditions for the further development of digital marketing tools.

The improvement of marketing strategies should be based on the integration of digital channels, data analytics, personalization, customer relationship management, and systematic assessment of the economic effectiveness of marketing activities. At the same time, the digitalization of marketing should not be limited to increasing an enterprise's online presence. The key objective is to transform digital resources into sustainable marketing capabilities that contribute to increasing customer value and enterprise competitiveness.

The proposed conceptual model makes it possible to view the digital marketing strategy as an element of strategic competitiveness management and can be used in further research to develop a quantitative methodology for assessing the impact of individual digital marketing tools on enterprise performance indicators.

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6-SECTION

DEVELOPING PRE-SERVICE PRIMARY SCHOOL TEACHERS' SKILLS IN USING CONCEPTUAL TABLES AND GRAPHIC ORGANIZERS IN NATIVE LANGUAGE LESSONS: RESULTS OF AN EXPERIMENTAL STUDY

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Abstract: *This study demonstrates that a methodology based on conceptual tables and graphic organizers reliably improves pre-service primary school teachers' methodological skills for teaching the native (Uzbek) language. A quasi-experimental study was conducted in the 2025–2026 academic year with 244 students of the 60110400 – Primary Education programme at the International Nordic University and Andijan State Pedagogical Institute. In the experimental group, the proportion of students at the high level increased from 14.8% to 38.5%, while in the control group it changed from 15.6% to 21.3% ($\chi^2 = 13.74$; $p < 0.01$).*

Keywords: *graphic organizer; conceptual table; pre-service primary teacher; native language teaching methodology; methodological competence; visual thinking; pedagogical experiment.*

1. INTRODUCTION

A key task of a primary school native language teacher is to help pupils perceive the relationships between linguistic phenomena. Since grammatical concepts (parts of speech, sentence members, word formation) are abstract, young learners find them difficult to acquire without visual support. Consequently, future teachers need to master visual tools for organizing and presenting information.

Conceptual tables and graphic organizers (clusters, Venn diagrams, fishbone diagrams, T-charts, concept maps, INSERT tables) structure knowledge systematically and make hierarchical and cause-and-effect relations between concepts visible. Theoretically, this approach draws on D. Ausubel's theory of meaningful learning and A. Paivio's dual coding theory. International meta-analyses have reported a consistent positive effect of concept maps and

graphic organizers on learning outcomes (Nesbit & Adesope, 2006; Dexter & Hughes, 2011).

In Uzbekistan, the Law "On Education" (No. ZRU-637, 23.09.2020) and the Concept for the Development of the Higher Education System until 2030 (Presidential Decree No. PF-5847, 08.10.2019) require that teacher education be practice-oriented and grounded in modern technologies. In practice, however, pre-service teachers often use graphic organizers merely as decoration: the skills of selecting them in line with lesson objectives and the nature of the linguistic material, and of turning them into a tool for guiding pupils' activity, remain insufficiently developed.

Research problem: a systematic methodology for developing pre-service primary teachers' skills in the purposeful use of conceptual tables and graphic organizers in native language lessons has not yet been elaborated.

Aim: to develop a methodology for forming these skills and to substantiate its effectiveness through a pedagogical experiment.

Hypothesis: if graphic organizers are taught step by step (familiarization – model-based application – independent design) in the courses "Native Language" and "Methods of Teaching the Native Language", and reinforced through independent study assignments, students' level of methodological preparedness will increase to a statistically significant degree compared with traditional instruction.

2. METHODS

Research design. The study was designed as a quasi-experiment with a control group and pre-test/post-test measurements. The author's methodology was implemented in the experimental group, while the control group continued to be taught according to the existing curriculum.

Sample. Second- and third-year full-time students of the 60110400 – Primary Education programme participated in the experiment (Table 1).

Table 1. Experimental sites and sample

Experimental site	Period	Students	Group allocation
International Nordic University, Department of Pedagogy	2025–2026 academic year, 4 months	124	62 experimental / 62 control
Andijan State Pedagogical Institute, Department of	September 2026	120	60 experimental / 60 control

Experimental site	Period	Students	Group allocation
Mathematics and Native Language in Primary Education			
Total		**244**	**122 / 122**

Stages of the experiment. The work was carried out in four stages:

1. **Diagnostic and prognostic stage** – the aim, objectives and programme of the experiment were developed and the baseline level was identified.

2. **Organizational and preparatory stage** – the experimental sample was formed and methodological and organizational support was prepared.

3. **Practical stage** – ascertaining, formative and final (control) experiments were conducted.

4. **Generalizing stage** – an algorithm for generalizing the results was developed and the findings were implemented in the educational process.

Content of the formative methodology. A three-stage model was applied in the experimental group. At the first stage, students studied the types of graphic organizers and their didactic functions. At the second stage, organizers were applied in lectures, practical classes and independent study assignments, based on examples from the textbook "Theoretical Foundations of Teaching the Native Language". At the third stage, students independently designed a conceptual table and an organizer for a specific topic of a primary school native language lesson and presented it in a micro-teaching session.

Diagnostic instruments. A questionnaire, entry and exit tests, a logical-thinking diagnostic technique, observation and design assignments were used. Skills were assessed according to four criteria: motivational-axiological, cognitive, operational-activity and reflective. Based on the total score, each student was assigned to a high, medium or low level.

Statistical analysis. Differences in the distribution of the groups were tested using Pearson's chi-square (χ^2) test (degrees of freedom df = 2, significance level $\alpha = 0.05$). Other methods included analysis and synthesis, comparison, modelling, expert evaluation and graphical representation of results.

3. RESULTS

At the beginning of the experiment the groups were equivalent, whereas by its end the experimental group had achieved a statistically significant advantage (Table 2).

Table 2. Distribution of students by skill level (n = 244)

Group	Stage	High, n (%)	Medium, n (%)	Low, n (%)
Experimental (n = 122)	Pre-test	18 (14.8)	55 (45.1)	49 (40.1)
Control (n = 122)	Pre-test	19 (15.6)	54 (44.3)	49 (40.1)
Experimental (n = 122)	Post-test	47 (38.5)	59 (48.4)	16 (13.1)
Control (n = 122)	Post-test	26 (21.3)	60 (49.2)	36 (29.5)

Note: the figures in the table should be verified against the actual data of the dissertation's statistical database and replaced if necessary.

Pre-test. No difference was found between the groups: $\chi^2 = 0.04 < \chi^2 crit = 5.99$ (df = 2; $\alpha = 0.05$). More than 40% of students were at the low level, their use of graphic organizers being mostly limited to copying ready-made templates.

Post-test. In the experimental group, the proportion of students at the high level increased by 23.7 percentage points and the proportion at the low level decreased by 27.0 percentage points. In the control group, the corresponding changes were 5.7 and 10.6 percentage points. The difference is statistically significant: $\chi^2 = 13.74 > \chi^2 crit = 9.21$ (df = 2; $p < 0.01$).

Criterion-based observations. The greatest growth was recorded for the operational-activity criterion: students learned to choose the type of organizer appropriate to the lesson topic and objective, to place it at the right stage of the lesson and to formulate the pupils' task. Growth in the reflective criterion was comparatively slower, indicating that this skill requires longer practice.

Practical outcomes. Based on the research, the textbook "Theoretical Foundations of Teaching the Native Language" was published (registered by the Ministry of Higher Education, Science and Innovation of the Republic of Uzbekistan on 10 August 2026, No. 3418-016a-79be-93ba-bb30-0620-0886). The textbook has been introduced into the educational process of both higher education institutions, and 12 scientific articles have been published as approbation of the findings.

4. DISCUSSION

The results confirm the research hypothesis: step-by-step instruction in graphic organizers develops students' ability to use them as a methodological tool more effectively than traditional teaching.

These findings are consistent with international research. Nesbit and Adesope's meta-analysis showed that working with concept maps yields a consistent advantage over reading text passages or attending lectures. Hyerle demonstrated that organizers are most effective when matched to a specific thinking process (classification, comparison, cause and effect). Likewise, in our study the greatest growth was observed for the operational criterion, which trained precisely the alignment of "linguistic material – thinking operation – type of organizer".

The novelty of the study lies in transforming the graphic organizer from a learning tool for the student into a teaching tool for his or her future professional activity. The student first experiences the organizer as a user and then designs it for primary school pupils. This "two-step transfer" mechanism is a core element of the profession-oriented teaching model.

The methodology integrates divergent and convergent thinking. Cluster and brainstorming organizers expand the range of ideas, while conceptual tables and T-charts systematize them and lead to conclusions. The experiment at Andijan State Pedagogical Institute showed that this approach also fosters critical thinking competence.

Limitations. First, the groups were formed from existing academic groups without random assignment. Second, the experiment in Andijan was limited to one month; therefore, the durability of the skills should be verified through a delayed post-test. Third, students' actual lessons during teaching practice were not assessed separately, which constitutes a direction for further research.

5. CONCLUSION

The proposed methodology effectively develops pre-service primary school teachers' skills in using conceptual tables and graphic organizers in native language lessons. The main conclusions are as follows:

1. Teaching graphic organizers in the sequence "familiarization – model-based application – independent design" raised the proportion of high-level students from 14.8% to 38.5% (21.3% in the control group; $p < 0.01$).

2. The most effective component is teaching students to select the type of organizer in accordance with the linguistic material and the thinking operation involved.

3. The methodology has been tested in two higher education institutions and is ready for wider use through the published textbook.

Recommendations. It is advisable to introduce a separate practical module on graphic organizers into the curriculum of the course "Methods of Teaching the Native Language", to include an organizer-based lesson design in

teaching practice assignments, and to use this methodology in in-service teacher training courses.

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WHO IS A CIVIL SERVANT? TOWARDS A MULTI-CRITERIA MODEL OF LEGAL IDENTIFICATION IN COMPARATIVE PERSPECTIVE AND ITS RELEVANCE FOR UZBEKISTAN

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Abstract. *The adoption of the 2022 Law of the Republic of Uzbekistan "On State Civil Service" and the 2025–2026 reforms introducing competency models and job families bring to the fore a question that doctrine has rarely addressed directly: on what legal grounds is a particular person classified as a civil servant, while another person working in the same state apparatus is not? This paper outlines the preliminary results of a comparative study covering Uzbekistan, Germany, France, Poland, Slovenia, Croatia, the United Kingdom and the United States. It shows that none of the traditional features — employment in a state body, holding a post, performing state functions, the manner of appointment, the employment contract or special status — is sufficient on its own. As a working hypothesis, a multi-criteria model of legal identification is proposed, combining institutional, formal-positional, functional-competence and special-status criteria. The paper argues that what can be universalised across legal systems is not a definition of the civil servant but a method for identifying one.*

Keywords: *civil service, civil servant, legal identification, legal status, civil service position, public function, competency model, comparative administrative law, Uzbekistan.*

INTRODUCTION

The Law of the Republic of Uzbekistan No. ZRU-788 of 8 August 2022 established the civil service as a distinct object of special legal regulation [1]. Subsequent presidential acts introduced basic competency models for the support, political and managerial groups of positions [2], as well as the categorisation of job families, the diagnostics of professional skills and continuous professional development [3]. These reforms make the boundaries of the civil service corps a practical issue: does the special regime extend to every

employee of a state body, to persons holding support or political positions, or to officials of special types of service?

Legal scholarship has examined in detail the concept of public service and the legal status of civil servants [5; 6]. Much less attention has been paid to the prior question of *legal identification* — the criteria by which a person enters the category to which that status applies. The aim of this paper is to formulate a hypothesis for a multi-criteria identification model and to test it in outline against comparative and Uzbek material.

Materials and Methods

The study draws on Uzbek civil service and labour legislation [1–4]; the legislation of Germany, France, Poland, Slovenia, the United Kingdom and the United States [9–12; 15; 17]; and Russian, Polish and Croatian scholarship [5–8; 13; 14; 16]. The leading method is the functional comparative method: the categories *Beamter*, *fonctionnaire*, *agent public*, *służba cywilna* and *civil servant* are compared not by their names but by their legal function and by the set of features that create status. Formal-legal, systemic and logical methods are used as supporting tools.

Results

1. The limits of single-criterion approaches

Existing doctrinal approaches each capture one dimension of the civil service. The functional approach defines the service as professional activity ensuring the exercise of state functions [7], yet public functions are also served by political officeholders, judges, military personnel and employees of state institutions. The administrative-law (status) approach reveals the special nature of the servant's position [6], but when status is used as an identification criterion the reasoning becomes circular: restrictions and guarantees apply *because of* status and cannot themselves create it. The labour-law approach correctly reflects the employment component of service [5; 8], but does not explain which legal quality turns an employee of a state body into a civil servant. Thus, doctrine answers the questions "what is the civil service?" and "what is the servant's status?", but not "why is this person a civil servant?"

2. Comparative evidence

The comparative material confirms that no single feature has universal identifying capacity. Under § 4 of the German Federal Civil Servants Act, a *Beamter* stands in a public-law relationship of service and loyalty, and under § 5 this status is reserved mainly for the exercise of sovereign functions [9]: status derives from the nature of the relationship, not from working for the state as such. In France, the notion of *agent public* covers both the tenured *fonctionnaire*

and the contractual agent [10], so the status of the post and the status of the person do not necessarily coincide. In the United States, the civil service is divided into the competitive service, the excepted service and the Senior Executive Service, each with different entry rules [11]; competitive selection is therefore not universal either.

The Slovenian Public Employees Act of 2025 regulates public employees together with their employment relations while distinguishing posts that involve public tasks from professional-technical posts [12]. Croatian doctrine notes the absence of a single European model of the civil service corps and the special position of posts linked to public authority [13; 14]. Polish scholarship places civil service law at the border between administrative and labour law [16], and the British Civil Service Code, grounded in the Constitutional Reform and Governance Act 2010, forms part of the terms of service [17]. It follows that a contractual form and a public-service nature are compatible, and that the branch of law is not a primary identification criterion. Rather than legal families, it is more accurate to speak of *configurations of criteria*: the German model leans towards status and functional-competence elements, the American towards position and procedure, the British towards institutional and ethical elements.

3. The Uzbek model

Law No. ZRU-788 links civil servant status to a citizen performing duties in a civil service position and ties its acquisition to appointment to such a position; the State Register of Positions defines the personal scope of the Law [1]. This formal-positional mechanism provides legal certainty, but leaves open the question of which material criteria justify including a given position in the Register. The statutory reference to “ensuring the exercise of the powers of state bodies” is too broad on its own, as it may cover almost all activity within a body, including technical maintenance. The labour-law elements [4] relate to the mechanism for regulating service rather than to the ground of identification. The competency reforms [2; 3] add the question “what competencies must the person have?” to “what position does the person hold?”, yet so far they function as tools of selection and assessment rather than as a criterion of status.

4. A multi-criteria identification model

On this basis, a three-level structure is proposed: (a) status-creating criteria; (b) variable features of national models (competition, form of appointment, contract, source of funding); and (c) consequences of acquired status (rights, duties, restrictions, guarantees, liability). The first level consists of four interrelated criteria summarised in Table 1.

Table 1.

Status-creating criteria of legal identification

Criterion	Question it answers	Role in identification
Institutional	Is the person linked to the state apparatus?	Necessary but auxiliary; defines the environment of service
Formal-positional	Does the person hold a post formally assigned to the civil service (e.g. in a register)?	Provides legal certainty; the carrier of status
Functional-competence	Does the post involve preparing, adopting, executing or controlling public-authority decisions?	Material ground for including the post in the civil service
Special-status	Has the legislator attached a special public-service regime to the post?	Distinguishes the civil service from ordinary public employment

Applied to borderline categories in Uzbekistan, the model shows that an employee of a state body meets only the institutional criterion; for support positions, the decisive line runs between direct professional support of a body's competence and general organisational-technical servicing; and special types of service (diplomatic, military, law-enforcement) share several criteria but are set apart by their own regimes.

Discussion

The functional, administrative-law, labour-law and merit-based approaches are not mutually exclusive: they describe the civil service at different levels — its purpose, the nature of status, the legal form of activity and the quality of personnel. The proposed model does not replace them but shifts the inquiry to a level that comes before the debate about which branch of law governs the relationship: before classifying the service relationship, one must establish why a person holds civil servant status. The model does not treat *Beamter*, *fonctionnaire*, civil servant and the Uzbek civil servant as identical; it offers a common analytical question — how a legal order separates the professional corps from adjacent categories.

For Uzbekistan, the preliminary findings suggest several directions for legislative development: setting out material criteria for including positions in

the Register; clarifying the notion of "ensuring the exercise of powers"; and establishing a normative chain linking state function, the competence of the body, job family, position, required competencies and scope of special status. If current reforms continue, positions are likely to be linked more closely to their functional profile and competencies, with the Register becoming part of that broader architecture rather than disappearing. These hypotheses require further verification for each group of positions, in particular for the boundary between political positions and the professional civil service.

CONCLUSION

The study shows that the question of who is a civil servant constitutes a distinct problem of legal identification, separate from the concept of the civil service and from the content of the servant's status. None of the traditional features, taken in isolation, performs this identifying function, whereas a combination of institutional, formal-positional, functional-competence and special-status criteria makes it possible to compare national models as configurations of criteria. The Uzbek civil service can be preliminarily characterised as an evolving mixed status-and-employment model with a predominant formal-positional mechanism of identification and a growing functional and competence-based component.

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SOCIO-PSYCHOLOGICAL FACTORS OF PSYCHOLOGICAL COHESION IN MARITAL RELATIONSHIPS OF MIGRANT FAMILIES

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Abstract. *This thesis examines the socio-psychological factors influencing the formation of psychological cohesion in marital relationships, with particular emphasis on migrant families. Migration changes the habitual structure of family interaction and may affect emotional intimacy, communication, role distribution, mutual support, and marital satisfaction. Psychological cohesion is considered as a multidimensional phenomenon reflecting spouses' ability to maintain emotional closeness, mutual understanding, acceptance, cooperation, and stability under changing social conditions. The analysis emphasizes that migration should not be regarded as an exclusively negative determinant of marital relations; rather, its psychological effects depend on the interaction of individual, interpersonal, family, and social factors.*

Keywords: *psychological cohesion, marital relationships, migrant family, migration, marital satisfaction, emotional intimacy, socio-psychological factors.*

INTRODUCTION

Contemporary migration processes have substantially transformed the structure and functioning of families. Labour migration can lead to prolonged physical separation between spouses, redistribution of family responsibilities, changes in communication patterns, and increased emotional and social demands. Under these circumstances, maintaining psychological cohesion becomes an important condition for the stability of marital relationships.

Psychological cohesion in marital relationships may be understood as an integrative socio-psychological characteristic that reflects emotional closeness, mutual acceptance, psychological support, coordinated family behaviour, and spouses' ability to preserve constructive interaction. This phenomenon is related to marital satisfaction, love and sympathy, the psychological climate of the family, and the level of social frustration. At the same time, psychological cohesion should not be reduced to any single one of these indicators.

MAIN PART

The psychological consequences of migration are not uniform. In some families, prolonged separation may weaken everyday emotional communication and increase psychological distance. In other families, spouses adapt successfully to changed circumstances and develop new forms of communication, decision-making, and mutual support. Therefore, migration itself cannot be treated as a direct and universal cause of deterioration in marital relations.

Emotional factors constitute one of the central dimensions of marital cohesion. Love, sympathy, emotional attachment, trust, and mutual support help spouses preserve a sense of belonging and relational continuity even when they are geographically separated. Emotional support is particularly significant when one or both spouses experience uncertainty, occupational stress, or difficulties associated with adaptation to a new social environment.

Communicative factors are also essential. Constructive communication allows spouses to discuss difficulties, coordinate decisions, express emotional needs, and prevent the accumulation of unresolved conflicts. Digital communication technologies provide opportunities to maintain contact across distance; however, the frequency of communication alone does not guarantee psychological closeness. Openness, emotional responsiveness, mutual listening, and the ability to discuss family problems constructively are more meaningful indicators of communication quality.

A further group of factors concerns family roles and responsibilities. Migration can change established patterns of household management, childcare, financial decision-making, and responsibility for everyday family functioning. The spouse who remains at home may assume additional domestic and parental responsibilities, while the migrant spouse may experience increased pressure connected with employment and financial provision. Psychological cohesion is more likely to be maintained when these changes are acknowledged by both partners and family roles are adapted flexibly rather than interpreted as evidence of reduced commitment.

Social frustration is another relevant socio-psychological factor. Difficulties related to employment, income, social status, separation, limited social support, and uncertainty about the future may increase psychological tension. When accumulated frustration is transferred into marital interaction, it can influence the family psychological climate and subjective satisfaction with marriage. Conversely, supportive marital interaction can serve as an important psychological resource in coping with migration-related stress.

From a conceptual perspective, the relationships among the studied variables may be represented as follows: social and migration-related conditions, social frustration, family psychological climate, emotional relationships, marital satisfaction, psychological cohesion. This sequence should be interpreted as a theoretical framework rather than a rigid causal chain, because marital relationships are shaped by multiple interacting variables and require empirical verification through appropriate statistical models.

For psychological practice, this approach indicates that work with migrant families should not focus only on the fact of migration. Assessment should include the quality of spousal communication, emotional support, perceived fairness of role distribution, family psychological climate, satisfaction with marital relationships, coping resources, and the broader social context. Such a multidimensional assessment makes it possible to identify both risk factors and protective resources.

CONCLUSION

Psychological cohesion in migrant families is a complex socio-psychological phenomenon determined not by migration alone but by the interaction of emotional, communicative, family-role, and social factors. Mutual trust, emotional support, constructive communication, flexible distribution of responsibilities, and effective coping with social frustration contribute to the preservation of marital cohesion.

Accordingly, psychological support for migrant families should be differentiated and resource-oriented. Programmes aimed at strengthening marital relationships may include communication skills, emotional self-regulation, constructive conflict resolution, clarification of family roles, and maintenance of emotional intimacy during periods of physical separation. Further empirical research is needed to clarify the relative contribution of these factors and to test conceptual models of psychological cohesion in different groups of migrant families.

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READING CULTURE AS A SOCIOLOGICAL INDICATOR OF SOCIAL INTELLIGENCE AMONG YOUTH: EMPIRICAL EVIDENCE FROM A UNIVERSITY STUDENT SAMPLE IN UZBEKISTAN

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Abstract. *This article examines reading culture as a sociological indicator associated with the empathic dimension of social intelligence among university students. A cross-sectional survey of 598 students assessed reading frequency, format, motives, barriers, digital information behaviour and an author-developed empathic-sensitivity index. Electronic texts predominated, while lack of time and social-media distraction were the leading barriers. Regular readers had higher empathic-sensitivity scores, and reading frequency correlated strongly with empathy ($r = 0.72$; $p < 0.001$). The association is not interpreted causally. The findings support coordinated practices combining focused reading, discussion, reflection and information literacy.*

Keywords: *reading culture, social intelligence, youth, empathy, digital environment, reading behaviour, social institutions.*

INTRODUCTION

Digital communication has altered not only where young people read, but also how attention is distributed across texts, platforms and social interaction. For sociological analysis, reading culture is therefore more than the number of books read. It includes motivation, regularity, format choice, comprehension, critical interpretation and the ability to relate textual meanings to lived social experience. In Uzbek scholarship, A. Umarov (2004) similarly treats reading culture as a broader cultural practice rather than a purely technical act of reading.

This perspective is particularly relevant to social intelligence. Thorndike (1920) defined social intelligence in terms of understanding people and acting effectively in human relations; later work emphasised social perception, contextual interpretation and the reading of interpersonal behaviour (Kihlstrom & Cantor, 2011). Bourdieu's (1986) concept of cultural capital also helps explain why reading matters sociologically: interpretive and linguistic competencies acquired through cultural practices can become resources in education and communication. The present study examines whether reading practices are

associated with the empathic dimension of social intelligence among university students in Uzbekistan, while avoiding causal claims that the design cannot support.

MATERIALS AND METHODS

The empirical study was conducted at Tashkent University of Economics and Technology between February and April 2022 using a quantitative cross-sectional design. The quota sample comprised 598 students: 208 men (34.8%) and 390 women (65.2%); 440 respondents (73.6%) lived in urban areas and 158 (26.4%) in rural areas. By age, 319 participants were 17–20 years old, 175 were 21–25, and 104 were 26 or older.

The principal instrument was the author-developed "Reading Culture and Information Behaviour" questionnaire with 28 items organised into four blocks: reading frequency and format, motives, barriers, and behaviour in the digital information environment. A 30-student pilot preceded the main survey; the principal scales showed acceptable internal consistency (Cronbach's $\alpha \geq 0.72$). Empathic sensitivity was operationalised through five observable indicators: response to a character's actions, interpretation of emotional states, reconsideration of one's own position, openness to alternative interpretations, and the ability to connect textual situations with life experience. The integral score was converted to a 0–10 scale.

Data were processed in IBM SPSS Statistics 26 and Microsoft Excel. Descriptive statistics and Pearson correlation were used for the analyses reported here; statistical significance was assessed at $\alpha = 0.05$. Participation was voluntary and anonymous. Because the sample came from one university and was quota-based rather than probabilistic, the results are not nationally representative. The cross-sectional design also does not establish causal direction, and the author-developed empathic-sensitivity index requires independent psychometric validation.

RESULTS

Reading in the surveyed group was predominantly digital. Electronic texts were preferred by 71% of respondents, printed materials by 25%, and both formats by 4%. This distribution describes format preference rather than reading quality; it nevertheless shows that any intervention aimed at strengthening reading culture must function effectively within the digital environment already used by students.

Reading frequency was heterogeneous. Thirty-two per cent reported reading two or three times per week, 27% about once per week, 18% mainly on a monthly basis, and 23% said they hardly read. The pattern suggests four

practical segments—relatively regular, moderately regular, episodic and disengaged readers—whose needs cannot be addressed by a single promotional strategy.

The leading motives were knowledge acquisition (63%), personal development (52%), study assignments (48%) and meaningful use of leisure time (41%). By contrast, the most common barriers were lack of time (58%), time spent on social networks (56%), insufficient motivation (37%), high book prices (33%) and lack of suitable reading conditions (22%). Forty per cent described reading as useful but boring. The two dominant barriers were thus related to time and attention rather than direct access to books.

Respondents also perceived the digital information environment as influential: 67% rated its effect on reading culture as high, 24% as moderate and 9% as low. When asked whether young people used internet and social-network sources for effective reading, 19% answered positively, while 56% believed that time was being wasted. These are subjective assessments, not direct behavioural measurements, but they reveal a tension between extensive digital access and perceived reading effectiveness.

The central statistical result concerns reading frequency and empathic sensitivity. Regular readers had a mean empathic-sensitivity score of 8.2, compared with 5.1 among less frequent readers. Pearson's correlation showed a strong positive association between reading frequency and empathic sensitivity ($r = 0.72$; $n = 598$; $p < 0.001$; approximate 95% confidence interval 0.68–0.76). The result identifies a substantial association within the sample, but it does not show that reading itself causes higher empathy. Reverse direction and third variables—including family cultural environment, parental education, gender and place of residence—remain plausible explanations.

DISCUSSION

The findings support a sociological view of reading as a practice through which young people encounter unfamiliar perspectives, interpret motives and compare symbolic situations with their own experience. In this sense, the observed relationship with empathic sensitivity is consistent with theories of social intelligence centred on understanding social contexts. It also fits the cultural-capital perspective, in which interpretive competence can acquire value in educational and communicative settings (Bourdieu, 1986).

The results do not justify a simple opposition between printed and electronic reading. Most participants preferred electronic texts, whereas their main reported difficulties concerned fragmented attention, time and motivation. The practical question is therefore how to organise sustained and reflective

reading within a digital environment rather than how to return students to a single medium.

On the basis of the dissertation findings, a "Reading + Intelligence" model was proposed that links focused reading with discussion, reflective interpretation, theatrical reading, information-literacy exercises and digital monitoring. The model should be understood as an intervention framework to be tested, not as an already proven programme. Universities and libraries could pilot scheduled deep-reading sessions and discussion spaces, while digital tools could support recommendations and reading logs. Its effectiveness should be evaluated through pre- and post-measurements, comparison groups where feasible, and independently validated instruments.

CONCLUSION

Within the studied university sample, reading culture was meaningfully associated with the empathic component of social intelligence. Digital formats dominated reading preferences; knowledge and self-development were the main motives, while lack of time and social-media distraction were the leading barriers. Regular readers showed higher empathic-sensitivity scores, and reading frequency correlated strongly with empathic sensitivity ($r = 0.72$; $p < 0.001$).

These findings are evidence of association, not causation, and should not be generalised to all young people in Uzbekistan. They provide a justified basis for testing coordinated reading practices that combine focused reading, discussion, reflection and information literacy. Future research should use broader samples, longitudinal or experimental designs, and independently validated measures to determine whether such practices produce sustainable changes in social-intelligence indicators.

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LABOR REGULATIONS OF PUBLIC TRANSPORT WORKERS IN THE UZBEK SSR DURING THE 1950S–1970S.

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Annotation: *This text highlights the formation of the motor transport and road management system in the Uzbek SSR, as well as the role of trade unions and public institutions in strengthening labor discipline and legality within the sector. Furthermore, based on archival sources and reports, it analyzes the working conditions, work and rest time norms for drivers and transport workers, anti-alcoholism measures, and the impact of socialist competitions on production efficiency during the 1950s–1970s.*

Key words: *labor discipline, trade unions, socialist competition, work and rest schedule, labor protection.*

INTRODUCTION

In implementing labor regulations and social living conditions in the Uzbek SSR, reliance was placed on the activities of specific social institutions. The most important among them were trade unions, which occupied a central place in ensuring the legal, social, and cultural protection of workers at manufacturing enterprises. Particularly within the system of motor transport and road management, the activities of trade unions stood out by organizing tasks such as regulating labor conditions and improving social life. These directions—protecting the rights and interests of workers, labor discipline, the work and rest schedule of drivers, and similar processes-represented the comprehensive activities of the trade unions.

MAIN BODY

"As noted in the 1955 report of the Ministry of Automobile Transport and Highways of the Uzbek SSR, serious shortcomings were observed in labor and state discipline. Within the scale of the Andijan Oblast Trust, 578 violations of labor discipline were recorded, of which 371 accounted for drivers and 86 for conductors. A total of 522 administrative measures were applied for these offenses [Note: translating exact numbers: 549 total administrative measures applied, with drivers held accountable in 404 cases]. Furthermore, 29 cases were sent to civil courts, of which 9 were reviewed, demonstrating a significant

educational impact in restoring labor discipline. In particular, after the court decisions, electrician V. Devyatov at Bus Depot No. 52, conductor M. Dadabayeva and dispatcher Dimshits at Bus Depot No. 12 improved their labor discipline [1]. It is stated that this experience-conducting civil court hearings openly with public participation-proved to be an effective method in restoring labor discipline."

In 1962, alongside mass-cultural work carried out to strengthen labor discipline, the social impact of civil courts also played an important role. According to reports, 179 cases were reviewed by civil courts, and certain measures were taken against offenses such as coming to work intoxicated, immoral behavior, and violations of cash discipline. As a result of the social impact of court decisions, the violators acknowledged their actions, strictly adhered to labor discipline, and sought to increase honesty and responsibility in their activities.

According to the results of 1968, the role of trade union organizations was significant in the motor transport and road management system of the Namangan Oblast. High performance indicators were achieved by bus depots No. 86, 113, 4, 22, 58, and 12. During the 10 months of 1968, the plan for passenger taxis was fulfilled by 100 percent, and for freight transport by 115 percent. However, the passenger transport plan for buses was limited to 89 percent and the passenger-kilometer indicator to 91.7 percent. The increase in transport volume made the development of road infrastructure a necessity. Despite a shortage of various mechanisms and the weakness of repair bases, through socialist competitions with the participation of trade unions, 338.5 km of roads were repaired, fulfilling the plan by 113 percent. By the end of the year, a commitment was made to build an additional 157 km of roads. The funds allocated for road works were fully utilized, and the plan was fulfilled by 100.1 percent [2]."

"The fulfillment of production programs was ensured through effectively organized socialist competition. Such competition served as an important instrument of trade union activities, aimed at increasing the initiative of workers, enhancing production efficiency, and improving product quality. Trade unions fully organized the competition, monitored the fulfillment of commitments, and provided material and moral incentives to advanced collectives. The practice of awarding the title of 'Communist Labor' served to intensify competition and increase responsibility [3]."

"In the mid-1970s, under the slogan 'Drunkenness is a social evil,' measures were implemented by justice, party, and trade union organizations to combat drunkenness and alcoholism. Propaganda, agitation, prevention, and legal

influence were designated as the main methods of struggle. Nevertheless, violations of discipline continued in the vehicle depots throughout 1975. Within a short period, 17 drivers and railway workers committed offenses related to alcohol consumption, and certain drivers, including Pasyrov, Kostekno, and Tillakhodjayev, were dismissed from work due to drunkenness [4]. These cases once again confirmed the negative impact of drunkenness on labor productivity, public safety, and labor discipline.

Under public control over the data, 12 meetings were held during the year. At these meetings, issues concerning the behavior of drivers, labor discipline, and compliance with traffic regulations were reviewed. As a result, 53 drivers were discussed, 8 individuals were deprived of the right to drive a vehicle, 8 were given reprimands, and 91 were issued warnings [5]. These figures demonstrated the important role of public control in strengthening road safety and labor discipline.

According to the temporary regulations regulating the labor activity of drivers engaged in international freight and passenger transport within the Uzbek SSR automotive transport system in 1970, the working hours of drivers were established in accordance with the requirements of the Labor Code. In accordance with vehicle schedules, the duration of a work shift was typically set at 7 hours for a six-day workweek and 8 hours for a five-day workweek. In certain cases, this shift could be extended up to 12 hours. If vehicle operation exceeded 8 hours without providing the driver with rest time, such a vehicle had to be operated by 2 drivers. Daily rest time between shifts for drivers generally amounted to 16 hours, but under no circumstances was this time to be less than the duration of the previous work shift [6]. A working time norm of 178 hours per month was established for a single driver [7].

Weekly rest times for drivers were set to be evenly distributed across different days of the month, and the weekly rest time was required to be at least 42 hours. The duration of continuous vehicle operation was established not to exceed 5 hours. In this regard, a rest period of 5 minutes along the road had to be allocated after the initial two hours, and 10 minutes after the subsequent two hours. If the vehicle was operated by 2 drivers, their turns were alternated every two hours. If the vehicle was operated by 1 driver, depending on the route, a stopping time of no less than 30 minutes and no more than 2 hours was provided for meals every 3 to 5 hours. Trolleybus drivers initially had a schedule of 1 day of work and 1 day of rest, and later two shifts—namely, 1 driver until 14:00, after which another driver took over. These rules and regulations served the labor

activity and health of industry employees, as well as the provision of passenger safety.

CONCLUSION

In conclusion, during the researched period, the issues of labor organization, labor protection, and the improvement of employees' social living conditions in motor transport enterprises were considered one of the important directions of the activities of enterprise administration and trade unions. The measures implemented regarding working hours norms, labor discipline, medical service, improvement of living conditions, and social support of employees served to increase the labor productivity of transport sector personnel. The practical activities of trade unions in improving labor and living conditions served as one of the important factors in ensuring the social protection and labor efficiency of employees."

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ELEKTRON TIJORAT PLATFORMALARINING FUQAROVIY-HUQUQIY JAVOBGARLIGI: NAZARIYA VA AMALIYOT MUAMMOLARI

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Annotatsiya: *Mazkur maqolada elektron tijorat platformalarining fuqaroviy-huquqiy javobgarligi bilan bog‘liq nazariy va amaliy muammolar tahlil qilinadi. Raqamli savdo munosabatlarida platformalarning huquqiy maqomi, shartnomaviy munosabatlardagi o‘rni hamda iste’molchilar va boshqa ishtirokchilar oldidagi javobgarligining asoslari va chegaralari o‘rganiladi. Xususan, platformaning javobgarligini belgilashda uning faqat vositachi sifatidagi rasmiy maqomiga emas, balki savdo jarayonidagi amaliy ishtiroki, nazorat imkoniyatlari va zimmasiga olgan majburiyatlariga e’tibor qaratish zarurligi asoslanadi. O‘zbekiston qonunchiligi qoidalari xorijiy huquqiy yondashuvlar bilan qiyosiy tahlil qilinib, elektron tijorat platformalarining fuqaroviy-huquqiy javobgarligini takomillashtirishga doir ilmiy-amaliy takliflar ilgari suriladi.*

Kalit so‘zlar: *elektron tijorat, elektron tijorat platformasi, fuqaroviy-huquqiy javobgarlik, raqamli muhit, elektron bitim, shartnomaviy munosabatlar, vositachi, iste’molchilar huquqlarini himoya qilish, platforma operatori, huquqiy tartibga solish.*

Abstract: *This article examines theoretical and practical issues relating to the civil liability of e-commerce platforms. It explores the legal status of platforms in digital commerce, their role in contractual relationships, and the grounds and limits of their liability towards consumers and other participants. Particular attention is given to the need to determine platform liability not solely on the basis of a platform’s formal status as an intermediary, but also by considering its actual involvement in commercial transactions, its capacity to exercise control, and the obligations it has undertaken. The article provides a comparative analysis of Uzbek legislation and foreign legal approaches and advances scholarly and practical proposals aimed at improving the civil liability framework for e-commerce platforms.*

Keywords: *e-commerce, e-commerce platform, civil liability, digital environment, electronic transaction, contractual relations, intermediary, consumer protection, platform operator, legal regulation.*

KIRISH

Raqamlashtirish jarayonining jadallashuvi elektron tijoratni fuqarolik-huquqiy munosabatlarning muhim shakliga aylantirib, tovarlar, ishlar va xizmatlarni masofadan realizatsiya qilishning yangi mexanizmlarini shakllantirmoqda. Ayniqsa, marketplace modeli asosida faoliyat yurituvchi elektron tijorat platformalari sotuvchi va iste'molchi o'rtasidagi munosabatlarda nafaqat texnik vositachi, balki axborot taqdim etish, to'lovlarni tashkil etish, buyurtmalarni qayta ishlash, yetkazib berish va qaytarish jarayonlarida ishtirok etuvchi faol subyekt sifatida namoyon bo'lmoqda. Bu esa platformalarning fuqaroviy-huquqiy maqomi va ular zimmasidagi javobgarlik chegaralarini aniqlash masalasini dolzarb qiladi. O'zbekiston Respublikasining "Elektron tijorat to'g'risida"gi Qonunida elektron savdo maydonchasi va uning operatori elektron tijoratning alohida subyektlari sifatida belgilangan hamda operatorga elektron tijorat ishtirokchilariga tegishli xizmatlarni ko'rsatish bilan bir qatorda, qonunchilikda nazarda tutilgan ayrim majburiyatlar yuklatilgan. Biroq platformaning texnik vositachi sifatidagi faoliyati bilan tranzaksiyada faol ishtirok etuvchi subyekt sifatidagi faoliyati o'rtasidagi huquqiy chegaralar, shuningdek, uning iste'molchi oldidagi fuqaroviy-huquqiy javobgarligi barcha holatlar bo'yicha yetarlicha aniq tartibga solinmagan. Natijada tovar yoki xizmatni realizatsiya qilish jarayonida zarar yuzaga kelganida javobgarlikning aynan sotuvchiga, platformaga yoki ayrim holatlarda har ikkala subyektga taalluqli ekanligini aniqlash muammosi yuzaga keladi. Mazkur muammo elektron tijorat platformalarining fuqaroviy-huquqiy javobgarligini faqat ularning shartnoma taraflari sifatidagi formal maqomi orqali emas, balki elektron tijoratdagi real funksional ishtiroki asosida baholash zarurligini ko'rsatadi. Platformaning sotuvchini tanlash va tekshirishdagi ishtiroki, to'lov va yetkazib berish jarayonlarini tashkil etishi, iste'molchiga beriladigan axborotni nazorat qilishi hamda tranzaksiya shartlarini belgilashdagi roli uning javobgarlik doirasini aniqlashda muhim mezonlar sifatida namoyon bo'lishi mumkin. Xorijiy huquqiy tajribada ham platformalarning javobgarligi alohida huquqiy masala sifatida shakllanmoqda. Yevropa Ittifoqida online marketplace operatorlarining iste'molchiga sotuvchining maqomi va shartnoma bo'yicha majburiyatlar to'g'risida axborot berish majburiyatlari belgilangan. AQSh huquqida esa internet vositachilarining javobgarligi, xususan, uchinchi shaxslar tomonidan joylashtirilgan axborot uchun javobgarlik masalasi maxsus huquqiy mexanizmlar asosida tartibga solinadi. Mazkur yondashuvlar elektron tijorat platformalarining javobgarligini aniqlashda turli huquqiy modellar mavjudligini ko'rsatadi. Shu munosabat bilan tadqiqotning maqsadi elektron tijorat

platformalarining fuqaroviy-huquqiy javobgarligi yuzaga kelishining nazariy va amaliy asoslarini aniqlash, O‘zbekiston qonunchiligidagi mavjud tartibga solishni tahlil qilish hamda xorijiy tajriba asosida uni takomillashtirish bo‘yicha ilmiy asoslangan takliflar ishlab chiqishdan iborat. Tadqiqot doirasida elektron tijorat platformasining fuqarolik-huquqiy maqomi va javobgarlik doirasi o‘rtasidagi bog‘liqlik, platformaning iste’molchi va sotuvchi bilan munosabatlaridagi funksional roli, shuningdek, platforma va uchinchi tomon sotuvchisi o‘rtasida javobgarlikni taqsimlash mezonlari o‘rganiladi.

Tadqiqotning ilmiy yangiligi elektron tijorat platformalarining javobgarligini ularning tranzaksiyadagi “funksional ishtiroki darajasi” asosida differensiallashtirish zaruratini asoslashdan iborat. Mazkur yondashuv platformani faqat texnik vositachi sifatida emas, balki elektron tijorat munosabatlaridagi real funksiyalarini hisobga olgan holda baholash va tegishli fuqaroviy-huquqiy javobgarlik chegaralarini belgilash imkonini beradi.

Metodlar

Mazkur tadqiqot elektron tijorat platformalarining fuqaroviy-huquqiy javobgarligini nazariy va amaliy jihatdan o‘rganishga qaratilgan bo‘lib, unda formal-yuridik, tizimli-huquqiy, qiyosiy-huquqiy va funksional tahlil metodlaridan foydalanildi. Tadqiqotning metodologik asosini elektron tijorat platformalarining huquqiy maqomi, ularning shartnomaviy munosabatlardagi o‘rni hamda javobgarlik chegaralarini kompleks ravishda baholash tashkil etdi.

Formal-yuridik metod orqali O‘zbekiston Respublikasining elektron tijorat, fuqarolik huquqi va iste’molchilar huquqlarini himoya qilishga oid normativ-huquqiy hujjatlaridagi tegishli qoidalar tahlil qilindi. Bunda elektron tijorat platformalari va ularning operatorlariga nisbatan belgilangan huquq va majburiyatlar, shuningdek, fuqaroviy-huquqiy javobgarlikning umumiy asoslari o‘rganildi.

Tizimli-huquqiy metod platformaning huquqiy maqomini alohida norma doirasida emas, balki fuqarolik huquqining shartnoma, majburiyat, zarar yetkazish va iste’molchilar huquqlarini himoya qilish institutlari bilan o‘zaro bog‘liqlikda tadqiq etish uchun qo‘llanildi. Ushbu yondashuv platformaning elektron tijoratdagi turli funksiyalari uning huquq va majburiyatlariga qanday ta’sir ko‘rsatishini aniqlash imkonini berdi.

Qiyosiy-huquqiy metod doirasida O‘zbekiston Respublikasidagi huquqiy tartibga solish Yevropa Ittifoqi va AQShdagi elektron tijorat platformalari hamda internet vositachilarining javobgarligiga oid yondashuvlar bilan qiyoslandi. Qiyoslashda platformaning iste’molchi oldidagi majburiyatlari, uchinchi tomon sotuvchilari faoliyati bilan bog‘liq javobgarlik va platformaning

vositachi sifatidagi huquqiy maqomini belgilash mezonlariga alohida e’tibor qaratildi.

Funksional tahlil metodidan platformaning elektron tijorat tranzaksiyasidagi real ishtiroki va ushbu ishtirokning uning fuqaroviy-huquqiy javobgarligiga ta’sirini aniqlash maqsadida foydalanildi. Bunda platformaning axborot taqdim etish, sotuvchilarni verifikatsiya qilish, to‘lovlarni tashkil etish, yetkazib berish va qaytarish jarayonlaridagi ishtiroki kabi funksiyalari alohida huquqiy mezonlar sifatida ko‘rib chiqildi.

Tadqiqotning manba bazasini O‘zbekiston Respublikasining normativ-huquqiy hujjatlari, xalqaro va xorijiy huquqiy hujjatlar, ilmiy maqolalar, monografiyalar hamda elektron tijorat va platforma javobgarligiga oid ilmiy tadqiqotlar tashkil etdi. Normativ-huquqiy manbalarni tanlashda ularning amaldagi holati va tadqiqot predmetiga bevosita aloqadorligi, ilmiy manbalarni tanlashda esa mavzuning nazariy va qiyosiy-huquqiy jihatlarini yoritish darajasi asosiy mezon sifatida belgilandi.

Natijalar

Elektron tijorat platformasining fuqarolik-huquqiy maqomi

Elektron tijorat platformasining fuqarolik-huquqiy maqomini aniqlash uning zimmasidagi huquq va majburiyatlar hamda javobgarlik chegaralarini belgilashning dastlabki shartidir. Chunki elektron tijorat munosabatlarida platforma, sotuvchi va xaridor bir xil huquqiy funksiyani bajarmaydi. Shu sababli platformaning elektron tijoratdagi ishtirokini faqat texnik vositachilik faoliyati sifatida baholash uning real huquqiy rolini to‘liq aks ettirmasligi mumkin. O‘zbekiston Respublikasining “Elektron tijorat to‘g‘risida”gi Qonunida elektron savdo maydonchasi tovarlar, ishlar va xizmatlarning oldi-sotdisini masofadan turib amalga oshirish imkonini beruvchi axborot tizimi, uning operatori esa elektron tijorat ishtirokchilariga elektron savdo maydonchasi xizmatlarini ko‘rsatuvchi yuridik shaxs sifatida belgilangan.[34] Mazkur Qonunga ko‘ra, elektron tijorat subyektlari elektron tijorat ishtirokchilari va elektron tijorat operatorlaridan tashkil topadi. Shu jihatdan elektron savdo maydonchasi operatori xaridor yoki sotuvchining o‘zi emas, balki elektron tijorat jarayonining alohida tashkiliy-huquqiy subyekti sifatida namoyon bo‘ladi.[35] Bunda qonunchilik platforma operatorining maqomini faqat axborot tizimini texnik jihatdan ta’minlash bilan cheklamaydi. Xususan, elektron tijorat operatorlariga

[34] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni, 3-modda.
[35] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni, 8-11-moddalari.

elektron tijorat sohasidagi xizmatlarni shartnoma asosida ko‘rsatish, xizmat ko‘rsatish shartlarini belgilash huquqi berilgan bo‘lsa, ularga axborot tizimlarining uzluksiz ishlashini ta’minlash, qonunchilik va elektron tijorat sohasidagi standart hamda qoidalarga rioya qilish, tegishli axborotni oshkor etish va elektron hujjatlar hamda shaxsga doir ma’lumotlarni himoya qilish kabi majburiyatlar yuklatilgan.[36] Demak, operatorning huquqiy maqomi uning elektron tijorat infratuzilmasidagi muayyan tashkiliy va xizmat ko‘rsatish funksiyalarini bajarishi bilan bog‘liq.

Elektron savdo maydonchasi operatorining maqomi esa umumiy elektron tijorat operatorining maqomidan nisbatan kengroq mazmunga ega. Qonunning 13-moddasida unga, bir tomondan, elektron savdo maydonchasida tovarlar, ishlar va xizmatlarni bevosita va mustaqil ravishda sotish, ikkinchi tomondan esa ayrim faoliyat turlarini amalga oshiruvchi sotuvchilarning litsenziyalari, ruxsat beruvchi hujjatlari yoki xabarnomalarini tekshirish huquqi berilgan. Shu bilan birga, operator zimmasiga muomalasi cheklangan yoki muomaladan chiqarilgan tovarlar realizatsiyasining oldini olish, savdo qoidalari va xizmat ko‘rsatish shartlarini platformada muntazam aks ettirish hamda elektron tijorat ishtirokchilariga tegishli shartnoma shartlari bilan tanishish imkoniyatini yaratish kabi majburiyatlar yuklangan.[37] Mazkur normalar platformaning fuqarolik-huquqiy maqomini baholashda muhim nazariy xulosaga olib keladi. Ya’ni, elektron savdo maydonchasi operatorining huquqiy tabiati faqat “vositachi” tushunchasi bilan izohlanishi mumkin bo‘lgan bir xil maqomdan iborat emas. Qonunchilikning o‘zi operatorga turli darajadagi funksiyalarni bajarish imkoniyatini beradi: u platforma xizmatlarini ko‘rsatishi, sotuvchilar faoliyatiga oid ayrim ma’lumotlarni tekshirishi va ayrim holatlarda tovar yoki xizmatlarni bevosita, mustaqil ravishda sotishi mumkin. Shu sababli elektron tijorat platformasining fuqarolik-huquqiy maqomini aniqlashda uning funksional roli asosiy mezonlardan biri sifatida qaralishi lozim. Agar platforma faqat sotuvchi va xaridor o‘rtasida axborot almashish imkoniyatini yaratib, shartnoma mazmuni va uning bajarilishiga bevosita aralashmasa, uning huquqiy roli cheklangan operator sifatida namoyon bo‘lishi mumkin. Aksincha, platforma shartnoma tuzilishi, to‘lov, yetkazib berish, qaytarish yoki mahsulot realizatsiyasining boshqa muhim bosqichlarida faol ishtirok etsa, uning huquqiy maqomini faqat texnik vositachi sifatida belgilash yetarli bo‘lmaydi.

[36] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni, 12-modda
[37] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni, 13-modda

Bu masalada Fuqarolik kodeksining umumiy qoidalari ham muhim ahamiyatga ega. Fuqarolik-huquqiy munosabatlarda yuridik shaxs o‘z nomidan huquq va majburiyatlarga ega bo‘lishi, majburiyatlarni bajarishi hamda qonunchilik va shartnomaga muvofiq javobgar bo‘lishi mumkin.[38] Shu nuqtayi nazardan, platformaning muayyan fuqarolik-huquqiy majburiyatlari uning elektron tijorat operatori sifatidagi maxsus maqomidan tashqari, platforma ishtirok etayotgan muayyan bir shartnoma va boshqa fuqarolik-huquqiy munosabatlarning mazmunidan ham kelib chiqishi mumkin. Shunday qilib, elektron tijorat platformasining fuqarolik-huquqiy maqomini yagona va o‘zgarmas huquqiy model sifatida emas, balki platformaning aniq elektron tijorat operatsiyasidagi funksional ishtiroki bilan bog‘liq holda baholash maqsadga muvofiq. Mazkur yondashuv keyingi bosqichda platformaning shartnomaviy munosabatlardagi rolini va uning iste’molchi oldidagi javobgarligi chegaralarini aniqlash uchun metodologik asos bo‘lib xizmat qiladi.

Platformaning elektron tijoratdagi shartnomaviy roli

Elektron tijorat platformasining fuqaroviy-huquqiy maqomini aniqlashdan keyingi muhim masala uning elektron tijorat munosabatlarida shartnomaviy rolini belgilashdan iborat. Platformada amalga oshiriladigan har bir operatsiyada platformaning mavjudligi uning avtomatik ravishda asosiy shartnoma tarafi bo‘lishini anglatmaydi. Shu sababli platforma operatorining shartnoma tuzilishidagi ishtiroki, uning elektron oferta va aksept jarayonidagi funksiyasi hamda platformada joylashtiriladigan foydalanish qoidalarining huquqiy ahamiyatini alohida aniqlash zarur. O‘zbekiston Respublikasining “Elektron tijorat to‘g‘risida”gi Qonunida elektron tijoratda shartnoma tuzishning maxsus mexanizmlari belgilangan. Unga ko‘ra, aksept elektron raqamli imzo bilan tasdiqlangan elektron hujjat, elektron tijorat ishtirokchisining roziligi bildirilgan elektron xabar yoki ofertada ko‘rsatilgan shartlarni bajarishga qaratilgan harakatlar orqali amalga oshirilishi mumkin. Shartnoma esa oferta yuborgan elektron tijorat ishtirokchisi tomonidan aksept olingan paytdan boshlab tuzilgan deb e’tirof etiladi.[39] Mazkur qoida elektron tijorat platformasining shartnomaviy munosabatlardagi rolini aniqlash uchun muhim ahamiyatga ega. Chunki elektron tijorat platformasi odatda shartnoma tuzish jarayonini texnik jihatdan ta’minlashi mumkin, biroq bu holat uning o‘z-o‘zidan sotuvchi yoki xaridor bilan tuzilayotgan asosiy shartnomaning tarafi ekanligini bildirmaydi. Shartnoma taraflarini aniqlashda, avvalo, oferta kim tomonidan

[38] O‘zbekiston Respublikasining Fuqarolik kodeksi 12.09.2026-y., 03/26/1175/0921-son
[39] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni, 19-modda.

berilgani, aksept kim tomonidan amalga oshirilgani va majburiyatni bajarish kimning zimmasiga yuklanganiga e'tibor qaratish lozim. Elektron tijoratda ofertaning mazmuni ham platformaning shartnomaviy rolini aniqlashda alohida ahamiyatga ega. Qonunchilik oferta tarkibida ofertani yuborgan shaxs to‘g‘risidagi ma'lumotlar, shartnoma tuzish tartibi, akseptni yuborish va chaqirib olish tartibi, tovarlar yoki xizmatlarni yetkazib berish va haq to‘lash shartlari hamda boshqa zarur axborot ko‘rsatilishini nazarda tutadi.[40] Shundan kelib chiqib, marketplace platformasida mahsulot to‘g‘risidagi ma'lumotning joylashtirilishi bilan shartnoma bo‘yicha majburiyatning aynan qaysi subyekt zimmasiga yuklatilganligini farqlash lozim. Platforma interfeysida mahsulot sotuvga qo‘yilgan bo‘lishi uning operatorini avtomatik ravishda ushbu mahsulotning sotuvchisiga aylantirmaydi. Bunda sotuvchining nomi, rekvizitlari, shartnoma shartlari va xaridorga taqdim etiladigan boshqa ma'lumotlarning qanday ko‘rsatilishi huquqiy ahamiyat kasb etadi. Fuqarolik kodeksining oferta va akseptga oid umumiy qoidalari ham ushbu yondashuvni tasdiqlaydi. Xususan, oferta shartnoma tuzishga qaratilgan aniq taklifni, aksept esa ushbu taklifni to‘liq va pisandasiz qabul qilishni anglatadi. Ofertada ko‘rsatilgan shartlarni bajarishga qaratilgan harakatlar ham qonunchilikda yoki ofertada boshqacha tartib belgilanmagan bo‘lsa, aksept sifatida e'tirof etilishi mumkin.[41]

Elektron tijorat platformasining o‘z shartlari va qoidalari esa boshqa masalani tashkil etadi. Platformadan foydalanish qoidalari, ro‘yxatdan o‘tish shartlari, to‘lov, yetkazib berish, qaytarish va nizolarni ko‘rib chiqish tartibiga oid qoidalar platforma operatori bilan foydalanuvchi o‘rtasidagi alohida huquqiy munosabatlarning mazmunini belgilashi mumkin. Biroq bunday qoidalar platformada sotuvchi va xaridor o‘rtasida tuziladigan asosiy oldi-sotdi yoki xizmat ko‘rsatish shartnomasining taraflarini avtomatik ravishda o‘zgartirmaydi. O‘RQ-792-son Qonunning 18-moddasida elektron tijorat ishtirokchilariga, agar qonunchilikda boshqacha qoida nazarda tutilmagan bo‘lsa, o‘zaro kelishuv asosida identifikatsiya qilish, elektron hujjat va xabar almashish, oferta joylashtirish va yuborish, akseptni amalga oshirish hamda axborotning ishonchliligini tekshirish tartibini belgilash imkoniyati berilgan.[42] Bu norma elektron platformalarda shartnoma tuzish jarayonining texnik mexanizmlari va huquqiy oqibatlarini oldindan belgilash imkonini beradi. Shu

[40] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni, 19-modda.
[41] O‘zbekiston Respublikasining Fuqarolik kodeksi (birinchi qism), 367–370-moddalar.
[42] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni, 18-modda

bilan birga, elektron tijorat platformasining texnik funksiyani bajarishi bilan uning shartnomaviy majburiyatlari o‘rtasidagi chegara aniq ajratilishi lozim. Agar platforma faqat oferta va aksept almashinuvini texnik jihatdan ta’minlasa, uning roli cheklangan bo‘lishi mumkin. Biroq platforma o‘z foydalanish shartlari orqali to‘lovni qabul qilish, buyurtmani tasdiqlash, yetkazib berishni tashkil etish, qaytarish yoki pul mablag‘larini qaytarish kabi majburiyatlarni o‘z zimmasiga olsa, mazkur harakatlar platforma bilan foydalanuvchi o‘rtasida mustaqil majburiyatlarning vujudga kelishiga asos bo‘lishi mumkin.

Demak, elektron tijorat platformasining shartnomaviy roli ikki alohida darajada baholanishi lozim: birinchisi — platformaning sotuvchi va xaridor o‘rtasidagi asosiy elektron shartnomani tuzish jarayonidagi funksiyasi; ikkinchisi — platformaning o‘z xizmatlarini ko‘rsatish bilan bog‘liq ravishda foydalanuvchi oldida olgan mustaqil majburiyatlari. Aynan ushbu ikki darajani farqlash platformaning keyinchalik yuzaga kelishi mumkin bo‘lgan fuqaroviy-huquqiy javobgarligini to‘g‘ri belgilash imkonini beradi. Shunday qilib, platformaning shartnomaviy munosabatlardagi ishtiroki uning faqat “shartnoma tarafi” yoki “vositachi” sifatidagi formal maqomi bilan chegaralanmasligi kerak. Platforma tomonidan bajarilayotgan muayyan bir funksiyalar, foydalanuvchiga taqdim etilgan shartlar va platformaning o‘z zimmasiga olgan majburiyatlari uning fuqaroviy-huquqiy javobgarligi doirasini aniqlashda muhim mezon bo‘lib xizmat qiladi.

Elektron tijorat platformasining iste’molchi oldidagi fuqaroviy-huquqiy javobgarligi va uning chegaralari

Elektron tijorat platformasining iste’molchi oldidagi fuqaroviy-huquqiy javobgarligini belgilashda, avvalo, platformaning o‘z faoliyati doirasida zimmasiga olgan majburiyatlari va ularning bajarilishini baholash lozim. Platforma bilan iste’molchi o‘rtasida bevosita oldi-sotdi shartnomasi tuzilmagan taqdirda ham, platforma iste’molchiga elektron tijorat xizmatlarini ko‘rsatish, axborot tizimining barqaror ishlashini ta’minlash, to‘lovlarni qayta ishlash yoki buyurtma holati haqida ma’lumot berish kabi mustaqil majburiyatlarni olishi mumkin. Bunday majburiyatlarning buzilishi platformaning javobgarligi masalasini keltirib chiqaradi.

O‘zbekiston Respublikasi Fuqarolik kodeksining 324-moddasiga muvofiq, majburiyatni bajarmaslik yoki lozim darajada bajarmaslik natijasida kreditorga yetkazilgan zarar qarzdor tomonidan qoplanishi lozim. Kodeksning 333-moddasi esa majburiyatlarni buzganlik uchun javobgarlik asoslarini, jumladan, ayb bilan bog‘liq umumiy qoidalarni belgilaydi. Tadbirkorlik faoliyatida majburiyatni bajarmagan shaxs, qonunchilik yoki shartnomada

boshqacha qoida nazarda tutilmagan bo‘lsa, fors-major holatini isbotlay olmagan taqdirda javobgar bo‘ladi.[43] Shu nuqtayi nazardan, platformaning iste’molchi oldidagi javobgarligini aniqlashda majburiyatning mavjudligi, uning buzilishi, zarar va buzilish bilan zarar o‘rtasidagi sababiy bog‘lanish, shuningdek, qonunchilikda belgilangan javobgarlik shartlari birgalikda tahlil qilinishi kerak. “Elektron tijorat to‘g‘risida”gi Qonunning 12-moddasida elektron tijorat operatorlari zimmasiga qonunchilik talablariga rioya qilish, o‘z axborot tizimlarining uzluksiz ishlashini ta’minlash choralarini ko‘rish, xizmatlari va ularni ko‘rsatish shartlari to‘g‘risidagi axborotni oshkor etish, elektron hujjatlar hamda shaxsga doir ma’lumotlarni ruxsatsiz foydalanishdan himoya qilish kabi majburiyatlar yuklatilgan.[44] Mazkur talablar platformaning faqat texnik vositachi sifatidagi faoliyatiga emas, balki iste’molchining elektron tijorat jarayonida xavfsiz va ishonchli xizmatdan foydalanish imkoniyatiga ham taalluqlidir. Masalan, platformaning o‘z axborot tizimidagi kamchiliklar tufayli iste’molchi to‘lovni takroran amalga oshirishi, buyurtma ma’lumotlari yo‘qolishi yoki shaxsga doir ma’lumotlari ruxsatsiz oshkor etilishi natijasida zarar ko‘rishi mumkin. Bunday vaziyatlarda javobgarlik masalasi platformaning aynan qaysi majburiyatni buzganligi va ushbu buzilish iste’molchiga yetkazilgan zarar bilan qay darajada bog‘liqligidan kelib chiqib hal etilishi lozim. Shu bilan birga, operatorning qonunda belgilangan javobgarlik doirasi va uning shartnoma asosida zimmasiga olgan qo‘shimcha majburiyatlarini farqlash muhimdir. Qonunning 12-moddasi operatorga qonunchilik va shartnomaga muvofiq boshqa majburiyatlar ham yuklatilishi mumkinligini nazarda tutadi.[45] Demak, platforma buyurtmani yetkazib berish, to‘lovni qabul qilish va sotuvchiga o‘tkazish, tovarni qaytarish jarayonini tashkil etish yoki iste’molchining murojaatlarini ko‘rib chiqish kabi xizmatlarni o‘z zimmasiga olgan bo‘lsa, mazkur xizmatlarning lozim darajada bajarilmaganligi uning shartnomaviy javobgarligiga asos bo‘lishi mumkin. Bunda platforma qoidalarida javobgarlikni umumiy tarzda sotuvchiga yuklashning o‘zi operatorning mustaqil majburiyatlarini bekor qilmaydi. Shartnoma shartlari qonunchilikning majburiy talablariga muvofiq bo‘lishi, iste’molchining qonun bilan kafolatlangan huquqlarini asossiz ravishda cheklamasligi kerak. **Platformaning**

[43] O‘zbekiston Respublikasining Fuqarolik kodeksi. Birinchi qism. 1995-yil 21-dekabr. 324-modda — majburiyatni bajarmaslik yoki lozim darajada bajarmaslik oqibatlari; 333-modda — majburiyatlarni buzganlik uchun javobgarlik asoslari.

[44] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni. 12-modda — elektron tijorat operatorlarining huquq va majburiyatlari.

[45] O‘zbekiston Respublikasining 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonuni. 12-modda.

javobgarligini belgilashda alohida e’tibor talab qiladigan masalalardan biri — uchinchi tomon sotuvchisining harakatlari yoki harakatsizligi oqibatida iste’molchiga zarar yetkazilgan holatlardir. Elektron savdo maydonchasida tovarning sifati, tavsifi, narxi, mavjudligi yoki yetkazib berish shartlari haqidagi ma’lumotlar, odatda, sotuvchi tomonidan taqdim etiladi. Shu sababli tovarning shartnomaga mos kelmasligi, noto‘g‘ri tavsiflanishi yoki sotuvchi tomonidan majburiyatlarning bajarilmasligi uchun javobgarlik, umumiy qoida tariqasida, tegishli majburiyatni o‘z zimmasiga olgan sotuvchiga taalluqli bo‘ladi. Biroq bu qoida platformaning o‘z harakatlari bilan bog‘liq javobgarligini istisno qilmaydi. Xususan, platforma sotuvchining taklifini tekshirish, mahsulot haqidagi ma’lumotlarni tasdiqlash, tovarning qonuniy muomalada bo‘lishini nazorat qilish yoki iste’molchiga muayyan kafolatlarni taqdim etish majburiyatini o‘z zimmasiga olgan bo‘lsa, ushbu vazifalarni lozim darajada bajarmaslik mustaqil javobgarlik asosiga aylanishi mumkin. Xuddi shuningdek, platforma o‘zining reklama materiallari, interfeysi yoki shartnoma shartlari orqali o‘zini sotuvchi yoxud bitimning asosiy ijrochisi sifatida namoyon qilgan vaziyatlarda uning iste’molchi oldidagi huquqiy holati faqat vositachilik maqomi bilan izohlanmasligi kerak. Bunda platformaning iste’molchida shakllantirgan asosli ishonchi, bitimdagi real ishtiroki va zimmasiga olgan majburiyatlari baholanishi lozim. Shu o‘rinda platformaning sotuvchi harakatlari uchun javobgarligini aniqlashda uning sotuvchi faoliyati ustidan nazorat imkoniyati va muayyan huquqbuzarlikdan xabardorligi ham ahamiyat kasb etadi. Masalan, platforma noqonuniy yoki iste’molchini chalg‘ituvchi taklif haqida yetarli ma’lumotga ega bo‘la turib, o‘z vakolatlari doirasida tegishli choralarni ko‘rmagan bo‘lsa, uning harakatsizligi bilan yuzaga kelgan zarar o‘rtasidagi sababiy bog‘lanish alohida tekshirilishi zarur. Biroq platformaning sotuvchi haqidagi barcha ma’lumotlarni tekshirish yoki sotuvchi bajargan har bir bitimning natijasini kafolatlash majburiyati bor, degan xulosaga faqat platforma sifatida faoliyat yuritayotganidan kelib chiqib kelish mumkin emas. Bunday majburiyatning mavjudligi qonun, shartnoma yoki platformaning iste’molchi oldida olgan aniq kafolatlari bilan asoslanishi kerak. Demak, platforma va sotuvchi o‘rtasidagi javobgarlik chegarasini belgilashda birgina shartnomada ko‘rsatilgan maqomga tayanish yetarli emas. **Platformaning bitimdagi funksiyasi, iste’molchiga taqdim etilgan axborot, sotuvchi faoliyatiga ta’sir ko‘rsatish imkoniyati, xizmat yoki kafolatlarni o‘z zimmasiga olganligi, shuningdek, zarar yuzaga kelishidagi xatti-harakati kompleks baholanishi lozim.** Bu mezonlar platformani sotuvchining har qanday majburiyati uchun javobgar qilishga ham, uning mustaqil harakatlari oqibatidagi javobgarlikdan asossiz ozod etishga ham

yo‘l qo‘ymaydi. Shunday qilib, elektron tijorat platformasining iste’molchi oldidagi fuqaroviy-huquqiy javobgarligi uning formal maqomidan ko‘ra, iste’molchi bilan munosabatda zimmasiga olgan aniq majburiyatlari va bitimdagi real funksional ishtirokiga asoslanishi kerak. Javobgarlikni aniqlashda majburiyatning mazmuni, uning buzilishi, zarar, sababiy bog‘lanish va qonunchilikda nazarda tutilgan boshqa shartlar hisobga olinishi lozim. Mazkur yondashuv platformaning o‘z harakatlari uchun javobgarligi bilan uchinchi tomon sotuvchisining harakatlari oqibatidagi javobgarlikni farqlash, shuningdek, platformaning javobgarlik chegaralarini uning real ishtirokiga mutanosib ravishda belgilash imkonini beradi.

Muzokara

Elektron tijorat platformalarining fuqaroviy-huquqiy javobgarligini belgilashda asosiy muammolardan biri platformaning oddiy vositachi sifatidagi maqomi bilan bitimda faol ishtirok etuvchi subyekt sifatidagi rolini chegaralashdan iborat. An’anaviy fuqarolik-huquqiy munosabatlarda shartnoma taraflarini aniqlash nisbatan oson bo‘lsa, elektron tijoratda platforma bir vaqtning o‘zida sotuvchi va iste’molchini bog‘lash, takliflarni joylashtirish, buyurtmalarni qabul qilish, to‘lovlarni qayta ishlash, yetkazib berishni tashkil etish yoki qaytarish jarayonlarini boshqarish kabi turli funksiyalarni bajarishi mumkin. Shu sababli platformaning faqat formal maqomiga asoslanish uning real huquqiy rolini to‘liq aks ettirmaydi.

Yevropa Ittifoqi tajribasi ushbu masalani, avvalo, iste’molchining axborotga bo‘lgan huquqi va platformaning tashkiliy majburiyatlari orqali hal qilishga intilayotganini ko‘rsatadi. Xususan, 2019/2161-son Direktivaga muvofiq, onlayn marketplace iste’molchiga uchinchi tomon sotuvchisining tadbirkor yoki tadbirkor emasligini, takliflarning reytingiga ta’sir qiluvchi asosiy parametrlarni hamda, tegishli hollarda, platforma va sotuvchi o‘rtasida shartnoma bo‘yicha majburiyatlar qanday taqsimlanganini ma’lum qilishi kerak.[46] Bu yondashuvda platforma avtomatik ravishda sotuvchining barcha majburiyatlari uchun javobgar qilinmaydi, biroq uning iste’molchiga yetarli va aniq axborot berishdagi mustaqil majburiyatlari e’tirof etiladi. Mazkur yondashuv Digital Services Act doirasida yanada rivojlantirilgan. Reglamentning 30-moddasi iste’molchilarga tadbirkorlar bilan masofaviy shartnoma tuzish imkonini beruvchi platformalardan sotuvchilar haqida muayyan ma’lumotlarni oldindan olishni talab qiladi. 31-modda esa platforma interfeysi sotuvchiga iste’molchi uchun zarur bo‘lgan huquqiy va xavfsizlikka

[46] Directive (EU) 2019/2161 of the European Parliament and of the Council of 27 November 2019, Article 4, amending Directive 2011/83/EU by inserting Article 6a.

oid ma’lumotlarni taqdim etish imkonini beradigan tarzda tashkil etilishini nazarda tutadi.[47] Bunda Yevropa Ittifoqi modelining muhim jihati platformani sotuvchining majburiyatlari uchun umumiy tarzda javobgar qilish emas, balki platformaning o‘z nazorat va tashkiliy imkoniyatlari doirasidagi majburiyatlarini aniq belgilashdan iborat. Mazkur tajriba O‘zbekiston uchun ham ahamiyatli bo‘lib, platformaning sotuvchi haqidagi ma’lumotlarni olish, ularni iste’molchiga yetkazish va o‘z zimmasiga olgan xizmatlar to‘g‘risida aniq axborot berish majburiyatlarini rivojlantirish zaruratini ko‘rsatadi. AQSh tajribasida esa platformaning javobgarligi, xususan, nuqsonli mahsulotlar bilan bog‘liq nizolarda, uning mahsulotni sotish va tarqatish zanjiridagi amaliy ishtiroki bilan bog‘lanishi mumkin. Masalan, “Bolger v. Amazon.com, LLC” ishida Kaliforniya apellyatsiya sudi Amazonning mahsulotni sotish jarayonidagi funksiyalarini mahsulot javobgarligi nuqtayi nazaridan baholagan. Ishda platforma mahsulotni xaridordan buyurtma qilish, to‘lovni amalga oshirish, mahsulotni ombordan olish, qadoqlash va jo‘natish jarayonlarida ishtirok etgani muhim fakt sifatida ko‘rib chiqilgan.[48] Keyingi “Loomis v. Amazon.com, LLC” ishida ham sud Amazonning uchinchi tomon sotuvchilari bilan ishlashdagi biznes amaliyotlarini mahsulotni tarqatish zanjiridagi o‘rni bilan bog‘liq holda tahlil qilgan.[49] Biroq AQSh tajribasini O‘zbekiston qonunchiligiga to‘liq ko‘chirish maqsadga muvofiq emas. Birinchidan, AQShda mahsulot javobgarligi bo‘yicha qoidalar shtatlar kesimida farqlanadi. Ikkinchidan, onlayn platformalarning uchinchi shaxslar tomonidan joylashtirilgan kontentga nisbatan javobgarligini cheklovchi 47 U.S.C. § 230 kabi maxsus normalar mavjud. Mazkur norma platformani uchinchi shaxs tomonidan yaratilgan axborot uchun ayrim hollarda “publisher or speaker” sifatida javobgarlikdan himoya qiladi, biroq u platformaning o‘z mustaqil majburiyatlari yoki boshqa huquqiy asoslar bo‘yicha javobgarligini avtomatik ravishda istisno etmaydi.[50]

Qiyosiy tahlil shuni ko‘rsatadiki, Yevropa Ittifoqi va AQShda platforma javobgarligini belgilash usullari turlicha bo‘lsa-da, ikkala yondashuvda ham platformaning bitimdagi real funksiyasi muhim ahamiyatga ega. Shu nuqtayi nazardan, **O‘zbekiston uchun platformaning javobgarligini faqat “vositachi” yoki “shartnoma tarafi” kabi formal kategoriyalar orqali belgilashdan ko‘ra, uning muayyan elektron tijorat operatsiyasidagi funksional ishtirokini hisobga olish maqsadga muvofiq**. Maqolada taklif

[47] Regulation (EU) 2022/2065 of the European Parliament and of the Council of 19 October 2022 (Digital Services Act), Arts. 30–31.
[48] Bolger v. Amazon.com, LLC, 53 Cal. App. 5th 431 (Cal. Ct. App. 2020).
[49] Loomis v. Amazon.com, LLC, 63 Cal. App. 5th 466 (Cal. Ct. App. 2021).
[50] 47 U.S.C. § 230(c), Communications Decency Act.

etilayotgan **“funksional ishtirok yondashuvi”** aynan shu ehtiyojdan kelib chiqadi. Unga ko‘ra, platformaning javobgarligi quyidagi ketma-ketlik asosida aniqlanishi mumkin: platformaning muayyan bitimdagi funksiyasini aniqlash; ushbu funksiyadan kelib chiqadigan qonuniy yoki shartnomaviy majburiyatlarni belgilash; majburiyatning buzilganligini aniqlash; zarar va sababiy bog‘lanishni tekshirish; shundan keyin javobgarlik masalasini hal qilish. Bunda platformalar shartli ravishda passiv texnik vositachi, faol marketplace operatori va integratsiyalashgan platforma sifatida tavsiflanishi mumkin. Biroq ushbu tasnif qat’iy huquqiy kategoriyalar emas, balki javobgarlikni baholash uchun funksional mezon sifatida qo‘llanishi lozim. O‘zbekiston qonunchiligini takomillashtirish nuqtayi nazaridan, birinchi navbatda, iste’molchiga platforma va sotuvchining huquqiy maqomi, ularning shartnoma bo‘yicha majburiyatlari hamda platforma tomonidan ko‘rsatiladigan xizmatlar to‘g‘risida aniq axborot berilishini kuchaytirish maqsadga muvofiq. Ikkinchidan, platformaning sotuvchi faoliyatiga nisbatan nazorat yoki tekshiruv vakolatlari mavjud bo‘lgan hollarda uning tegishli majburiyatlari aniq belgilanishi lozim. Uchinchidan, platforma o‘z zimmasiga olgan to‘lov, yetkazib berish, qaytarish yoki kafolat xizmatlarini bajarmagan holatlarda uning mustaqil fuqaroviy-huquqiy javobgarligi sotuvchining majburiyatlaridan farqlangan holda belgilanishi zarur.

Shunday qilib, xorijiy tajriba va O‘zbekiston qonunchiligining amaldagi holatini qiyosiy tahlil qilish platforma javobgarligining yagona universal modelini belgilashdan ko‘ra, uning real funksional ishtiroki va zimmasiga olgan majburiyatlariga mutanosib javobgarlik tizimini shakllantirish muhimligini ko‘rsatadi. Bunday yondashuv bir tomondan, platformalarni ular nazorat qila olmaydigan sotuvchi harakatlari uchun asossiz javobgarlikka tortishning oldini olsa, ikkinchi tomondan, platformaning o‘z faoliyati natijasida iste’molchiga yetkazilgan zarar uchun javobgarlikdan formal vositachilik maqomi orqali qochish imkoniyatini cheklaydi.

XULOSA

O‘tkazilgan tadqiqot natijalari elektron tijorat platformalarining fuqaroviy-huquqiy javobgarligini belgilashda ularning formal huquqiy maqomidan tashqari, bitimdagi real funksional ishtiroki va zimmasiga olgan majburiyatlarini ham hisobga olish zarurligini ko‘rsatdi. Platformaning vositachi sifatida faoliyat yuritishi uning o‘z harakatlari yoki harakatsizligi oqibatida iste’molchiga yetkazilgan zarar uchun javobgarligini istisno etmaydi. Shu bilan birga, uchinchi tomon sotuvchisining barcha majburiyatlarini platforma zimmasiga yuklash ham huquqiy jihatdan asosli yondashuv hisoblanmaydi. Qiyosiy tahlil asosida platforma javobgarligini uning funksional ishtirokiga

mutanosib ravishda belgilashga asoslangan yondashuv taklif etildi. Ushbu yondashuv platformaning muayyan bitimdagi vazifalarini aniqlash, tegishli qonuniy yoki shartnomaviy majburiyatlarini belgilash, ularning buzilishi, zarar va sababiy bog‘lanishni baholash orqali javobgarlik masalasini hal qilishni nazarda tutadi. Platformalarni passiv texnik vositachi, faol savdo maydonchasi operatori va integratsiyalashgan platforma sifatida shartli tasniflash esa javobgarlikni farqlash uchun tahliliy mezon bo‘lib xizmat qilishi mumkin. O‘zbekiston qonunchiligini takomillashtirish uchun quyidagi yo‘nalishlar muhim deb hisoblanadi: birinchidan, iste’molchiga platforma va sotuvchining maqomi hamda ular o‘rtasida taqsimlangan majburiyatlar haqida aniq axborot berish talablarini rivojlantirish; ikkinchidan, platformaning sotuvchi faoliyatiga doir tekshiruv va nazorat imkoniyatlariga mutanosib majburiyatlarini belgilash; uchinchidan, platformaning o‘zi zimmasiga olgan to‘lov, yetkazib berish, qaytarish va kafolat xizmatlarini bajarmaganlik uchun javobgarligini sotuvchining majburiyatlari buzilishidan farqlash. Xulosa qilib aytganda, elektron tijorat platformalarining fuqaroviy-huquqiy javobgarligini funksional ishtirok va aniq majburiyatlar asosida belgilash huquqiy aniqlikni oshirish, platformalar faoliyatida mas’uliyatni ta’minlash hamda iste’molchilar huquqlarini samarali himoya qilishga xizmat qilishi mumkin.

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ТРАНСФОРМАЦИЯ ТРУДОВОЙ МОТИВАЦИИ ГОСУДАРСТВЕННЫХ ГРАЖДАНСКИХ СЛУЖАЩИХ И СОЦИАЛЬНО-ПСИХОЛОГИЧЕСКАЯ СТРАТЕГИЯ ПОВЫШЕНИЯ ЕЁ ЭФФЕКТИВНОСТИ

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Аннотация. *В данной статье рассматриваются социально-психологические закономерности трансформации трудовой мотивации государственных гражданских служащих в условиях масштабных цифровых и институциональных реформ в Узбекистане. Автором проанализирован сдвиг в ценностно-смысловой сфере служащих от доминирования внешних утилитарных стимулов к внутренним факторам самореализации. Эмпирически доказана взаимосвязь между внутренним локусом контроля, удовлетворенностью трудом и эффективностью профессиональной деятельности (KPI). Разработана и обоснована комплексная социально-психологическая стратегия повышения эффективности труда в госсекторе, включающая в себя оптимизацию организационного климата, профилактику профессионального выгорания и внедрение меритократических принципов.*

Ключевые слова: *государственная гражданская служба, трудовая мотивация, трансформация мотивации, социально-психологический климат, локус контроля, профессиональное выгорание, эффективность труда (KPI).*

ВВЕДЕНИЕ

Современный этап развития государственности в Республике Узбекистан характеризуется коренной модернизацией аппарата управления, переходом на цифровые форматы взаимодействия и внедрением жестких метрик оценки эффективности (KPI). В условиях реализации Указа Президента Республики Узбекистан «О Стратегии развития и управления человеческими ресурсами в системе государственной гражданской службы до 2030 года» на первый план выдвигается проблема оптимизации человеческого фактора. Государственный служащий сегодня находится под воздействием

интенсивных когнитивных, информационных и эмоциональных нагрузок, что неизбежно приводит к трансформации его мотивационной сферы.

Традиционная модель мотивации в госсекторе, долгие годы опиравшаяся преимущественно на внешние стимулы (стабильность, статус, фиксированный оклад), в условиях быстрых реформ демонстрирует свою ограниченность. Высокий темп работы, внедрение прозрачных меритократических фильтров и цифровизация управленческих процессов требуют от чиновника принципиально иного психологического настроя - гибкости, проактивности, развитого эмоционального интеллекта и внутренней увлеченности делом.

В отечественной и зарубежной психологии труда (А.Н. Леонтьев, Б.Ф. Ломов, К. Альдерфер, Х. Хекхаузен) установлено, что наиболее устойчивой и продуктивной является именно внутренняя (интринсивная) мотивация, когда деятельность сама по себе представляет ценность для субъекта. Для государственной службы это означает сдвиг от парадигмы «исполнения обязанностей ради избегания наказания» к парадигме «служения обществу ради профессиональной самореализации».

Несмотря на высокую практическую значимость, социально-психологические детерминанты, управляющие процессом этой трансформации в условиях реформ в Узбекистане, остаются недостаточно изученными.

Цель исследования: Выявить социально-психологические особенности трансформации трудовой мотивации государственных служащих и разработать комплексную стратегию повышения эффективности их деятельности на основе оптимизации их мотивационного профиля.

Методы. Для реализации поставленной цели в период с января по май 2026 года было проведено комплексное эмпирическое исследование. В качестве респондентов выступили 140 государственных гражданских служащих (78 мужчин и 62 женщины) министерств и ведомств социально-экономического блока Республики Узбекистан в возрасте от 24 до 52 лет.

Диагностический комплекс (батарея тестов) включал в себя следующие валидные и надежные методики:

1. Методика А.А. Реана и В.А. Якунина (в модификации Н.С. Бадмаевой): Применялась для диагностики ведущих мотивов профессиональной деятельности (выявление долей внутренней, внешней положительной и внешней отрицательной мотивации).

2. Опросник субъективного локального контроля (С.Р. Пантелеев, В.В. Столин): Использовался для определения уровня интернальности/ экстернальности служащих, что отражает степень их личной ответственности за результаты труда.

3. Тест-сопросник удовлетворенности учебной/трудовой деятельностью (Л.В. Мищенко): Позволил измерить уровень эмоционально-психологического комфорта сотрудников в организационной среде.

4. Анализ объективных показателей деятельности: Индивидуальные квартальные оценки эффективности (Key Performance Indicators - KPI), предоставленные департаментами управления человеческими ресурсами (HR) с согласия участников.

Математико-статистическая обработка данных выполнялась с использованием пакета SPSS Statistics. Применялись методы описательной статистики, частотный анализ, корреляционный анализ по коэффициенту r-Пирсона, а также t-критерий Стьюдента для сравнительного анализа групп.

Результаты. Первый этап анализа данных был направлен на определение доминирующих типов мотивации среди чиновников. Частотный анализ по методике Реана-Якунина показал гетерогенную структуру выборки. Было выделено три устойчивых мотивационных профиля служащих:

Профиль 1 - «Внутренне ориентированный» (38% выборки): Высокие баллы по шкалам профессиональных и социальных мотивов. Эти сотрудники ориентированы на карьерный рост через повышение квалификации и видят ценность своей работы в принесении пользы обществу.

Профиль 2 - «Внешне позитивный» (42% выборки): Доминирование мотивов престижа, материального благополучия и стабильности. Деятельность продуктивна, но сильно зависит от внешних поощрений.

Профиль 3 - «Внешне негативный / Защитный» (20% выборки): Преобладание мотивации избегания неудач и страха дисциплинарных взысканий.

Для проверки гипотезы о влиянии внутренней структуры личности на эффективность труда был проведен корреляционный анализ. Полученная корреляционная матрица обнаружила глубокие психологические взаимосвязи (см. Таблицу 1).

Таблица 1.

Матрица корреляционных взаимосвязей показателей мотивации, личности и эффективности служащих (n=140)

психологические показатели	1. sam_real	2. mot_int	3. loc_int	4. burnout	5. объективный KPI
1. самореализация	1.00	**0.54***	**0.48***	*-0.41**	**0.51***
2. внутр. мотивация	**0.54***	1.00	**0.61***	*-0.52**	**0.58***
3. интернальность	**0.48***	**0.61***	1.00	*-0.38**	**0.46***
4. выгорание	*-0.41**	*-0.52**	*-0.38**	1.00	*-0.49**
5. объективный KPI	**0.51***	**0.58***	**0.46***	*-0.49**	1.00

** Примечание: связи значимы при $p < 0.01$.*

Анализ коэффициентов Пирсона показывает, что объективная эффективность труда (KPI) имеет сильную прямую связь с внутренней мотивацией (r = 0.58) и уровнем интернальности (r = 0.46). Это означает, что госслужащие, обладающие внутренним локусом контроля (принимающие ответственность за свои успехи и неудачи на себя), демонстрируют значительно более высокие рабочие показатели, нежели их коллеги с экстернальным (внешним) вектором ответственности.

В то же время, синдром профессионального выгорания предсказуемо находится в жесткой отрицательной корреляции со всеми позитивными параметрами, особенно разрушая внутренний интерес к деятельности ($r = -0.52$) и снижая итоговый KPI (r = -0.49).

Применение t-критерия Стьюдента для сравнения возрастных групп показало, что молодые специалисты (до 30 лет) имеют более выраженную склонность к трансформации мотивации под влиянием цифровой среды, однако они в 1.4 раза чаще подвержены депрессивным фазам выгорания из-за несовпадения идеализированных ожиданий с жесткой бюрократической реальностью.

Обсуждение. Полученные результаты наглядно подтверждают, что в условиях когнитивной и технологической трансформации госаппарата

Узбекистана внешнее администрирование перестает быть гарантом сверхэффективности. Жёсткое внедрение KPI без учета психологического климата порождает феномен, зафиксированный у 20% сотрудников «защитного» профиля - работу «ради красивого отчета», сопровождающуюся скрытым саботажем и колоссальным внутренним выгоранием.

Опираясь на функциональную теорию систем П.К. Анохина, можно утверждать, что когда у госслужащего доминирует внешняя отрицательная мотивация, в его сознании «акцептор действия» настроен лишь на минимизацию личных рисков (избегание штрафа), а не на созидательное решение государственных задач. Напротив, интеграция внутренней мотивации и интернального локуса контроля (субъективного признания своей автономии) высвобождает творческий и аналитический потенциал чиновника.

Комплексная социально-психологическая стратегия включает в себя 3 магистральных вектора:

Вектор оптимизации оргкультуры (Горизонтальный уровень): Трансформация авторитарного стиля руководства в трансформационный и поддерживающий. Снижение токсичности коммуникаций в министерствах, развитие каналов обратной связи, где чиновник чувствует себя не «винтом в машине», а ценным интеллектуальным ресурсом.

Вектор психологической разгрузки и профилактики деструкций (Внутренний уровень): Организация на базе ведомств постоянных психологических служб поддержки, проведение тренингов по эмоциональной саморегуляции, тайм-менеджменту и борьбе с когнитивной перегрузкой

Вектор ценностно-смыслового обогащения (Вертикальный уровень): Прозрачная увязка карьерного продвижения исключительно с реальными заслугами, что переводит внешнюю материальную мотивацию служащего в плоскость долгосрочных мотивов самореализации и общественного признания.

ЗАКЛЮЧЕНИЕ

Процесс реформирования государственного управления в Узбекистане выступает мощным экзогенным детерминантом, трансформирующим структуру мотивов служащих. Происходит отмирание пассивных моделей мотивации и актуализация потребности в автономии.

Доказано, что наивысшие показатели объективной эффективности (KPI) демонстрируют сотрудники с доминированием внутренней профессиональной мотивации и интернальным локусом контроля. Внешнее административное давление без психологического подкрепления ведет к резкому выгоранию кадров.

Разработанная социально-психологическая стратегия, основанная на переходе от тотального контроля к управлению вовлеченностью, создании психологически безопасной среды и поддержке меритократии, является ключевым инструментом повышения эффективности государственного управления на долгосрочную перспективу.

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ISH JOYIDAGI IJTIMOIY MEDIAGA QARAMLIK: MAHSULDORLIK MUAMMOLARI VA TAKLIF QILINGAN YECHIMLAR

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Annotatsiya: *Ushbu tadqiqot ish joyida ijtimoiy tarmoqlardan foydalanish bilan bog'liq nazariy hissa qo'shadi. Yuqori ish faoliyatini ko‘rsatgan ishtirokchilar ijtimoiy tarmoqlardan foydalanib, hamkasblari bilan muloqot qilishga yordam berishdi. Odamlar yuqori ish faoliyati ham bir muddat qoniqarsiz ishdan qochib, ish joyida ijtimoiy tarmoqlardan foydalanib, bir muddat talabchan ishdan qochib ketayotganlar ekanini ko‘rsatdilar. Ish joyida ijtimoiy tarmoqlardan foydalanishning yuqori chastotasi natijasida ish faoliyati ko'paydi.*

Kalit so'zlar: *Ijtimoiy media, ish unumdorligi, ishlatilishi va qoniqishlari.*

Аннотация: *Данное исследование вносит теоретический вклад, связанный с использованием социальных сетей на рабочем месте. Участники, показавшие высокую производительность труда, использовали социальные сети для общения со своими коллегами. Люди, показавшие высокую производительность труда, также были теми, кто на некоторое время убегал от неудовлетворительной работы и на некоторое время убегал от сложной работы, используя социальные сети на рабочем месте. Высокая частота использования социальных сетей на рабочем месте привела к повышению производительности труда.*

Ключевые слова: *социальные медиа, производительность труда, использование и вознаграждение*

Abstract: *This study makes theoretical contributions related to social media usage in the workplace. Participants who showed high work performance used social media to help communicate with their colleagues. People showed high work performance were also the ones escaping from an unsatisfying job for a while and escaping from a demanding job for a while by using social media in the workplace. High frequency of using social media in the workplace resulted in increased work performance.*

Keywords: *Social Media, Work Performance, Uses and Gratifications*

KIRISH

Deyarli o'n yil oldin tadqiqotchilar elektron pochtaning ish joyidagi ta'sirini va bu tashkilotlarning unumdorligini pasaytiradimi yoki yo'qligini

o'rganishgan foydalanishning ortishi bilan tadqiqotchilar ushbu yangi aloqa usulini o'rganishga e'tibor qaratmoqdalar. Ijtimoiy tarmoqlardan foydalanishning ko'payishi shaxslararo munosabatlarning pasayishiga olib keladi. Millenial ishchilar yuzma-yuz gaplashish o'rniga hamkasblariga elektron pochta xabarlarini yozishni afzal ko'radilar. Ming yillik ishchilarga qo'shimcha ravishda, tobora ko'proq xodimlar yig'ilishlarda suhbatlarni tinglash va ularga hissa qo'shish o'rniga matnli xabarlarni yuborishadi. Ijtimoiy tarmoqlarning bir zumda mavjud bo'lishi va do'stlarning so'nggi xabarlarini tekshirish istagi odatiy xatti-harakatlar bo'lib, ish joylarida katta chalg'itish ro`y beradi."Cheklangan tadqiqotlar kompyuter vositachiligida, xususan, ijtimoiy mediadan foydalanishda ish joyidan qoniqishni o'rgandi". Cheklangan tadqiqotlar orasida ish joyida ijtimoiy mediadan foydalanish va uning xodimlarning samaradorligiga ta'sirini o'rganuvchi tadqiqotlar mavjud. Masalan, Munene va Nyaribo xodimlar eng ko'p pul sarflashlarini aniqladilar. Ish joyidagi va ish bilan bog'liq bo'lmagan faoliyat uchun ijtimoiy tarmoqlarda o'z vaqtlarini o'tkazadi va bu qaramlik ishchilarning ish faoliyatini pasaytiradi. Facebookda tadqiqot o`tkazildi va natijada Facebook ishda unumdorlikni pasaytirishi hujjatlashtirildi. Xuddi shunday, ijtimoiy mediadan foydalanish ish joyida tobora kuchayib borayotgan muammo ekanligini va xodimlar ijtimoiy mediadan qanchalik ko'p foydalansa, ular uni chalg'ituvchi deb bilishmaydi. Shunday qilib, ular ish joyida ijtimoiy tarmoqlarni taqiqlash o'rniga, tashkilotlarga undan foydalanish vaqtini kuzatib borishni tavsiya qiladi. Shunday qilib, ijtimoiy tarmoq saytlarida ortiqcha vaqt o'tkazadigan xodimlar ish joyida mumkin bo'lgan intizomiy jazoga tortilishi mumkin. SNS ning mehnat unumdorligiga salbiy ta'siridan farqli o'laroq, Seman 2014-yil o'z tadqiqotida tashkilot xodimlari SNS dan ijobiy tarzda foydalanganliklarini aniqladilar, bu esa o'z malakalarini oshirish bilan birga stress darajasini pasaytiradi. Boshqa bir tadqiqotida, agar ijtimoiy media menejerlar tomonidan to'g'ri boshqarilmasa, bu ishda muammoli vaziyatga aylanishini aniqladi, chunki u foydalanuvchilarni chalg'itadi. Ta'kidlashicha, ijtimoiy media xodimlarning ikki tomonlama muloqotiga va ish hamkorligiga ijobiy ta'sir ko'rsatdi va natijada samaradorlikka erishildi.

NAZARIY ASOSLAR

Foydalanish va qoniqish tushunchasi odamlarning qoniqishlari borligi va ularni qondirish uchun ommaviy axborot vositalarini izlashiga asoslanadi. Rohatlanish ommaviy axborot vositalaridan foydalanish natijasida to'plangan ehtiyojlarni anglatadi. Odamlarning ko'plab ehtiyojlari bor, ulardan ba'zilari ijtimoiy, boshqalari esa psixologik. O'z ehtiyojlarini qondirish uchun odamlar ma'lum ommaviy axborot vositalaridan foydalanishning afzalliklarini

boshqalarga nisbatan faol baholaydilar va ularni tanlaydilar. Foydalanish va qoniqish nazariyasi odamlarning turli xil ehtiyojlari (masalan, ma'lumot yig'ish) va bu ehtiyojlar medianing to'g'ri turini tanlash orqali (masalan, Google qidiruvi orqali) qondirilishini ta'kidlaydi. "Bu iste'molchilar ommaviy axborot vositalarini tanlashda faol va ular muayyan ehtiyojlarni qondirish uchun ma'lum texnologiyalar bilan shug'ullanadilar" degan taxmindan kelib chiqadi. Internet va ijtimoiy tarmoqlarning kundalik hayotimizga kirib borishi bilan endi odamlarning tanlash imkoniyatlari ko‘payib bormoqda. Ular Internet va ijtimoiy mediadan o'zlarining eng muhim ehtiyojlaridan biri bo'lgan ijtimoiy aloqa va ijtimoiy tarmoqqa tegishli bo'lgan ijtimoiy tarmoqlardan foydalanish orqali qondirish uchun foydalanadilar.

Papacharissi va Rubinning internetdan foydalanish motivlari va ularning beshta motivi (shaxslararo foydalilik, ma'lumot izlash, o'yin-kulgi, qulaylik va vaqt o'tkazish) bo'yicha topilmalari bo'yicha tadqiqotlari Internet va ijtimoiy media asosidagi ko'plab tadqiqotlarning asosi hisoblanadi.

“Shaxslararo yordam” ijtimoiy tarmoqlardan foydalanishning muhim omili hisoblanadi. Cha tadqiqotida ma'lum bo'lishicha, shaxslararo foydalilik motivatsiyasi tufayli odamlarning ijtimoiy tarmoq saytlaridan foydalanish chastotasi va davomiyligi oshgan.

Li onlayn video reklamalarni tomosha qilish uchun beshta motivatsiyani topdi, ular: ijtimoiy o'zaro ta'sir, dam olish, ma'lumot, qochish vaqti va o'yin-kulgi. Bae foydalanuvchilarning SNS-ni davom ettirish niyati ularning SNS-dan foydalanishdan qoniqishlari bilan bog'liqligini aniqladi. Xonning YouTube-dan qoniqish bo'yicha tadqiqoti shuni ko'rsatdiki, dam olish motivlari bor o'yin-kulgi, ijtimoiy muloqot va ma'lumot berish.

Gao va Feng ijtimoiy mediadan qoniqishlarni besh toifaga ajratdi, ular: ma'lumot izlash, o'yin-kulgi, ijtimoiy o'zaro ta'sir, o'zini ifoda etish va taassurotlarni boshqarish. Heravi onlayn ijtimoiy tarmoqdan foydalanish uchun to'rtta o'lchovni topdi, ular: munosabatlarni saqlash, o'yin-kulgi, munosabatlarni o'rnatish va ma'lumot qidirish. Ijtimoiy mediani martaba rivojlanishi, o'z-o'zini marketing va ishchi-ish beruvchi munosabatlari uchun o'rganib chiqdi, ijtimoiy mediadan o'z-o'zini marketing vositasi sifatida foydalanadigan xodimlar ijobiy obro'ga ega bo'lishga harakat qilishlarini va ularning muloqoti bilan assimetrik ekanligini aniqladilar. Skeels va Grudin 2009 ish joyida Facebook va LinkedIn-dan foydalanishni o'rganib chiqdi va keng ijtimoiy va ish bilan bog'liq foydalanishni topdi. Leftheriotis va Giannakos sug'urta kompaniyasida ijtimoiy mediadan foydalanish va xodimlarning ish samaradorligi o'rtasidagi bog'liqlikni o'rganib chiqdi va ijtimoiy media axborot almashish imkonini beradi va

xodimlarga bilim uzatishni yaxshilashga yordam beradi. Tulu 2017 universitet akademiklari o‘rtasida onlayn ijtimoiy tarmoqlardan foydalanishni o‘rganib chiqdi va ijtimoiy tarmoqlardan foydalanish rasmiy ish vaqtida o‘qituvchilarning mehnat unumdorligini pasaytirmasligini aniqladi. Nduhura va Prieler 2017-yildagi, ish joyidagi ijtimoiy media bo'yicha o'tkazgan tadqiqotlarida ijtimoiy media davlat muassasalari faoliyatida va xodimlarning turli tadbirlarni muvofiqlashtirish, jumladan, uchrashuvlar tashkil etish va ma'lumot almashishda ijtimoiy mediadan foydalanish usullarida markaziy rol o'ynashini aniqladi. Tajudeen o'z tadqiqotlarida tashkilotlar tomonidan ijtimoiy mediadan foydalanishning afzalliklari borligini tasdiqladi. Jiang o`z topilmalari ijtimoiy tarmoqlardan foydalanish va ishtirokchilarning etakchilik xatti-harakatlari o'rtasida sezilarli bog'liqlik borligini ko'rsatdi. Robertson va Kee Facebook’ning hamkasblar bilan o‘zaro munosabati xodimlarning ishdagi qoniqishini ijobiy tomonga oshirganini aniqladi. Ijtimoiy tarmoqlar kundalik hayotda tobora ko'proq joy egallamoqda. Bizning mavjudligimizning ajralmas qismiga aylangan. Shu bilan birga, ularning faol foydalanuvchilari sonining tez o'sishi bilan birga roli doimiy ravishda o'sib bormoqda. Onlayn shovqin ko'proq qo'llanila boshlandi shaxsiy muloqot, ijtimoiy tarmoqlar odamlarning turmush tarzi, muloqoti, qiziqishlari va psixologiyasiga jiddiy ta'sir ko'rsata boshladi. Ijtimoiy tarmoqlardan foydalanish jadal sur'atlar bilan kengayib bormoqda va dunyo aholisining uchdan biridan ko'prog'ini qamrab oldi, shuning uchun turli xil tadqiqotchilar mamlakatlar ijtimoiy tarmoqlarni faol o'rganmoqda. Katta empirik materiallar to'plangan, umumlashtirish va tushunishni talab qiladi, bu ko'rib chiqishning maqsadi edi. Ijtimoiy tarmoqlarga qaramlik va depressiya, tashvish, stress o'rtasidagi ijobiy aloqalar, nevrotizm, hissiy muammolar, o'z-o'zini past baholash, kiber qurbonlik, jismoniy sog'liq muammolari, ruhiy kasalliklar, yolg'izlik, kechikish, smartfon va internetga qaramlik va munosabatlardagi xiyonat. Ijtimoiy tarmoqlarga qaramlik va qoniqish o'rtasidagi salbiy bog'liqlik aniqlangan, maktab o'quvchilari va talabalarning o'quv natijalari, mehnat unumdorligi va o'z xodimlarining tashkilotga sodiqligi, ijtimoiy kapital, yoshi. Asosiy sabab ijtimoiy tarmoqlarga qaramlik muloqotga bo'lgan ehtiyojdir va umuman ayollar ijtimoiy tarmoqlarda ishtirok etishda erkaklarga qaraganda faolroq. Sharh faqat turli sohalarda o'tkazilgan bir qator tadqiqotlarda aniqlangan ijtimoiy tarmoqlarga qaramlik mamlakatlar o'rtasidagi aloqalarni taqdim etadi.Taqdim etilgan natijalar ijtimoiy tarmoqlarga qaramlikni aniqlaydigan chet tili so'rovnomalari yordamida chet elda olingan.

METODOLOGIYA

Ko'p tanlovli savollar orasida, ishtirokchilarning ish joyida ijtimoiy mediadan foydalanish chastotasi haqidagi ettinchi savol va o'n ikkinchi savol - ishtirokchilarning ijtimoiy mediadan foydalanishga ishonishlari va bu ularning ish samaradorligiga yordam berishini takidlab o`tishdi. Savollarni qulayroq qilish uchun biroz o'zgartirildi. Ular "ha-yo'q savollar" ko'rinishida bo'lgan va javoblarga "ishonchsiz" tanlovini qo`llashdi. Yopiq variantlarda "faqat uyda kirish" bekor qilindi va u "har kuni tashrif buyurmayman" bilan almashtirildi. Boshqa ko'p tanlov savollari mualliflar tomonidan adabiyotlarni ko'rib chiqish asosida ishlab chiqilgan.

Ish joyidagi ijtimoiy tarmoqlardan foydalanish shkalasi

Xodimlarning ish joylarida ijtimoiy tarmoqlarda ishtirok etishining asosiy sabablarini tushunish uchun yettita banddan iborat 5 ballli Likert shkalasi savollari ishlab chiqilgan va mualliflar tomonidan tadqiqotga kiritilgan. Bu savollar:

- Ishga oid ma'lumotlarni topish va uni yuklab olish
- Bu menga hamkasblarim bilan muloqot qilishda yordam beradi
- Bu mening menejerlarim bilan muloqot qilishimga yordam beradi
- Bu mening ishimni muvofiqlashtirishga yordam beradi
- Bu menga biznes-reja tuzishda yordam beradi
- Men bir lahzada muloqot qila olaman
- Men favqulodda vaziyatda muloqot qila olaman.
- Ishbilarmonlik aloqalarini o'rnatish uchun
- Hamkasblar bilan ma'lumot almashish uchun
- Ishga oid ma'lumotlarni qidirish uchun
- Kundalik tartibning bir qismi
- Qoniqarsiz ishdan bir muddat qochib qutulmoq
- Qattiq talabchan ishdan bir muddat qochish.

Ish samaradorligi shkalasi

Ish samaradorligi - bu xodimlarning o'z ish faoliyatini ko'rsatish darajasi. Ish samaradorligi shkalasi Leftheriotis va Giannakos tadqiqotidan qabul qilingan. Biz o'zgaruvchilarni o'lchash uchun 5 ballli Likert shkalasidan foydalandik ("To'liq qo'shilmayman", ""Rozimasman",""Neytral", "Roziman"" va "To'liq roziman"").

Ishonchlilik

Tadqiqot ichki muvofiqlikni tekshirish orqali ishonchliligini tekshirish maqsadida ishonchlilik testidan o'tkazildi. Ichki muvofiqlik ish samaradorligi uchun a = 0,787 va ish joyidagi ijtimoiy media ishtiroki uchun a = 0,844 qaytarilgan asbobning Cronbach alfa Cronbach alfa testi bilan baholandi.

Bog'liq va mustaqil o'zgaruvchilar

Mustaqil o'zgaruvchilar - bu ishtirokchilarning demografik profili, ijtimoiy tarmoqlarga tashrif buyurish chastotasi va ish joyidagi ijtimoiy media ishtiroki bilan bog'liq o'zgaruvni - bu ish samaradorligi.

Tahlil

Ma'lumot to'plash uchun so'rov usuli qo'llanildi va ma'lumotlar SPSS 22 dasturi yordamida tahlil qilindi. Ish joyidagi ijtimoiy media ishtirokining ish samaradorligiga ta'sirini o'lchash uchun omil tahlili, chastota va regressiya tahlilidan foydalandik. 455 kishi ishtirok etishni ma'qul ko'rdi va so'rovdan o'tdi. 259 nafari tadqiqotda ishtirok etmadi. Ishtirokchilar turli muassasalarda ishlaydi. Bular Kibris Ilim universiteti, Yaqin Do'g'u universiteti, Girne universiteti, Do'g'a kolleji, Qandil dorixonasi, Fikri Terkan qurilish, Bücürük bolalar kiyimlari, Temedya reklama agentligi, Lapta Yavuzlar o'rta maktabi, Nikosiya yer idorasi, Nikosiya kompaniyalari ro'yxatga olish boshqarmasi, Nikosiya Hisob palatasi, Xalqaro final universiteti va Lefke Yevropa universiteti.

Demografik ma'lumotlar

Ayollar (58%) erkaklardan (42%) ko'proq edi. Ishtirokchilarning asosiy qismini Shimoliy Kiprliklar (69,2%), undan keyin turklar (19,3%), inglizlar (4,8%), eronlar (4,8%) va boshqa millatlar (1,8%). Ishtirokchilar 36-46 (38,9%), 25-35 (30,3%), 47-57 (21,1%), 58-68 (7,7%) va 69-79 (2%) orasida edi. Aksariyati xususiy universitetda (52,5%), boshqalari davlat ishlarida (35,8%) va xususiy sektorda (11,6%) ishlagan. Ularning 51 foizi akademik, o‘qituvchi, 11,6 foizi idora xodimlari, 5,5 foizi rahbar va 31,9 foizi boshqa unvonlarga ega edi. WhatsApp (46,2%) ish joyida eng ko'p foydalaniladigan ijtimoiy media edi. Ikkinchi o‘rinni Facebook 32,5%, Intagram 13,6% uchinchi, Twitter 5,3% to‘rtinchi va Viber 2,4% ijtimoiy tarmoqlardan foydalangan beshinchi o‘rinni egalladi. Ko'pchilik uni kuniga bir yoki ikki marta ishlatgan (45,1%), 33,2% kuniga 10 martagacha, 10,8% deyarli har doim ishlatgan. Ozchilik (9,7%) har kuni tashrif buyurmagan va faqat 1,3% ish joyida ijtimoiy tarmoqlardan foydalanmagan.

Ish joyidagi ijtimoiy media fikrlari uchun natijalar

Yuqori foizga ega bo‘lgan ishtirokchilar (80,4%) “ish joyidagi ijtimoiy tarmoqlardan foydalanish ijobiy ikki tomonlama muloqotga hissa qo‘shishini” tasdiqlagan, 13,4 foizi buni tasdiqlamagan, 6,2 foizi esa ishonchsiz.

50,3% “Ish joyida ijtimoiy tarmoqlardan foydalanish xodim va ish beruvchi o‘rtasidagi muloqotni yaxshilaydi”, deb ishonmagan, ulardan 36,5 foizi bu yaxshilanishga ishongan, 13,2 foizi esa ishonchsiz.65,7% “ha” deb javob berdi: “Ish joyida ijtimoiy tarmoqlardan foydalanish xodimlar va xodimlar

o‘rtasidagi muloqotni yaxshilaydi. 21,5% bu savolga yo'q, 10,3% ishonchsiz deb javob berdi. Ko'proq ishtirokchilar (52,7%) "ish joyida ijtimoiy tarmoqlardan foydalanish ish samaradorligiga yordam beradi" deb ishonishgan va kamroq ishtirokchilar 34,9% bu savolga "yo'q" deb javob berishgan. 12,1% bunga ishonchi komil emas. Ularning 47,7 foizi “yo‘q”,

35,6 foizi “ish joyida ijtimoiy tarmoqlardan foydalanish ish samaradorligini oshiradi” degan fikrga “ha” desa, 16,5 foizi ishonchsiz. “Yo‘q” deb javob bergan ishtirokchilar (49%) “Ish joyida ijtimoiy tarmoqlardan foydalanish samaradorlikni oshiradi” degan gapga “ha” (33,2%) javob bergan ishtirokchilardan ko‘proq edi. Ularning 17,8 foizi ishonchsiz edi.

XULOSA

Blumler va Katz ta'kidlashicha, ommaviy axborot vositalarining to'g'ri turini tanlash orqali odamlar o'z ehtiyojlarini qondiradilar. Ushbu tadqiqot ish joyidagi ijtimoiy mediadan foydalanishi va ulardan foydalanishdan qoniqishini o'rganish uchun foydalanish va qoniqish nazariyasidan foydalangan. Yangi media va uning odamlarga ta'siri sohasida so'nggi foydalanish va qoniqish bo'yicha tadqiqotlar olib borildi. Ushbu tadqiqot ish joyidagi ehtiyojlarini qondirish uchun ijtimoiy mediadan foydalanishni o'rgangan ulardan biridir.

Natijalar shuni ko'rsatdiki, WhatsApp va Facebook birgalikda ish joyida eng ko'p foydalaniladigan ijtimoiy media (78,7%).

Ishtirokchilar "ish joyida ijtimoiy tarmoqlardan foydalanish ijobiy ikki tomonlama muloqotga yordam beradi" (80,4%), deb hisoblashdi. Ular "ish joyida ijtimoiy tarmoqlardan foydalanish xodimlar va xodimlar o'rtasidagi aloqani yaxshilashni (65,7%) qo'llab-quvvatladilar. Ularning ta'kidlashicha, "ish joyida ijtimoiy tarmoqlardan foydalanish ish samaradorligiga yordam beradi" (52,7%). Ishtirokchilar ijtimoiy media ishchi va ish beruvchi o'rtasidagi muloqotga ijobiy ta'sir ko'rsatishiga rozi bo'lishmadi (36,5%). Ish joyida ijtimoiy tarmoqlardan foydalanish chastotasi oshganida, bemorlarning ish qobiliyati oshdi. Biroq, oldingi tadqiqotlarning ba'zilari ish joyida ijtimoiy mediadan foydalanish xodimlarning unumdorligini pasaytirganini aniqladi.

Natijalar Aguenza va boshqalarni tasdiqlagan tadqiqotida ular ijtimoiy medianing xodimlarning ikki tomonlama muloqoti va hamkorligiga ijobiy ta'sirini aniqladilar. Natijalar, shuningdek, Leftheriotis va Giannakos , Tulu, Nduhura and Prieler, Tajudeen va boshqalar tomonidan olib borilgan tadqiqotlarni qo'llab-quvvatladi. 2018 yil Robertson va Kee ish joyida ijtimoiy mediadan foydalanish o'rtasida ijobiy munosabatni topdilar. Ushbu tadqiqot, shuningdek, ijtimoiy tarmoqlardan foydalangan holda bir muncha vaqt talabchan va qoniqarsiz ishdan qochish ularning ish samaradorligini oshirishini aniqladi.

Ko'plab tadqiqotlar natijalari ijtimoiy tarmoqlarga qaramlik ko'p narsalarni keltirib chiqaradi degan aniq xulosaga olib keladi. Muammolar: ko'pchilik bilan bu qaramlikning ijobiy aloqalari mavjud, salbiy omillar va bir qator ijobiy omillar bilan salbiy aloqalar. Ijtimoiy tarmoqlarga qaramlikda topilgan ijobiy havolalar depressiya, tashvish, stress, nevrotizm, hissiy muammolar, o'zini past baho, kiber qurbonlik, jismoniy muammolar bilan salomatlik, ruhiy kasalliklar, yolg'izlik, kechiktirish, smartfon va internetga qaramlik, munosabatlardagi xiyonat.Ijtimoiy tarmoqlarga qaramlik o'rtasidagi salbiy aloqalar va hayotdan qoniqish, maktab o'quvchilari va talabalarning o'quv natijalari, mehnat unumdorligi, o'z xodimlarining tashkilotga sadoqati.

Turli mamlakatlardagi tadqiqotchilar ijtimoiy tarmoqlarga qaramlikning asosiy sabablaridan biri muloqotga bo‘lgan ehtiyoj ekanligi, ayollar esa ijtimoiy tarmoqlarda ishtirok etishda odatda erkaklarga qaraganda faolroq ekanligiga rozi.

Tarmoqlarda yosh foydalanuvchilar keksalarga qaraganda faolroq.

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THE INTERRELATIONSHIP BETWEEN EMOTIONAL INTELLIGENCE AND THE DEVELOPMENT OF THINKING IN PRESCHOOL-AGE CHILDREN

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Abstract. *This article examines the relationship between emotional intelligence and the development of thinking in children aged 3–7. Based on a theoretical analysis of psychological and pedagogical literature, it shows that the ability to recognise, understand and regulate emotions creates favourable conditions for the development of attention, working memory, cognitive flexibility and verbal-logical thinking. The article describes the mechanisms of this interaction, including executive functions, emotional language and play, and proposes pedagogical conditions for integrating emotional and cognitive development in preschool education institutions of Uzbekistan.*

Keywords: *emotional intelligence, preschool age, thinking, executive functions, emotion understanding, self-regulation, cognitive development, preschool education.*

INTRODUCTION

Preschool age is a sensitive period in which the foundations of both emotional and intellectual development are laid. For a long time, the development of thinking in young children was studied mainly as a cognitive process, largely separate from the child's emotional life. However, research over the past three decades has shown that emotional and cognitive processes are closely interwoven and that emotional competence is an important predictor of later academic success (Denham et al., 2003; Trentacosta & Izard, 2007).

The concept of emotional intelligence, introduced by Salovey and Mayer (1990), refers to the ability to perceive, use, understand and manage emotions. In the ability model, emotions are treated as a source of information that can facilitate thinking (Mayer, Caruso, & Salovey, 2016). This position is particularly relevant for the preschool period, when the child's thinking moves from visual-action forms to visual-imaginative and the first elements of verbal-logical thinking.

In Uzbekistan, the Law "On Preschool Education and Upbringing" (2019) and the state curriculum emphasise the comprehensive development of the child, including socio-emotional development. Nevertheless, in practice, emotional and cognitive development are often addressed in separate activities. The aim of this article is therefore to analyse the mechanisms that link emotional intelligence and thinking in preschool children and to identify pedagogical conditions for their integrated development.

METHODS

The study is theoretical and analytical in design. It is based on the analysis and synthesis of international psychological and pedagogical literature on emotional intelligence, emotion understanding, executive functions and cognitive development in children aged 3–7. Classic theoretical works (L. S. Vygotsky, J. Piaget) and empirical studies published in peer-reviewed journals were examined. Comparative analysis and generalisation were used to identify the main mechanisms linking emotional and cognitive development and to formulate practical recommendations for preschool education.

RESULTS AND DISCUSSION

1. The unity of affect and intellect. L. S. Vygotsky argued that affect and intellect form a dynamic system and that the separation of thinking from emotion is one of the main shortcomings of traditional psychology (Vygotsky, 1978). Piaget (1952) likewise considered affectivity as the energetic side of intellectual activity. From this perspective, emotions are not merely an accompaniment of cognition but a factor that directs and energises the child's thinking: interest, surprise and the joy of discovery motivate the child to explore, compare and draw conclusions.

2. Executive functions as a link. The analysis shows that executive functions — working memory, inhibitory control and cognitive flexibility — are a key mechanism connecting emotional and cognitive development (Diamond, 2013). A child who can calm down after frustration, wait for a turn or control an impulsive reaction is also better able to hold attention on a task, keep instructions in mind and switch between strategies. Blair and Razza (2007) found that self-regulation, including effortful control and executive function, predicted early mathematics and literacy skills in kindergarten. Thus, emotional self-regulation and cognitive control develop in close interaction and support each other (Ursache, Blair, & Raver, 2012).

3. Emotion understanding and thinking operations. Understanding emotions itself requires cognitive operations: comparison, classification, establishing cause-and-effect relationships and taking another person's

perspective. Pons, Harris and de Rosnay (2004) showed that between the ages of 3 and 11, children progressively understand the external causes of emotions, the role of desires and beliefs, and mixed emotions. When a child explains why a character in a story is sad, he or she practises causal reasoning and elements of theory of mind. Longitudinal data confirm that emotion knowledge at age 5 predicts academic competence years later (Izard et al., 2001), and meta-analytic evidence shows a stable link between children's emotion knowledge and school success (Voltmer & von Salisch, 2017).

4. Emotional language and verbal-logical thinking. The development of an emotional vocabulary (joy, sadness, anger, fear, surprise, shame, pride) enriches the child's speech and supports the transition to verbal-logical thinking. Naming and discussing emotions helps the child generalise experience, form concepts and reflect on his or her own inner states. In this way, emotional language becomes a tool of thinking, in line with Vygotsky's view of speech as a means of mediating mental processes.

5. Play as a space of integration. Role play, games with rules and dramatisation simultaneously require the child to understand the feelings of characters, follow rules, plan actions and imagine situations. Therefore, play is the natural context in which emotional and cognitive development occur together. Programmes such as Preschool PATHS, which combine emotion knowledge, self-control and problem solving, have been shown to improve children's emotional competence and social-emotional outcomes (Domitrovich, Cortes, & Greenberg, 2007).

Based on the analysis, the following pedagogical conditions for the integrated development of emotional intelligence and thinking in preschool education institutions can be proposed: (1) systematically including emotion recognition and naming tasks in cognitive activities (for example, classifying pictures of emotions, finding causes and consequences in stories); (2) using games that train self-regulation and executive functions (games with "stop–go" rules, memory games, task switching); (3) organising discussions of emotional situations in fairy tales and everyday life to develop causal reasoning and perspective taking; (4) creating an emotionally safe environment in the group, since stress and anxiety reduce working memory and attention; (5) involving parents in supporting emotional vocabulary and emotion talk at home; (6) training educators to recognise and respond to children's emotional states, since the teacher's own emotional intelligence influences the group climate (Brackett, Rivers, & Salovey, 2011).

CONCLUSION

Emotional intelligence and thinking in preschool children develop as an interrelated system rather than as separate lines of development. Executive functions, emotion understanding, emotional language and play are the main mechanisms of this interaction. The ability to understand and regulate emotions frees cognitive resources, increases motivation for learning and trains the operations of analysis, comparison and causal reasoning. Consequently, the development of emotional intelligence should be seen not only as a goal of social-emotional education but also as an effective means of developing children's thinking. Further empirical studies with Uzbek preschool children, using validated instruments for measuring emotional intelligence and executive functions, are needed to test these relationships and to develop evidence-based intervention programmes for preschool education institutions.

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MODERN METHODS OF COLLECTING DIGITAL EVIDENCE WITHIN INVESTIGATIVE ACTIONS IN THE INVESTIGATION OF CYBERCRIMES: TECHNICAL-PROCEDURAL AND CRIMINALISTIC ANALYSIS

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Abstract. *This thesis examines modern methods of obtaining, preserving, and documenting digital evidence after its identification in the investigation of cybercrimes, including the handling of data from computers and mobile devices, network and cloud services, social networks, and crypto-assets. The study proposes a technical and procedural model for collecting digital evidence in accordance with the criminal procedural legislation of the Republic of Uzbekistan and substantiates methods aimed at ensuring the integrity, reliability, and legality of evidence. It also develops practical recommendations on expedited preservation, hash verification, screen recording, and the verification of blockchain data.*

Keywords: *digital evidence, investigative actions, digital forensics, expedited preservation, chain of custody, hash value, authentication.*

INTRODUCTION

The collection of digital evidence is a technically complex stage of the investigation of cybercrimes, one whose procedural significance and consequences are high. The identification of digital data alone is not sufficient: the subsequent fate of the evidence depends on how it was obtained, copied, recorded, stored, and whether it can be examined in court. For this reason, the present study singles out, as an independent object of research, the separate stageof collection lying between the identification of digital evidence and the subsequent stages of analysis. The conceptual boundary of the study is defined as follows: whereas the preceding stage answers the question ‘what must be found, and where?’, the present study answers the question ‘how must the data be obtained from an identified source in a manner that is legally and technically correct and subsequently verifiable?’ Here, “collection” is used as a general

concept, while “acquisition” is used to denote the process of obtaining a technical copy of digital data or of officially submitted electronic data [10].

The purpose of the study is to develop an effective technical-procedural model for the collection of digital evidence on the basis of the criminal procedural legislation of the Republic of Uzbekistan [1; 2]. **The objectives of the study** are: to determine the procedure for collecting digital evidence; to systematize the methods of obtaining data from various sources; to define the mechanisms for ensuring the integrity and reliability of evidence; to harmonize international experience with national legislation; and to propose a mechanism for expedited preservation. **The methodology of the study** is based on normative-legal, comparative-legal, systemic, and technical-criminalistic methods of analysis. The practical applicability of the proposed model is assessed on the basis of typical investigative situations.

The collection of digital evidence is regarded not as an independent investigative action, but as a technical-procedural component carried out within the framework of inspection, search, seizure, and other relevant procedural actions [1; 10]. For this reason, technical acquisition and the procedural decision must not be separated from one another, yet their functions must also not be conflated [10; 17].

The first layer of the proposed model is a general procedural algorithm [12; 17]:

1) assessing the source and its degree of volatility;
2) verifying the legal basis and the necessary procedural safeguards;
3) determining the necessity of the participation of a specialist or expert;
4) preparing the tools and verifying their fitness for use;
5) selecting the acquisition method;
6) recording the process by photo-video and in writing;
7) verifying integrity;
8) packaging, storage, and documenting the access history;
9) consolidating the technical report and the procedural materials into a single system.

These stages provide a general management template for all sources, but the technical method of acquisition varies according to the type of source. For this reason, the concept of a ‘single algorithm’ is to be interpreted not as the application of an identical technical operation to all devices, but as the unity of a general procedural template together with differentiated procedures appropriate to the source.

For stationary computers, servers, and storage media, the principal method is regarded as taking a static ‘bitstream’ (exact) copy, using ‘write-blocking’ mechanisms that, to the extent possible, preclude any write access to the source medium, calculating hash values for both the copy and the source, and documenting the results [10; 12; 17]. Here, the function of the hash value consists in verifying that the copy has not been altered; by itself, it does not automatically prove either that the evidence was obtained lawfully or the authenticity of its content [11].

In running systems, ‘live forensics’ is regarded as a separate mode [12]. Data with a high degree of volatility, such as RAM, network connections, temporary files, or the temporary keys of an encrypted disk, may be lost as a result of the device being powered off [12; 17]. For this reason, the sequence of acquisition is adapted to the degree of volatility of the source. In mobile devices, logical, file-system, and physical levels of acquisition are distinguished [13]. The risks of device locking, encryption, and ‘remote wipe’ are taken into account [13]. In cases where isolation from the network is necessary, appropriate protective means are applied [4]. However, the mere availability of a technical means does not automatically render its result procedurally admissible; the conditions of acquisition and the authority [of those performing it] are also documented [1; 7].

For cloud and network sources, instead of physical copying, what is important is obtaining official data from the service provider, exporting logs, and mechanisms for the expedited preservation of data [8; 9; 16]. Here, because the original source is not under the control of the investigative body, the time zone, the basis of the request, the person who performed the export, the file format, and integrity control are separately recorded [2].

In social networks and messengers, ‘screen-recording’ may be used as a means of recording evidence, but by itself it does not prove the account holder’s identity, the original source of the content, or the authenticity of the metadata [17]. For this reason, the official export function of the platform, procedural inspection, time and address particulars, and, where necessary, independent verification tools are assessed together [6].

In evidence relating to crypto-assets, the transaction identifier, time, amount, and associated addresses are recorded by means of a ‘blockchain explorer’ [19]. However, linking a blockchain address to a real individual is a separate matter of authentication [5]. For this reason, the model provides for the separate verification of each link in the chain ‘transaction → wallet → service provider/exchange → identification data → individual’ [20].

In working with digital evidence, its integrity, its attribution to the source, and the lawfulness of the manner in which it was obtained must be separately assessed [1; 2]. Integrity ensures that the data has not been altered after being copied, while authentication ensures the determination of which source it belongs to [11]. The admissibility of evidence, in turn, is connected with its having been obtained in the procedure established by law [7]. Recording by whom, when, and under what circumstances the evidence was obtained, stored, and handed over ensures its chain of origin and custody [10; 14]. The use of a hash value, in turn, provides the means of verifying that the digital copy has not been altered [12]. For this reason, the condition of the device, the technical means used, the time of acquisition, the hash value, and the processes of storage and hand-over must be recorded in the relevant documents [15].

Data held on cloud services, messengers, and foreign platforms may be quickly deleted or altered [16]. For this reason, it is important to introduce a mechanism for preserving such data before it is lost [8; 9]. Here, on the basis of a substantiated request from the investigative body, the data is temporarily preserved by the provider, and its subsequent obtaining is carried out in the procedure established by law [2]. The principal purpose of this approach is not the immediate obtaining of the data, but the prevention of its loss. In this respect, it is proposed that the stages of temporarily preserving data and of subsequently submitting it be legally distinguished from one another.

To assess the practical significance of the proposed model, the procedure for obtaining digital evidence may be applied in various investigative situations. Here, situations such as obtaining data from computers and servers, preserving data on mobile devices, and obtaining electronic data from messengers and cloud services are taken as examples. In assessing the model, the following are established as the principal criteria: the non-loss of data, the correspondence of the copy to the original data, the re-verifiability of the actions performed, the completeness of the documentation, and the correspondence of the chosen method to the relevant type of source [18]. These criteria serve to determine the practical applicability of the proposed model.

The scientific novelty of the study is manifested not in repeating international standards, but in developing a practical model that harmonizes them with the criminal procedural legislation of the Republic of Uzbekistan [1; 2; 10]. This model covers three principal directions: the general procedural order for collecting digital evidence, methods of obtaining data appropriate to the type of source, and the guarantees for ensuring the integrity, source-attribution, and lawfulness of evidence.

First proposal — to develop a single national methodological standard for the collection of digital evidence and to establish model forms for protocols and technical reports [14; 15]. **Second proposal** — to introduce a legal-technical mechanism encompassing the procedure for the expedited preservation of digital data and its subsequent submission [8; 9]. **Third proposal** — to systematize the typical technical errors encountered in the process of obtaining digital evidence and to form a register thereof [18; 19]. **Fourth proposal** — to clearly define the powers of the investigator, the specialist, and the expert in obtaining digital evidence [1; 3]. **Fifth proposal** — to separately record, in procedural documents, the hash value, the history of the storage and hand-over of the evidence, and the data confirming its source [10; 14].

CONCLUSION

The collection of digital evidence is an important technical-procedural process lying between the stages of identifying and analyzing evidence in the investigation of cybercrimes. The study proposed a model that unites methods of obtaining data appropriate to the type of source and that is harmonized with the criminal procedural requirements of the Republic of Uzbekistan [1; 2; 10; 12]. In it, the matters of the integrity of digital evidence, the confirmation of its source and its having been obtained in a lawful procedure, as well as the expedited preservation of data, were substantiated [8; 9; 11; 14]. Testing the proposed model in practical investigative and forensic examination processes will make it possible to assess its effectiveness.

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RAQAMLI MUHITDA FUQAROVIY-HUQUQIY MUNOSABATLARNI TARTIBGA SOLISH: ZAMONAVIY YONDASHUVLAR VA MUAMMOLAR

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Annotatsiya: *Mazkur tezisda raqamli muhitda vujudga keladigan fuqaroviy-huquqiy munosabatlarni tartibga solishning zamonaviy yondashuvlari hamda ushbu sohada yuzaga kelayotgan huquqiy muammolar tahlil qilinadi. Raqamlashtirish jarayonining fuqarolik huquqining an'anaviy institutlariga ta'siri, elektron bitimlar va shartnomalarning huquqiy tabiati, elektron rozilikni ifodalash shakllari, raqamli obyektlar, internet-platformalar faoliyati hamda raqamli muhitda fuqarolik-huquqiy javobgarlik masalalariga e'tibor qaratiladi. Shuningdek, raqamli munosabatlarni tartibga solishda texnologik neytrallik va prinsiplar asosida tartibga solish kabi zamonaviy yondashuvlarning ahamiyati ko'rib chiqiladi. Raqamli muhitning doimiy rivojlanib borishi sharoitida amaldagi fuqarolik qonunchiligining yangi munosabatlarga moslashuvchanligini ta'minlash masalasi alohida tahlil qilinadi.*

Kalit so'zlar: *Raqamli muhit, fuqaroviy-huquqiy munosabatlar, raqamlashtirish, elektron bitim, elektron shartnoma, elektron rozilik, raqamli obyektlar, internet-platforma, fuqarolik-huquqiy javobgarlik, texnologik neytrallik.*

Abstract: *This thesis analyzes contemporary approaches to the regulation of civil law relations arising in the digital environment, as well as the legal challenges emerging in this area. Particular attention is paid to the impact of digitalization on traditional institutions of civil law, the legal nature of electronic transactions and contracts, forms of expressing electronic consent, digital objects, the activities of Internet platforms, and issues of civil liability in the digital environment. The study also examines the significance of contemporary regulatory approaches, including technological neutrality and principle-based regulation, in governing digital relations. In the context of the continuous development of the digital environment, particular consideration is*

given to ensuring the adaptability of existing civil legislation to emerging forms of legal relations.

Keywords: *digital environment, civil law relations, digitalization, electronic transaction, electronic contract, electronic consent, digital objects, Internet platforms, civil liability, technological neutrality.*

Bugungi kunda raqamlashtirish jarayonlarining jadal rivojlanishi jamiyat hayotining deyarli barcha sohalariga, shu jumladan, fuqarolik-huquqiy munosabatlarga ham sezilarli ta’sir ko‘rsatmoqda. Internet tarmog‘i va raqamli texnologiyalarning keng qo‘llanilishi natijasida shaxslar o‘rtasidagi huquqiy munosabatlarning vujudga kelishi, o‘zgarishi va bekor bo‘lish shakllari tobora raqamli muhitga ko‘chib bormoqda. Natijada fuqarolik huquqining an’anaviy institutlari bilan bir qatorda elektron shaklda tuziladigan shartnomalar, raqamli xizmatlar, internet-platformalar, raqamli obyektlar hamda elektron rozilik kabi yangi huquqiy hodisalarni huquqiy jihatdan tartibga solish zarurati yuzaga kelmoqda.

Raqamli muhitning o‘ziga xosligi shundaki, unda huquqiy munosabatlar taraflarning jismoniy ishtirokisiz, elektron aloqa vositalari orqali va ko‘pincha avtomatlashtirilgan jarayonlar yordamida amalga oshiriladi. Xususan, elektron tijoratda shartnoma tuzish, xizmatlardan foydalanish shartlarini qabul qilish, elektron to‘lovlarni amalga oshirish yoki raqamli platformalarda muayyan harakatlarni bajarish orqali shaxsning huquqiy ahamiyatga ega irodasi ifodalanishi mumkin. Bunday munosabatlarda tarafning aynan kimligini aniqlash, uning irodasi erkin va ongli ravishda ifodalanganligini baholash, elektron harakatlarning huquqiy oqibatlarini belgilash hamda yuzaga kelgan nizolarda tegishli elektron ma’lumotlardan dalil sifatida foydalanish masalalari alohida ahamiyat kasb etadi. Shu bilan birga, raqamli muhitning chegarasiz xususiyati fuqaroviy-huquqiy munosabatlarni tartibga solishda qo‘shimcha murakkabliklarni yuzaga keltirmoqda. Bir davlat hududida joylashgan shaxs boshqa davlatda ro‘yxatdan o‘tgan internet-platforma orqali xizmat yoki tovar xarid qilishi, shartnoma esa uchinchi davlat qonunchiligi bilan bog‘liq bo‘lishi mumkin. Bunday holatlarda qo‘llaniladigan huquqni aniqlash, taraflarning huquq va majburiyatlarini belgilash, zarar yetkazilganda javobgar shaxsni aniqlash kabi masalalar an’anaviy fuqarolik-huquqiy mexanizmlarni qayta ko‘rib chiqishni talab etadi.

Mazkur sharoitda raqamli muhitda fuqaroviy-huquqiy munosabatlarni tartibga solishda faqat mavjud texnologiyalarni qonunchilikda alohida-alohida tartibga solish emas, balki raqamli texnologiyalarning doimiy rivojlanishini hisobga oluvchi moslashuvchan huquqiy mexanizmlarni shakllantirish

muhimdir. Xususan, texnologik neytrallik, taraflar irodasining erkinligi, shartnoma erkinligi, huquqiy aniqlik va manfaatlar muvozanatini ta’minlash kabi fuqarolik-huquqiy prinsiplarning raqamli muhitda samarali qo‘llanilishi muhim ahamiyatga ega.

O‘zbekistonda ham raqamlashtirish jarayonlarining kengayishi fuqarolik-huquqiy munosabatlarni zamonaviy sharoitlarga moslashtirish zaruratini kuchaytirmoqda. Elektron tijorat, elektron hujjat aylanishi, elektron raqamli imzo va raqamli xizmatlarning rivojlanishi natijasida fuqarolik qonunchiligi oldida yangi huquqiy munosabatlarni aniq va samarali tartibga solish vazifasi yuzaga kelmoqda. Shu nuqtayi nazardan, raqamli muhitda fuqaroviy-huquqiy munosabatlarning o‘ziga xos xususiyatlarini aniqlash, amaldagi tartibga solish mexanizmlarini tahlil qilish va mavjud huquqiy muammolarga maqbul yechimlarni ishlab chiqish dolzarb ilmiy-amaliy ahamiyatga ega.

Tadqiqotning maqsadi raqamli muhitda vujudga keladigan fuqaroviy-huquqiy munosabatlarni tartibga solishning zamonaviy yondashuvlarini tahlil qilish, amaldagi huquqiy mexanizmlarning samaradorligini baholash hamda mavjud huquqiy muammolarni aniqlash asosida ularni takomillashtirishga qaratilgan ilmiy-amaliy takliflarni ishlab chiqishdan iborat.

Mazkur maqsadga erishish uchun raqamli muhitdagi fuqaroviy-huquqiy munosabatlarning o‘ziga xos xususiyatlarini aniqlash, elektron bitim va shartnomalarning huquqiy tabiatini tahlil qilish, raqamli obyektlar va internet-platformalar bilan bog‘liq munosabatlarning huquqiy jihatlarini o‘rganish, raqamli muhitda fuqarolik-huquqiy javobgarlik masalalarini ko‘rib chiqish hamda O‘zbekiston qonunchiligini takomillashtirish bo‘yicha takliflar ishlab chiqish vazifalari belgilandi.

Raqamli muhitda fuqaroviy-huquqiy munosabatlarning o‘ziga xos xususiyatlari

Raqamli texnologiyalarning jadal rivojlanishi fuqarolik-huquqiy munosabatlarning shakli, mazmuni va ularni amalga oshirish mexanizmlarida sezilarli o‘zgarishlarni yuzaga keltirmoqda. An’anaviy fuqarolik-huquqiy munosabatlarda taraflarning irodasi, shartnoma tuzish jarayoni, huquq va majburiyatlarning vujudga kelishi hamda ularning bajarilishi, odatda, moddiy makon va bevosita aloqa bilan bog‘liq bo‘lgan bo‘lsa, raqamli muhitda mazkur jarayonlarning katta qismi elektron aloqa vositalari va axborot tizimlari orqali amalga oshiriladi. Shu sababli raqamlashtirishni faqat fuqarolik huquqi munosabatlarining texnik shakli o‘zgarishi sifatida emas, balki ularning huquqiy tabiatini anglash va tartibga solish usullarini qayta ko‘rib chiqishni talab qiluvchi jarayon sifatida baholash lozim.

Ilmiy adabiyotlarda raqamli huquqning fuqarolik-huquqiy jihatlari, xususan, raqamli huquqlar va raqamli obyektlarning fuqarolik muomalasidagi o‘rni alohida tadqiq etilmoqda. R. Xursanov raqamli huquqni fuqarolik huquqi nuqtayi nazaridan tahlil qilib, raqamli huquqlarning fuqarolik huquqi obyektlari tizimidagi o‘rnini belgilash, ularning huquqiy tabiatini aniqlash va fuqarolik muomalasiga kiritish bilan bog‘liq nazariy hamda amaliy masalalarning mavjudligini qayd etadi.[51] Mazkur yondashuvdan kelib chiqib, “raqamli muhit” tushunchasini faqat internet tarmog‘i bilan tenglashtirish to‘g‘ri bo‘lmaydi. Raqamli muhit kengroq tushuncha bo‘lib, elektron aloqa vositalari, internet-platformalar, mobil ilovalar, axborot tizimlari, elektron identifikatsiya vositalari, avtomatlashtirilgan tizimlar va boshqa raqamli texnologiyalar orqali huquqiy ahamiyatga ega harakatlar amalga oshiriladigan makonni qamrab oladi. Shu ma’noda raqamli muhit fuqarolik-huquqiy munosabatlarning alohida turi emas, balki mavjud fuqarolik-huquqiy munosabatlarning amalga oshirilish shakli va muhiti sifatida namoyon bo‘ladi.

Shundan kelib chiqib, raqamli muhitdagi fuqaroviy-huquqiy munosabatlarni “raqamli texnologiyalar vositasida vujudga keladigan, o‘zgaradigan yoki amalga oshiriladigan, taraflarning mulkiy va shaxsiy nomulkiy huquq hamda majburiyatlarini yuzaga keltiruvchi fuqarolik-huquqiy munosabatlar” sifatida ta’riflash mumkin. Bunda raqamli muhit munosabatning mohiyatini emas, avvalo uning vujudga kelish va amalga oshirish usulini belgilaydi.

Mazkur jihat elektron shartnomalarning huquqiy tabiatini aniqlashda ham muhimdir. F. Allambergenovaning tadqiqotida elektron shartnoma mustaqil shartnoma turi sifatida emas, balki fuqarolik-huquqiy shartnomaning raqamli shaklda ifodalanishi sifatida ko‘rib chiqiladi. Muallif elektron rozilik, elektron hujjat, elektron imzo, oferta va aksept masalalarini elektron shartnomaning fuqarolik-huquqiy tabiatini belgilovchi asosiy masalalar qatorida ko‘rsatadi.[52] Bunday yondashuv fuqarolik huquqining fundamental prinsiplaridan biri — shartnoma erkinligi prinsipini raqamli muhitda ham saqlab qolish imkonini beradi. Ya’ni texnologik vositaning o‘zgarishi shartnoma tuzishning umumiy huquqiy asoslarini avtomatik ravishda o‘zgartirmaydi. Aksincha, mavjud fuqarolik-huquqiy qoidalar yangi texnologik sharoitda qanday qo‘llanilishi va ularning funksional jihatdan yetarliligi masalasi yuzaga keladi. Xalqaro

[51] Xursanov R. Theoretical and Legal Analysis of Digital Law // Eurasian Journal of Academic Research. – 2022. – Vol. 2, No. 13. – B. 651–657.
[52] Allambergenova F. The Concept of an Electronic Contract and Its Civil-law Nature: Substantive and Procedural Aspects of Electronic Form and Analysis of International Doctrines // Yurist axborotnomasi. – 2026. – Vol. 1, No. 4. – B. 93–100.

miqyosda ham aynan shu yondashuv kuzatiladi. Birlashgan Millatlar Tashkilotining Xalqaro savdo huquqi bo‘yicha komissiyasi (UNCITRAL) tomonidan ishlab chiqilgan 1996-yilgi Elektron tijorat to‘g‘risidagi namunaviy qonunda elektron va qog‘oz shaklidagi axborotga nisbatan teng huquqiy munosabatda bo‘lish, texnologik neytrallik va funksional ekvivalentlik asosiy prinsiplar sifatida shakllantirilgan.[53] Texnologik neytrallik prinsipi qonunchilik muayyan texnologiyani ustun qo‘ymasligi yoki faqat bitta texnologik yechimga bog‘lanib qolmasligini anglatadi. Mazkur prinsip raqamli texnologiyalarning tezkor rivojlanishi sharoitida alohida ahamiyatga ega. Chunki muayyan texnologiyaga asoslangan haddan tashqari batafsil tartibga solish qisqa vaqt ichida eskirishi va yangi texnologiyalarni amaldagi huquqiy tizim doirasida qo‘llashga to‘sqinlik qilishi mumkin. UNCITRAL ushbu sababga ko‘ra texnologik neytral qoidalar kelajakdagi texnologik rivojlanishlarni qo‘shimcha qonunchilik o‘zgartirishlarisiz ham qamrab olish imkonini berishini ta’kidlaydi.Funksional ekvivalentlik prinsipi esa elektron shakldagi huquqiy harakatning an’anaviy qog‘oz shaklidagi harakat bajaradigan funksiyani bajarishi mumkin bo‘lgan hollarda unga tegishli huquqiy ahamiyat berishni nazarda tutadi. Masalan, qog‘oz hujjatdagi “yozma shakl”, “asl nusxa” yoki “imzo” kabi talablarning elektron muhitda qanday funksiyani bajarishi aniqlanadi va ushbu funksiyani ishonchli tarzda ta’minlaydigan elektron vositaga huquqiy kuch beriladi.[54]

Raqamli muhitdagi fuqaroviy-huquqiy munosabatlarning yana bir muhim xususiyati — taraflarning identifikatsiyasi va ularning haqiqiy irodasini aniqlash masalasidir. An’anaviy shartnomada tarafning shaxsi va uning imzosi ko‘pincha bevosita aniqlanishi mumkin. Elektron muhitda esa shaxsning elektron pochta manzili, foydalanuvchi akkaunti, SMS-kod, elektron raqamli imzo, biometrik identifikatsiya yoki boshqa autentifikatsiya vositalari orqali aniqlanishi mumkin. Shu sababli elektron shakldagi huquqiy harakatning haqiqiyligini baholashda nafaqat harakatning mavjudligi, balki ushbu harakat aynan tegishli shaxs tomonidan amalga oshirilganligini aniqlash imkoniyati ham muhim ahamiyat kasb etadi. UNCITRALning Elektron imzolar to‘g‘risidagi namunaviy qonunida ham elektron imzoning huquqiy samaradorligini belgilashda texnologik ishonchlilik mezonlariga e’tibor qaratilgan. Mazkur hujjat elektron imzo va qo‘lda qo‘yilgan imzo o‘rtasidagi funksional ekvivalentlikni ta’minlashga qaratilgan bo‘lib, qonunchilikda muayyan texnologiyani majburiy ravishda

[53] UNCITRAL. Model Law on Electronic Commerce with Guide to Enactment. – New York, 1996.
[54] UNCITRAL. Model Law on Electronic Commerce with Guide to Enactment. – New York, 1996.

tanlashdan ko‘ra texnologik neytrallikni saqlashga urg‘u beradi.[55]Bundan tashqari, raqamli muhit fuqaroviy-huquqiy munosabatlarda avtomatlashtirish darajasining oshishiga olib kelmoqda. Bugungi kunda ayrim shartnomalar va bitimlarning tuzilishi yoki bajarilishi insonning har bir alohida harakatini talab qilmaydigan avtomatlashtirilgan tizimlar orqali amalga oshirilishi mumkin. Ushbu holat fuqarolik huquqining an’anaviy “taraflarning irodasi” va “huquqiy harakat” tushunchalarini yangi texnologik sharoitda qayta talqin qilish zaruratini yuzaga keltirmoqda. Mazkur tendensiya xalqaro huquqiy tartibga solishda ham o‘z aksini topgan. Xususan, UNCITRAL tomonidan 2024-yilda qabul qilingan Avtomatlashtirilgan shartnomalar to‘g‘risidagi namunaviy qonun avtomatlashtirilgan tizimlar, shu jumladan sun’iy intellekt va smart-kontraktlardan foydalanish orqali shartnomalarni tuzish va bajarishga huquqiy aniqlik kiritishga qaratilgan. Ushbu hujjatda avtomatlashtirilgan tizimlardan foydalanish shartnomaning yuridik kuchini o‘z-o‘zidan inkor etmasligi, balki bunday tizimlardan foydalanishning huquqiy oqibatlarini belgilash zarurligi nazarda tutiladi.[56]

Shunday qilib, raqamli muhitdagi fuqaroviy-huquqiy munosabatlarning o‘ziga xosligi ularning an’anaviy fuqarolik-huquqiy munosabatlardan butunlay ajralib turishida emas, balki huquqiy munosabatlarning raqamli vositalar orqali amalga oshirilishi natijasida ayrim klassik huquqiy kategoriyalarning yangi sharoitda qo‘llanilishida namoyon bo‘ladi. Bunda, ayniqsa, taraflarning identifikatsiyasi, irodaning elektron shaklda ifodalanishi, elektron hujjat va elektron dalillarning huquqiy kuchi, raqamli obyektlarning fuqarolik muomalasidagi maqomi hamda avtomatlashtirilgan tizimlarning huquqiy oqibatlari alohida ahamiyat kasb etadi. O‘zbekiston qonunchiligida ham ushbu munosabatlarning ayrim jihatlari maxsus normativ-huquqiy hujjatlar orqali tartibga solingan. Jumladan, 2022-yil 29-sentabrdagi O‘RQ-792-son “Elektron tijorat to‘g‘risida”gi Qonun elektron tijorat sohasidagi munosabatlarning huquqiy asoslarini belgilaydi. Shuningdek, elektron raqamli imzodan foydalanish bilan bog‘liq munosabatlar maxsus qonunchilik bilan tartibga solinadi.[57]

Biroq raqamli muhitning rivojlanishi mavjud maxsus normalarning o‘zi bilan cheklanib qolmaydi. Elektron shartnomalar, raqamli obyektlar, internet-platformalar, avtomatlashtirilgan bitimlar va elektron dalillar o‘rtasidagi o‘zaro bog‘liqlik fuqarolik qonunchiligining umumiy qoidalarini raqamli sharoitda

[55] UNCITRAL. Model Law on Electronic Signatures with Guide to Enactment. – New York, 2001.
[56] UNCITRAL. Model Law on Automated Contracting. – New York, 2024.
[57] O‘zbekiston Respublikasining “Elektron tijorat to‘g‘risida”gi Qonuni, O‘RQ-792-son, 29.09.2022.

izchil qo‘llashni talab qiladi. Shu bois raqamli muhitni tartibga solishda alohida texnologiyalar uchun doimiy ravishda yangi qoidalar yaratishdan ko‘ra, fuqarolik huquqining asosiy prinsiplarini raqamli munosabatlarga moslashtirish va ularning funksional samaradorligini ta’minlash muhim ahamiyat kasb etadi.

Raqamli muhitdagi fuqaroviy-huquqiy munosabatlarni takomillashtirish bo‘yicha takliflar

Yuqoridagi tahlildan kelib chiqib, O‘zbekistonda raqamli muhitdagi fuqaroviy-huquqiy munosabatlarni tartibga solishni takomillashtirish bo‘yicha quyidagi takliflarni ilgari surish mumkin.

Birinchidan, fuqarolik qonunchiligida elektron shaklda ifodalangan irodaning huquqiy ahamiyatini yanada aniqroq belgilash maqsadga muvofiq. Xususan, elektron shakldagi oferta va aksept, elektron rozilik hamda avtomatlashtirilgan tizim orqali ifodalangan irodaning huquqiy oqibatlarini umumiy qoidalar asosida tartibga soluvchi normalarni takomillashtirish lozim.

Ikkinchidan, “elektron rozilik” tushunchasini qonunchilikda alohida belgilash taklif etiladi. Bunda elektron rozilikning haqiqiyligini baholash uchun shaxsning irodasi aniq ifodalanganligi, shartlar bilan tanishish imkoniyati mavjudligi, rozilik berish harakati qayd etilganligi va zarur hollarda uni muayyan shaxsga nisbat berish imkoniyati kabi mezonlarni nazarda tutish mumkin.

Uchinchidan, internet-platformalarning fuqaroviy-huquqiy maqomi va javobgarligini ularning real funksiyalaridan kelib chiqib differensial tartibga solish maqsadga muvofiq. Platforma faqat texnik vositachi bo‘lgan holat bilan platforma shartnoma tuzilishida faol ishtirok etadigan yoki tovar va xizmatlarni o‘z nomidan taklif qiladigan holat o‘rtasidagi huquqiy farq qonunchilikda aniq aks ettirilishi lozim.

To‘rtinchidan, elektron dalillarning ishonchliligini baholashda texnologiyaga bog‘lanmagan umumiy huquqiy mezonlarni mustahkamlash zarur. Bunda elektron ma’lumotning yaxlitligi, kelib chiqishi, yaratilgan vaqti, muayyan shaxsga tegishliligi va o‘zgartirilmaganligini aniqlash imkoniyati asosiy mezonlardan bo‘lishi mumkin.

Beshinchidan, transchegaraviy elektron shartnomalar bo‘yicha qo‘llaniladigan huquq va yurisdiksiya masalalarini yanada aniq tartibga solish lozim. Xususan, iste’molchi va xorijiy platforma o‘rtasidagi munosabatlarda taraflarning kelishuvi bilan bir qatorda iste’molchining huquqlarini himoya qiluvchi imperativ normalarning amal qilish chegaralarini aniqlashtirish muhim.

Oltinchidan, avtomatlashtirilgan shartnomalar bo‘yicha fuqarolik qonunchiligini texnologik neytrallik prinsipi asosida rivojlantirish maqsadga

muvofiq. Bunda sun’iy intellekt, smart-kontrakt yoki boshqa muayyan texnologiyani alohida tartibga solishdan ko‘ra, avtomatlashtirilgan tizimlardan foydalanish natijasida vujudga keladigan huquqiy oqibatlar, ularni taraflarga nisbat berish va kutilmagan natijalar yuzaga kelgandagi huquqiy mexanizmlarni belgilashga e’tibor qaratish lozim.

Umuman olganda, raqamli muhitda fuqaroviy-huquqiy munosabatlarni samarali tartibga solish uchun yangi texnologiyalarni fuqarolik huquqining mavjud institutlariga qarama-qarshi qo‘yish emas, balki ularning huquqiy funksiyalarini mavjud prinsiplar bilan uyg‘unlashtirish talab etiladi. Bunda texnologik neytrallik, funksional ekvivalentlik, shartnoma erkinligi, huquqiy aniqlik va taraflar manfaatlarining muvozanati asosiy metodologik yo‘nalish sifatida xizmat qilishi mumkin. Mazkur yondashuv raqamli texnologiyalar rivojlanishining tezligi bilan qonunchilikning barqarorligi o‘rtasidagi muvozanatni ta’minlash imkonini beradi.

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THE ROLE OF WOMEN IN LITERARY WORKS: REPRESENTATION, SUBJECTIVITY, AND NARRATIVE FUNCTION

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Abstract. *The representation of women has occupied a significant and changing place in literary history. Female characters have been presented at different times as embodiments of beauty, loyalty, motherhood, moral virtue, social transgression, resistance, or individual freedom. This article examines the role of women in literary works not simply as a matter of character description, but as a complex interaction of representation, subjectivity, psychological development, and narrative agency. The study applies close reading, comparative-historical analysis, and narratological approaches to consider how female characters contribute to plot development, characterization, psychological depth, and the ideological and aesthetic structure of literary texts. The analysis demonstrates that the artistic significance of a female character cannot be determined solely by whether she occupies a central or secondary position. More important are her capacity for decision-making, her narrative agency, the representation of her inner world, and her relationships with other characters and social spaces. The article argues that women in literature may simultaneously function as individual psychological subjects, agents of narrative change, and cultural figures through whom a literary work explores questions of family, identity, power, love, freedom, and social expectations.*

Keywords: *female character, women in literature, literary representation, subjectivity, gender, narrative agency, psychological characterization, characterization, narratology, literary criticism.*

1. INTRODUCTION

Women have been present in literary works from the earliest traditions, yet the meanings attached to female characters have changed considerably across historical periods, literary movements, and cultural contexts. In some works, women appear primarily through conventional roles such as mother, wife, daughter, beloved, or moral ideal. In others, they are represented as complex individuals whose desires, decisions, contradictions, and conflicts influence the development of the narrative. The difference is not merely a matter of the number of female characters in a text. It concerns the position from which they

speak, the degree of agency they possess, and the extent to which their inner experience becomes visible to the reader.

The study of female representation has therefore become an important part of modern literary criticism. Feminist literary criticism, in particular, has questioned established assumptions about the ways women are represented, read, and positioned within literary traditions. Mary Eagleton notes that literary representations of women have long been connected with wider questions of gender, authority, and cultural power [1]. At the same time, feminist literary theory has expanded the discussion beyond the simple opposition between positive and negative images of women. It has drawn attention to voice, authorship, subjectivity, silence, embodiment, and the social conditions under which literary meanings are produced [2].

Virginia Woolf's A Room of One's Own remains particularly significant for discussions of women's literary production because it connects creative work with material and intellectual conditions. Her argument about the need for economic independence and private intellectual space demonstrates that the history of women in literature cannot be separated completely from the social structures that determine who has access to education, time, property, and authorship [3]. Simone de Beauvoir similarly challenged the idea that women's social position can be understood as a purely natural or fixed condition, emphasizing the role of culture and historical experience in the construction of femininity [4].

However, the study of women in literature should not be reduced to a search for feminist messages. A female character may be important because of her psychological complexity, her contribution to the structure of the plot, her function in revealing other characters, or her symbolic relationship with a particular social environment. In many literary works, a woman may simultaneously be a mother, an individual with private desires, a social subject, a source of conflict, and a narrative agent. Such multiplicity is precisely what makes literary characterization different from a simple sociological description.

The purpose of this article is to examine the principal functions performed by female characters in literary works and to clarify the relationship between female representation, psychological characterization, and narrative agency. Particular attention is paid to four questions: how female characters are constructed as individual subjects; how their decisions influence narrative development; how their relationships reveal broader systems of power and identity; and how literary space contributes to the representation of women's social and psychological experience.

2. METHODOLOGY

The study is based on qualitative literary analysis and combines close reading, comparative-historical interpretation, and narratological analysis. Close reading is used to examine the linguistic and structural details through which female characters are constructed, including dialogue, internal monologue, description, memory, action, silence, and interaction with other characters. The comparative-historical approach makes it possible to identify continuities and changes in the representation of women across literary traditions, while the narratological approach focuses on the position and function of female characters within the organization of the story.

The theoretical framework draws on feminist literary criticism and narrative theory. Elaine Showalter's work is particularly relevant to the historical study of women's writing because it considers female literary production in relation to broader cultural and literary traditions [5]. Lori Finke's approach similarly emphasizes the relationship between feminist theory, literary representation, and the production of meaning [2]. Narrative theory provides an additional perspective by directing attention to who speaks, who acts, whose experience is represented, and whose decisions alter the course of events.

For the purposes of this study, the term 'female character' is understood broadly. It refers not only to protagonists but also to secondary characters whose presence has a significant structural, psychological, or symbolic function. The analysis therefore avoids treating centrality as the only measure of importance. Instead, narrative agency is considered an important analytical category. A character demonstrates narrative agency when her choices, actions, desires, or refusals contribute materially to the direction, conflict, or resolution of the story.

The analysis also distinguishes between representation and evaluation. A literary text may reproduce a traditional stereotype without necessarily endorsing it, or it may present a socially powerful woman while simultaneously exposing the psychological costs of that power. Consequently, the study considers the relationship between characterization and narrative perspective rather than assigning a simple positive or negative value to a particular representation.

3. RESULTS

The analysis indicates that one of the most significant functions of female characters is the representation of psychological experience. Literary women are frequently used to explore emotions and states such as fear, desire, grief, jealousy, guilt, attachment, loneliness, ambition, insecurity, and the need for recognition. When such states are represented through internal monologue,

memory, free indirect discourse, or changes in narrative perspective, the character becomes more than a social type. She becomes an individual whose actions can be interpreted through a particular psychological history.

Psychological characterization is especially important because external behavior does not always correspond directly to internal motivation. A character who appears passive may be experiencing intense resistance internally; a character who appears confident may be driven by fear or a need for validation. Such contradictions are not weaknesses in characterization. On the contrary, they create psychological density and make the character less predictable. The literary representation of women becomes particularly compelling when the text allows conflicting motivations to coexist rather than reducing the character to one defining quality.

A second major finding concerns narrative agency. In traditional narrative patterns, women are sometimes positioned primarily as objects of desire, sources of emotional motivation, or figures whose fate depends on decisions made by male characters. In more complex narratives, however, female characters can become active agents whose decisions initiate or redirect major events. Their choices may produce conflict, change relationships, expose secrets, determine outcomes, or force other characters to reconsider their own positions.

Narrative agency should not be confused with physical strength, social status, or overt rebellion. A woman may exercise agency through speech, silence, refusal, emotional restraint, intellectual decisions, economic choices, or moral judgment. Conversely, a character who occupies a socially powerful position may have limited psychological freedom. This distinction makes it possible to analyze female characters without reducing them to a binary opposition between 'strong' and 'weak' women.

A third finding concerns the function of female characters in the construction of other characters. The relationship between a woman and the people around her often reveals the psychological and ethical dimensions of those people. A man's attitude toward his mother, wife, daughter, or female colleague may expose his understanding of authority, intimacy, responsibility, or control. Similarly, relationships between women can reveal competition, solidarity, social pressure, generational conflict, or different responses to cultural expectations. Thus, a female character may contribute to characterization beyond her own individual profile.

The fourth finding concerns literary space. The contrast between domestic and public spaces frequently becomes a means of representing women's social possibilities and limitations. The home may be represented as a place of security,

emotional attachment, surveillance, confinement, or conflict, while workplaces, educational institutions, cities, and other public spaces may provide opportunities for autonomy as well as new forms of pressure. Recent work in literary geography also demonstrates the value of examining gender in relation to the spatial organization of literary narratives [7].

Finally, the analysis demonstrates that female characters often exist in tension with established cultural stereotypes. Literary traditions contain recurring figures such as the ideal mother, faithful wife, innocent girl, seductive woman, sacrificial woman, or rebellious woman. Yet psychologically developed characters rarely remain completely inside one such category. They can embody contradictory qualities at the same time. A mother may experience resentment as well as love; an independent woman may still experience insecurity; a morally admirable character may make questionable decisions. Such contradictions create individualization and prevent the character from becoming a purely symbolic figure.

4. DISCUSSION

The results suggest that the literary significance of women cannot be adequately understood through the question of whether a representation is simply positive or negative. Such a binary approach may overlook the complexity of characterization. A female character who makes morally questionable decisions may nevertheless be psychologically complex and structurally central to the narrative. Conversely, an apparently idealized woman may have limited subjectivity if the text gives her little opportunity to speak, choose, or act independently.

This distinction is important because literary representation operates at several levels simultaneously. At the character level, the woman is an individual with a psychological history. At the narrative level, she may be an agent whose actions influence the sequence of events. At the cultural level, she may embody or challenge assumptions about family, sexuality, motherhood, professional identity, marriage, power, or independence. These levels should not be isolated from one another because the meaning of the character emerges from their interaction.

The question of voice is particularly important. In some narratives, a woman initially appears primarily through descriptions provided by other characters. Her body, appearance, social position, or relationship to a man may be described before the reader is given access to her own perspective. In other narratives, the movement from silence toward speech becomes a central part of characterization. The emergence of a personal voice can represent a change in

self-understanding and narrative authority. Scholarship on imposed silence in women's narratives has shown how voice can become a central element in the construction of female subjectivity [8].

At the same time, the gender of the author should not be treated as a sufficient explanation of the representation. A male author may construct a psychologically complex female character, while a female author may reproduce conventional stereotypes. Literary representation is shaped by genre, historical period, narrative perspective, cultural conventions, and the individual aesthetic choices of the writer. Therefore, the analysis of a female character should remain grounded in the textual evidence rather than relying on assumptions about the author's identity.

The relationship between gender and literary style also deserves attention. Literary language is not culturally neutral: conventions concerning beauty, emotion, rationality, authority, and acceptable behavior may influence how women and men are described. Studies of gender and literary style consequently examine not only what happens to female characters but also the linguistic and aesthetic means through which they are represented [9]. This perspective shifts attention from the character alone to the entire representational system of the text.

A further implication is that female characters should be studied within networks of relationships rather than in isolation. Mother-daughter, husband-wife, sister-sister, employer-employee, and female-friend relationships can generate different forms of intimacy and conflict. These relationships may also reveal how individual choices are shaped by social expectations. The literary importance of a woman may therefore lie not only in her independent actions but also in the way her presence reorganizes the psychological and ethical landscape of the narrative.

The findings also support a broader understanding of women's representation in literature. The development of a female character does not necessarily require a complete rejection of family, motherhood, love, or social attachment. A character may seek independence while valuing family, or accept certain traditions while rejecting others. Such complexity is particularly important in contemporary literary analysis because it avoids replacing one stereotype with another. The objective is not to determine what an 'ideal' literary woman should be, but to understand how individual characters are constructed within particular textual and cultural circumstances.

5. CONCLUSION

Women occupy a multifaceted position in literary works. Their significance extends beyond their roles as mothers, wives, daughters, or romantic figures. Female characters may function as psychologically complex individuals, agents of narrative development, mirrors through which other characters are revealed, and cultural figures through whom literature examines identity, power, family, freedom, and social expectations.

The analysis demonstrates that the most productive way to study female representation is to consider several dimensions together: psychological characterization, narrative agency, voice, relationships, spatial position, and cultural context. Centrality alone cannot determine the importance of a female character. A secondary character may transform the meaning of an entire narrative, while a protagonist may have limited agency if her decisions are consistently controlled by others.

The study therefore concludes that the role of women in literature should be examined as a dynamic relationship between representation and subjectivity. The literary value of a female character is revealed not simply by the social role she occupies, but by the complexity of her inner world, the choices she makes, the consequences of those choices, and the way the narrative gives meaning to her experience. Such an approach provides a more precise basis for understanding the changing representation of women across literary periods and genres.

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LINGUOCULTURAL FEATURES OF LEXICAL UNITS RELATED TO THE CONCEPT OF HOSPITALITY IN UZBEK AND ENGLISH

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Abstract: *This article examines the linguocultural features of lexical units associated with the concept of hospitality in Uzbek and English. The study compares the meanings and cultural associations of Uzbek units such as mehmon (“guest”), mezbon (“host”), mehmondo‘stlik (“hospitality”), mehmonnavoz (“hospitable”), and izzat-ikrom ko‘rsatmoq (“to show respect and honour”) with English units including guest, host, hospitality, hospitable, welcome, and accommodate.*

Keywords: *hospitality, linguocultural analysis, lexical semantics, Uzbek, English, guest, host, cultural concept.*

Annotatsiya: *Ushbu maqolada o‘zbek va ingliz tillarida mehmondo‘stlik konseptiga oid leksik birliklarning lingvomadaniy xususiyatlari tahlil qilinadi. Tadqiqotda mehmon, mezbon, mehmondo‘stlik, mehmonnavoz, izzat-ikrom ko‘rsatmoq kabi o‘zbekcha birliklar guest, host, hospitality, hospitable, welcome, accommodate singari inglizcha birliklar bilan qiyoslanadi. Lug‘aviy ma’nolar va odatiy ifodalar sifat tahliliga asoslangan qiyosiy yondashuv, komponent tahlil hamda lingvomadaniy tahlil yordamida o‘rganiladi.*

Kalit so‘zlar: *mehmondo‘stlik, lingvomadaniy tahlil, leksik semantika, o‘zbek tili, ingliz tili, mehmon, mezbon, madaniy konsept.*

Аннотация: *В статье анализируются лингвокультурные особенности лексических единиц, связанных с концептом гостеприимства в узбекском и английском языках. Сопоставляются узбекские единицы mehmon («гость»), mezbon («хозяин»), mehmondo‘stlik («гостеприимство»), mehmonnavoz («гостеприимный»), izzat-ikrom ko‘rsatmoq («проявлять уважение и почёт») и английские guest, host, hospitality, hospitable, welcome, accommodate.*

Ключевые слова: *гостеприимство, лингвокультурный анализ, лексическая семантика, узбекский язык, английский язык, гость, хозяин, культурный концепт.*

INTRADUCTION

Hospitality is a social practice expressed through language as well as through action. It involves such activities as receiving a visitor, offering food or accommodation, and establishing a courteous relationship between host and guest. The concept can therefore be studied through individual lexical meanings, conventional phrases, and the cultural associations attached to them. A linguocultural approach considers how linguistic forms encode and evoke culturally significant meanings. It does not assume that every speaker of a language shares the same beliefs or practices. Rather, it examines recurring associations and conventions that can be observed in lexical and phraseological usage (Wierzbicka, 1997; Sharifian, 2017). In this article, "hospitality" refers broadly to the reception of a guest and the associated forms of welcome, care, and accommodation.

The Uzbek and English lexical fields share a basic semantic structure: both distinguish, explicitly or implicitly, between a guest and a host and include actions such as welcoming and providing accommodation. Their lexical patterns also differ. Uzbek expressions connected with hospitality frequently foreground respect and honour, while English *hospitality* is used both for interpersonal conduct and for a commercial service sector.

The aim of this study is to identify and compare the linguocultural features of selected Uzbek and English lexical units related to hospitality. It addresses three questions:

1. What core semantic components are shared by the selected units

2. What cultural associations are prominent in their use?

3. In which respects do the lexical fields differ?

This study uses a qualitative contrastive design. The material consists of selected Uzbek and English words and conventional expressions associated with hospitality:

Uzbek: mehmon, mezbon, mehmondo'stlik, mehmonnavoz, kutib olmoq, izzat-ikrom ko'rsatmoq, and dasturxon yozmoq;
English: guest, host, hospitality, hospitable, welcome, accommodate, and entertain.

The analysis draws on Uzbek and English dictionary definitions and on commonly used expressions. Dictionary meanings were treated as evidence of a word's conventional semantic range, not as complete accounts of its cultural significance. The analysis was informed by lexicographic sources including the *Explanatory Dictionary of the Uzbek Language* and English learner's dictionaries.

Uzbek *mehmondo‘stlik* names the quality or practice of treating guests well. Its semantic associations are reinforced by *mehmonnavoz*, which describes a hospitable person or setting, and by expressions such as *izzat-ikrom ko‘rsatmoq* (“to show respect and honour”). These units foreground the interpersonal and evaluative dimensions of receiving a guest.

English *hospitality* also denotes friendly and generous treatment of visitors.

However, it is additionally used as an umbrella term for accommodation, food, and related services. The expression *the hospitality industry*, for example, refers to commercial sectors such as hotels, restaurants, and tourism. This institutional usage gives the English word a broader professional and economic application in contemporary contexts.

A salient tendency in the Uzbek examples is the explicit expression of respect and honour. Units such as *izzat-ikrom ko‘rsatmoq* make the evaluative aspect of hospitality linguistically visible. The expression *dasturxon yozmoq* also shows how a concrete activity can acquire a broader social meaning when used in a guest-reception context. These observations indicate that the Uzbek lexical field offers several ways to verbalise the treatment and esteem shown to a guest.

The English examples include comparable interpersonal meanings, particularly in *hospitable*, *welcome*, and *make yourself at home*. At the same time, the established phrase *hospitality industry* demonstrates a prominent institutional use of *hospitality*. This usage does not replace the word’s interpersonal sense; rather, it extends its application to professional services.

The study finds that hospitality-related lexical units in Uzbek and English share a core meaning involving the reception, welcome, and care of a guest. The principal participant terms-*mehmon/guest* and *mezbon/host*-and the central nouns *mehmondo‘stlik/hospitality* provide a basis for comparing the two lexical fields.

The selected Uzbek material gives particular lexical prominence to respect, honour, and generous treatment, as seen in expressions such as *izzat-ikrom ko‘rsatmoq* and *dasturxon yozmoq*. English shares the interpersonal meaning of hospitality but also uses *hospitality* widely for commercial services and the related industry. These are tendencies in lexical usage, not fixed cultural rules.

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THE SIGNIFICANCE OF THE TRANSPORT SYSTEM IN THE HISTORY OF THE SOUTHERN ARAL REGION IN THE 19TH CENTURY (THE CASE OF CARAVAN AND WATER ROUTES)

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Summary: *This article pays special attention to the role of caravan and water routes in the transport system of the Southern Aral Sea region. Based on historical sources, it reveals the significance of these trade routes in the socio-economic life of the region and demonstrates that caravan and water routes together formed a unified picture of the regional transport system.*

Key words: *Caravan routes, waterways, Chimbay, Khojeyli, Kungrad, H. Vamberi, Amu Darya, Aral Sea.*

In the historical development of the Southern Aral Sea region, caravan and water routes played an important role in fostering economic, social, and cultural ties. In particular, caravan routes significantly influenced the development of trade, economic, and diplomatic relations between the countries of the East and the West. The Great Silk Road, which for more than two thousand years connected Europe with the countries of the East through Central Asia, left a profound mark on human history. As for river and sea basins, since ancient times they have directly influenced the formation of trade routes, settlements, and political and economic centers. The Southern Aral region is also one such natural-geographical space, where the Amu Darya and the Aral Sea served as key factors in the region's transport system, trade relations, and economic activity.

One of the caravan routes passing through the territory of Southern Aral Sea region led toward Gurganj through Mizdakhkan, while another passed through Kuskhana, Azizler-bobo, Krantau, Porlytau, and Bakirgan (Kungrad). In addition, there was a road along the Aral Sea leading east from Ustyurt to Bakirgan (Kungrad), Kuyuk-Kala, Baghdad, and the Kyrk-Jigit fortress [1, p. 55].

During this period, caravan trade routes connected the following cities: Chimbay, Khojeyli, Kungrad, Kunya-Urgench, and Khiva; the second route ran

from Kungrad to Khojeyli, and from Kunya-Urgench to Khiva (along the left bank of the Amu Darya). Along the right bank of the Amu Darya, the road ran from Chimbay to the Qipchoq Pass, then, after crossing to the left bank, through Mangit to Khiva; furthermore, a caravan route connecting Kazalinsk with Khiva passed through Chimbay. Another caravan route passed near Kungrad through Khiva and Ustyurt [2, p. 111].

The following roads connected the Khorezm oasis:

1) Petro-Alexandrovsk - Nukus - Chimbay (234 versts), in addition to the Nukus-Kungrad branch (84 versts), which connected the northern part of the Khiva Khanate with the Amudarya department.

2) The Khiva-Khazavat-Ilali-Kunya-Urgench-Kungrad road (260 versts) connected the northern part of the khanate with the southern part.

3) Petro-Alexandrovsk-Khanki-Khiva (67 versts) and Petro-Alexandrovsk-Khanki-New Urgench-Shahabad-Ilali-Kunya-Urgench (219 versts) roads connected the city of Petro-Alexandrovsk with Khiva and other important cities of the khanate.

The caravan route connecting Bukhara with Russia, which passed from the Caspian Sea through Kungrad and Ustyurt, was more convenient than the 1,800-verst road from Orenburg to Bukhara through Kazalinsk. On the Orenburg-Kazaly-Bukhara road, sands covered 700 versts. The length of the caravan route from the Caspian Sea to Bukhara via Kungrad was 1,100 versts [3, p. 9].

The Caspian–Kungrad–Bukhara trade route was 220 versts shorter than the Caspian–Krasnovodsk–Amudarya route; furthermore, 215 versts of the second route consisted of sandy terrain with only one well along the entire distance. Due to the lack of water and the sand, the Caspian–Krasnovodsk–Amudarya route posed difficulties for merchants [4, p. 10]. When shipping goods from Bukhara to Ilchik, and from there to Kungrad and to the Dead Kultuk Bay on the Caspian Sea, the following rates were charged per 1 pood of cargo: Bukhara–Ilchik — 10 kopecks, Ilchik–Kungrad — 25 kopecks, Kungrad–Dead Kultuk — 60 kopecks, Dead Kultuk–Nizhny Novgorod — 40 kopecks, Nizhny Novgorod–Moscow — 22 kopecks [5, p. 12].

The Hungarian scholar Hermann Vambery, who visited the Karakalpaks in the 19th century and witnessed their way of life firsthand, wrote the following about travel routes: "From Kungrad to Khiva, the journey is mostly made by land, as traveling by river against the current by ship takes - days. Therefore, only heavy cargo is transported by ship against the current. By land, people travel via the following routes:

1. Through Kunya-Urgench, along the so-called Summer Road, which bypasses all the lakes and streams that branch off from the Oxus in the summer. This is the longest route, measuring 56 farsakhs (a farsakh is a unit of length; one farsakh equals 6-7 km);

2. Through Khojeyli; this route is taken in winter, after the lakes freeze over, and its length is 40 farsakhs;

3. A roundabout, sandy steppe route passing along the right bank of the Oxus." [6, p. 17].

It should be noted that although numerous shipping channels passed through the territory of the Khiva Khanate until the mid-19th century, the population of the Khanate rarely used waterways and preferred to transport goods by caravan. At the same time, it is worth noting that goods were sometimes sent to Bukhara via the Amu Darya and its canals. This is likely explained by the fact that water routes required more time than land ones, and therefore the latter was considered more preferable as a convenient and, most importantly, fast way to transport goods.

In the book of the renowned scholar R.K. Kosbergenov "Колониаль дәўирдеги қарақалпақлардың мәдениятыҳәм турмысы" the following information is provided regarding the roads of the Karakalpaks in the 19th century: "A road was laid over Karatau from Petro-Aleksandrovsk to Nukus." The fact that, in some cases, elderly people still refer to the highway as "Orisjol" is also preserved from those times. After all, there were no such roads before the Russians arrived. "Orisjol" was also built from Kungrad to the city of Chimbay. The route of this road ran from Kungrad to Kyrk Sadak, from there to Nayman (Markabay tree), and from there to Porly (there was a working bank at that time). There was a direct road to Porly that led to Chimbay. The Akboget-Chimbay caravan route, which began from the Aral Sea coast, was also laid by the Russians at that time. The Amudarya branch also established land caravan trade relations: with Uralsk through Petro-Aleksandrovsk, Kungrad, Orenburg, and Emba, spanning 1300 versts; with the Perarevich Bay on the Caspian Sea through Kungrad, spanning 422–447 versts; with New Charzhou through Petro-Aleksandrovsk, Sadivar, Dargan-ata, and Kabakly, spanning 374 versts; and with Kazalinsk through Petro-Aleksandrovsk, Karabatyr, Bay Kurat, and Jumak-Kul, spanning 494 versts [8, c. 17-18].

In the 19th century, the territory of the Southern Aral Sea region was considered the crossroads of the main land routes connecting the Russian Empire with the Khanate of Khiva and the Emirate of Bukhara, and the sole transit region. The land routes of the region were primarily adapted to desert and plateau

landscapes, and the network of natural water sources (wells) and caravanserais played a decisive role in determining their routes.

Based on historical sources, the routes that passed through the Southern Aral Sea region in the 19th century can be divided into the following strategic directions:

1. Along the eastern coast of the Aral Sea, a caravan route connecting Kazalinsk with Khiva passed through Chimbay.

2. From Khiva, a route passed through Ustyurt, near Kungrad, to the city of Uralsk.

3. From the city of Khiva, a route ran along the western coast of the Southern Aral Sea region, passing north through the Ustyurt Plateau toward the city of Orenburg.

4. A caravan route connecting Russia with Bukhara ran from the Caspian Sea through Kungrad and Ustyurt.

In the 19th century, waterways also played an important role in the economic and strategic life of the Southern Aral region. Unlike the region's complex overland desert routes, the Amu Darya and the Aral Sea served as natural highways, allowing for the relatively cheap and rapid transportation of large volumes of cargo. In the 19th century, the Amu Darya and its internal routes served not only as a vital resource for agriculture but also as the primary waterway connecting the Southern Aral region and its trade centers (Kungrad, Khojeyli, Chimbay, and Petro-Aleksandrovsk) with the center of the Khiva Khanate and the territories of the Emirate of Bukhara.

During this period, boats became widespread in the northern part of the Khorezm oasis. The Karakalpaks sailed them from the upper reaches of the Amu Darya to Charjuy, from its lower reaches to the Aral Sea, and from there to the lower reaches of the Syr Darya. Boatmen also navigated the internal canals within Karakalpak territory. On the right bank of the Amu Darya, the Kegeyli, Kuvanchjarma, and Shartanbay, and on the left bank, the Kiyatzhargan, Shomanay, and Khanjap served as navigable inland waterways. The Kuvanchjarma canal on the right bank of the Amu Darya was of great importance, supplying water to many other canals. According to A.V. Kaulbars, who explored the Karakalpak lands in 1873, the canal was named after the person who had it dug [7, p. 204].

In conclusion, although land routes were difficult and arduous, constant communication was maintained through them for centuries. Caravan routes stretched along the Southern Aral Sea region, through Ustyurt to the countries of Eastern Europe, and from there along the Aral Sea, through other regions of

Central Asia to the countries of the East, including China. These routes served humanity for centuries: scientific and cultural innovations were disseminated through them, and economic relations were conducted.

From the second half of the 19th century, changes occurred in the Karakalpaks' means of transportation; alongside the carts used for centuries, new light boats for fishing and large boats for transporting cargo began to be used. Greater attention was paid to using the Amu Darya and Syr Darya for transport, and sailing ships and steamers appeared.

In the 19th century, the transport system of the Southern Aral Sea region formed a single chain consisting of inextricably linked land and water routes. Goods from the Russian Empire arrived via the Aral Sea, were unloaded at ports (Kungrad, Chimbay), and from there were distributed to the inner territories of the Khiva Khanate using traditional carts and camel caravans.

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РОЛЬ РЕФЛЕКСИВНОЙ КУЛЬТУРЫ В ПРОВЕРКЕ И ПЕРЕСМОТРЕ ПРОФЕССИОНАЛЬНЫХ СУЖДЕНИЙ ПСИХОЛОГА-КОНСУЛЬТАНТА

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Аннотация. *Цель статьи — обосновать калибровку профессиональных суждений как механизм рефлексивной культуры психолога-консультанта. На основе анализа исследований метакогниции, экспертизы и обратной связи предложена модель проверки консультативной гипотезы. Выделены показатели обоснованности суждения и его пересмотра. Разработан проект исследования с поэтапным предъявлением случаев и независимым экспертным оцениванием. Модель конкретизирует связь рефлексивной культуры с профессионализацией и требует эмпирической проверки.*

Ключевые слова: *рефлексивная культура, психолог-консультант, профессионализация, метакогниция, калибровка суждений, обратная связь.*

Abstract. *The article examines professional judgment calibration as a mechanism of reflective culture in counseling psychologists. Analysis of metacognition, expertise, and feedback research informs a model for testing counseling hypotheses. Indicators of judgment justification and revision are proposed. A research procedure combines sequential case vignettes with independent expert ratings. The model specifies a potential link between reflective culture and professionalization and requires empirical validation.*

Keywords: *reflective culture, counseling psychologist, professionalization, metacognition, judgment calibration, feedback.*

ВВЕДЕНИЕ

Профессионализация психолога-консультанта предполагает освоение способов проверки собственных решений. При выборе интервенции субъективная убедительность объяснения может опережать достаточность данных. Возникает вопрос, как включить контроль этого расхождения в интегративную модель профессионализации, рассматривающую рефлексивную культуру как ресурс развития консультанта.

Продолжительность практики сама по себе не является достаточным доказательством качества работы [5]. Цель исследования — разработать теоретическую модель калибровки суждений и определить её наблюдаемые показатели. Авторский вклад заключается в связывании уверенности, проверки альтернатив и обоснованного пересмотра решения в единую исследовательскую процедуру.

МАТЕРИАЛЫ И МЕТОДЫ

Работа выполнена как теоретическое исследование с проблемно-ориентированным анализом литературы. Целевой поиск проводился по сочетаниям понятий metacognition, judgment calibration, psychotherapy expertise, routine outcome monitoring и alliance rupture repair. Для сопоставления отобраны пять публикаций 2014–2024 годов, непосредственно раскрывающих измерение метакогниции, критерии экспертизы и использование обратной связи. Это целевая концептуальная выборка, не претендующая на полноту систематического обзора.

Анализ включал разграничение понятий, сопоставление единиц оценки и построение модели. Определялось, что оценивает каждый подход: уверенность, обоснованность решения или изменение взаимодействия. Результат представляет собой концептуальный синтез и проект операционализации. Первичные данные не собирались, апробация процедуры не проводилась.

РЕЗУЛЬТАТЫ

В предлагаемой модели рефлексивная культура определяется как организация самоанализа, при которой специалист проверяет основания выводов, учитывает позицию клиента и принимает ответственность за коррекцию действий. Профессионально регулирующая функция рефлексии проявляется в способности указать данные, поддерживающие решение, и условия его пересмотра.

Калибровка в узком измерительном смысле обозначает соответствие субъективной уверенности фактической правильности ответов. Исследования метакогниции различают общий уровень уверенности и

способность распознавать собственные правильные и ошибочные решения [3]. Поэтому высокий показатель уверенности нельзя автоматически трактовать как компетентность, а осторожность — как её недостаток. В консультировании правильность сложной интерпретации часто нельзя установить однозначно. Здесь предлагается оценивать соразмерность уверенности доступным основаниям, сохраняя различие между строгой измерительной калибровкой и профессиональным анализом обоснованности.

Единицей анализа выступает эпизод профессионального суждения: конкретная гипотеза, заявленные основания, степень уверенности и последующее решение. Первая операция — разделение наблюдаемого факта и его объяснения. Запись «клиент дважды перенёс встречу» описывает событие, тогда как вывод об избегании остаётся гипотезой. Вторая операция — формулирование альтернативного объяснения и указание недостающих данных. Это препятствует превращению первоначальной интерпретации в единственную допустимую версию.

Третья операция состоит в обозначении уверенности и условий её изменения. До получения следующей информации консультант фиксирует, какой ответ клиента или наблюдаемый факт ослабит гипотезу. Четвёртая операция — сопоставление прогноза с обратной связью. Пятая — обоснованный пересмотр: сохранение, уточнение либо отклонение гипотезы с изменением плана при необходимости. Фиксация исходного предположения нужна для различения реального обновления позиции и объяснения результата задним числом.

Для операционализации предложены четыре раздельных показателя: точность разделения факта и интерпретации, качество альтернатив, соразмерность уверенности основаниям и обоснованность обновления решения. Их преждевременное объединение в суммарный индекс может скрыть разные профили. Например, специалист предлагает несколько объяснений, но игнорирует данные, противоречащие предпочитаемому.

Процедуру иллюстрирует сконструированный пример. Консультант объясняет отказ клиента от задания низкой мотивацией. Затем выясняется, что клиент опасается последствий задания для семейных отношений. Калиброванное решение предполагает уточнение безопасности и приемлемости задания, обсуждение цели и пересмотр первоначального объяснения. Изменение позиции оценивается по связи с новой информацией. Простая замена одного категоричного вывода другим не свидетельствует о развитии рефлексивной культуры.

ОБСУЖДЕНИЕ

Предложенная модель конкретизирует роль обратной связи в профессионализации. Barkham с соавт. [1] рассматривают мониторинг как процесс, включающий сбор данных, их возвращение в терапевтическую работу и адаптацию помощи. Следовательно, наличие заполненных опросников ещё не показывает, как специалист использовал сведения. McAleavey с соавт. [4] подчёркивают значение персонализации и условий внедрения мониторинга. В предлагаемой модели центральным становится переход от получения информации к изменению основания решения. Его необходимо оценивать отдельно от частоты измерений.

Обратная связь может затрагивать отношения с клиентом. Метаанализ Eubanks с соавт. [2] выявил связь восстановления нарушенного альянса с благоприятными исходами, однако отдельный анализ обучения восстановлению альянса не показал статистически значимого общего эффекта на исход. Поэтому полезность анализа взаимодействия не доказывает эффективность любой программы рефлексивного обучения. Авторская модель предлагает проверяемое предположение: фиксация условий пересмотра гипотезы может способствовать более обоснованной реакции консультанта на несогласие клиента. Это предположение пока не является установленным результатом.

Эмпирическую проверку целесообразно строить на случаях с поэтапным предъявлением информации. На первом этапе участник формулирует гипотезу и оценивает уверенность. После дополнительных сведений он объясняет, какие основания изменились, и выбирает следующее действие. Для задач с проверяемым ответом можно сопоставлять уверенность с точностью на серии заданий. Для неоднозначных случаев следует использовать независимое оценивание качества аргументации, не объявляя экспертное согласие объективной истинностью интерпретации.

Рубрику оценивания необходимо разработать заранее. Наблюдаемыми признаками могут служить наличие альтернативы, указание ограничения данных и объяснение связи новых сведений с решением. Согласованность независимых экспертов должна проверяться до интерпретации индивидуальных различий. Самоотчётную оценку рефлексивной культуры и профессиональной идентичности целесообразно сопоставить с выполнением заданий. Стаж, подготовку в конкретном подходе и опыт супервизии следует учитывать как возможные

сопутствующие факторы. Связь показателей сама по себе не установит причинного влияния рефлексивной культуры.

В подготовке консультантов модель предполагает разбор значимого эпизода: исходной гипотезы, её оснований и последующего действия. Материалы практики используют с согласия и после обезличивания. Ограничения модели связаны с культурной обусловленностью интерпретаций, зависимостью экспертной оценки от подхода и риском усвоения формальных ответов без переноса навыка в практику.

ЗАКЛЮЧЕНИЕ

Калибровка профессиональных суждений предложена как механизм связи рефлексивного анализа с коррекцией консультативного действия. Теоретический результат включает модель проверки гипотезы и раздельные показатели её оценки. Дальнейшая работа требует проверки надёжности процедуры, связи с реальной практикой и дополнительной объяснительной ценности по отношению к самоотчётной рефлексивности.

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7-SECTION

PREEKLAMPSIYANI PROGNOZ QILISHDA KO'Z ARTERIYASI DOPPLEROMETRIYASI: ZAMONAVIY DALILLAR VA KLINIK ISTIQBOLLAR

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***Annotatsiya**: Preeklampsiya (PE) butun dunyoda onalar va perinatal kasallanish hamda o'limning asosiy sabablaridan biri bo'lib qolmoqda. Birinchi trimestr skriningida sezilarli yutuqlarga erishilganiga qaramay, PEning klinik belgilari paydo bo'lishidan oldin onadagi qon-tomir disfunksiyasini aks ettira oladigan qo'shimcha noinvaziv markerlarni aniqlash muhim ilmiy yo'nalish bo'lib qolmoqda. Zamonaviy skrining strategiyalari onaning xususiyatlari va anamnezini o'rtacha arterial bosim (MAP), bachadon arteriyasi pulsatsiya indeksi (UtA-PI) hamda platsentar o'sish omili (PlGF) kabi biofizik va biokimyoviy markerlar bilan birlashtiradi. Shunga qaramay, ularning mavjudligi va prognostik samaradorligi turli sog'liqni saqlash tizimlarida farq qiladi.*

So'nggi yillarda onaning ko'z arteriyasi dopplerometriyasi (OAD) PE bilan bog'liq qon-tomir o'zgarishlarini baholashning istiqbolli noinvaziv usuli sifatida qaralmoqda. Ko'z arteriyasi ichki uyqu arteriyasining tarmog'i bo'lib, shu sababli onaning miya qon aylanishini baholash uchun qulay imkoniyat yaratadi. Uning Doppler to'lqin shaklidagi o'zgarishlar homiladorlikdagi gipertenziv buzilishlar bilan bog'liq serebral tomir qarshiligi va autoregulyatsiyaning o'zgarishini aks ettirishi mumkin.

Abstract: *Preeclampsia (PE) remains one of the major causes of maternal and perinatal morbidity and mortality worldwide. Despite substantial advances in first-trimester screening, the identification of additional non-invasive markers capable of reflecting maternal vascular dysfunction before the clinical onset of PE remains an important research priority. Current screening strategies combine maternal characteristics and medical history with biophysical and biochemical markers, including mean arterial pressure (MAP), uterine artery pulsatility index (UtA-PI), and placental growth factor (PlGF). Nevertheless, their availability and predictive performance vary across healthcare settings.*

In recent years, maternal ophthalmic artery Doppler (OAD) has emerged as a promising non-invasive method for evaluating vascular changes associated with PE. The ophthalmic artery is a branch of the internal carotid artery and therefore provides an accessible window into the maternal cerebral circulation. Changes in its Doppler waveform may reflect altered cerebral vascular resistance and autoregulation associated with hypertensive disorders of pregnancy.

Kalit so‘zlar: *preeklampsiya; ko‘z arteriyasi; Doppler ultratovush tekshiruvi; pik cho’qqi; ikkinchi sistolik cho‘qqi; miya gemodinamikasi; prognozlash; homiladorlikdagi gipertenziv buzilishlar*

Keywords: *preeclampsia; ophthalmic artery; Doppler ultrasound; peak ratio; second systolic peak; cerebral hemodynamics; prediction; hypertensive disorders of pregnancy.*

MAQSAD

Preeklampsiyani prognoz qilishda ko‘z arteriyasi dopplerometriyasi parametrlarining o‘rni bo‘yicha zamonaviy dalillarni ko‘rib chiqish va ularning zamonaviy skrining strategiyalariga qo‘shishi mumkin bo‘lgan hissasini baholash.

Materiallar va usullar

Mavjud adabiyotlarning narrativ sharhi o‘tkazildi; bunda PubMed/MEDLINE bazasida indekslangan tadqiqotlar hamda 2026-yilgacha chop etilgan asosiy tizimli sharhlar va meta-tahlillarga alohida e’tibor qaratildi. Adabiyotlarni qidirishda preeklampsiya; ko‘z arteriyasi, doppler ultratovush tekshiruvi, pik cho’qqi, ikkinchi sistolik cho‘qqi, miya gemodinamikasi; prognozlash; homiladorlikdagi gipertenziv buzilishlar atamalaridan foydalanildi. Ko‘z arteriyasi dopplerometriyasining yakka holda va PE skriningining tasdiqlangan markerlari bilan birgalikdagi prognostik samaradorligini baholagan so‘nggi prospektiv tadqiqotlar, tizimli sharhlar va meta-tahlillarga ustuvor ahamiyat berildi.

Zamonaviy dalillar

Preeklampsiya rivojlanishida platsenta faoliyatining buzilishi, tizimli endotelial disfunksiya va ona organizmidagi qon-tomir o‘zgarishlari muhim o‘rin tutadi. Kasallik og‘irlashganda miya qon aylanishida ham sezilarli o‘zgarishlar yuzaga kelishi mumkin. Bu holat bosh og‘rig‘i, ko‘rish buzilishlari, miya shishi, eklampsiya va og‘ir holatlarda insult kabi asoratlarning rivojlanishi bilan bog‘liq. Shu sababli homiladorlik davrida miya qon aylanishidagi o‘zgarishlarni erta aniqlash muhim ahamiyatga ega. Ko‘z arteriyasi ichki uyqu arteriyasining tarmog‘i bo‘lganligi sababli, uning Doppler ko‘rsatkichlari ona miya qon aylanishi holatini noinvaziv tarzda baholash imkonini beradi.

Ko‘z arteriyasi dopplerometriyasida bir nechta asosiy gemodinamik ko‘rsatkichlar o‘rganiladi: pulsatsiya indeksi (PI), rezistentlik indeksi (RI), cho‘qqi sistolik tezlik (PSV), yakuniy diastolik tezlik (EDV), ikkinchi sistolik cho‘qqi (P2 yoki PSV2) va peak ratio (PR). PR ikkinchi sistolik cho‘qqining birinchi sistolik cho‘qqiga nisbatini ifodalaydi. Tadqiqotlar preeklampsiyada ko‘z arteriyasining qon oqimi o‘zgarishini ko‘rsatadi. Odatda PI va RI pasayadi, P2 va PR esa ortadi. Ushbu o‘zgarishlar tomir qarshiligining kamayishi va miya qon oqimining o‘zgarishi bilan bog‘liq bo‘lishi mumkin.

Hozirgi ma’lumotlarga ko‘ra, P2 va PR ko‘z arteriyasi dopplerometriyasining eng istiqbolli ko‘rsatkichlari hisoblanadi. 2023-yilda 1 425 nafar homilador ayolni qamrab olgan tizimli sharh va meta-tahlilda PR ko‘rsatkichi preeklampsiyani aniqlashda taxminan 84% sezgirlik va 92% xoslikni ko‘rsatgan. P2 uchun esa sezgirlik taxminan 85%, xoslik 88% ni tashkil etgan. Ushbu natijalar P2 va PR an’anaviy PI va RI ko‘rsatkichlariga nisbatan preeklampsiyani aniqlashda ko‘proq ma’lumot berishi mumkinligini ko‘rsatadi.

So‘nggi yillarda ko‘z arteriyasi dopplerometriyasidan faqat mavjud preeklampsiyani aniqlash uchun emas, balki kasallikni klinik belgilar paydo bo‘lishidan oldin prognoz qilish uchun foydalanish imkoniyatlari ham faol o‘rganilmoqda. 2025-yilda chop etilgan tizimli sharh natijalariga ko‘ra, OADning prognostik samaradorligi tekshiruv o‘tkazilgan homiladorlik muddati, ayollarning xavf guruhi va tanlangan Doppler parametriga bog‘liq. Ayniqsa, PSV nisbati va PSV2 preeklampsiyani prognoz qilish uchun istiqbolli ko‘rsatkichlar sifatida baholangan. Ikkinchi trimestrda PSV nisbatini onaning klinik xususiyatlari va o‘rtacha arterial bosimga qo‘shish muddatidan oldingi preeklampsiyani aniqlash imkoniyatini yaxshilashi mumkin.

2025-yilda oltita tadqiqot va jami 10 408 ta homiladorlikni o‘z ichiga olgan meta-tahlilda ko‘z arteriyasi dopplerometriyasini mavjud skrining modeliga qo‘shishning samaradorligi baholangan. Ona omillari, bachadon

arteriyasi pulsatsiya indeksi va o‘rtacha arterial bosimni o‘z ichiga olgan modelda AUC taxminan 0,80 ni tashkil etgan. Ko‘z arteriyasi Doppler ko‘rsatkichlari qo‘shilganda bu ko‘rsatkich taxminan 0,84 gacha oshgan. Bu natija OAD mavjud skrining usullarini to‘ldirishi mumkinligini ko‘rsatsa-da, uning qo‘shimcha prognostik qiymatini aniq tasdiqlash uchun yana yirik tadqiqotlar talab etiladi.

2026-yilda e’lon qilingan eng yangi ma’lumotlar ham ko‘z arteriyasi dopplerometriyasini istiqbolli usul sifatida baholaydi. Biroq birinchi trimestrda OADni mustaqil skrining usuli sifatida qo‘llashning prognostik samaradorligi hozircha yetarlicha isbotlanmagan. Shu sababli, hozirgi bosqichda ko‘z arteriyasi dopplerometriyasini preeklampsiya skriningining mavjud usullarini almashtiruvchi emas, balki ularni to‘ldiruvchi qo‘shimcha marker sifatida ko‘rib chiqish maqsadga muvofiq.

Ko‘z arteriyasi dopplerometriyasining asosiy afzalliklaridan biri — uning noinvazivligi va nisbatan oson bajarilishidir. Tekshiruv uchun qon olish yoki maxsus laborator tahlil talab etilmaydi. Bundan tashqari, bachadon arteriyasi Doppleri asosan uteroplatsentar qon aylanishini baholasa, ko‘z arteriyasi Doppleri onaning qon-tomir tizimi va miya gemodinamikasidagi o‘zgarishlar haqida qo‘shimcha ma’lumot beradi. Shu jihatdan OAD o‘rtacha arterial bosim, bachadon arteriyasi dopplerometriyasi va angiogen biomarkerlar bilan birgalikda qo‘llanganda ayniqsa istiqbolli bo‘lishi mumkin.

Shu bilan birga, ko‘z arteriyasi dopplerometriyasini kundalik klinik amaliyotga keng joriy etish uchun ayrim masalalarni hal qilish zarur. Hozirgi tadqiqotlarda tekshiruv metodikasi, homiladorlik muddati, baholanadigan Doppler parametrlari va ularning chegara qiymatlari bir xil emas. Kelgusida standart tekshiruv protokollarini ishlab chiqish, homiladorlikning turli muddatlari uchun me’yoriy ko‘rsatkichlarni aniqlash hamda yirik ko‘p markazli tadqiqotlarda usulning prognostik qiymatini tasdiqlash muhim hisoblanadi.

XULOSA

Ko‘z arteriyasi dopplerometriyasi preeklampsiya bilan bog‘liq onaning qon-tomir moslashuvi va miya gemodinamikasidagi o‘zgarishlarni baholashning istiqbolli noinvaziv usulidir. Zamonaviy dalillar ikkinchi sistolik cho‘qqi va cho‘qqi sistolik tezlik nisbati an’anaviy PI va RI ga qaraganda ko‘proq axborot berishini ko‘rsatadi. Biroq OADning birinchi trimestrda alohida marker sifatidagi prognostik qiymati hali ham noaniq.

Ko‘z arteriyasi dopplerometriyasining eng katta salohiyati uni onaning xususiyatlari, MAP, bachadon arteriyasi Doppleri va angiogen biomarkerlar bilan birgalikdagi multimarker prognostik modellarga kiritishda bo‘lishi

mumkin. OADni PEning kundalik skriningi uchun tavsiya etishdan oldin standartlashtirilgan Doppler protokollari va tashqi validatsiyaga ega yirik prospektiv ko‘p markazli tadqiqotlar zarur.

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THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF GAMIFICATION TECHNOLOGY IN TEACHING ENGLISH VOCABULARY TO PRIMARY SCHOOL LEARNERS

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Abstract: *There are examined the theoretical and methodological foundations of gamification technology to teach English vocabulary to primary school learners in this article. The main focus is on the specific characteristics of vocabulary acquisition of primary school learners, and how gamification makes the learning process more engaging, meaningful, and learner-centered. There is analyzed the role of game elements like rewards, feedback, challenges, competition, and points in terms of educational potential. The most important things are selecting and applying gamification elements according to learners' language proficiency, their age, learning objectives, and vocabulary content. Also, there is discussed the importance of gamification to support learners' motivation, active participation, and repeated exposure to new words. The effective gamification requires using game elements by integrating vocabulary learning objectives and appropriate teaching methods purposefully in the conclusion part. The findings can be methodologically effective to develop more engaging and student-oriented approaches to English vocabulary acquisition in primary education.*

Keywords: *Gamification technology, English vocabulary acquisition, primary school learners, theoretical foundations, game elements, language learning.*

Annotatsiya: *Mazkur maqolada boshlang'ich sinf o'quvchilariga ingliz tilidagi so'z boyligini o'rgatishda geymifikatsiya texnologiyasining nazariy va metodik asoslari ko'rib chiqiladi. Asosiy e'tibor boshlang'ich sinf o'quvchilarining lug'at boyligini o'zlashtirish xususiyatlariga hamda geymifikatsiyaning ta'lim jarayonini yanada qiziqarli, mazmunli va o'quvchiga yo'naltirilgan shaklda tashkil etish imkoniyatlariga qaratiladi. Shuningdek, mukofotlar, tezkor fikr-mulohaza, topshiriqlar, musobaqa va ball kabi o'yin elementlarining ta'limiy imkoniyatlari tahlil qilinadi. Geymifikatsiya elementlarini tanlash va qo'llashda o'quvchilarning yosh xususiyatlari, til*

darajasi, ta'lim maqsadlari hamda o'rgatiladigan lug'aviy materialning mazmunini hisobga olish muhimligi ta'kidlanadi. Bundan tashqari, geymifikatsiyaning o'quvchilarning motivatsiyasi, faol ishtiroki va yangi so'zlar bilan takroriy ishlashini qo'llab-quvvatlashdagi ahamiyati yoritiladi. Samarali geymifikatsiya o'yin elementlarini lug'at o'rgatish maqsadlari va tegishli metodik yondashuvlar bilan maqsadli ravishda uyg'unlashtirishni talab qiladi. Tadqiqot natijalari boshlang'ich ta'limda inglizcha so'z boyligini o'zlashtirishga yo'naltirilgan yanada qiziqarli va o'quvchiga yo'naltirilgan metodik yondashuvlarni ishlab chiqishda nazariy-metodik asos bo'lib xizmat qilishi mumkin.

Kalit so'zlar: geymifikatsiya texnologiyasi, inglizcha so'z boyligini o'zlashtirish, boshlang'ich sinf o'quvchilari, nazariy asoslar, o'yin elementlari, til o'rganish.

Аннотация: *В данной статье рассматриваются теоретические и методические основы использования технологии геймификации при обучении английской лексике учащихся начальных классов. Основное внимание уделяется особенностям усвоения словарного запаса учащимися начальной школы, а также возможностям геймификации сделать процесс обучения более интересным, содержательным и ориентированным на учащегося. Анализируется образовательный потенциал таких игровых элементов, как поощрения, обратная связь, задания, соревнование и баллы. Особое внимание уделяется важности выбора и применения элементов геймификации с учётом возраста учащихся, уровня владения языком, целей обучения и содержания изучаемого лексического материала. Кроме того, рассматривается значение геймификации в поддержании мотивации учащихся, их активного участия и повторного использования новых слов. Эффективное применение геймификации требует целенаправленного сочетания игровых элементов с целями обучения лексике и соответствующими методическими подходами. Результаты исследования могут служить теоретико-методической основой для разработки более интересных и ориентированных на учащихся подходов к усвоению английской лексики в начальном образовании.*

Ключевые слова: *технология геймификации, усвоение английской лексики, учащиеся начальных классов, теоретические основы, игровые элементы, изучение языка.*

INTRODUCTION

It is clear that one of the fundamental aspects of learning English is acquiring vocabulary; after all, how can one learn a language without learning its words? Even primary school students learn to follow a teacher's instructions, answer questions, and comprehend the content of their study materials by learning English vocabulary. Teachers make use of English words even when explaining basic grammatical rules—for instance, when identifying "I" as the subject and "do" as the verb in the Present Simple tense. Consequently, primary education often places a strong emphasis on vocabulary learning. However, students frequently feel bored with the repetitive nature of memorization and practice. Naturally, from a psychological perspective, children tire of doing the same task for extended periods, and want active, interactive games. In this context, teaching vocabulary through gamification can be both engaging and effective; it is a teaching method that proves particularly valuable for primary school students. Moreover, simply acquiring words through repetition or standard practice does not always succeed in transforming passive vocabulary into active vocabulary or ensuring long-term retention. Consequently, integrating words learned theoretically into games proves far more effective than conventional learning methods. Derived from English, the term "gamification" refers to the methodological practice of incorporating game-like elements into the teaching process. Deterding et al. (2011) define gamification as the use of game design elements in non-game contexts. Since a lesson is not a game in itself, introducing game elements—such as points, competition, praise, prizes, and challenges—into this non-game environment boosts students' interest and motivation. Gamification is not merely about playing games; it is a significant pedagogical concept. Game elements must serve specific educational objectives; therefore, the games themselves should be structured according to the students' age, language proficiency, and interests, as well as the lesson content. In this context, the primary objective of this article is to analyze the theoretical and methodological foundations of gamification technology in teaching English vocabulary to primary school students, identify its key elements, and outline the principles for their purposeful integration into the vocabulary instruction process.

MATERIALS AND METHODS

This study is based on the theoretical methodology, analyzing scientific and pedagogical literature regarding gamification, English vocabulary instruction, and primary education. The main aim is to identify the methodological potential of using gamification technology in teaching English vocabulary to primary school learners. There are used some methods like

theoretical analysis, comparison, and generalization. The role of gamification elements such as points, rewards, tasks, competition, feedback are examined in the vocabulary teaching process. Also, selecting these elements are taken into consideration of students' age, their language proficiency level, learning objectives, and the characteristics of the course material.

Based on the theoretical analysis, there is examined how and when gamification elements can be used to teach primary school students. The result shows that making gamification elements appropriate with learners' age, their learning aims, and activating new vocabularies. In this way, the fundamental methodological principles were established to using gamification to develop the vocabulary acquisition of primary school students.

RESULTS

The Role of Gamification in English Vocabulary Teaching

According to the analysis of the selected literature the gamification can provide practical methodological opportunities for teaching English vocabulary to primary school learners. Deterding et al. (2011) describes gamification as the use of game design elements in non-game fields. Meaning is that teachers can integrate game elements with vocabulary activities, but not turning into the whole lesson into a game.

Game based or gamified approaches can create more active and engaging learning condition to learn vocabulary. According to Budiarti et al. (2025) gamification in primary L2 vocabulary learning was associated with positive outcomes like learner motivation, active participation, vocabulary recall, and repeated practice. In this case, these findings show that gamification not only a simple entertaining classroom technique, but also it can be a methodological approach supporting vocabulary learning when connecting to clear instructional objectives.

At the same time, Thompson and Gillern (2020) found that video-game-based vocabulary instruction made overall effects on English vocabulary instruction in a meta-analysis, but also reported variations across studies. This means that the educational value of gamification is related to designing and implementing learning activities.

The Use of Gamification Elements in Vocabulary Teaching

According to the literature analysis some game elements can be integrated into primary vocabulary instruction. They can be points, rewards, challenges, cooperation, competition, feedback, levels. Each one can be used with a particular pedagogical purpose. Students are encouraged with rewards to active participation in vocabulary activities by completing learning tasks. Challenges

and levels make learners more patient and active, and make clear how short-term goals come. When competition may increase interest and fastness, learners practice vocabulary with their classmates in cooperative activities. Feedback is useful by allowing learners to recognize mistakes and understand their progress. Especially, giving feedback immediately after each participation in gamification-integrated lessons can be much more effective.

The findings, however, shows that choosing a game element should depend on the learning objective, learners' age and proficiency, and the vocabulary type which is being taught. That means teachers do not need to use all of the game elements at the same time. Yieng and Abdul Aziz (2022) emphasize how considering learners' characteristics, learning materials, and game features to use game-based learning for primary English vocabulary and spelling. In this case, selecting game elements purposefully rather than adding to a lesson simply to make it mor entertaining.

Methodological Principles of Using Gamification in Primary Vocabulary Teaching

There can be identified several methodological principles to use gamification in primary English vocabulary instruction according to the theoretical analysis. Firstly, aligning learning-objective is essential as each game element should support a particular vocabulary objective like introducing new words, practicing their meaning, and using them in simple sentences. Secondly, their age should be appropriate with heir activities. According to primary school learners' learning level, activities should be simple and clear since if tasks are too complicated, they may shift their attention from learning new words to understanding the rules of the activity. Thirdly, repetition and reinforcement should be considered as learners can get opportunities to encounter and use the same words in different contexts with gamified activities. Fourthly,

DISCUSSION

The findings show that gamification can be a useful methodological approach that not simply makes lessons enjoyable, but gives opportunities for learners to practice new words, and use them actively. This is why this approach is practical for young learners who do not want to do repeated practice by being bored. The gamification does not have the same effect in every situation as the literature showcases. While Budiarti et al. (2025) told positive associations with vocabulary recall, motivation, and participation in learning primary L2 vocabulary, Thompson and von Gillern (2020) noticed differences among studies of game-based vocabulary instruction. In this case, how lesson is designed, how learner characteristics, learning objectives, and classroom

conditions are connected to the gamification elements, the success of gamification depends on these factors. This means that teachers should integrate gamified vocabulary activities by planning according to the specific needs of their learners. For primary students, if activities are clear, manageable, and connected to the vocabulary which is being taught, it can be viewed not as a separate activity, but as a way of practicing active and engaging. Thus, the purposeful and age-appropriate gamification usage can provide a practical methodological basis for teaching English vocabulary to primary school learners.

CONCLUSION

The gamification can be used as the theoretical method that can be used to teach primary school learners according to the theoretical analysis. If this approach is used properly by considering learners' proficiency, age, the content of vocabulary, and classroom conditions, this way can create many opportunities to practice and activate to use new words. In this way, the gamification can be used purposefully to study not turning the whole lesson into entertainment only. The study also shows that if there are some students who are not that active, not lesson-focused in class, probably, they attend actively to the gamification-based activity as they take a break from the boring lesson, recharge their battery.

Overall, there is provided a basis for using a gamification purposefully in primary English vocabulary teaching in this theoretical and methodological analysis.

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ROL O‘YINLARI VA NUTQIY FAOLIYATNING INGLIZ TILINI O‘QITISHDA KOMMUNIKATIV YONDASHUVDAGI O‘RNI

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Annotatsiya. *Maqolada ingliz tilini kommunikativ yondashuv asosida o‘qitishda o‘yin va nutqiy faoliyatning o‘rni tahlil qilinadi. Badiiy adabiyot namunalari asosida rolli o‘yin, dialog, munozara va vaziyatli topshiriqlarning o‘quvchilarning ingliz tilida erkin fikrlash va muloqot qilish ko‘nikmalarini rivojlantirishdagi imkoniyatlari ko‘rsatib beriladi.*

Kalit so‘zlar: *kommunikativ yondashuv, nutqiy faoliyat, o‘yin, rolli o‘yin, ingliz tili, dialog, badiiy matn, kommunikativ kompetensiya.*

Abstract. *This article examines the role of games and speech activities in teaching English through the communicative approach. Based on examples from literary works, it demonstrates the potential of role-plays, dialogues, discussions, and situational tasks in developing learners’ ability to think freely and communicate effectively in English.*

Keywords*: communicative approach, speech activity, game, role-play, English language, dialogue, literary text, communicative competence.*

KIRISH

Bugungi ingliz tili darsida o‘quvchining grammatik qoidani bilishi yetarli emas. U o‘z fikrini tushunarli ifodalashi, suhbatdoshining gapini anglab, unga mos javob bera olishi, savol berishi, fikrini asoslay olishi va muayyan vaziyatda til vositalaridan o‘rinli foydalanishi kerak. Shu sababli chet tilini o‘qitishda tilni faqat bilim sifatida emas, balki muloqot vositasi sifatida o‘rgatishga e’tibor kuchaydi. Kommunikativ yondashuvning asosiy mazmuni ham shunda: o‘quvchi til birliklarini yodlab qolish bilan cheklanmay, ularni real yoki realga yaqin kommunikativ vaziyatlarda qo‘llashi lozim. W. Littlewood kommunikativ til o‘qitishda funksional va ijtimoiy muloqot faoliyatlariga alohida e’tibor qaratadi. Uning fikricha, til shakli va uning kommunikativ vazifasi bir-biridan ajratilmasligi kerak [1]. Littlewoodning kitobida funksional kommunikativ faoliyatlar hamda ijtimoiy o‘zaro ta’sirga asoslangan mashg‘ulotlarning alohida yoritilgani ham shundan dalolat beradi.

Kommunikativ yondashuv doirasida o‘yin va nutqiy faoliyatning ahamiyati ayniqsa katta. Chunki o‘yin jarayonida o‘quvchi tayyor gapni takrorlamaydi, balki vaziyatga qarab gapirishga majbur bo‘ladi. Masalan, “*You are a shop assistant and your partner is a customer”* kabi oddiy topshiriq ham o‘quvchini savol berish, javob qaytarish, narxni aytish, taklif bildirish kabi nutqiy harakatlarga jalb qiladi. Bunday mashg‘ulotda grammatik shakl kommunikativ maqsadga xizmat qiladi.

Kommunikativ kompetensiya tushunchasi tilni grammatik jihatdan to‘g‘ri qo‘llash bilan bir qatorda, uni ijtimoiy vaziyatga mos ravishda ishlata olishni ham nazarda tutadi. S. Savignon kommunikativ kompetensiyani tilning ijtimoiy o‘zaro ta’sir jarayonidagi qo‘llanishi bilan bog‘laydi [2]. Shu nuqtayi nazardan qaraganda, ingliz tili darsidagi nutqiy faoliyatni faqat “speaking exercise” sifatida tushunish torlik qiladi. Savol-javob, juftlikdagi suhbat, kichik guruh muhokamasi, bahs, intervyu, hikoya tuzish, rolga kirish va muammoli vaziyatni hal qilish kabi faoliyatlar o‘quvchini haqiqiy muloqotga yaqinlashtiradi.

Masalan, o‘quvchilarga quyidagi vaziyat berilishi mumkin:

“Alice has returned from Wonderland. She tells her classmates what she saw there. One student asks questions about the strange creatures and another student disagrees with her interpretation.”

Bu topshiriqda L. Carrollning “*Alice’s Adventures in Wonderland*” asaridan foydalaniladi. O‘quvchi Alice roliga kirib, voqealarni ingliz tilida bayon qiladi; boshqa o‘quvchilar esa savollar beradi. Natijada Past Simple, question forms, adjectives yoki reported speech kabi til birliklari alohida mashq sifatida emas, balki mazmunli suhbat tarkibida ishlatiladi. Bu usulning muhim tomoni shundaki, badiiy matn o‘quvchi uchun tayyor “*grammatik material*” emas, balki suhbatga sabab bo‘ladigan manbaga aylanadi.

O‘yin ingliz tili darsida shunchaki ko‘ngilochar vosita emas. To‘g‘ri tashkil etilganda, u o‘quvchini ma’lum kommunikativ vazifani bajarishga undaydi. O‘quvchi o‘yinda g‘olib bo‘lish, vazifani bajarish yoki o‘z rolini himoya qilish uchun ingliz tilidan foydalanadi. Masalan, Ch. Dickensning “*Oliver Twist*” asari asosida “*Who is Oliver*?” nomli rolli mashg‘ulot tashkil etish mumkin. Bir guruh o‘quvchilar Oliver, Mr. Brownlow, Nancy va boshqa personajlar rollarini bajaradi. Boshqa guruh esa “*interviewers*” sifatida ularga savollar beradi:

Why did Oliver leave the workhouse?

What did you feel when you met Mr. Brownlow?

Why did Nancy help Oliver?

Bu yerda o‘quvchi faqat asar mazmunini eslab qolmaydi. U savol tuzadi, javob beradi, sabab bildiradi, fikrini himoya qiladi. Shu sababli badiiy asar kommunikativ topshiriq uchun tabiiy kontekst yaratadi.

I. K. Ghosn bolalar adabiyotidan foydalanish til o‘rganish uchun mazmunli va qiziqarli kontekst yaratishini, shuningdek, og‘zaki nutq, fikrlash va madaniyatlararo tushunchalarni rivojlantirish imkonini berishini ta’kidlaydi [3, 172–179].

Rolli o‘yin kommunikativ yondashuvda alohida ahamiyatga ega. Chunki unda o‘quvchi o‘z nomidan emas, muayyan obraz nomidan gapiradi. Bu ayrim o‘quvchilarda nutqiy qo‘rquvni kamaytirishi mumkin. Masalan, Sh. Brontening “Jane Eyre” romani asosida Jane va Mr. Rochester o‘rtasidagi suhbatni sahnalashtirish mumkin. O‘quvchilar asardagi tayyor dialogni ko‘chirib aytish bilan cheklanmasdan, vaziyatni davom ettirishlari mumkin:

Jane: I want to know the truth.

Rochester: What would you do if the truth changed everything?

Jane: I would still make my own decision.

Keyingi bosqichda o‘qituvchi “What would you do if you were Jane?” savolini beradi. Shunday qilib, adabiy obrazdan real o‘quvchining shaxsiy fikriga o‘tiladi. Bu esa kommunikativ yondashuvning muhim xususiyatlaridan biridir.

Badiiy adabiyot ingliz tili darsida turli kommunikativ topshiriqlar uchun qulay material bo‘la oladi. J. Collie va S. Slater badiiy asar bilan ishlashda o‘quvchini faol ishtirokchiga aylantiradigan turli mashg‘ulotlardan foydalanishni tavsiya qiladi. Ularning qo‘llanmasida badiiy matn bilan ishlashning boshlang‘ich bosqichi, matnning muhim qismlarini muhokama qilish, yakuniy qism ustida ishlash va to‘liq asarni o‘rganish uchun amaliy faoliyatlar berilgan [4].

Mazkur yondashuvni quyidagi tarzda tashkil etish mumkin:

Badiiy asar	***Kommunikativ faoliyat***	***Asosiy nutqiy vazifa***
Alice’s Adventures in Wonderland	*“Interview with Alice”*	*Savol-javob*
Oliver Twist	*“Courtroom / Interview”*	*Fikrni asoslash*
Jane Eyre	*“Role-play”*	*Dialogik nutq*
Treasure Island	*“Plan the journey”*	*Kelishuv va qaror qabul qilish*

R. L. Stevensonning “*Treasure Island*” asari asosida “*Plan the journey*” topshirig‘ini tashkil qilish mumkin. O‘quvchilar kichik guruhlarga bo‘linadi va ular xazina izlash uchun sayohat rejasini tuzadilar. Har bir guruh a’zosi o‘z taklifini beradi:

We should take more water.

I think we need a map.

We should not travel at night.

I disagree because...

Bu mashqda *should, have to, need to, I think, I agree, I disagree* kabi birliklar tabiiy kommunikativ vaziyatda ishlatiladi. Demak, til materiali o‘zi uchun emas, muayyan fikrni ifodalash uchun kerak bo‘ladi.

O‘yin faoliyatining samarasi uning nutqiy maqsad bilan bog‘langaniga ko‘p jihatdan bog‘liq. Agar o‘yin faqat harakat yoki musobaqadan iborat bo‘lsa, uning til o‘rganishdagi imkoniyati cheklangan bo‘ladi. Aksincha, har bir o‘yin aniq kommunikativ vazifa bilan bog‘lansa, o‘quvchi tildan foydalanishga ehtiyoj sezadi.

Masalan, “Guess the character” o‘yinida o‘quvchi Dickens yoki Carroll asaridagi qahramonlardan birini tanlaydi. Boshqalar esa *Yes/No* savollar orqali uni aniqlashga harakat qiladi:

Are you a child?

Do you live in London?

Are you afraid?

Do you travel to another world?

Bu yerda o‘yin grammatik shakllarni mexanik takrorlash emas, balki axborot olish vositasiga aylanadi.

Shuningdek, “*Continue the story*” o‘yini ham samarali. O‘qituvchi badiiy asardan bir vaziyatni beradi, o‘quvchilar esa voqeani davom ettiradi. Masalan:

“Oliver opens the door and sees someone standing in the darkness...”

Har bir o‘quvchi hikoyaga bir yoki ikki gap qo‘shadi. Natijada o‘quvchilar nafaqat grammatik va leksik birliklardan foydalanadi, balki voqealar o‘rtasidagi mantiqiy bog‘liqlikni ham saqlashga harakat qiladi.

Kommunikativ darsda o‘qituvchining vazifasi o‘zgaradi. U dars davomida barcha gaplarni o‘zi aytadigan asosiy nutq subyekti bo‘lib qolmaydi. O‘quvchilarga gapirish uchun vaziyat yaratadi, savollar beradi, kerakli til vositalarini taklif qiladi va muloqot jarayonini boshqaradi.

H. D. Brown interaktiv til pedagogikasida juftlik, kichik guruh, suhbat, topshiriq va boshqa faoliyatlarning o‘quvchi nutqini rivojlantirishdagi o‘rniga

e’tibor qaratadi [5]. Brownning metodikasi til o‘qitishdagi amaliy faoliyatlarni ikkinchi tilni o‘zlashtirish tamoyillari bilan bog‘lashga qaratilgan.

Shu bois o‘qituvchi o‘quvchining har bir grammatik xatosini darhol to‘xtatib tuzatishdan ko‘ra, avvalo uning fikrini yetkazishiga imkon berishi maqsadga muvofiq. Masalan, o‘quvchi “*He go to London yesterday*” desa, suhbatni to‘xtatib grammatik qoida tushuntirish o‘rniga keyingi bosqichda “*Yes, he went to London yesterday*” shaklida to‘g‘ri variantni tabiiy ravishda takrorlash mumkin.

Bunda aniqlik va ravonlik o‘rtasidagi muvozanat saqlanadi. Littlewood ham kommunikativ yondashuv grammatik bilimning ahamiyatini inkor etmasligini, grammatik bilim samarali kommunikatsiya uchun zarurligini ta’kidlaydi [1].

Yuqoridagi misollar shuni ko‘rsatadiki, o‘yin va nutqiy faoliyat bir-birini to‘ldiradi. O‘yin o‘quvchiga vaziyat beradi, nutqiy faoliyat esa shu vaziyatni til orqali amalga oshirish imkonini yaratadi. Badiiy adabiyot esa mazkur ikki jarayon uchun mazmuniy asos vazifasini bajaradi.

Ayniqsa bolalar va o‘smirlar bilan ishlashda badiiy obrazlarning imkoniyati katta. Alice, Oliver Twist, Jane Eyre yoki Jim Hawkins kabi qahramonlar o‘quvchiga oddiy grammatik mashqdan ko‘ra kuchliroq suhbat mavzusini beradi. O‘quvchi “*What is the Past Simple*?” savoliga javob berishdan ko‘ra, “*Why did Oliver leave the workhouse?*” savoliga javob berishda tilni mazmun bilan bog‘laydi.

Bunday yondashuv o‘quvchining shaxsiy munosabatini ham yuzaga chiqaradi. “*Do you agree with Jane?”, “Would you help Oliver?”, “Would you follow Jim Hawkins?”, “What would you do in Wonderland?”* kabi savollar o‘quvchini matnni qayta aytishga emas, o‘z fikrini ingliz tilida ifodalashga undaydi.

Ghosnning bolalar adabiyotidan foydalanish haqidagi tadqiqotida ham badiiy matnlarning motivatsiya, og‘zaki nutq, fikrlash, madaniyatlararo anglash va emotsional rivojlanish bilan bog‘liq imkoniyatlari qayd etilgan [3].

Shu bilan birga, badiiy asardan foydalanishda matnning murakkabligi o‘quvchining til darajasiga moslashtirilishi kerak. To‘liq roman matnini boshlang‘ich darajadagi o‘quvchiga berish har doim ham kutilgan natijani bermaydi. Ayrim hollarda qisqa parcha, dialog yoki moslashtirilgan matn yetarli bo‘ladi. Muhimi, tanlangan parcha o‘quvchini gapirishga undaydigan mazmunga ega bo‘lishidir.

XULOSA

Ingliz tilini kommunikativ yondashuv asosida o‘qitishda o‘yin va nutqiy faoliyat o‘quvchining til bilimini amaliy muloqotga aylantirishga xizmat qiladi. O‘yin o‘quvchini kommunikativ vaziyatga olib kirsa, dialog, munozara, intervyu, rolli o‘yin va hikoya tuzish kabi nutqiy faoliyatlar ushbu vaziyatni ingliz tilida amalga oshirish imkonini beradi. Badiiy adabiyot esa kommunikativ mashg‘ulotlar uchun mazmunli va tabiiy material vazifasini bajaradi. Dickens, Brontë, Carroll va Stevenson asarlaridagi obraz va vaziyatlar asosida tashkil etilgan rolli o‘yin, intervyu, munozara, hikoyani davom ettirish va muammoli topshiriqlar o‘quvchini ingliz tilida mustaqil fikr bildirishga undaydi. Shunday qilib, kommunikativ yondashuvda o‘yin maqsad emas, muloqotga olib boradigan vosita, badiiy matn esa oddiy o‘qish materiali emas, nutqiy faoliyatni yuzaga keltiradigan mazmuniy manba sifatida qaralishi lozim. Bunday tashkil etilgan darsda grammatika ham, lug‘at ham, o‘qish va gapirish ko‘nikmalari ham alohida-alohida emas, balki yagona kommunikativ jarayon tarkibida shakllanadi.

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PROCESSES OF PHONOLOGICAL CATEGORIZATION IN LATE BILINGUISM

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"Boshlang'ich ta'lim" kafedrasi katta-o'qituvchi

Annotation.*The article raises questions devoted to the peculiarities of phonological categorization in late bilingualism, as well as the identification of linguacognitive foundations of language interaction at the phonetic-phonological level with the involvement of neurophysiological data. The fundamental possibility of mastering a second language in adulthood, the mechanisms of formation of phonological categories of a second language, the processes of interference of linguistic and mental structures, as well as the causes of the emergence of a phonetic accent in speech in a non-native language are studied.*

Key words: *Phonologikal categorization, late bilingualism, cognitive basis for phonological interference, phonetic accent.*

This article is devoted to the study of the features of phonological categorization in the mental space of a bilingual, as well as the identification of the linguacognitive foundations of the modification of sound images of the second language under the influence of the sound system of the native language at the stage of formation of a bilingual personality in late bilingualism. Analysis of the stages of formation of phonological cognitive models structuring the language space of a bilingual allows modeling the patterns of functional interaction of languages at the phonetic-phonological level. The range of research tasks includes the question of the fundamental possibility of achieving a sufficient level of proficiency in a second language from the point of view of a person's linguacognitive abilities, the mechanisms of formation of phonological categories of a second language, the processes of interference of linguistic (including sound) and mental structures, as well as the reasons for the emergence of a phonetic accent in speech in a non-native language.

Based on the understanding of language as one of the modes of cognition, it can be assumed that the stability of linguacognitive connections formed as a result of the interaction of mental space and the space of the native language becomes a fairly powerful barrier when learning a second language in adulthood. In this regard, the question of the possibility of fully mastering a second language

from the point of view of the linguacognitive abilities of an adult is natural. Back at the beginning of the last century (1929–1934), L.S. Vygotsky, based on many years of research, put forward the position that thinking and speech are functionally interconnected, but genetically independent systems [1]. In the cognitive studies of his followers, it is recognized that thinking is actually carried out without the obligatory use of language: the instrument of thinking is the universal subject code - the neurophysiological substrate of thinking, a certain mental system that has a common structure for processing information about reality received through different sense organs [2]. With the help of a universal subject code, the recipient of speech transforms it into a model of the segment of reality that is being communicated, and "a denotation arises, the consideration of which corresponds to the act of understanding" [5, p. 80]. Such a subject code is considered as a "universal language from which translations into all other languages are possible" [3].

If we imagine learning a second language as a process of forming an alternative language submodus of cognition, then we can talk about the admissibility of connecting through it to the "universal subject code", that is, about the fundamental possibility of activating the same ensembles of neural networks, at the preverbal mental level in the brain of a bilingual with subsequent (in speech production) or preceding (in speech perception) "materialization" of thoughts, emotions, feelings and other mental entities through the complex bipolar language mode formed in the consciousness as a result of mastering the second language. It should be noted that the potential feasibility of interlingual code switching does not mean the unhindered formation of an alternative linguistic submodus, since this is a long-term dynamic process complicated by the factor of interference of both linguistic (including sound) and mental structures as a result of their interaction at different stages of the development of a bilingual personality. It is this factor that explains the emergence of phonetic accent, as well as errors in the choice of lexical means of verbalization, especially culturally marked vocabulary, syntactic constructions in speech in a foreign language, often leading to annoying communicative failures [4]. Phonetic interference and accent in speech at the initial level of learning a second language in late bilingualism are a consequence of phonetic-phonological lacunarity (absence of certain phonemes, types of syllabic structures, prosodic phenomena of various kinds), discrepancies in the rules of compatibility of phonetic-phonological units in the studied and native languages, as well as a certain acoustic-articulatory similarity of units of the sound systems of the two languages. Examples of interlingual sound lacunarity, divergences in the

principles of phonotactics and variability in the use of acoustic contrasts are numerous: the anterior lingual apical-interdental obtrusive fricative consonants [θ] and [ð], represented in such languages, like English and Spanish (for example, English thing – thing, Spanish cine – cinema, cena – dinner), are not used in the phoneme systems of Russian, French, Chinese, Korean and many other languages of the world; aspiration of plosive stops [p], [t], [k] is an additional non-distinctive phonetic feature in English and Chinese, and in Thai it acts as a relevant distinctive feature of the phonemes [ph], [th], [kh], distinguishing them from the unaspirated phonemes [p], [t], [k].

The uniqueness of the sound systems of the world's languages becomes a certain obstacle when studying them as an adult. Thus, a native Russian speaker who is at the basilect level of English proficiency, when producing and perceiving speech in the target language, does not differentiate such pairs of words as thin – sin, think – sink, bathe – base, both – boss; in turn, many native speakers of Asian languages replace the sound [θ] with the sound [t], and [ð] with the sound [d]: think – tink, three – tree, nothing – noting, there – dare, that – dat, etc. The absence of labiodental fricative consonants [f] and [v] in the Korean language leads to the appearance of phonetic doublets in the English speech of Koreans, such as coffee – copy, fork – pork, cough – cop, etc.

How does the formation of new linguistic, in particular phonetic-phonological, categories occur in the consciousness of a person when learning a second language? “When learning a new language, the involvement of already formed systems of the first language is inevitable” [5]. It is known that the fundamental property of the human linguacognitive system, like any other system, is stability, i.e. the ability to withstand external influences that can lead to destruction or modification. Therefore, the formation of bilingual phonological categories is carried out on the basis of already formed stable commensurable primary categories of the native language, which leads to the construction of multidimensional linguacognitive phonological models. In any language, the categorization of sound units involved in the formation of the shells of significant units and in the differentiation of meaning is carried out according to three principles: contrastive, characteristic and allophonic. The properties of phonetic contrast allow us to distinguish one phonological unit from another, the characteristic ones allow us to characterize the material acoustic-articulatory structure of the unit, while allophonic features make it possible to determine the spectrum of sound units that are in complementary distribution relationships with each other in the system of a given language.

Thus, secondary phonological categorization, as well as the organization of language categories of the second language in general, is a dynamic process and, accordingly, the level of proficiency or the stage of formation of bilingualism are important factors that must be taken into account in research. The most productive in studying the phonological problems of late bilingualism should be recognized as the system-dynamic approach. It is necessary to speak, apparently, about the stage-by-stage formation of a complex structure of the linguistic mode of cognition and the formation of parallel explicative speech channels of a bilingual personality, in whose mental space, as a result of the formation of new linguacognitive connections brought by the second language, new concepts and categories are built and existing ones become more complex in structure and content.

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TUYG‘ULAR TO‘LQINIGA TO‘YINGAN SHE’RIYAT

(XOSIYAT BOBOMURODOVA SHE’RIYATI MISOLIDA)

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Rezyume: *Maqolada Xosiyat Bobomurodova she‘riyatda aks etuvchi tuyg‘ular tasviri va uning janriy-kompozitsion yaxlitlashuvidagi o‘rni, shuningdek, shoira lirikasining o‘ziga xos xususiyatlari hamda ijodkor badiiy mahorati masalalari ilmiy-nazariy jihatdan tadqiq etiladi.*
Tayanch so‘zlar: *lirika, she’riyat, tuyg‘ular tasviri, lirik tasvir, dramatik tasvir, badiiy ifoda, ishq, oshiq.*
Резюме: *В статье Хосият Бабомуродова научно-теоретически исследуются вопросы отражения чувств в поэзии и их место в жанрово-композиционном обобщении, а также особенности лирики поэтессы и художественного мастерства ее создателя.*
Ключевые слова: *Лирика, поэзия, изображение чувств, лирический образ, драматический образ, художественное выражение, любовь, влюбленный.*
Summary: *The article will research scientifically and theoretically the image of the feelings reflected in the poetry of Khosiat Bobomurodova and its role in the genre-compositional rounding, as well as the specifics of the poet's lyrics and the issues of creative artistic skill.*
Key words: *Lyricism, poetry, depiction of feelings, lyrical image, dramatic image, artistic expression, love, in love.*

Adabiyot insonshunoslikdir. Shuning uchun ham ijodkor oldida turgan eng qiyin, eng sharafli vazifa – insonni o‘rab turgan voqelikdan tashqari uning ma’naviy dunyosini ham, ruhiyatini ham ishonarli, ta’sirli tarzda yoritib berish hisoblanadi. Ijodda muhim ahamiyatga molik bo‘lgan yana bir haqiqat shundaki, ijodkor inson hayoti haqidagi eng real tasavvurini o‘z sezgilari vositasi bilan ilg‘aydi va tasvirlaydi. Zero, ijodkor yaratgan obrazning tashqi qiyofasidan tortib, xarakteri va bu obraz orqali ilgari surmoqchi bo‘lgan g‘oyalarida uning lirik “men”iga xos barcha fazilatlari mujassam bo‘ladi.

Ijodkor o‘z tuyg‘usini Yaratganga, vatanga, yurtga, xalqiga, ota-onasiga, do‘stiga nisbatan izhor qilishi, tabiiy. Ana shunday yuksak tuyg‘ular mavzusiga bag‘ishlangan asarlarning umri uzoq va ta’sirli bo‘ladi. Chunki unda kishiiiig butun vujudini pokiza va sirli bir his chulg‘aydi, tomirlarida toza qon ko‘piradi, qalbga oppoq nur kirib keladi. Bu nur tananing butun puchmoqlariga tarqalib, nafsoniy tuyg‘ularni quvadi, fikr tetiklashadi. Butun olam ko‘ziga benihoya go‘zal tuyuladi. Chunki go‘zallik ezgulikdir. Vujud esa ardoqli armonlarga to‘la. Ayniqsa, bunday holat she’riyatda yorqinroq ko‘zga tashlanadi. Unda shoir tuyg‘usi, dardlari she’rxon dardiga oniy lahzadayoq singadi. Haqiqiy tuyg‘u bilan yo‘g‘rilgan chinakam she’riyatning ta’sir quvvati ummonga teng bo‘ladi. Bugungi pokiza va sirli tuyg‘ular mavzusi – muhabbat haqidagi she’rlar ana shu ohangda.

Muhabbat haqidagi she’rlar o‘zida oshiqlik fasli bilan bog‘liq sirli bir hislarni jamlaydi. Donishmand shoir Alisher Navoiy “Hayrat ul-abror” dostonida haqiqiy oshiq haqida shunday yozadi: “Haqiqiy oshiq deb sen bilki, u dard bilan yashaydi; uning tili ham, dili ham, ko‘zi ham pok bo‘ladi. Ishq uni o‘z “men”idan pok qilib, hatto fano o‘tiga xashak qilgan bo‘ladi, yuzini sariq qilib, dardini yashira-di; ko‘zini ariq qilib yosh oqizadi”[1.173]. Bundan ko‘rinadiki, haqiqiy oshiqning ahvoli dil izhoridan emas, holatidan bilinadi. Shu boisdan shoirlar o‘zlarining ishqqa mubtaloligini va ruhiy kechinmalarini so‘zda shunchaki bayon qilmaydi, balki holat tasvirida ko‘rsatadi. Xalqimizning ardoqli shoirasi Xosiyat Bobomurodova “Bir daryo oqar qalbimda” turkumiga kirgan she’rida shunday yozadi:

Kim chertar eshikii ohista, bilmam,
Ko‘ksimdan sug‘rilib chiqqanday tikon.
Qushday uchib borsam, chopiblar borsam,
Bag‘ri cho‘g‘ hamdardim xazonlar ekan. [2.32].

Bu o‘rinda kimgadir intiq odamning yorqin holati ifodasini topgan. “Bag‘ri cho‘g‘ hamdardim” iborasi shoira chuqur qayg‘uni, balki yongan, dardkash va iztirob chekayotgan qalbni nazarda tutmoqda. Ijodkorning inson ruhiyati, so‘z qudrati va she’riyatning o‘lmas kuchi haqidagi falsafiy mushohadalarini o‘zida mujassam etgan ayni jumlalar odatda armonli, sinovli damlarda bir-birining dardiga sherik bo‘la oladigan yaqin insonlarga nisbatan qo‘llaniladi. Zeroki, o‘zgaga intiq odamning butun vujudi quloqqa aylanadi, xayolida faqat uning yodi kezadi, qo‘li qanday yumushda bo‘lmasin, ko‘z oldida kutgani bo‘ladi. She’rdagi lirik qahramon shu holatda. Uning iztirobli holati, ayniqsa, to‘rtinchi misradagi tashbehda yaxshi ochilgan. Lirik qaxramon “men” eshik chertgan kim deb borsa, “Bag‘ri cho‘g‘ hamdardim xazonlar ekan”. Demak, hijronda

qahramonning yuzi xazondek sarg‘aygan, xazon yuzidagi taram-taramlikdan esa qalb kuyishi ifodasi tasvirlanadi. Bu holat keyingi misralarda yana-da aniqlashib, tiniqlashib boradi: eshitilgan sasni u, deb o‘ylasa, sabo bo‘lib chiqadi, derazaning tiq-tiqidan xursand bo‘lsa, kutgani emas, yomg‘ir ekan. Shunda o‘yga cho‘mgan ko‘ngil birdan xovliqib ketadi, chunki shovqin kelgandi. Lekin intilgani emas, shamol bo‘lib chiqadi. Shoira tilga olgan holatlar bir onli, bir lahzali bo‘lsa-da, biroq ular to‘fonining qudrati niqoyatda katta. Shoirning ularni tilga olishi qalbdagi po‘rtanalarga ishoradir. Bular hamisha yo‘lda, hamisha olam kezadi. Shundan ularga murojaati ham mantiqli:

Yomg‘ir, shamol, xazon, to‘xtang, qaytinglar,
Eshitib ketinglar qo‘shiqlarimni.
Yo‘qlab kelmasimga borib aytinglar,
Yig‘lab ochib ko‘ydim eshiklarimni. [2.32].

Ijodkorning mahorati, tasavvur va xayolot olamining kengligi, ayniqsa uning so‘z qo‘llash mahoratida yaqqol namoyon bo‘ladi. Masalan, tabiat bilan jonli olam bir-biriga chambarchas bog‘liq. Tabiatning go‘zal manzaralari inson qalbiga ko‘chirib, uning botinida ajib, nozik tuyg‘ularni yuzaga keltirsa, ruhning qalqishini esa tabiat tajallisidagina ifodalash mumkin. [3.122]. Bu jihatlarni iste’dodli shoiramiz she’rlari orqali yorqinroq his qilishimiz mumkin.

Xosiyat Bobomurodovaning badiiy mahorati shundaki, uning asarlari mazmunida his uyg‘otish ta’siri bir-biriga yaqin bo‘lgan bunday holatlarni chog‘ishtirish, tasvirning ta’sir quvvatini yanada oshirish kabi jihatlarda ko‘zga yaqqol tashlanib turadi. Umuman, uning turkum she’rlari ruhan bir-biriga juda yaqin. “Sizning ham qirlarda o‘sarmi maysa” deb boshlanadigan she’rida sog‘inch tuyg‘ulari o‘z ifodasini topgan. She’rda bu holat shu qadar samimiylik bilan berilganki, bu tuyg‘u she’rxon qalbiga ko‘chib, uning qalbini yayratib yuboradi. Bu hol tuyg‘ular tajallisini chuqur his va aniq tasavvur qilgandagina ro‘y berishi mumkin. Shoira buning uddasidan chiqqan. Shoira yozadi:

Sizda ham suvlarning ko‘pirib qoni
O‘zlarini tog‘dan tashlaydilarmi?
Kurtaklarning gulga aylanish oni
Bu shirin azobni boshlaydilarmi? [2.32].

Xosiyat Bobomurodova she’riyatida tasvir vositalarining jozibasi o‘ziga xos. Shoiraning har bir misrasi fikr va tuyg‘u uyg‘unligiga ega. Bu – hammaga ham nasib qilmaydigan noyob hodisa. Masalan, tahlilimizdagi misralarda tasvirlanmish suvning ko‘pirishi – bilakdagi qonning ko‘pirishiga ishora

sifatida qo‘llanilmoqda. Qon esa, ma’lumki, o‘z-o‘zidan ko‘pirmaydi, balki, u kuchli hayajon, quvonch va zavqlanishdan sodir bo‘lajak ruhiy holat. Lirik qahramon tabiatning sehrli manzarasi tufayli shu tuyg‘uni boshdan kechirmoqda: yuksakdan o‘rkach-o‘rkach bo‘lib tushayotgan suvning zavqidan qalb yayraydi, vujudi muzdek shabada epkinini his qilib, undan orom oladi, fikr tiniqlashadi. Kurtaklarning gulga aylanishidagi shirin azob esa muhabbatning qalbda tug‘ilish oniga ishora bo‘lishi bilan birga, hayotdagi ikkinchi umrini, ya’ni ulg‘ayish, komillik yo‘li sari qadam tashlash lahzalarini nazarda tutadi.

Shoira she’rida yurtiga bo‘lgan mehr yoriga bo‘lgan muhabbat bilan uyg‘unlikda tasvirlanadi. Uning “Turnalarim” nomli she’riy to‘plamidan joy olgan asarlari mohiyatida insoniy tuyg‘ular, sog‘inch, hayot mazmuni va tabiat tasvirlari mujassamlashgan. Yurtining tarovatidan quyoshning boshi aylanadi, bulutlarning ko‘zi tinadi, qaytgan turnalar maskanni ko‘rib, xursandchiligidan ko‘z yosh to‘kadi. Bu holat lirik qahramonning qalbida kechgan po‘rtanalar, visol oni yaqinlining hayajonli daqiqalari sifatida ifodalanadi.

Muhabbat har bir insonning qalbiga entikish, surur baxsh etadigan buyuk tuyg‘u. Garchi hali uni boshidan o‘tkazmasa ham, ko‘nglidan kechirmasa ham hayolan havaslarida orzulanadi. Shundan shoira bir she’rida shunday satrlarni bitadi:

Tinglamaydi hech kim arzu dodini,
Tutilgan unutar nasli, zotini.
Senu men kim bo‘pmiz, bu sevgi yana,
Telba qilar mingta Xosiyatini. [2.35].

Darhaqiqat, bizni o‘rab turgan rango rang olam, borliq va tabiatdagi hodisalar, ulardagi manzaralar misoli ko‘zgudek lirik “men”ning ichki kechinmalarini, tuyg‘ularini ko‘rsatib turadi. [4.72]. Tabiat turfligini tasvirlab, kitobxonga tiniq tuyg‘ular ifodasini hadya etgan shoira asosiy voqealar, qahramonlarni tasvirlashdan oldin o‘quvchini unga tayyorlab oladi. Zero, botinda hamma narsalar tabiatga ko‘chgan. Ammo ayni holat sevgilisida bu hodisa ro‘y bermaganidan o‘kinadi:

Ko‘ngildagi armon, yurakdagi g‘am
Ko‘chib ketmasmidi gulga, chamanga?
Nega buncha jimsiz, buncha xotirjam,
Bahor kelmadimi, sizlar tomonga?! [2.33].

Agar shunday bo‘lganda, u (sevgilisi) insonlashardi, ezgulashardi. Insonda boshqalarning tuyg‘usini chuqur xis qila bilish, yuqtira bilish qobiliyati bo‘lganligi uchun ham, – deb yozgan edi L. Tolstoy, – bugun odamzod shu vaqtgacha boshdan kechirgan hamma narsani har bir kishi xis qila bilishi mumkin. Inson zoti bundan ming yil oldin o‘tgan kishilarning tuyg‘ularini ham

his qila olish va o‘z tuyg‘ularini boshqalarga yuqtira olish imkoniyatiga egadir. Shundan ezgu yurak hamma narsani qalb ko‘zi bilan ko‘radi va idrok etadi. “Jonimning egasi” she’rida teran fikrli ijodkor o‘z sevgilisiga shunday iltijo qiladi:

Bahor olib ketsa bahorlarimni,
G‘amlar bosib olsa ne xorlarimni,
Kuzlar to‘kib ketsa ohorlarimni,
Jonim egasi, so‘nsam maylimi? [2.33].

She’rxon qalbiga yoniq nur, tafakkuriga ezgulik urug‘ini sepish istagida bo‘lgan shoira bu tayg‘ularni tirik holicha yetkazib berishga o‘zida mas’ullik sezadi. Demakki, misralarda akslangan lirik “men”ning iltijosi umumlashma xarakterga ega bo‘lib, barcha oshiqlar o‘z mahbubini bunday ahvolga solmaslikka va ularni qadrlashga da’vati sifatida ifodalanmoqda.

Xulosa qilib aytganda, Xosiyat Bobomurodovaning tuyg‘ular ummoniga to‘yingan nozik badiiy tashbehlar qamrovidagi ehtirosli she’riyati ayol qalbi va dardi, muhabbat va sadoqat, vatan va tabiat uyg‘unligi, ayolning jamiyatdagi o‘rni, onalik mehri va orzu-armonlar talqiniga bag‘ishlangan ijod namunalari sanaladi.

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SOCIOLINGUISTIC FEATURES OF CHARACTER SPEECH IN ENGLISH AND UZBEK DETECTIVE DISCOURSE: A COMPARATIVE ANALYSIS

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Abstract: *With an emphasis on the connections between linguistic choice, social identity, interpersonal interaction, and narrative development, this article examines the sociolinguistic structure of character speech in English and Uzbek detective discourse. The study looks at how character speech represents social status, professional identity, age, gender, interpersonal distance, forms of address, politeness, speech style, lexical choice, and culturally marked expressions. To find convergent and divergent patterns in English and Uzbek detective discourse, a comparative qualitative method is used. The speech of detectives, suspects, witnesses, victims, and other participants in investigative interactions is given special consideration.*

Keywords: *sociolinguistics, detective discourse, character speech, social identity, comparative linguistics, forms of address, politeness, professional discourse, English, Uzbek.*

INTRODUCTION

One of the main ways that people create and express their social identities is through language. Not only do speakers choose words to convey propositional information, but their language choices can also reveal their social standing, occupation, age, relationships with others, geographic location, level of familiarity with an interlocutor, and communicative intentions. As a result, studying language in its social context offers crucial insights into the connection between social organization and linguistic behavior. In literary discourse, this relationship is especially evident. Fictional characters are portrayed through their speech in addition to their physical attributes and narrative commentary. By giving them specific vocabulary, grammatical patterns, address terms, interactional techniques, and speech patterns, authors can create unique characters. Thus, character speech can be understood as a linguistically constructed social identity representation.

Particularly rich material for this kind of analysis is found in detective fiction. Communication is essential to the genre. Suspects are questioned by detectives, witnesses testify, victims may leave verbal clues, and characters often

try to hide or divulge information. As a result, dialog becomes a crucial part of the investigation process. What a character says, how they say it, and to whom they say it can all affect how the mystery is interpreted in many detective stories. The customs of England and Uzbekistan provide a helpful basis for comparative research. Both languages have well-established systems for conveying respect, social distance, interpersonal connections, and professional identity, but these systems differ. Recent comparative studies have brought attention to variations in address forms and manners. For example, Uzbek distinguishes between sen and siz, but English usually uses you for both formal and informal second-person reference. Although kinship-based and honorific address forms are also frequently used in Uzbek, titles, professional forms, surnames, and first-name addresses are more frequently used in English.

Sociolinguistic Approach to Character Speech. Sociolinguistic analysis is concerned with the relationship between linguistic variation and social factors. In literary texts, this approach makes it possible to investigate how authors represent social distinctions through language. Character speech should consequently be understood as a multidimensional phenomenon. It has at least three interconnected levels:

1. **linguistic level** – vocabulary, grammar, syntax and discourse markers;
2. **social level** – status, profession, age, gender, social group and identity;
3. **pragmatic level** – communicative intention, interpersonal relationship and contextual meaning. These levels interact continuously. For instance, a detective addressing a suspect formally may simultaneously demonstrate professional authority, maintain institutional distance, and create a particular interactional frame. Literary dialogue is not identical to spontaneous conversation. It is artistically constructed, selected, and organized by the author. Nevertheless, literary dialogue can draw on recognizable features of everyday speech. Research on narrative discourse has demonstrated that written literary texts may incorporate features associated with spoken interaction, including repetition, involvement, and interpersonal orientation. Therefore, the analysis of character speech should take into consideration both its literary construction and its sociolinguistic interpretation.

Detective Discourse as a Sociolinguistic Environment

Communication often serves an investigative purpose, which sets detective discourse apart from many other literary genres. Participants may challenge statements, refute accusations, avoid asking questions, give partial

answers, or try to sway the investigator. As a result, the communication situation is frequently asymmetrical. A suspect might be put in a relatively vulnerable position, whereas a detective might have institutional authority. Language behavior may be impacted by this asymmetry. An investigator might, for instance, use: direct inquiries, indirect inquiries, clarification requests, demands, formal language, statements of evidence, accusations, and tactful manners.

On the other hand, a suspect might use: evasive responses, ambiguous language, hesitation, denial, mitigation, counter-questions, register shifts, and attempts to build unity. Detective discourse is especially well-suited for sociolinguistic and pragmatic research because of these distinctions.

Politeness and Power Relations

Detective discourse frequently involves power asymmetry. An investigator may question an individual who is suspected of committing a crime. The linguistic strategies used during such interaction can reveal the relationship between institutional authority and individual resistance.

Compare:

“Where were you last night?”

with:

“Could you tell me where you were last night?”

The first question is direct. The second uses a modal construction to reduce the force of the request. Comparative research on English and Uzbek politeness indicates that both languages possess strategies for expressing respect and reducing interpersonal tension, although their realization differs. English frequently employs modal and syntactic mitigation, while Uzbek can combine lexical, morphological and honorific resources. This distinction becomes particularly meaningful in detective discourse. An investigator may intentionally employ politeness to encourage cooperation:

“Would you mind telling me what happened?”

Thus, politeness is not simply an expression of good manners. Within detective discourse, it can become an **investigative strategy**.

Implications for Translation

The findings have important implications for translation between English and Uzbek. Literal translation may preserve the propositional content of a sentence while losing its sociolinguistic meaning. For example, translating an Uzbek address term solely according to its dictionary meaning may fail to reproduce its function as an indicator of respect, familiarity, age, or social hierarchy. Similarly, an English first-name address may need contextual interpretation when translated into Uzbek because the appropriate Uzbek form may depend on age, status, and interpersonal distance. Detective fiction presents an additional challenge because the sociolinguistic meaning of a form may contribute to the mystery itself. If a translation removes an important address distinction or register shift, a narrative clue may become less visible. Consequently, translators should consider not only lexical equivalence but also:

Using Character Speech as a Narrative Hint

The potential for speech to become evidence is a key characteristic that sets detective discourse apart from many other types of literary discourse. A character might unintentionally disclose:

knowledge they shouldn't have;

familiarity with someone they say they don't know;

professional knowledge at odds with their line of work;

regional knowledge;

an odd word;

an unanticipated emotional response.

For instance, if a suspect claims to have no knowledge of forensic procedures but uses highly specialized terminology about a crime scene, the language choice may raise suspicions within the narrative.

Character and Gender Representation

Though it shouldn't be viewed as a deterministic explanation for speech behavior, gender can also affect how fictional characters are represented linguistically. A sociolinguistic analysis can determine whether specific characters vary in:

degree of directness; courteousness techniques;

emotive language; interruption;

control of the conversation;

mitigation; and expressions of solidarity.

The crucial point is that these characteristics cannot be presumptively assumed; instead, they must be proven by textual evidence. This method enables

researchers to discern between stereotypes that may be imposed by the researcher and linguistic patterns that are genuinely present in detective texts.

CONCLUSION

The comparative sociolinguistic analysis of character speech in English and Uzbek detective discourse demonstrates that language performs a much broader function than the simple transmission of information. Character speech contributes simultaneously to characterization, social positioning, interpersonal communication and narrative development. Detective discourse in Uzbek and English serves similar basic communicative purposes. In both traditions, detectives interrogate suspects, establish authority, ask for information, and negotiate relationships with other people. In both traditions, suspects and witnesses may cooperate, resist, flee, or use language to manipulate.

Detective discourse in Uzbek and English serves similar basic communicative purposes. In both traditions, detectives interrogate suspects, establish authority, ask for information, and negotiate relationships with other people. In both traditions, suspects and witnesses may cooperate, resist, flee, or use language to manipulate. However, these functions are realized differently in each language. While Uzbek offers additional sociolinguistic resources through sen/siz, kinship-based address, honorific forms, and culturally established expressions of respect, English regularly uses titles, first names, modal constructions, indirectness, and register variation.

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THE ROLE OF WALTER SCOTT IN THE DEVELOPMENT OF THE HISTORICAL NOVEL

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Abstract: *This article examines the role of the prominent English-language writer Walter Scott in the development of the historical novel as a literary genre. It analyzes the writer's ability to combine historical events with artistic fiction, his methods of depicting historical figures and ordinary people, and his representation of national identity, social relations, and historical settings. The article also explores the formation of the poetics of the historical novel through such works as Waverley, Ivanhoe, and Rob Roy, as well as Scott's influence on subsequent world literature. The study argues that Walter Scott made a significant contribution to establishing the historical novel as an independent genre with considerable artistic potential.*

Keywords: *Walter Scott, historical novel, history and literature, Romanticism, historical character, national identity, Waverley, Ivanhoe, novel poetics.*

INTRODUCTION

Although the artistic representation of historical reality has existed in literature since ancient times, the historical novel began to develop rapidly as an independent literary genre, particularly in the early nineteenth century. In this process, the Scottish writer **Walter Scott (1771–1832)** occupies a particularly important position. Rather than simply retelling historical events, he sought to recreate the social, political, and spiritual atmosphere of a particular historical period through artistic means.

One of the most important characteristics of Scott's work is that he represented history not only through the activities of famous rulers and political figures but also through the lives, customs, worldview, and everyday experiences of ordinary people. In this respect, his novels became literary works that reveal the relationship between historical processes and individual human destinies.

Walter Scott's literary career was closely connected with the literary processes of the Romantic period. Romantic writers showed a particular interest in history, national heritage, folk traditions, and national identity. Scott likewise

turned to the history and folklore of Scotland and created vivid artistic representations of the past.

Published in 1814, ***Waverley*** was one of Scott's most significant experiments in the historical novel. The novel depicts the political and social environment of eighteenth-century Scotland, the Jacobite movement, and the lives of different social groups. Although Edward Waverley is at the center of the narrative, the historical significance of the novel extends beyond the fate of an individual character and reflects the social spirit of an entire historical period. Scott connected historical events with the personal destiny of his protagonist, thereby enabling readers to understand complex historical processes through an engaging artistic narrative. This method was later developed by numerous writers in different national literatures.

One of the major poetic characteristics of Scott's historical novels is the combination of historical fact and artistic fiction. The writer connects actual historical events with the personal lives of fictional characters. As a result, historical reality is not presented as a dry chronicle but through human experiences, emotions, and conflicts. For example, ***Ivanhoe*** depicts the political and social environment of twelfth-century England. Historical figures such as King Richard I and Prince John are incorporated into a fictional narrative involving knights, Saxons, and Normans. Through these events, the novel portrays social conflicts, national and political interests, and the traditions of medieval chivalry. Historical figures and fictional characters perform complementary functions in the novel. Through fictional characters, the writer reveals broader characteristics of the historical period. Consequently, the historical process in Scott's novels is closely connected with individual human destinies.

One of Walter Scott's major contributions to the historical novel was his representation of history through the lives of ordinary people. His novels include not only kings, rulers, and prominent historical figures but also merchants, peasants, soldiers, craftsmen, and representatives of other social groups. This approach considerably expanded the scope of historical fiction. Scott demonstrated that history does not consist solely of the activities of political leaders; it is also shaped by the lives and relationships of different social groups. From this perspective, Scott's historical novels strengthened the relationship between socio-historical thought and artistic representation. The writer paid particular attention to the effects of historical transformations on the lives of individuals.

National history and national identity occupy an important place in Scott's literary works. In particular, his novels about Scotland contain extensive representations of traditional customs, folklore, clothing, language, and cultural practices.

In ***Waverley*** and ***Rob Roy***, different stages of Scottish history are represented artistically. Through the depiction of historical events, the writer also emphasizes the importance of collective memory and historical consciousness. Scott's approach subsequently influenced the development of historical fiction in other national literatures. Writers from different countries increasingly turned to their own histories, national traditions, and historical figures, thereby expanding the artistic possibilities of the historical novel. A number of important principles of historical-novel poetics can be observed in Scott's works:

1. **Broad representation of the historical period.** Rather than focusing exclusively on a single historical event, the writer depicts the broader social and cultural environment in which that event occurred.

2. **Integration of historical and fictional characters.** Real historical figures interact with fictional characters within the same narrative world.

3. **Connection between individual destiny and historical processes.** The effects of historical events on human lives are revealed through the experiences and destinies of individual characters.

4. **Use of national color.** Customs, folklore, clothing, language, and local traditions contribute to the creation of an authentic historical atmosphere.

5. **Transformation of historical conflict into artistic conflict.** Political and social contradictions are expressed through personal relationships, struggles, and destinies of the characters.

6. These characteristics significantly expanded the artistic possibilities of the historical novel.

Walter Scott's literary experience had a significant influence on nineteenth-century European literature. His methods of creating historical novels can be observed, in various forms, in the historical works of such writers as Alexandre Dumas, George Eliot, Leo Tolstoy, and many others. In particular, Leo Tolstoy's ***War and Peace*** demonstrates the connection between historical events and the destinies of ordinary people. However, Tolstoy developed his own philosophical approach to the relationship between history and the individual. Therefore, Scott's influence should not be understood simply as direct imitation. Rather, his importance lies in the fact that he expanded the possibilities of the historical novel and provided later writers with a productive literary model.

Scott's methods of reconstructing historical environments, turning to national history, and connecting historical processes with artistic narratives were subsequently developed in various national literatures. In this sense, his work represents an important stage in the formation of the historical novel as a major genre of world literature.

The development of the historical novel is also an important phenomenon in Uzbek literature. Works such as Abdulla Qodiriy's ***O'tkan kunlar*** (*Bygone Days*), Oybek's ***Navoiy***, and Pirimqul Qodirov's ***Yulduzli tunlar*** (*Stars of the Night*) portray historical periods, national life, and individual destinies in close relationship with one another. It would not be accurate to regard these works as direct imitations of Walter Scott's novels, because each writer relied on the historical experience, national aesthetic consciousness, and literary traditions of his own people. Nevertheless, general poetic principles such as the artistic reconstruction of historical reality, the creation of a convincing historical environment, and the integration of historical and fictional characters can be studied comparatively in relation to Scott's tradition.

From this perspective, Scott's experience in world historical fiction represents an important literary phenomenon for the theoretical and poetic study of the Uzbek historical novel as well.

Walter Scott occupies an important place in the formation and development of the historical novel as a literary genre. His major contribution lies in connecting historical events with artistic fiction, individual human destinies, national life, and social relationships.

Scott presented history not merely as a collection of facts about the past but as a complex process reflected in people's lives, ideas, and destinies. His novels, including ***Waverley***, ***Ivanhoe***, and ***Rob Roy***, provided influential examples of how historical periods could be artistically reconstructed. Scott's literary experience contributed to the development of historical-novel poetics, encouraged new approaches to the relationship between historical and artistic truth, and stimulated the growth of historical fiction in world literature. For these reasons, Walter Scott remains a significant figure in the history and development of the historical novel.

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DISTINCTIVE CHARACTERISTICS OF LACONIC STYLE IN WESTERN AND EASTERN SHORT STORIES

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Annotation. *This article presents a comparative analysis of the distinct aesthetic characteristics of laconism and the principles of laconic expression in Western and Eastern literature. Furthermore, it examines the poetic functions of artistic conciseness, the semantic scope of detail, and the phenomenon of subtext, drawing upon examples from the works of prominent figures in world and Uzbek short-story writing.*

Keywords. *Laconism, laconic style, Chekhov, K.Mensfield, Zulfiya Qurolboy qizi, symbolism.*

INTRODUCTION

In literary studies and linguistics, concise forms of expression in speech have traditionally been- and continue to be-examined in the context of the economy of linguistic means. Indeed, brevity and fluency are among the key characteristics of language in imaginative literature, stemming from its capacity for imagery. Indeed, imaginative literature derives its appeal from the ability to convey ideas in simple, accessible language and to distill profound meaning into concise sentences. Regarding this quality of folk language, the following observations are made: “Stay close to the language of the people,” “Seek a simplicity, brevity, and robust power that can create an image with just two or three words,” and “There is great wisdom in the simplicity of words; proverbs and folk songs are always brief, yet they reflect content that might otherwise fill entire books” (Abdumannatova 2023 : 59). Thus, the more concise the sentences, the deeper and more intelligible the meaning becomes. The term “laconism” serves precisely to achieve this brevity in both text and speech.The laconic style is the art of achieving maximum depth of meaning through the economy of language; while it relies on aesthetic principles shared by Eastern and Western literature, it possesses distinctive characteristics regarding its formative roots and philosophical foundations. In particular, Grant Faulkner states: *“Indeed, short-form writing demands greater humility from the writer. You do not write to command attention through verbosity or ornate stylistic flourishes; instead, you select the precise word for the precise spot, all while revealing the nuances*

of the events. In reality, the aesthetics of brevity are not limited to short works alone. Even when writing at length, I aim for 'maximum clarity,' considering which words can be removed from phrases and how paragraphs and chapters might be shifted or signaled." (Faulkner 2023 :21). Thus, rather than always laying out his ideas in an explicit, linear fashion, G. Faulkner often favored mystery and reticence. By utilizing gaps between chapters, he created opportunities for readers to draw their own conclusions and reflect on the material. For the author, the primary goal was to instill the underlying idea in the reader-keeping it implicit-by minimizing the word count as much as possible.

MAIN BODY

The laconic style has long existed in both Western prose and Eastern poetry; it holds a distinctive place in literature and serves as a medium for specific genres. The short story, in particular, is considered one of the most suitable and effective genres for employing this style. A significant aspect of brevity in the short story genre is that truth can sometimes be revealed most powerfully through conciseness, while readers are confronted with events featuring thrilling-or even perilous-twists. A true artist can develop characters in a unique way even within a limited scope and with a restricted cast. In this approach, the focus is not on the entirety of life's events, but rather on a specific moment in a particular destiny.

When discussing the use of a laconic style in the short story genre, it is impossible to overlook the work of A.P. Chekhov. Although Chekhov's works share thematic similarities with those of Russian literary giants such as N.A.Nekrasov, F.M. Dostoevsky, I.S. Turgenev, and L.N. Tolstoy, he possesses a distinct individuality in terms of style and language. It is strikingly evident that every work-and indeed, literally every sentence-is imbued with the author's own personality. Chekhov's works offer a rich subject for complex analysis and interpretation. Leo Tolstoy remarked of him, "Chekhov is the Pushkin of prose". Following Chekhov's death, Tolstoy observed:"He created new forms of writing-entirely new to the world, and forms I had never encountered anywhere else... Casting aside any false modesty, I can affirm that Chekhov is far superior to me in writing technique". No matter how brief Chekhov's laconic stories and novellas might appear, in terms of substance, they could rival ten-volume collections of works. Of course, A.P. Chekhov's talent and distinctive style were not immediately appreciated by readers. Even in the second half of the 1980s, there were critics who believed that the short story format hindered Chekhov from fully portraying his characters and depicting their actions convincingly.

Furthermore, the characteristics of a laconic style are uniquely manifested in the short story “Ayol”(Woman) by Zulfiya Qurolboy qizi-an author who has earned a place in readers' hearts through her works in contemporary Uzbek storytelling. The story primarily depicts the struggle between life and death through the fate of a single woman. Although the story is brief and concise, it succeeds in evoking a dramatic mood in the reader. It begins by introducing a hospital room in the simplest of terms: “*Devorlari oppoq xona. Deraza oynasidan to‘kilayotgan oppoq nur ayolning yuzida jilva qildi, yumuq qovoqlarini qizartirdi, barmoqlaridagi uzukning olmos ko‘zchalarida aks etdi. Ayol ko‘zlarini ochdi. Shu’la endi uning qorachiqlarida akslandi.”*[58]. Note how the sentences follow one another in a simple, straightforward manner. Even without superfluous adjectives or details, we sense a positive atmosphere within the story: “*Qanday yoqimli... Tiriklikning yana bir tongi otdi, - ayol ko‘zlarini yumib, quyosh nurlarini simirdi, keyin yana ohista pichirladi: — Seni qanchalik yaxshi ko‘raman, quyosh!..”*[59]. Through these lines, we witness the protagonist's profound love for life and her intense desire to live. Although the pain in Nazokat’s body intensified due to her illness and she sensed herself drawing closer to death with each passing day, she continued to live with hope. The repeated references to light, the sun, and radiance underscore the strength of her enduring faith in life. The story unfolds within the confined setting of a hospital room, involving only a few characters; yet, it powerfully conveys the immeasurable value of human life and the idea that the very act of breathing is a magnificent miracle. Nature’s imagery harmonizes with the emotions stirring in Nazokat’s heart. While the author does not specify the exact nature of her illness, we realize her life is ebbing away through the physical changes she undergoes and the doctors' hopeless words. Yet, this impending death cannot extinguish her passion or her struggle to live. As we observe the brevity of certain sentences and dialogues in this story-the way deeply meaningful emotions are conveyed in just a few words-we instinctively begin to notice elements of laconism.*“Yostiq nam tortdi. Ayol yig‘lardi, unsiz yig‘lardi...*[60] These excerpts are examples of this.

At the same time, we can analyze the nuances of the laconic style in the stories of Katherine Mansfield-a renowned English writer of New Zealand origin

[58] Zulfiya Qurolboy qizi. Ayol (hikoya) *“A room with stark white walls. Pure white light pouring through the window played across the woman’s face, reddened her closed eyelids, and shimmered in the diamond settings of the ring on her finger. The woman opened her eyes. The radiance was now reflected in her pupils”*

[59] *“How delightful... Another morning of life has dawned” the woman thought, closing her eyes and drinking in the sunlight, then whispered softly: “How I love you, O sun!..”*

[60] *"The pillow grew damp. The woman wept, wept in silence".*

who was active in the late 19th and early 20th centuries- as the unique emotional resonance of her narratives successfully captivated readers. Although she consistently wrote from a third-person perspective, she was able to delve into the deepest recesses of her characters' psyches and vividly bring them to life for the reader. The symbols she employed served to animate her characters and underpin the success of her works; for instance, one can discern significant meaning in symbols such as the cat and pear tree in "Bliss", the glove in "A Dill Pickle", and the small lamp in "The Doll's House". Her story "The Fly" is another work embodying profound psychological depth; despite its brevity and concise plot, it masterfully illustrates universal human traits through the unfolding events. The story conveys the atmosphere of the post-World War I era, the fates of those grappling with loss and powerlessness, and the bloody consequences of the war to the reader through symbolic elements. "The Boss" the story's protagonist, loses his only son in the war-a tragedy that breaks his spirit and plunges him into deep sorrow. One day, a friend named Mr. Woodifield visits and mentions that he has just returned from visiting the son's grave. Left alone in the room, the Boss expects to feel that familiar grief once more, but he is alarmed to find himself unable to shed a single tear. After all, hadn't this loss shattered his entire life and ambitions, casting him into a vortex of loneliness? At that moment, he notices a fly that has fallen into the inkwell and is struggling desperately to escape. It cleans its wings and fights to live, refusing to give up; yet, although this fighting spirit impresses the Boss, he cannot stop himself from repeatedly pouring ink over the creature, tormenting it until it finally succumbs to exhaustion and dies. As he throws the dead fly into the wastebasket, the Boss orders his staff to bring fresh ink, and-unexpectedly-he forgets what he had been thinking about; the story ends there.

The characters in the story are symbolic, each serving a specific function. While the fly symbolizes the vulnerable people living in that era and environment, the "Master" is interpreted as representing the officials or leaders who instigated the war, the force of destiny capable of derailing human lives, or perhaps even God-the One who governs the cosmos, alters fate, and subjects humanity to trials. Although the work emphasizes the tragic consequences of war, it avoids specific details of the conflict, instead revealing its meaning through symbolism. Every detail in the story serves to articulate the central idea; objects such as the picture hanging on the wall, the new carpet, the fly, and the inkwell help to vividly portray the human psyche and the atmosphere of the setting. Furthermore, the brevity and detached nature of the dialogue between the characters carry philosophical significance. The author does not explicitly

narrate internal emotions or problems; instead, the story conveys them through an objective perspective, details, dialogue, and symbols, leaving the reader to draw their own conclusions. The work does not reach a conventional resolution or deliver a verdict; it avoids emotional indulgence and concludes with a sense of abruptness. However, through this short story, it is possible to highlight complex, universal themes—such as human traits, the laws of life, the immense power of time, and the fact that human wealth can prove worthless when the moment demands it.

CONCLUSION

In conclusion, the majority of scholars and literary experts affirm that the significance of a literary text or speech is assessed not by the volume of words, but rather by the clarity with which its content and essence are revealed. Ideas expressed concisely and succinctly tend to leave a more profound impression on readers and listeners. Furthermore, although Western and Eastern literature differ in the origins of their respective forms of laconism and their modes of depiction, they share a common underlying idea: a concise text-devoid of excessive lyrical or mundane exposition—offers the reader the opportunity for independent thought and allows them to fill in the work's subtext.

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ЦИФРОВАЯ КОММУНИКАЦИЯ И КУЛЬТУРА РЕЧИ СОВРЕМЕННОГО ПРЕПОДАВАТЕЛЯ

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Аннотация: *В статье рассматривается проблема культуры речи преподавателя в условиях цифровой трансформации высшего образования. Особое внимание уделяется изменению характера педагогической коммуникации при использовании образовательных платформ, видеоконференций, электронных образовательных ресурсов, мессенджеров и других цифровых средств. Обосновывается положение о том, что цифровая компетентность преподавателя не ограничивается техническим владением цифровыми инструментами, а включает способность эффективно, этично, грамотно и педагогически целесообразно взаимодействовать со студентами в цифровой среде. Анализ современных исследований показывает, что коммуникация и сотрудничество являются существенными компонентами цифровой компетентности преподавателя высшей школы. Предлагается структурная модель взаимосвязи цифровой коммуникации и речевой культуры преподавателя.*

Ключевые слова: *цифровая коммуникация, культура речи, преподаватель, высшее образование, цифровая компетентность, педагогическая коммуникация, речевая культура, цифровая образовательная среда.*

ВВЕДЕНИЕ

Цифровая трансформация высшего образования существенно изменила традиционные формы взаимодействия преподавателя и студента. Современная образовательная коммуникация осуществляется не только в аудитории, но и посредством электронных образовательных платформ, видеоконференций, электронной почты, мессенджеров и социальных цифровых сред. В результате профессиональная речь преподавателя приобретает новые формы и функции.

Современный преподаватель должен не только владеть цифровыми технологиями, но и уметь использовать их для организации содержательного, понятного и этичного педагогического взаимодействия. Исследования цифровой компетентности преподавателей высшей школы показывают, что коммуникация и сотрудничество являются самостоятельными компонентами профессиональной цифровой компетентности.

В условиях цифрового обучения особое значение приобретает культура речи. Если традиционная педагогическая коммуникация преимущественно опирается на устную речь и непосредственную обратную связь, то цифровая коммуникация сочетает устные, письменные, визуальные и мультимедийные формы взаимодействия. Поэтому требования к речи преподавателя становятся более комплексными.

1. Теоретические основы культуры речи преподавателя

Культура речи преподавателя представляет собой совокупность языковых, коммуникативных и этических норм, обеспечивающих эффективное профессиональное взаимодействие с обучающимися.

К основным характеристикам профессиональной речи преподавателя относятся:

- грамотность;
- точность;
- логичность;
- ясность;
- доступность;
- выразительность;
- этичность;
- уместность;
- профессиональная терминологическая компетентность.

В педагогическом процессе речь является не только средством передачи информации, но и инструментом формирования образовательной мотивации, организации взаимодействия и управления учебной деятельностью.

В цифровой образовательной среде эти функции сохраняются, однако способы их реализации изменяются. Например, письменное сообщение преподавателя в электронной системе обучения должно быть одновременно кратким, понятным, информативным и корректным. Отсутствие интонации и невербальных сигналов требует особенно внимательного выбора языковых средств.

2. Цифровая коммуникация преподавателя

Цифровую коммуникацию преподавателя можно определить как профессиональное взаимодействие преподавателя и обучающихся посредством цифровых технологий с целью передачи информации, организации совместной деятельности, консультирования, обратной связи и поддержки образовательного процесса.

К основным формам цифровой коммуникации относятся:

Форма	**Основной инструмент**	**Особенности**
Синхронная коммуникация	Zoom, Teams и др.	непосредственное взаимодействие
Асинхронная коммуникация	LMS, электронная почта	возможность обдуманного ответа
Мессенджер-коммуникация	Telegram, WhatsApp и др.	оперативность
Видеокоммуникация	видеолекции, вебинары	сочетание речи и визуального материала
Письменная коммуникация	электронные задания, комментарии	точность и краткость
Интерактивная коммуникация	онлайн-дискуссии, форумы	совместное построение знаний

Исследования цифровой компетентности преподавателей высшей школы показывают, что преподаватели используют цифровые технологии не только для передачи содержания, но и для коммуникации, сотрудничества и организации образовательной деятельности.

3. Особенности речевой культуры преподавателя в цифровой среде

Цифровая коммуникация предъявляет дополнительные требования к культуре речи преподавателя.

3.1. Точность

Информация в цифровой среде должна формулироваться максимально точно. Неясные инструкции могут привести к неправильному выполнению задания.

3.2. Краткость

Большой объём цифровой информации требует умения выделять главное. Особенно это важно при написании сообщений студентам.

3.3. Доступность

Сложные научные понятия необходимо объяснять с учётом уровня подготовки обучающихся.

3.4. Этичность

Цифровая коммуникация требует уважительного отношения к студентам, соблюдения профессионального этикета и недопустимости унижающих или дискриминационных формулировок.

3.5. Диалогичность

Современный преподаватель должен не только передавать информацию, но и создавать условия для обратной связи, вопросов и обсуждения.

Таким образом, культура цифровой речи включает не только правильность языка, но и способность выбирать соответствующую форму коммуникации в зависимости от образовательной ситуации.

4. Взаимосвязь цифровой компетентности и культуры речи

Современные исследования показывают, что цифровая компетентность преподавателя имеет комплексный характер. В HeDiCom framework для высшего образования выделяются четыре основные области: цифровая педагогическая практика, расширение возможностей студентов в цифровом обществе, цифровая грамотность преподавателя и профессиональное развитие. Отдельное место занимает коммуникация и сотрудничество.

Данная модель показывает, что техническое владение цифровыми инструментами само по себе не обеспечивает эффективного педагогического взаимодействия.

5. Проблемы культуры цифровой речи преподавателя

Особую проблему представляет отсутствие невербальных компонентов коммуникации. В письменной коммуникации студент не видит интонацию, мимику и жесты преподавателя. Поэтому даже нейтральное сообщение иногда может восприниматься как резкое или критическое.

6. Пути развития культуры цифровой коммуникации преподавателя

Для повышения культуры цифровой речи преподавателя целесообразно использовать следующие направления:

1. Развитие цифровой компетентности.

Преподавателю необходимо регулярно осваивать новые цифровые образовательные инструменты.

2. Развитие коммуникативных навыков.
Особое внимание следует уделять формулированию инструкций, вопросов и обратной связи.

3. Освоение цифрового этикета.
Необходимо соблюдать нормы профессионального общения в электронной среде.

4. Использование диалогических методов.
Онлайн-дискуссии, форумы и интерактивные задания позволяют повысить активность студентов.

5. Рефлексия собственной речи.
Преподавателю полезно анализировать собственные сообщения, видеолекции и онлайн-занятия.

6. Использование обратной связи студентов.
Опросы студентов позволяют определить, насколько понятной и доступной является коммуникация преподавателя.

Исследования цифровой коммуникационной компетентности также подчёркивают необходимость дальнейшего изучения взаимосвязи технологических и педагогических компонентов компетентности преподавателя.

ЗАКЛЮЧЕНИЕ

Цифровизация высшего образования приводит к расширению профессиональной роли преподавателя. Современный преподаватель выступает не только источником учебной информации, но и организатором цифрового взаимодействия, консультантом, модератором и участником образовательного диалога.

В этих условиях культура речи становится важным компонентом профессиональной и цифровой компетентности преподавателя. Грамотность, точность, логичность, доступность и этичность должны сочетаться с умением выбирать адекватные цифровые каналы коммуникации.

Таким образом, эффективная цифровая коммуникация может рассматриваться как результат интеграции **цифровой, коммуникативной, речевой и педагогической компетентностей** преподавателя.

Перспективным направлением дальнейшего исследования является эмпирическое изучение того, как студенты оценивают культуру цифровой речи преподавателей и какие характеристики коммуникации наиболее тесно связаны с их вовлечённостью в образовательный процесс.

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8-SECTION

PSYCHOLOGICAL ASPECTS OF CHILDREN'S SCHOOL READINESS

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Abstract: *This study examines sex differences in psychological school readiness using aggregate results for 300 children. Ten indicators covered graphomotor performance, nonverbal reasoning, motivation and anxiety. Benjamini–Hochberg adjustment of the reported p values retained differences in writing-copying and Raven series B (both adjusted p = .030), with small rank-biserial effect magnitudes (.167 and .181). Composite scores, motivation and anxiety showed no statistically significant differences after adjustment. Unverified scoring conventions and regional imbalance constrain interpretation. The findings support assessment of individual readiness profiles and do not establish an overall readiness advantage for either sex.*

Keywords: *school readiness, sex differences, graphomotor skills, nonverbal reasoning, motivation, psychological assessment.*

INTRODUCTION

School readiness includes coordinated action, reasoning, motivation and emotional adjustment. These capacities may develop unevenly. Blair and Raver (2015) explain readiness through interacting developmental and environmental processes. Grissmer et al. (2010) identify fine motor skills and early knowledge as additional readiness indicators. This study asks whether sex differences persist across ten indicators after multiple-testing adjustment.

Cameron et al. (2012) link fine motor skills and executive function to kindergarten achievement, while Sher-Censor et al. (2016) show that self-regulation and maternal representations interact in subsequent school adjustment. In a later developmental period, Mamanazarov (2024, 2026) examines cognitive, emotional and social dimensions of moral self-awareness. His work offers a conceptual reason to avoid reducing development to one score; it does not establish preschool readiness effects.

METHODS

This exploratory analysis uses aggregate cross-sectional results for 300 children: 137 boys and 163 girls, with 100 participants each from Tashkent city, Sirdarya and Tashkent region. Valid observations ranged from 283 to 300 by indicator. Individual records, exact ages and recruitment procedures were

unavailable, preventing independent verification of the original tests and missing-data mechanisms.

Measures comprised Kern–Jirásek person-drawing, writing-copying and dot-copying tasks and their total; Raven series A, B and S and their total; Luskanova motivation scores; and a percentage anxiety index. Local Raven labels are retained without assuming equivalence to a standard edition. Kern–Jirásek scoring direction requires protocol verification; higher values are therefore described as higher recorded scores.

The ten reported Mann–Whitney comparisons formed one family. Benjamini–Hochberg adjustment was applied to rounded p values at a .05 threshold (Benjamini & Hochberg, 1995). Effect magnitudes were calculated as $|1 - 2U/(n_1n_2)|$, treating U as the smaller statistic. The extract reports adjusted values of .028 for the two retained findings; recalculation gives .030. Unrounded output is needed to reconcile this discrepancy.

Ethical approval, parental consent and child assent were not documented in the extract and require author confirmation before submission. This aggregate analysis collected no new participant data.

RESULTS

Table 1 reports the complete comparison family. Four unadjusted p values were below .05; only writing-copying and Raven series B remained below that threshold after adjustment. Neither composite score showed a statistically significant difference.

Table 1. Sex comparisons across readiness indicators

Indicator	U	p	Adjusted p
Person drawing	9406.0	0.126	0.180
Writing-copying	8935.0	0.004	0.030
Dot-copying	10455.5	0.398	0.442
Kern–Jirásek total	9041.0	0.060	0.105
Raven A	9660.0	0.040	0.100
Raven B	9149.5	0.006	0.030
Raven S	10841.5	0.658	0.658
Raven total	9781.0	0.063	0.105
Anxiety index	9421.0	0.379	0.442
Motivation total	9517.0	0.031	0.100

Writing-copying medians were 4 in both groups; interquartile ranges were [3, 4] for boys (n = 134) and [4, 4] for girls (n = 160). The U statistic was 8935.0 and the effect magnitude was .167. Scores of 4 or 5 occurred in 65.7% of boys

and 81.3% of girls. This indicates a small distributional shift towards higher recorded scores among girls, whose developmental interpretation remains conditional on the scoring key.

For Raven B, both groups had a median of 9 and an interquartile range of [8, 10]. Nevertheless, 10–12 points were recorded for 27.0% of boys and 42.9% of girls (U = 9149.5; effect magnitude = .181). Equal medians therefore did not imply identical distributions. Raven total medians were both 27 (p = .063), while Kern–Jirásek total medians were 11 for boys and 12 for girls (p = .060).

Motivation medians were 25 for boys and 27 for girls, but the adjusted p value was .100. Anxiety medians were 14.3% in both groups (adjusted p = .442). These results provide insufficient evidence of group differences; they do not demonstrate equivalence. The source additionally reports exploratory region-stratified p values of approximately .051 for writing-copying and .014 for Raven B. These unadjusted supplementary tests were not independently reproducible from the aggregate extract.

DISCUSSION

Only two tasks showed small rank shifts. Equal medians can coexist with different rank distributions, and statistical significance does not measure practical importance (Wasserstein & Lazar, 2016). Neither result supports classifying individual children by sex.

The copying result is consistent with the relevance of fine motor assessment discussed by Cameron et al. (2012) and Escolano-Pérez et al. (2020), but its regional sensitivity limits interpretation. Raven B does not establish a general reasoning advantage. Smirni (2020) found no male–female mean differences in a different Raven sample aged 6–11; differences in age and test coding prevent direct equivalence.

Support should follow observed needs: shorter copying models, guided visual comparisons and caregiver discussion are possible applications, not interventions tested here. Mamanazarov's (2026) multidimensional educational model likewise encourages attention to several psychological processes, but transferring an adolescent model to preschool practice would require independent validation.

Missing ages, uneven sex composition across settings and unverified coding limit inference. The measures also omit language and peer cooperation. Follow-up research should document age in months, consent and scoring conventions, recruit several institutions per region, and test the two task-specific hypotheses independently.

CONCLUSION

The aggregate evidence identifies small sex-related differences on two recorded tasks, without establishing an overall school-readiness advantage. Individual assessment remains more defensible than expectations based on sex. Confirming test coding and study procedures is necessary before these findings can support stronger developmental claims.

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DEVELOPING REFLECTIVE COMPETENCE AMONG PRE-SERVICE EFL TEACHERS THROUGH REFLECTIVE JOURNALING

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Abstract: *The article deals with the issues based on the pedagogical potential of reflective journaling as a systematic tool for developing reflective competence among pre-service EFL teachers. Reflective competence has become an essential component of professional preparation for pre-service English as a Foreign Language (EFL) teachers, as contemporary teacher education requires future educators not only to acquire pedagogical knowledge but also to critically examine their own learning and teaching experiences. Particular attention is given to the relationship between reflective writing, self-awareness, metacognitive regulation, professional decision-making, and autonomous professional development.*

Keywords: *reflective competence, reflective journaling, pre-service EFL teachers, reflective practice, teacher education, metacognition, teacher autonomy, professional development.*

INTRODUCTION

Contemporary foreign language teacher education increasingly emphasizes the preparation of teachers who are capable of responding independently and thoughtfully to complex classroom situations. Professional competence can no longer be understood solely as the possession of subject knowledge, methodological techniques, or language proficiency. Teachers are expected to evaluate their own practices, recognize the needs of learners, make evidence-informed pedagogical decisions, and continuously improve their professional performance. Within this context, reflective competence represents an important dimension of teacher professionalism.

The concept of reflection has a long history in educational theory. Dewey (1933) described reflective thought as active, persistent, and careful consideration of beliefs and knowledge in light of the evidence supporting them. This understanding positioned reflection as a purposeful intellectual activity rather than a spontaneous response to experience. Schön (1983) subsequently developed the concepts of reflection-in-action and reflection-on-action,

emphasizing the ability of professionals to reconsider their decisions both during and after professional activity. These perspectives remain highly relevant to teacher education because teaching involves continuous decision-making under changing conditions.

For pre-service EFL teachers, reflection is particularly important. Language classrooms require teachers to integrate linguistic knowledge, pedagogical strategies, communication skills, assessment practices, classroom management, intercultural awareness, and sensitivity to individual learner differences. A teaching technique that works effectively with one group may produce different results with another. Consequently, future teachers need to develop the ability to interpret classroom experiences rather than mechanically reproduce previously learned teaching procedures.

One practical means of developing this ability is reflective journaling. A reflective journal provides pre-service teachers with a structured space in which they can document learning and teaching experiences, identify difficulties, analyze their decisions, evaluate outcomes, and formulate future actions. Unlike ordinary descriptive writing, systematic reflective journaling encourages learners to move beyond reporting what happened and consider why it happened, how their own actions influenced the situation, and what could be changed in future practice.

Reflective journaling is also closely associated with independent learning. When students regularly monitor their experiences and evaluate their own progress, they gradually assume greater responsibility for professional development. Reflection therefore connects teacher education with the broader principles of learner autonomy, metacognition, self-regulated learning, and lifelong professional learning.

Reflection has been widely recognized as a fundamental element of professional learning. Dewey's (1933) conceptualization of reflective thinking established an important theoretical foundation by distinguishing reflective thought from routine action. From this perspective, professional development occurs when individuals critically examine experience rather than simply repeat familiar patterns. Schön (1983) extended this understanding through his distinction between reflection-in-action and reflection-on-action. Reflection-in-action occurs while professional activity is taking place and enables practitioners to modify their actions in response to emerging circumstances. Reflection-on-action occurs after the event and involves retrospective analysis of decisions, outcomes, and alternative possibilities. In teacher education, both processes are important because effective teaching requires immediate responsiveness as well

as systematic post-lesson evaluation. Kolb's (1984) experiential learning theory provides another useful framework. His experiential learning cycle connects concrete experience, reflective observation, abstract conceptualization, and active experimentation. Applied to EFL teacher preparation, a pre-service teacher may conduct a microteaching lesson, reflect on learners' responses, connect observations with pedagogical concepts, and subsequently modify teaching strategies. Reflection thus functions as the link that transforms classroom experience into professional learning. Gibbs (1988) proposed a more structured reflective cycle comprising description, feelings, evaluation, analysis, conclusion, and action planning. This framework is particularly suitable for reflective journaling because it prevents reflection from remaining purely descriptive. Guided questions associated with each stage encourage pre-service teachers to examine both successful and problematic aspects of their experiences and to formulate specific plans for future action.

In language teacher education, reflective practice has received substantial attention because teachers continuously interpret complex interactions among learners, materials, language objectives, classroom activities, and assessment. Farrell (2015) argues for systematic reflection as an important component of language teachers' professional development. Reflection can help teachers make implicit beliefs more visible and examine the relationship between what they believe about teaching and what they actually do in classrooms.

Reflective competence can therefore be understood as a multidimensional professional capacity involving self-observation, analysis, evaluation, interpretation, and purposeful modification of professional activity. It incorporates cognitive and metacognitive processes as well as professional self-awareness.

Reflective journaling offers an accessible method for cultivating these capacities. Through regular written reflection, pre-service teachers can create a record of their developing professional experience. Journals allow them to revisit earlier assumptions, identify recurring difficulties, observe changes in their beliefs, and evaluate their progress over time.

However, journal writing does not automatically produce meaningful reflection. Students may simply summarize classroom events:

"I taught vocabulary today. Students completed the exercises. Some activities were difficult, but the lesson was generally successful."

Such writing provides little evidence of analytical reflection. A more developed reflective response might state:

"Although students completed the vocabulary matching task successfully, several were unable to use the target words during the subsequent speaking activity. This suggests that recognition did not necessarily result in productive vocabulary use. In my next lesson, I will include a short retrieval activity followed by contextualized pair work before asking students to participate in open-ended discussion."

The second example demonstrates a movement from description toward evidence-based interpretation and action planning. Developing this ability requires systematic scaffolding, appropriate prompts, constructive feedback, and repeated opportunities for reflection.

Reflective writing should be **systematic rather than occasional**. A single journal entry provides limited opportunities for developmental analysis, whereas repeated entries allow students to recognize patterns across experiences.

Reflection should also be **guided but gradually autonomous**. Beginning students may need structured prompts, while more experienced pre-service teachers can progressively determine their own reflective focus.

A psychologically supportive environment is equally important. If students perceive journals merely as another graded assignment, they may write what they believe the teacher expects rather than critically examining genuine difficulties. Teacher educators should therefore communicate that identifying weaknesses is part of professional learning.

Finally, reflection should lead to **action**. Journaling loses much of its pedagogical value when reflection ends with statements such as "I need to improve." A meaningful action plan should specify what will be changed, how it will be changed, and how the student will determine whether the change has been effective.

CONCLUSION

Reflective competence represents an important component of professional preparation for pre-service EFL teachers because effective teaching requires continuous interpretation, evaluation, adaptation, and professional learning. Reflective journaling provides a practical mechanism through which these processes can be systematically developed.

Reflective journaling should therefore be integrated into EFL teacher education not merely as a supplementary writing exercise but as an ongoing professional learning strategy. When combined with microteaching, teaching practicum, peer observation, feedback, and electronic portfolios, it can contribute to the preparation of reflective, autonomous, and professionally

responsible teachers who are capable of managing their continued development throughout their careers.

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TECHNOLOGY FOR DEVELOPING CRITICAL THINKING IN FUTURE TEACHERS

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Аннотация.В данной статье рассматриваются теоретико-методологические основы и *педагогические технологии развития критического мышления будущих педагогов. Особое внимание уделяется значению критического мышления в профессиональной подготовке педагогических кадров, формированию у студентов способности анализировать информацию, аргументированно выражать собственную позицию, принимать обоснованные решения и объективно оценивать педагогические ситуации. Раскрываются возможности применения интерактивных методов обучения, проблемных заданий, кейс-технологий, дискуссий, проектного обучения и рефлексивных технологий в процессе развития критического мышления. Обоснована необходимость создания образовательной среды, ориентированной на самостоятельность, аналитическую деятельность и творческий поиск будущих педагогов.*

Ключевые слова: *критическое мышление, будущий педагог, педагогическая технология, профессиональная компетентность, интерактивные методы, проблемное обучение, рефлексия, аналитическое мышление, педагогическое образование, профессиональная подготовка.*

Abstract.*This article examines the theoretical and methodological foundations and pedagogical technologies aimed at developing critical thinking among future teachers. Particular attention is paid to the role of critical thinking in professional teacher training and to the development of students' ability to analyze information, express and justify their opinions, make evidence-based decisions, and objectively evaluate pedagogical situations. The study highlights the potential of interactive teaching methods, problem-based tasks, case-study technologies, discussions, project-based learning, and reflective practices in fostering critical thinking skills. The necessity of creating an educational environment that promotes independence, analytical activity, and creative inquiry among future teachers is substantiated.*

Keywords: *critical thinking, future teachers, pedagogical technology, professional competence, interactive methods, problem-based learning, reflection, analytical thinking, teacher education, professional training.*

INTRODUCTION

The development of critical thinking has become one of the major objectives of modern higher education, especially in the system of teacher training. The rapidly changing educational environment, the growth of digital information, and the increasing complexity of professional pedagogical tasks require future teachers to possess not only theoretical knowledge but also the ability to analyze, compare, evaluate, and interpret information independently.Critical thinking enables future teachers to assess pedagogical situations objectively, distinguish reliable information from unsubstantiated opinions, identify cause-and-effect relationships, and make evidence-based decisions. These skills are particularly important in professional teaching practice, where educators regularly face diverse student needs, complex classroom situations, and the necessity to select appropriate methods and strategies.Traditional reproductive approaches to learning are not always sufficient for developing such competencies. Therefore, contemporary teacher education requires the systematic use of interactive, problem-based, reflective, and student-centered pedagogical technologies. These methods create opportunities for future teachers to actively participate in the educational process, defend their viewpoints, analyze alternative solutions, and develop independent professional judgments.

The purpose of this study is to examine the pedagogical conditions and instructional technologies that contribute to the development of critical thinking among future teachers and to determine their role in improving professional competence.

MATERIALS AND METHODS

The research was based on theoretical analysis, comparison, observation, pedagogical assessment, and the study of educational practices related to the development of critical thinking. The methodological basis of the study included learner-centered, competency-based, problem-based, and reflective approaches.Interactive methods such as case studies, problem-solving tasks, discussions, debates, project-based learning, reflective exercises, and collaborative activities were considered as the main instruments for developing critical thinking. These methods were selected because they encourage students to examine problems from different perspectives, formulate arguments, evaluate evidence, and make independent conclusions.During learning activities, future

teachers were encouraged to analyze pedagogical situations, identify possible solutions, discuss their advantages and limitations, and justify their decisions. Reflective tasks were also used to help students evaluate their own reasoning process, recognize weaknesses in their arguments, and improve their ability to make professional judgments.The effectiveness of the proposed approaches was assessed through observation of students' participation, the quality of their arguments, their ability to formulate conclusions, and their independence in solving educational and pedagogical problems.

RESULTS

The findings indicate that the systematic use of interactive and problem-based learning technologies positively influences the development of critical thinking among future teachers. Students became more active in analyzing educational situations and demonstrated a greater ability to compare different viewpoints and provide arguments supporting their own positions.

The use of case studies and problem-solving tasks improved students' ability to identify the essential aspects of pedagogical problems and search for alternative solutions. Discussions and debates contributed to the development of argumentation skills, logical reasoning, and communication competence. Project-based activities encouraged students to independently search for information, organize it, and apply it to practical educational tasks.

Reflective exercises also played an important role in the learning process. They helped students to assess the quality of their decisions, analyze their own learning strategies, and recognize the importance of evidence-based reasoning.

Overall, the results suggest that the effectiveness of critical thinking development depends on the regular and systematic integration of active teaching methods into the professional training process.

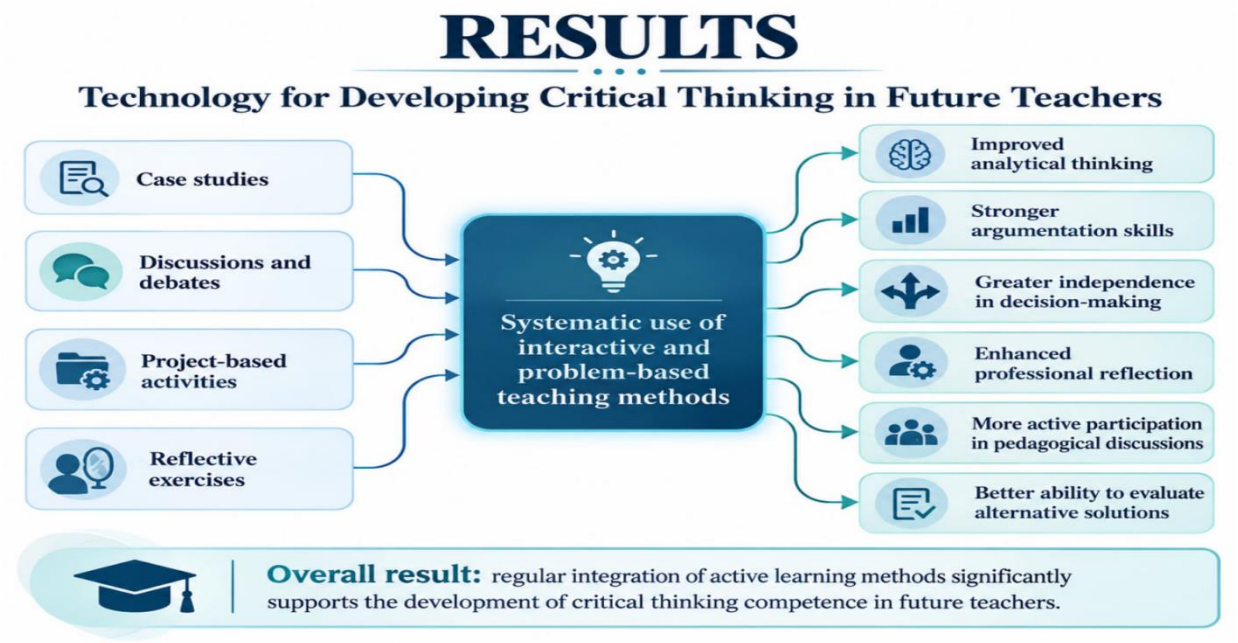

Figure 1.
Key outcomes of implementing critical thinking development technologies in future teacher education.

DISCUSSION

The obtained results demonstrate that critical thinking should be developed through active intellectual and practical engagement rather than through the simple transmission of theoretical knowledge. When students are involved in discussion, problem solving, reflection, and collaborative activities, they become more responsible for their own learning and more capable of making independent judgmentsThe findings also show that pedagogical situations and professionally oriented tasks are particularly effective for future teachers because they connect theoretical knowledge with real educational practice. Such tasks allow students to understand the complexity of teaching activities and develop the ability to choose appropriate solutions in uncertain or controversial situations.Another important aspect is the role of reflection in critical thinking development. Reflection enables students to reconsider their initial judgments, identify possible errors, and improve their decision-making process. In this regard, the combination of analytical, interactive, and reflective methods can be considered one of the most effective directions in the professional preparation of future teachers.Thus, the development of critical thinking should not be treated as a separate academic skill. It should be integrated into different subjects, practical classes, independent learning tasks, and professional training activities.

CONCLUSION

The development of critical thinking is an essential component of the professional competence of future teachers. It helps students analyze information, evaluate pedagogical situations, make well-grounded decisions, and respond effectively to complex professional challenges.The study shows that interactive, problem-based, project-based, and reflective teaching technologies create favorable conditions for developing these abilities. Their systematic use contributes to greater intellectual independence, analytical activity, professional reflection, and evidence-based decision-making.Therefore, higher education institutions should integrate critical thinking technologies into the content and methods of teacher training. This approach can contribute to preparing future teachers who are capable of independent judgment, flexible thinking, reflective practice, and effective professional activity in a rapidly changing educational environment.

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BOSHLANG‘ICH SINF O‘QISH DARSLARIDA O‘QUVCHILAR NUTQINI O‘STIRISH

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Annotatsiy: *Ushbu maqolada boshlang‘ich sinf o‘quvchilarining nutqini rivojlantirishda o‘qish darslarining o‘rni va ahamiyati yoritilgan. O‘quvchilarning og‘zaki va yozma nutqini shakllantirish, lug‘at boyligini kengaytirish, matn mazmunini anglash, mustaqil fikrlash va o‘z fikrini izchil bayon qilish ko‘nikmalarini rivojlantirishning samarali usullari tahlil qilingan. Shuningdek, o‘qish darslarida savol-javob, qayta hikoyalash, suhbat, rasm asosida hikoya tuzish, rollarga bo‘lib o‘qish kabi metodlardan foydalanishning pedagogik imkoniyatlari ko‘rsatib berilgan.*

Kalit so‘zlar: *boshlang‘ich ta’lim, o‘qish darsi, nutq o‘stirish, og‘zaki nutq, yozma nutq, lug‘at boyligi, ifodali o‘qish, mustaqil fikrlash, interfaol metodlar.*

Аннотация: *В статье освещаются вопросы развития речи учащихся начальных классов на уроках чтения. Рассматриваются эффективные методы и приемы формирования устной и письменной речи, расширения словарного запаса, развития навыков выразительного чтения, пересказа текста, самостоятельного мышления и последовательного выражения своих мыслей. Особое внимание уделяется использованию вопросов и ответов, беседы, пересказа, работы по картинкам, чтения по ролям и творческих заданий в процессе обучения.*

Ключевые слова: *начальное образование, урок чтения, развитие речи, устная речь, письменная речь, словарный запас, выразительное чтение, самостоятельное мышление, интерактивные методы.*

Abstract: *This article examines the development of primary school students’ speech skills during reading lessons. It discusses effective methods and techniques for developing oral and written speech, enriching vocabulary, improving expressive reading, retelling texts, independent thinking, and the ability to express ideas consistently. Particular attention is paid to the use of*

question-and-answer activities, discussions, retelling, picture-based storytelling, role reading, and creative tasks in the learning process.

Keywords: *primary education, reading lesson, speech development, oral speech, written speech, vocabulary, expressive reading, independent thinking, interactive methods.*

KIRISH

Boshlang‘ich ta’lim bosqichi o‘quvchining shaxs sifatida shakllanishida muhim davr hisoblanadi. Ayniqsa, bu bosqichda o‘quvchilarning to‘g‘ri, ravon, aniq va mazmunli fikrlash hamda o‘z fikrini og‘zaki va yozma ravishda ifodalash ko‘nikmalarini rivojlantirishga alohida e’tibor qaratiladi. Chunki bolaning keyingi ta’lim jarayonidagi muvaffaqiyati ko‘p jihatdan uning nutqiy kompetensiyasiga bog‘liq.

O‘qish darslari o‘quvchilarning nutqini o‘stirish uchun keng imkoniyat yaratadi. Badiiy va ilmiy-ommabop matnlarni o‘qish, ularning mazmunini tahlil qilish, savollarga javob berish, voqealar ketma-ketligini aniqlash, qahramonlarga tavsif berish va matnni qayta hikoya qilish orqali o‘quvchilarning so‘z boyligi ortadi hamda mustaqil fikrlash qobiliyati rivojlanadi.

O‘quvchilar nutqini o‘stirish — ularning faqat ko‘proq so‘z bilishini ta’minlash emas, balki mavjud so‘zlardan o‘rinli va to‘g‘ri foydalana olish, fikrni mantiqiy izchillikda ifodalash, suhbatdoshini tinglash va o‘z munosabatini bildirish ko‘nikmalarini shakllantirish jarayonidir.

Boshlang‘ich sinf o‘qish darslarida nutq o‘stirishning asosiy vazifalaridan biri o‘quvchilarning lug‘at boyligini kengaytirishdir. Matnda uchragan yangi so‘zlar ustida ishlash, ularning ma’nosini izohlash, so‘zlarni gap ichida qo‘llash va ularga ma’nodosh yoki zid ma’noli so‘zlarni topish samarali natija beradi. Masalan, o‘qituvchi yangi so‘zni tushuntirgach, o‘quvchilardan shu so‘z ishtirokida gap tuzishni so‘rashi mumkin. Bu usul yangi so‘zning faol lug‘at tarkibiga kirishiga yordam beradi.

Ifodali o‘qish orqali nutqni rivojlantirish

Ifodali o‘qish o‘quvchilarning nutq madaniyatini shakllantirishda muhim vositalardan biridir. O‘qituvchi matnni namunali va ifodali o‘qib berishi, so‘ng o‘quvchilarga matnni ovoz ohangi, pauza, urg‘u va talaffuzga rioya qilgan holda o‘qitishi mumkin.

Ifodali o‘qish jarayonida o‘quvchi nafaqat matn mazmunini tushunadi, balki undagi qahramonlarning holati, kechinmalari va voqealarning mazmunini ovoz orqali ifodalashga o‘rganadi. Natijada o‘quvchining talaffuzi yaxshilanadi, nutqi ravonlashadi va o‘z fikrini ifodalashga bo‘lgan ishonchi ortadi.

Savol-javob va suhbat metodidan foydalanish

O‘qilgan matn yuzasidan tashkil etiladigan savol-javoblar o‘quvchilarni faol fikrlashga undaydi. Savollar oddiy mazmuniy savollardan boshlab, asta-sekin tahliliy va ijodiy xarakterga ega bo‘lishi maqsadga muvofiq.

Masalan:

- Matnda qanday voqea tasvirlangan?
- Asarning asosiy qahramoni kim?
- Qahramonning xatti-harakatiga qanday munosabat bildirasiz?
- Siz qahramon o‘rnida bo‘lganingizda qanday yo‘l tutgan bo‘lardingiz?
- Matnga boshqa qanday sarlavha qo‘yish mumkin?

Bunday savollar o‘quvchini tayyor javobni takrorlashdan ko‘ra mustaqil fikrlashga va o‘z fikrini asoslashga yo‘naltiradi.

Matnni qayta hikoyalash

Matnni qayta hikoyalash boshlang‘ich sinf o‘quvchilarining nutqini rivojlantirishda eng samarali mashqlardan biridir. Bunda o‘quvchi o‘qilgan yoki tinglangan matn mazmunini o‘z so‘zlari bilan bayon qiladi.

Qayta hikoyalashning quyidagi turlaridan foydalanish mumkin:

1. Matnni to‘liq qayta hikoyalash.
2. Matnni qisqartirib hikoyalash.
3. Reja asosida hikoyalash.
4. Rasm asosida hikoyalash.
5. Qahramon nomidan hikoyalash.
6. Matnning ayrim qismlarini ijodiy davom ettirish.

Mazkur mashqlar o‘quvchining xotirasi, tafakkuri va nutqiy faolligini rivojlantiradi.

Rasm va ijodiy topshiriqlardan foydalanish

Boshlang‘ich sinf o‘quvchilari uchun ko‘rgazmalilik muhim ahamiyatga ega. Shu sababli o‘qish darslarida rasmlar, illyustratsiyalar va turli ko‘rgazmali materiallardan foydalanish o‘quvchilarning nutqiy faolligini oshiradi.

Masalan, o‘qituvchi o‘quvchilarga biror rasmni ko‘rsatib:

- Rasmda nimalarni ko‘ryapsiz?
- Voqea qayerda sodir bo‘layotgan bo‘lishi mumkin?
- Rasmda ishtirok etayotgan kishilar haqida nimalar deya olasiz?
- Rasm asosida kichik hikoya tuzing.

kabi topshiriqlar berishi mumkin.

Bunday faoliyat o‘quvchilarning tasavvurini kengaytiradi va ularni mustaqil ravishda gap hamda matn tuzishga o‘rgatadi.

Rollarga bo‘lib o‘qish

Dialog va suhbatlardan tashkil topgan matnlarni rollarga bo‘lib o‘qish ham nutq o‘stirishning samarali usullaridan biridir. O‘quvchilar qahramonlarning so‘zlarini tegishli ohangda ifodalashga harakat qiladilar. Bu jarayonda talaffuz, intonatsiya, nutq tezligi va muloqot madaniyatiga e’tibor qaratiladi.

Rollarga bo‘lib o‘qish o‘quvchilarda jamoada ishlash, boshqalarni tinglash va o‘z fikrini erkin ifodalash ko‘nikmalarini ham rivojlantiradi.

Nutq o‘stirishda o‘qituvchining roli

O‘quvchilar nutqining rivojlanishida o‘qituvchining nutqi muhim namuna hisoblanadi. O‘qituvchi dars davomida adabiy til me’yorlariga amal qilishi, so‘zlarni aniq va ravon talaffuz qilishi, o‘quvchilarning fikrini bo‘lmasdan tinglashi hamda ularni o‘z fikrini erkin ifodalashga rag‘batlantirishi lozim.

O‘quvchi javobida xatoga yo‘l qo‘yganida uni keskin tanqid qilish o‘rniga, xatosini to‘g‘ri shakl orqali ko‘rsatish samaraliroqdir. Bunday yondashuv o‘quvchida o‘z fikrini aytishdan qo‘rqmaslik va darsda faol ishtirok etish istagini shakllantiradi.

Shuningdek, har bir o‘quvchining nutqiy imkoniyatlari turlicha ekanini hisobga olish zarur. Nutqi sustroq rivojlangan o‘quvchilarga qisqa va sodda topshiriqlardan boshlab, asta-sekin murakkabroq vazifalar berish maqsadga muvofiq.

XULOSA

Xulosa qilib aytganda, boshlang‘ich sinf o‘qish darslari o‘quvchilar nutqini rivojlantirish uchun katta pedagogik imkoniyatlarga ega. O‘qish jarayonini faqat matnni o‘qish va mazmunini aytib berish bilan cheklab qo‘ymasdan, uni turli nutqiy va ijodiy topshiriqlar bilan boyitish zarur.

O‘quvchilarning lug‘at boyligini kengaytirish, ifodali o‘qishga o‘rgatish, savol-javob va suhbatlar tashkil etish, matnni qayta hikoyalatish, rasm asosida hikoya tuzdirish, rollarga bo‘lib o‘qitish hamda ijodiy topshiriqlardan foydalanish ularning og‘zaki va yozma nutqini izchil rivojlantirishga xizmat qiladi.

Eng muhimi, o‘qish darslarida o‘quvchining mustaqil fikrlashi va o‘z fikrini erkin bayon etishi uchun qulay pedagogik muhit yaratish lozim. Shundagina boshlang‘ich ta’lim bosqichida o‘quvchilarning nutqiy kompetensiyasi, muloqot madaniyati va fikrlash qobiliyatini samarali shakllantirish mumkin.

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5. Boshlang‘ich sinflar uchun ona tili va o‘qish savodxonligi darsliklari.

O‘QUVCHILARDA JISMONIY FAOLLIKNI O‘Z-O‘ZINI BOSHQARISH KOMPETENSIYASINI RIVOJLANTIRISHNING PEDAGOGIK MEXANIZMLARI

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Annotatsiya. *Maqolada o‘quvchilarda jismoniy faollikni o‘z-o‘zini boshqarish kompetensiyasini rivojlantirishning nazariy-pedagogik asoslari tahlil qilinadi. Mazkur kompetensiya shaxsiy maqsad qo‘yish, jismoniy faollikni rejalashtirish, yuklamani kuzatish, natijani baholash, refleksiya va korreksiya qilishni birlashtiruvchi integrativ sifat sifatida talqin etiladi. O‘z-o‘zini boshqarishga yo‘naltirilgan pedagogik mexanizmlar tizimi ishlab chiqilib, unda avtonom motivatsiyani qo‘llab-quvvatlash, maqsad va reja tuzish, o‘zini monitoring qilish, teskari aloqa, refleksiv baholash, ijtimoiy qo‘llab-quvvatlash hamda pedagogik boshqaruvni bosqichma-bosqich o‘quvchining mustaqil boshqaruviga o‘tkazish yetakchi mexanizmlar sifatida asoslanadi.*

Kalit so‘zlar: *jismoniy faollik, o‘z-o‘zini boshqarish, kompetensiya, o‘zini monitoring qilish, refleksiya, motivatsiya, teskari aloqa, pedagogik mexanizm.*

Аннотация. *В статье анализируются теоретико-педагогические основы развития у учащихся компетентности саморегуляции физической активности. Данная компетентность рассматривается как интегративное качество, объединяющее постановку личных целей, планирование двигательной активности, самоконтроль нагрузки, оценивание результатов, рефлексию и коррекцию поведения. Обоснована система педагогических механизмов, включающая поддержку автономной мотивации, целеполагание и планирование, самомониторинг, обратную связь, рефлексивное оценивание, социальную поддержку и поэтапный переход от внешнего педагогического контроля к самостоятельному управлению физической активностью учащегося.*

Ключевые слова: *физическая активность, саморегуляция, компетентность, самомониторинг, рефлексия, мотивация, обратная связь, педагогический механизм.*

Abstract. *The article examines the theoretical and pedagogical foundations for developing students' competence in self-regulation of physical activity. This competence is interpreted as an integrative quality combining personal goal setting, planning of physical activity, self-monitoring of workload, evaluation of outcomes, reflection, and behavioral adjustment. A system of pedagogical mechanisms is substantiated, including support for autonomous motivation, goal setting and planning, self-monitoring, feedback, reflective assessment, social support, and a gradual transfer from external teacher regulation to students' independent management of their physical activity.*

Keywords: *physical activity, self-regulation, competence, self-monitoring, reflection, motivation, feedback, pedagogical mechanism.*

KIRISH

Maktab yoshidagi o‘quvchilarning jismoniy faolligi ularning sog‘lom rivojlanishi, harakat tajribasi va kundalik hayot sifatining muhim shartlaridan biridir. Jahon sog‘liqni saqlash tashkilotining bolalar va o‘smirlar uchun tavsiyalarida jismoniy faollikning muntazamligi, intensivligi va davomiyligini sog‘liq bilan bog‘liq natijalar nuqtayi nazaridan boshqarish zarurligi qayd etiladi [1]. Shu sababli maktab jismoniy tarbiyasining zamonaviy vazifasi o‘quvchini faqat belgilangan mashqlarni bajarishga o‘rgatish bilan cheklanmaydi; u o‘z jismoniy faolligini mustaqil rejalashtira, kuzata, baholay va zarur hollarda o‘zgartira oladigan subyekt sifatida shakllanishi lozim. An’anaviy amaliyotda jismoniy faollik ko‘pincha o‘qituvchi tomonidan tashqi nazorat qilinadigan jarayon sifatida tashkil etiladi: o‘qituvchi topshiriq beradi, yuklamani belgilaydi, bajarilishini nazorat qiladi va natijani baholaydi. Bunday tashkil etish darsni boshqarish uchun zarur bo‘lsa-da, u o‘quvchining darsdan tashqari sharoitda mustaqil qaror qabul qilishi uchun yetarli emas. O‘quvchi nima uchun harakat qilayotgani, qaysi maqsadni ko‘zlayotgani, o‘zining hozirgi holatini qanday aniqlashi, natijani qaysi mezon bilan taqqoslashi va rejasini qachon o‘zgartirishi kerakligini anglamasa, jismoniy faollik tashqi topshiriq darajasida qolishi mumkin.

Mazkur muammo o‘z-o‘zini boshqarish nazariyasi bilan bevosita tutashadi. B. Zimmerman o‘z-o‘zini boshqariladigan faoliyatni maqsadni oldindan belgilash, bajarish jarayonida o‘zini kuzatish va yakunda o‘z faoliyatini refleksiv baholashdan iborat siklik tizim sifatida izohlaydi [3]. Jismoniy faollikka tatbiq etilganda bu mantiq o‘quvchining shaxsiy maqsad qo‘yishi, bajariladigan harakat hajmi va tartibini rejalashtirishi, o‘z holati hamda natijalarini kuzatishi, natijani tahlil qilib keyingi faoliyatga tuzatish kiritishi orqali namoyon bo‘ladi. Demak, jismoniy faollikni o‘z-o‘zini boshqarish

kompetensiyasi bilim, motivatsiya va amaliy harakatlarning integratsiyasiga tayangan murakkab pedagogik natijadir.

ADABIYOTLAR TAHLILI VA METODOLOGIYA

O‘z-o‘zini boshqarish muammosi ta’lim psixologiyasida maqsad qo‘yish, rejalashtirish, o‘zini kuzatish, strategiyalarni tanlash va refleksiv baholash kabi o‘zaro bog‘liq jarayonlar orqali tavsiflanadi [3]. Zamonaviy tadqiqotlar bolalar va o‘smirlardagi self-regulation konstruktini kognitiv, xulqiy hamda emotsional tarkiblar orqali o‘lchashga intilishini, biroq terminologiya va o‘lchash vositalari bir xilda emasligini ko‘rsatadi [4]. Bu holat jismoniy faollik sohasida kompetensiyani faqat bitta ko‘rsatkich masalan, kunlik qadamlar yoki mashg‘ulot davomiyligi bilan cheklab bo‘lmasligini anglatadi. Faoliyat miqdori bilan birga o‘quvchining maqsad tanlashi, o‘z imkoniyatini baholashi, qaror qabul qilishi va natijani tahlil qilishi ham hisobga olinishi kerak. Jismoniy tarbiya va jismoniy faollikni qo‘llab-quvvatlash bo‘yicha motivatsion tadqiqotlarda Self-Determination Theory alohida o‘rin tutadi. Ushbu yondashuv avtonomiya, kompetentlik va ijtimoiy aloqadorlik ehtiyojlarini qo‘llab-quvvatlaydigan muhit ichki yoki avtonom motivatsiya shakllanishiga ko‘maklashishini ta’kidlaydi [5]. Jismoniy tarbiya bo‘yicha sifat tadqiqotlarini umumlashtirgan sistematik sharhda tanlov, yangilik va mos darajadagi qiyinchilik o‘quvchilarning ijobiy tajribasi va motivatsiyasini qo‘llab-quvvatlashi, haddan tashqari taqqoslash va faqat natijaga yo‘naltirilgan pedagogik xatti-harakatlar esa kompetentlik hissini susaytirishi mumkinligi ko‘rsatilgan [6]. 2025-yildagi zamonaviy sharh ham jismoniy faollikni targ‘ib qilishda avtonom motivatsiya, ehtiyojlarni qo‘llab-quvvatlovchi muloqot va kompetentlik hissi muhim vositachi omillar ekanini qayd etadi [7]. Shu bilan birga, motivatsiyani qo‘llab-quvvatlashning o‘zi har doim xulqiy natijani kafolatlamaydi. Maktabdan tashqari jismoniy faollik bo‘yicha Self-Determination Theory asosidagi aralashuvlarning 2023-yilgi meta-tahlilida bir qator umumlashtirilgan effektlar statistik jihatdan ahamiyatli bo‘lmagan [8]. 2026-yilgi sistematik sharhda esa ijtimoiy qo‘llab-quvvatlash, self-monitoring va xulq bo‘yicha feedback istiqbolli xulq-atvor texnikalari sifatida ajratilgan, biroq dalillar sifati tufayli qat’iy xulosalarga ehtiyotkorlik bilan yondashish lozimligi ta’kidlangan [9]. Bu natijalar o‘quvchining jismoniy faolligini barqaror boshqarish bir omilga emas, maqsad, reja, monitoring, teskari aloqa, refleksiya va ijtimoiy muhitni birlashtiruvchi ko‘p komponentli pedagogik tizimga tayanishi kerakligini ko‘rsatadi.

NATIJALAR VA MUHOKAMA

Tahlil natijasida “jismoniy faollikni o‘z-o‘zini boshqarish kompetensiyasi” tushunchasini o‘quvchining shaxsiy sog‘lomlashtiruvchi va harakat maqsadlarini ongli belgilashi, o‘z imkoniyati hamda sharoitini hisobga olib faoliyatni rejalashtirishi, bajarish jarayoni va yuklamani kuzatishi, natijalarni mezonlar asosida baholashi, refleksiya orqali sabablarni aniqlashi va keyingi xatti-harakatiga asoslangan tuzatish kiritish qobiliyati sifatida talqin qilish taklif etiladi. Ushbu ta’rifda kompetensiyaning uchta muhim belgisi mujassam: birinchidan, o‘quvchi faoliyatning obyekti emas, qaror qabul qiluvchi subyektdir; ikkinchidan, boshqarish bir martalik emas, siklik jarayondir; uchinchidan, qarorlar xavfsizlik, sog‘liq va individual imkoniyat bilan muvofiqlashtiriladi.

Kompetensiyani rivojlantirish uchun tashqi pedagogik boshqaruvni birdan bekor qilish emas, balki uni bosqichma-bosqich ichki boshqaruvga ko‘chirish zarur. Dastlab o‘qituvchi maqsad va mezonlarni tushuntiradi, kuzatuv vositalarini namoyish etadi va qaror namunalarini beradi. Keyingi bosqichda o‘quvchi cheklangan tanlovlar asosida reja tuzadi, o‘qituvchi esa maslahat va feedback bilan yordam beradi. Yakuniy bosqichda o‘quvchi maqsad, reja, monitoring va korreksiyani mustaqil amalga oshiradi; pedagog esa xavfsizlik, haqqoniylik va refleksiya sifati bo‘yicha fasilitator vazifasini bajaradi.

1-jadval.

O‘quvchilarda jismoniy faollikni o‘z-o‘zini boshqarish kompetensiyasini rivojlantiruvchi pedagogik mexanizmlar

Pedagogik mexanizm	Mazmuni	Pedagogik vositalar	O‘z-o‘zini boshqarish natijasi
1. Maqsadli-ma’noviy yo‘naltirish	Jismoniy faollikni shaxsiy sog‘liq, farovonlik va rivojlanish maqsadlari bilan bog‘lash.	Shaxsiy maqsad kartasi, SMART-maqsad, “nima uchun?” refleksiyasi.	Ichki ma’no, ongli maqsad va javobgarlik shakllanadi.
2. Rejalashtirish va tanlov	Yuklama, vaqt, faoliyat turi va bajarish sharoitini individual	Haftalik reja, tanlovli topshiriqlar, bosqichli maqsadlar.	Mustaqil qaror qabul qilish va vaqtni boshqarish rivojlanadi.

	imkoniyatga mos rejalashtirish.		
3. O‘zini monitoring qilish	Faoliyat hajmi, intensivligi va subyektiv holatni muntazam kuzatish.	Kundalik, qadam hisoblagich, faollik ilovasi, RPE shkala, chek-list.	O‘quvchi real holat va reja o‘rtasidagi farqni ko‘ra boshlaydi.
4. Teskari aloqa va refleksiya	Ma’lumotni mazmunli sharhlash, sabab-oqibatni aniqlash va natijani baholash.	Qisqa feedback, refleksiv savollar, “reja–amal–natija” tahlili.	Metakognitiv nazorat va asoslangan baholash kuchayadi.
5. Korreksiya va adaptatsiya	Natija hamda holatga ko‘ra keyingi yuklama, maqsad yoki strategiyani o‘zgartirish.	Individual tavsiya, qayta rejalashtirish, kichik qadamlar strategiyasi.	Moslashuvchan boshqaruv va barqarorlik rivojlanadi.
6. Ijtimoiy qo‘llab-quvvatlash	O‘qituvchi, tengdosh va oila ko‘magini nazorat emas, maslahat va hamkorlik shaklida tashkil etish.	Juftlik monitoringi, rag‘batlantiruvchi muloqot, oilaviy qo‘llab-quvvatlash.	Avtonomiya saqlangan holda mas’uliyat va davomiylik mustahkamlanadi.

Jadvaldagi mexanizmlar alohida-alohida tadbirlar emas, yagona boshqaruv siklining funksional bo‘g‘inlaridir. Maqsadning mavjudligi rejalashtirishga yo‘nalish beradi; reja monitoring uchun mezon yaratadi; monitoring ma’lumoti feedback va refleksiya orqali talqin qilinadi; refleksiya esa korreksiyani asoslaydi. Ijtimoiy qo‘llab-quvvatlash va avtonom motivatsiya ushbu siklning barcha bosqichlarini birlashtiruvchi fon mexanizmi hisoblanadi.

Pedagogik mexanizmning samaradorligi monitoring vositasining murakkabligiga emas, undan qanday pedagogik maqsadda foydalanilishiga bog‘liq. Masalan, qadam hisoblagich yoki mobil ilova o‘quvchiga faqat raqam beradi. O‘qituvchi ushbu raqamni shaxsiy maqsad, yuklama hissi va oldingi ko‘rsatkichlar bilan taqqoslashga o‘rgatsa, raqam o‘zini boshqarish qarorining daliliga aylanadi. Shu sababli raqamli vosita nazorat vositasi emas, o‘zini

anglash va qaror qabul qilish vositasi sifatida joriy etilishi kerak. Self-Determination Theory nuqtayi nazaridan o‘quvchiga tanlov berish va uning fikrini inobatga olish avtonomiyani, mos qiyinchilikdagi topshiriqlar kompetentlik hissini, hamkorlik esa aloqadorlik ehtiyojini qo‘llab-quvvatlaydi [5-7]. Biroq 2023-yilgi meta-tahlil motivatsion nazariyaga tayangan aralashuvlarning o‘zi barcha holatlarda jismoniy faollik darajasini oshirmaganini ko‘rsatadi [8]. Shuning uchun mazkur maqolada motivatsiya “alohida mexanizm” sifatida emas, rejalashtirish, monitoring va refleksiyani ishlatishga undovchi shart sifatida qaraladi. O‘quvchi faqat faol bo‘lishni xohlashi emas, bu istakni aniq reja va kuzatiladigan xatti-harakatga aylantira olishi kerak. 2026-yilgi sistematik sharhda self-monitoring, feedback va ijtimoiy qo‘llab-quvvatlash istiqbolli usullar qatorida ko‘rsatilgan bo‘lsa-da, dalillar sifati bir xil emas [9]. Bu pedagogik amaliyot uchun ikki xulosani beradi. Birinchidan, bitta texnik vositani universal yechim sifatida ko‘rish to‘g‘ri emas. Ikkinchidan, turli mexanizmlar bir-birini to‘ldirishi lozim: monitoring feedbacksiz ma’nosiz raqamga, feedback maqsadsiz umumiy tavsiyaga, maqsad esa rejasiz niyatga aylanishi mumkin. Shuning uchun kompetensiya integratsiyalashgan boshqaruv sikli orqali shakllanishi maqsadga muvofiq. Maktab amaliyotida mazkur yondashuvni joriy etish uchun jismoniy tarbiya darsidagi baholashni faqat normativ natijalar bilan cheklamasdan, o‘quvchining boshqaruv jarayonini ham kuzatish zarur. Masalan, “maqsadning realligi”, “rejaning aniqligi”, “monitoringning muntazamligi”, “refleksiyaning sababiyligi” va “korreksiyaning asoslanganligi” kabi indikatorlar qo‘llanishi mumkin. Bunda o‘quvchilarni bir-biri bilan taqqoslashdan ko‘ra, shaxsiy dinamikani baholash o‘z-o‘zini boshqarishning mazmuniga ko‘proq mos keladi.

XULOSA

O‘quvchilarda jismoniy faollikni o‘z-o‘zini boshqarish kompetensiyasini rivojlantirish jismoniy tarbiyaning natijasini darsdagi ijrodan kundalik hayotdagi ongli va mustaqil faoliyatga ko‘chirish imkonini beradi. Mazkur kompetensiya shaxsiy maqsad qo‘yish, rejalashtirish, o‘zini monitoring qilish, natijani baholash, refleksiya va korreksiyani yagona siklda birlashtiradi. Uning pedagogik mexanizmlari sifatida maqsadli-ma’noviy yo‘naltirish, tanlovli rejalashtirish, o‘zini monitoring qilish, mazmunli feedback, refleksiv baholash, adaptiv korreksiya va ijtimoiy qo‘llab-quvvatlash asoslandi. Eng muhim metodik prinsip – tashqi pedagogik nazoratni birdan kamaytirish emas, balki o‘quvchini qaror qabul qilish vositalari bilan ta’minlagan holda boshqaruv funksiyalarini bosqichma-bosqich uning o‘ziga topshirishdir. Shu tarzda jismoniy faollik “berilgan topshiriq”dan shaxsning o‘z sog‘lig‘i va harakat

faoliyati uchun mas’uliyatli, dalillarga tayangan va refleksiv boshqaruv amaliyotiga aylanishi mumkin.

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REFLEKSIV DEBRIFING VOSITASIDA BO‘LAJAK O‘QITUVCHILARNING KASBIY REFLEKSIYASINI RIVOJLANTIRISHNING PEDAGOGIK IMKONIYATLARI

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Annotatsiya. *Mazkur maqolada refleksiv debrifingning bo‘lajak o‘qituvchilar kasbiy refleksiyasini rivojlantirishdagi pedagogik imkoniyatlari nazariy jihatdan tahlil qilingan. Kasbiy refleksiya pedagogik vaziyatni qayta ko‘rish, o‘z qarori va harakatining sabablarini anglash, ularni nazariy bilimlar bilan bog‘lash, muqobil yechimlarni ishlab chiqish hamda keyingi faoliyatni ongli ravishda rejalashtirish qobiliyati sifatida talqin etiladi. Refleksiv debrifing oddiy suhbat yoki voqeani qayta hikoya qilishdan farqli ravishda, tajribani dalillarga tayangan holda tahlil qilish, yashirin taxminlarni ochish, xatoni o‘rganish resursiga aylantirish va amaliy tajribani konseptual bilimga transformatsiyalashga xizmat qiluvchi strukturali pedagogik jarayon sifatida asoslanadi. Adabiyotlarni qiyosiy-tahliliy o‘rganish natijasida refleksiv debrifingning besh asosiy pedagogik imkoniyati ajratildi: tajribani verbalizatsiya qilish, sabab-oqibat aloqalarini aniqlash, nazariya va amaliyotni integratsiyalash, muqobil pedagogik qarorlarni loyihalash hamda refleksiyani yangi vaziyatlarga transfer qilish. Shuningdek, debrifingni samarali tashkil etishning pedagogik shartlari va savollar tizimi taklif etilgan.*

Kalit so‘zlar: *refleksiv debrifing, kasbiy refleksiya, bo‘lajak o‘qituvchi, pedagogik tajriba, tajribaviy* o‘rganish, metakognitsiya, pedagogik qaror, nazariya va amaliyot integratsiyasi.

Аннотация. *В статье теоретически обоснованы педагогические возможности рефлексивного дебрифинга в развитии профессиональной рефлексии будущих учителей. Профессиональная рефлексия рассматривается как способность повторно анализировать педагогическую ситуацию, осознавать причины собственных решений и действий, соотносить их с теоретическими знаниями, вырабатывать альтернативные решения и осознанно проектировать последующую деятельность. Рефлексивный дебрифинг раскрывается как структурированный педагогический процесс, обеспечивающий вербализацию опыта, выявление причинно-следственных связей,*

интеграцию теории и практики, проектирование альтернативных педагогических решений и перенос результатов рефлексии в новые профессиональные ситуации. Определены педагогические условия эффективной организации дебрифинга и предложена система направляющих вопросов.

Ключевые слова: *рефлексивный дебрифинг, профессиональная рефлексия, будущий учитель, педагогический опыт, опытное обучение, метакогниция, педагогическое решение, интеграция теории и практики.*

Abstract. *The article theoretically substantiates the pedagogical potential of reflective debriefing for developing future teachers' professional reflection. Professional reflection is interpreted as the ability to revisit a pedagogical situation, understand the reasons underlying one's decisions and actions, relate practical experience to theoretical knowledge, generate alternative solutions, and consciously plan subsequent professional activity. Reflective debriefing is considered a structured pedagogical process rather than a simple post-activity discussion. It supports the verbalization of experience, identification of cause-and-effect relationships, integration of theory and practice, design of alternative pedagogical decisions, and transfer of reflective conclusions to new professional situations. Based on a comparative analysis of the literature, five key pedagogical opportunities of reflective debriefing are identified, and pedagogical conditions as well as a guiding question system for its effective implementation are proposed.*

Keywords: *reflective debriefing, professional reflection, future teacher, pedagogical experience, experiential learning, metacognition, pedagogical decision-making, theory–practice integration.*

KIRISH

Oliy pedagogik ta'limning muhim vazifalaridan biri bo‘lajak o‘qituvchini tayyor pedagogik algoritmlarni takrorlaydigan ijrochi sifatida emas, balki o‘z faoliyatini tahlil qila oladigan, qarorlarining oqibatlarini baholaydigan va tajribadan yangi kasbiy bilim hosil qiladigan refleksiv mutaxassis sifatida tayyorlashdan iborat. Pedagogik faoliyatning vaziyatga bog‘liqligi, oldindan to‘liq prognoz qilib bo‘lmaydiganligi va insonlararo munosabatlarga tayanishi o‘qituvchidan nafaqat metodik bilim, balki o‘z harakatini kuzatish, tahlil qilish va qayta loyihalash qobiliyatini ham talab etadi. Shu ma'noda kasbiy refleksiya o‘qituvchining pedagogik tajribani mazmunli o‘zlashtirishi va uni keyingi faoliyatni takomillashtirish vositasiga aylantirishining asosiy mexanizmlaridan biridir. D.Schön refleksiyani professional faoliyatning ichki mexanizmi sifatida talqin qilib, amaliyotchi mutaxassisning “harakat jarayonidagi refleksiya” va

“harakatdan keyingi refleksiya” orqali noaniq vaziyatlarni anglashini ko‘rsatgan [1]. D.Kolbning tajribaviy o‘rganish modeli esa konkret tajriba, refleksiv kuzatish, abstrakt konseptuallashtirish va faol tajriba bosqichlarining o‘zaro bog‘liqligini asoslaydi [2]. Mazkur yondashuvlar pedagogik tajriba o‘z-o‘zidan bilimga aylanmasligini, buning uchun tajribani qayta ishlashga xizmat qiluvchi maxsus refleksiv mexanizm zarurligini ko‘rsatadi.

Amaliyotda talabadan “dars qanday o‘tdi?”, “nima yaxshi bo‘ldi?” yoki “qanday xato qildingiz?” kabi umumiy savollarga javob olish ko‘pincha refleksiya deb qabul qilinadi. Biroq bunday suhbatlar pedagogik hodisaning sabablarini, qaror ortidagi taxminlarni, muqobil harakatlarni va nazariy asoslarni ochib bermasa, ular tavsifiy darajada qolib ketadi. Refleksiv debrifing aynan shu muammoni bartaraf etishga qaratilgan: u tajriba tugagach tashkil etiladigan, maqsadli savollar, dalillar, hamkasblar fikri va nazariy tushunchalar yordamida faoliyat ma’nosini qayta qurishga xizmat qiluvchi strukturali tahlil jarayonidir. Maqolaning maqsadi refleksiv debrifing vositasida bo‘lajak o‘qituvchilarning kasbiy refleksiyasini rivojlantirishning pedagogik imkoniyatlarini nazariy jihatdan aniqlash va tizimlashtirishdan iborat.

Tadqiqot nazariy-tahliliy xarakterga ega bo‘lib, refleksiv amaliyot, tajribaviy o‘rganish, o‘qituvchi tayyorlash va debrifingga oid ilmiy manbalarni qiyosiy tahlil qilish, tushunchalarni chegaralash, umumlashtirish va pedagogik modellashtirish usullaridan foydalanildi. Tahlilning markaziy savoli quyidagicha belgilandi: refleksiv debrifing bo‘lajak o‘qituvchining tajribani shunchaki eslab qolishidan uni anglangan kasbiy xulosaga aylantirishigacha bo‘lgan jarayonni qanday qo‘llab-quvvatlaydi?

N.Hatton va D.Smith o‘qituvchi tayyorlashda refleksiya tushunchasining bir xilda talqin qilinmasligini qayd etib, tavsifiy yozuvdan dialogik va tanqidiy refleksiyagacha bo‘lgan sifat jihatdan turli darajalarni farqlash zarurligini ko‘rsatgan [3]. J Loughran ham samarali refleksiya odatiy hodisani qayta bayon qilishdan iborat emasligini, aksincha, o‘z-o‘zidan qabul qilingan taxminlarni savol ostiga qo‘yish va amaliyotni yangi nuqtayi nazardan ko‘rishni talab etishini ta’kidlaydi [4]. F.Korthagen va J.Kessels o‘qituvchi ta’limida nazariya va amaliyotni “avval nazariya, keyin qo‘llash” modeli bilangina bog‘lash yetarli emasligini asoslab, amaliy tajribadan kelib chiqadigan refleksiv o‘rganishni muhim deb hisoblaydi [5].

Debrifing tushunchasi dastlab simulyatsion ta’lim sohalarida tizimli ishlab chiqilgan. R.Fanning va D.Gaba debrifingni tajribadan keyingi o‘rganishning markaziy bosqichi sifatida tavsiflaydi; unda fasilitator ishtirokchilarning tajribasini tahlil qilish va undan o‘rganishni qo‘llab-

quvvatlaydi [6]. K.Dreifuerst debrifingning muhim belgisi chuqur refleksiya orqali yashirin ma’nolarni ochish va tajribani amaliy bilimga aylantirish ekanini ko‘rsatadi [7]. Keyingi tahlillar debrifingning yagona universal shakli yo‘qligini, ammo samarali variantlarda psixologik xavfsizlik, dalillarga tayanish, ochiq savollar va keyingi harakatga yo‘naltirish umumiy element sifatida namoyon bo‘lishini ko‘rsatgan [8]. So‘nggi tadqiqotlar mazkur yondashuvning o‘qituvchi tayyorlashdagi ahamiyatini ham tasdiqlamoqda. Simulyatsion o‘qitish bo‘yicha tadqiqotlarda refleksiv debrifing bo‘lajak o‘qituvchilarning kasbiy vaziyatlarni tahlil qilishi, hamkorlikda ma’no qurishi, emotsional o‘zini anglash va pedagogik qarorlarni qayta ko‘rib chiqishiga xizmat qilishi qayd etilgan [9; 10]. 2025-yilda e’lon qilingan tadqiqotda esa hamkorlikdagi debrifing suhbatlari bo‘lajak o‘qituvchilarga o‘z dars tajribasini tushuntirish, pedagogik bilimni birgalikda qurish va keyingi o‘qitish qarorlarini aniqlashtirishda yordam bergani ko‘rsatilgan [11]. Bu natijalar refleksiv debrifingni faqat simulyatsiyadan keyingi suhbat emas, balki pedagogik tajribani kasbiy bilimga aylantirish vositasi sifatida ko‘rishga asos beradi.

Nazariy manbalarni qiyosiy tahlil qilish refleksiv debrifingning kasbiy refleksiyani rivojlantirishga ta’siri bir necha o‘zaro bog‘liq mexanizmlar orqali yuz berishini ko‘rsatdi. Birinchidan, debrifing tajribani verbalizatsiya qiladi. Pedagogik faoliyat davomida ko‘plab qarorlar tezkor va intuitiv tarzda qabul qilinadi; talaba nima qilganini bilishi mumkin, biroq nega aynan shunday yo‘l tutganini aniq tushuntira olmaydi. Debrifingdagi “Nima sodir bo‘ldi?”, “Siz qaysi belgiga tayandingiz?”, “Qarorni qabul qilgan paytda nimani kutdingiz?” kabi savollar yashirin fikrlash jarayonini tilga ko‘chirishga yordam beradi. Natijada faoliyat “bajarilgan harakat”dan “tahlil qilinadigan tajriba”ga aylanadi.

Ikkinchidan, refleksiv debrifing sabab-oqibatli pedagogik tafakkurni rivojlantiradi. Oddiy o‘z-o‘zini baholashda talaba ko‘pincha natijani shaxsiy sifat bilan izohlaydi: “men yaxshi tushuntira olmadim”, “talabalar faol bo‘lmadi”. Strukturali debrifing esa dalilni talqindan ajratishga undaydi. Masalan, “Qaysi kuzatilgan fakt sizni shunday xulosaga olib keldi?”, “Talabalar javobidagi o‘zgarish siz qo‘llagan usul bilan qanday bog‘langan?”, “Boshqa sabab bo‘lishi mumkinmi?” kabi savollar pedagogik hodisaga ko‘p omilli qarashni shakllantiradi. Bu esa refleksiyani hissiy taassurotdan dalillangan tahlil darajasiga olib chiqadi.

Uchinchidan, debrifing nazariya va amaliyot o‘rtasida vositachilik qiladi. Bo‘lajak o‘qituvchi amaliyotda kuzatgan hodisasini pedagogik tushuncha, prinsip yoki qonuniyat bilan bog‘laganida tajriba konseptuallashadi. Masalan, sinfdagi faollik pasayishini faqat “o‘quvchilar qiziqmadi” deb izohlash o‘rniga,

motivatsiya, kognitiv yuklama, instruktsiya aniqligi yoki o‘zaro ta’sir strukturasiga oid nazariy tushunchalar bilan tahlil qilish mumkin. Shu yo‘l bilan talaba o‘z tajribasiga tashqi nazariy “yorliq” qo‘ymaydi, balki nazariyani vaziyatni tushuntirish vositasiga aylantiradi.

To‘rtinchidan, refleksiv debrifing muqobil pedagogik qarorlarni ishlab chiqishga imkon beradi. Refleksiya faqat “nima noto‘g‘ri bo‘ldi?” savolida tugasa, u retrospektiv tahlil bo‘lib qoladi. Kasbiy refleksiyaning rivojlangan shakli esa “keyingi safar nima qilaman va nima uchun?” savoliga olib kelishi kerak. Shu sababli debrifingda kamida ikki-uch muqobil qarorni ishlab chiqish, ularning ehtimoliy natijalarini solishtirish va tanlangan variantni nazariy yoki empirik dalil bilan asoslash zarur.

Beshinchidan, debrifing refleksiyani transfer qiladi. Bir martalik vaziyatdan olingan xulosa o‘sha voqeaning o‘ziga bog‘lanib qolsa, uning kasbiy rivojlanish qiymati cheklangan bo‘ladi. “Bu xulosani boshqa sinfda, boshqa yoshdagi o‘quvchilar bilan yoki boshqa fan vaziyatida qanday qo‘llash mumkin?” kabi savollar refleksiv bilimni yangi sharoitga ko‘chirishni ta’minlaydi. Shu tariqa talaba alohida epizoddan umumlashtirilgan pedagogik prinsipga o‘tadi.

1-jadval.

Refleksiv debrifingning kasbiy refleksiyani rivojlantirish imkoniyatlari

Bosqich	**Yetakchi savol**	**Rivojlanadigan refleksiv amal**	**Kutiladigan pedagogik natija**
Tajribani tiklash	Nima sodir bo‘ldi?	Faktni tavsiflash, voqea ketma-ketligini tiklash	Tajribaning aniq va xolis tasviri
Talqin qilish	Nega shunday bo‘ldi?	Sabab-oqibatni aniqlash, taxminlarni ochish	Pedagogik vaziyatning mazmunini anglash
Nazariya bilan bog‘lash	Qaysi tushuncha yoki prinsip bu holatni izohlaydi?	Konseptuallashtirish, dalillash	Nazariya va amaliyot integratsiyasi
Muqobil qaror	Yana qanday yo‘l tutish mumkin edi?	Variantlarni taqqoslash va asoslash	Pedagogik qaror repertuarining kengayishi

Transfer	Keyingi vaziyatda nimani o‘zgartiraman?	Umumlashtirish, rejalashtirish	Refleksiyadan kelajak faoliyatiga o‘tish

Mazkur ketma-ketlik debrifingni “hisobot berish” shaklidan “ma’no ishlab chiqish” jarayoniga aylantiradi. Bunda fasilitator tayyor hukm bermasligi, balki dalil va sabablar orqali talabaning o‘zi xulosa chiqarishiga sharoit yaratishi muhim. Refleksiya sifati savolning murakkabligi bilan emas, savolning talabaning real tajribasiga bog‘langanligi, dalil talab qilishi va keyingi harakatga olib borishi bilan belgilanadi.

Tahlil natijasida refleksiv debrifingni samarali tashkil etish uchun besh pedagogik shart ajratildi: 1) psixologik xavfsiz va ayblovsiz muhit; 2) debrifingning oldindan ma’lum strukturasi; 3) fikrlarni kuzatilgan dalil yoki artefaktlar bilan asoslash (video, dars ishlanmasi, o‘quvchi javobi, kuzatuv qaydi); 4) fasilitatorning hukm beruvchi emas, savol beruvchi pozitsiyasi; 5) yakunda individual “keyingi harakat” qarorini belgilash. Mazkur shartlar bajarilganda debrifing baholash jarayonidan o‘rganish jarayoniga aylanadi. Refleksiv debrifingning pedagogik qiymati, avvalo, uning kasbiy refleksiyani konkret faoliyatga bog‘lashidadir. Refleksiya mavhum “o‘z ustida ishlash” sifatida emas, ma’lum vaziyat, qaror va natija o‘rtasidagi aloqani qayta ko‘rish sifatida tashkil etilganda kasbiy rivojlanishga xizmat qiladi. Bu fikr Schönning refleksiv amaliyot konsepsiyasi [1], Kolbning tajribaviy o‘rganish sikli [2] va Korthagenning nazariya–amaliyot integratsiyasiga oid qarashlari [5] bilan mos keladi. Shu bilan birga, refleksiv debrifingni har qanday “muhokama” bilan tenglashtirish metodik xato bo‘ladi. Debrifing samarali bo‘lishi uchun uchta chegara saqlanishi zarur. Birinchisi, tavsif bilan tahlil o‘rtasidagi chegara: voqeani qayta aytish refleksiya uchun material beradi, ammo o‘zi refleksiya emas. Ikkinchisi, baholash bilan o‘rganish o‘rtasidagi chegara: debrifingda “to‘g‘ri/noto‘g‘ri” hukmi ustun bo‘lsa, talaba o‘z qarorini himoya qilishga o‘tadi va chuqur tahlil kamayadi. Uchinchisi, hissiy reaksiyani kasbiy xulosadan ajratish: “o‘zimni noqulay his qildim” muhim ma’lumot, lekin undan “nima uchun?”, “bu qarorimga qanday ta’sir qildi?” va “keyingi safar nima qilaman?” savollari orqali pedagogik ma’no hosil qilinishi kerak.

O‘qituvchi tayyorlash bo‘yicha zamonaviy simulyatsion tadqiqotlar ham aynan debrifing va hamkorlikdagi tahlilni kasbiy o‘rganishning muhim komponenti sifatida ko‘rsatadi. H.Flavian va O.Levin bo‘lajak o‘qituvchilar bilan olib borgan tadqiqotida simulyatsiya jarayoni va tengdoshlar fikri professional o‘zlikni anglash va kelajakdagi vaziyatlar uchun variantlarni ko‘ra

olishga yordam berganini qayd etadi [9]. O.Levin va hammualliflar tomonidan ishlab chiqilgan SLOTE o‘lchovida simulyatsion o‘rganish natijalari kommunikativ ko‘nikmalar, hamkorlikdagi o‘rganish va emotsional o‘zini anglash kabi tarkiblar bilan bog‘langan [10]. K.Pytash va D.Morgan esa debrifing suhbatlarida bo‘lajak o‘qituvchilar pedagogik bilimni birgalikda qurishi va keyingi o‘qitish qarorlarini qayta ko‘rib chiqishini ko‘rsatgan [11]. Bu dalillar refleksiv debrifingni pedagogik amaliyot, mikrodars, rolli vaziyat, simulyatsiya yoki videokuzatuvdan keyin qo‘llash istiqbolli ekanini ko‘rsatadi. Refleksiv debrifingni oliy pedagogik ta’limga joriy etishda uning baholash tizimi bilan munosabatini ham ehtiyotkorlik bilan qurish zarur. Agar talaba debrifingdagi ochiq tan olishi salbiy bahoga aylanishidan xavotir olsa, u xatolarni yashirishga va ijtimoiy maqbul javob berishga moyil bo‘ladi. Shu sababli shakllantiruvchi debrifingda refleksiyaning “xatosizligi” emas, tahlilning dalillanganligi, muqobil qarorlarning mavjudligi, nazariya bilan bog‘lanishi va keyingi harakatning aniqligi baholanishi maqsadga muvofiq. Bunday yondashuv xatoni jazolash obyektidan kasbiy o‘rganish manbaiga aylantiradi.

Refleksiv debrifing bo‘lajak o‘qituvchilarning kasbiy refleksiyasini rivojlantirish uchun yuqori pedagogik salohiyatga ega bo‘lgan strukturali o‘rganish vositasidir. Uning asosiy afzalligi pedagogik tajribani qayta hikoya qilish bilan cheklanmasdan, tajribaning sabablarini ochish, nazariy bilimlar bilan bog‘lash, muqobil qarorlarni ishlab chiqish va olingan xulosani yangi vaziyatlarga ko‘chirishga imkon berishidadir. Nazariy tahlil asosida refleksiv debrifingning besh imkoniyati tajribani verbalizatsiya qilish, sabab-oqibatli tahlil, nazariya va amaliyotni integratsiyalash, muqobil pedagogik qarorlarni loyihalash hamda transfer kasbiy refleksiyani rivojlantirishning izchil mantiqini tashkil etishi aniqlandi. Shu asosda debrifingni “tajribani tiklash – talqin qilish – nazariya bilan bog‘lash – muqobil qaror – transfer” ketma-ketligida tashkil etish taklif qilinadi. Mazkur yondashuv pedagogik amaliyot, mikrodars, simulyatsiya, keys va videokuzatuv kabi faoliyatlardan keyin qo‘llanilganda bo‘lajak o‘qituvchining tajribadan ongli ravishda o‘rganish kompetensiyasini kuchaytirishi mumkin. Keyingi tadqiqotlarda ushbu strukturani empirik sinovdan o‘tkazish, refleksiya sifatini o‘lchash mezonlarini validatsiya qilish va turli pedagogik vaziyatlarda uning samaradorligini solishtirish maqsadga muvofiq.

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ZAMONAVIY TA’LIM JARAYONIDA RAQAMLI TEXNOLOGIYALAR VA SUN’IY INTELLEKTDAN FOYDALANISHNING PEDAGOGIK-PSIXOLOGIK XUSUSIYATLARI

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Annotatsiya: *Ushbu maqolada zamonaviy ta’lim jarayonida raqamli texnologiyalar va sun’iy intellekt tizimlaridan foydalanishning pedagogik-psixologik jihatlari tahlil qilingan. Tadqiqotda o‘quv jarayoniga raqamli vositalarning integratsiyalashuvi o‘quvchilarning kognitiv faolligi, mustaqil ta’lim olish ko‘nikmalari hamda pedagog-o‘quvchi o‘rtasidagi o‘zaro munosabatlarga qanday ta’sir ko‘rsatishi ko‘rib chiqilgan. Xorijiy va mahalliy manbalar tahlili asosida raqamli ta’limning afzalliklari, shuningdek, undan foydalanishda yuzaga keladigan pedagogik-psixologik xavflar aniqlangan. Tadqiqot natijalari o‘qituvchilarning kasbiy tayyorgarligini oshirish, ta’lim mazmunini raqamlashtirish jarayonini ilmiy asoslash uchun amaliy tavsiyalar ishlab chiqishga xizmat qiladi.*

Kalit so‘zlar: *raqamli ta’lim, sun’iy intellekt, pedagogik texnologiya, kognitiv faollik, mustaqil ta’lim, ta’lim sifati, individuallashtirilgan ta’lim.*

Аннотация: *В статье анализируются педагогико-психологические аспекты использования цифровых технологий и систем искусственного интеллекта в современном образовательном процессе. Рассмотрено влияние интеграции цифровых средств обучения на когнитивную активность обучающихся, навыки самостоятельного обучения, а также на характер взаимодействия между педагогом и учащимся. На основе анализа зарубежных и отечественных источников выявлены преимущества цифрового образования, а также потенциальные педагогико-психологические риски. Результаты исследования могут быть использованы для повышения профессиональной подготовки педагогов и научного обоснования процесса цифровизации содержания образования.*

Ключевые слова: *цифровое образование, искусственный интеллект, педагогическая технология, когнитивная активность, самостоятельное обучение, качество образования, индивидуализация обучения.*

Abstract: *This article examines the pedagogical and psychological aspects of using digital technologies and artificial intelligence systems in the modern educational process. It considers how the integration of digital tools into the learning process affects students' cognitive activity, self-directed learning skills, and teacher-student interaction. Based on an analysis of foreign and domestic sources, the advantages of digital education as well as potential pedagogical and psychological risks are identified. The findings can be used to improve teachers' professional training and to provide a scientific basis for the digitalization of educational content.*

Keywords: *digital education, artificial intelligence, pedagogical technology, cognitive activity, self-directed learning, quality of education, personalized learning.*

KIRISH

So‘nggi o‘n yillikda jahon ta’lim tizimida kechayotgan raqamli transformatsiya jarayoni pedagogika fanining nazariy-metodologik asoslarini tubdan yangilamoqda. Internet tarmog‘ining keng qamrovliligi, mobil qurilmalarning ommalashuvi va, eng muhimi, sun’iy intellektga asoslangan dasturiy vositalarning ta’lim muhitiga faol kirib kelishi o‘quv jarayonining barcha bo‘g‘inlariga – mazmun, metod, shakl va nazorat tizimlariga – sezilarli ta’sir ko‘rsatmoqda. Bu jarayon nafaqat texnologik, balki chuqur pedagogik-psixologik xususiyatga ega bo‘lib, o‘quvchi shaxsining bilim olish, fikrlash va o‘zini o‘zi boshqarish mexanizmlarini qayta shakllantirmoqda.

Xalqaro tadqiqotchilar tomonidan o‘tkazilgan tizimli tahlillar shuni ko‘rsatadiki, sun’iy intellekt asosidagi ta’lim tizimlari (Artificial Intelligence in Education, AIEd) borasidagi ilmiy nashrlar soni so‘nggi o‘n yilda keskin oshgan [8; 9], biroq bu texnologik yutuqlarning pedagogik nazariya bilan uzviy bog‘liqligi hali yetarli darajada ta’minlanmagan. Xususan, moslashuvchan (adaptiv) o‘qitish tizimlari, aqlli repetitorlik dasturlari va suhbat-botlar (chat-bot) shaklidagi yordamchi vositalarning amaliyotga joriy etilishi tezlashgan bo‘lsa-da, ularning o‘quvchining kognitiv rivojlanishi, motivatsion holati va ijtimoiy-emotsional farovonligiga ta’sirini har tomonlama ilmiy asoslash borasida jiddiy bo‘shliqlar saqlanib qolmoqda.

O‘zbekiston Respublikasida ham ta’lim tizimini raqamlashtirish va sun’iy intellekt texnologiyalarini joriy etish davlat siyosati darajasida qo‘llab-quvvatlanmoqda [5; 6]. Xususan, mamlakatimizda sun’iy intellekt

texnologiyalarini rivojlantirish bo‘yicha qabul qilingan strategik hujjatlar ta’lim sohasida raqamli vositalardan foydalanishning huquqiy-tashkiliy asoslarini belgilab bermoqda. Shu bilan birga, amaliyotchi pedagoglar va ta’lim menejerlari ushbu vositalarni qanday pedagogik asosda, qaysi metodik yondashuvlar orqali qo‘llash lozimligi haqida yetarli ilmiy-uslubiy tavsiyalarga ega emas, bu esa mazkur mavzuni tadqiq etishning dolzarbligini yanada oshiradi.

Muammoning dolzarbligi, raqamli texnologiyalar va sun’iy intellekt vositalarining ta’lim jarayoniga integratsiyalashuvi bir tomondan ta’lim sifatini oshirish, individuallashtirish va samaradorlikni kuchaytirish imkoniyatlarini ochsa, ikkinchi tomondan o‘quvchining mustaqil fikrlash, diqqatni jamlash va ijtimoiy muloqot ko‘nikmalariga nisbatan yangi turdagi psixologik xavflarni yuzaga keltirmoqda. Ushbu ikki tomonlama ta’sirni ilmiy jihatdan muvozanatli tahlil qilish zaruriyati mazkur tadqiqotning asosiy muammosini tashkil etadi.

Tadqiqotning maqsadi – zamonaviy ta’lim jarayonida raqamli texnologiyalar va sun’iy intellekt tizimlaridan foydalanishning pedagogik-psixologik xususiyatlarini ilmiy jihatdan tizimlashtirish, ularning o‘quvchi shaxsini rivojlantirishga ko‘rsatadigan ijobiy va salbiy ta’sirlarini aniqlash hamda ushbu vositalardan samarali foydalanish bo‘yicha ilmiy-amaliy tavsiyalar ishlab chiqishdan iborat.

Ushbu maqsadga erishish uchun quyidagi vazifalar qo‘yildi: birinchidan, mavzuga oid mahalliy va xorijiy ilmiy adabiyotlarni izchil tahlil qilish va tizimlashtirish; ikkinchidan, raqamli ta’lim vositalarining o‘quvchilarning kognitiv faolligi, motivatsiyasi va mustaqil ta’lim olish ko‘nikmalariga ta’sir ko‘rsatish mexanizmlarini aniqlash; uchinchidan, sun’iy intellekt asosidagi tizimlarni qo‘llashda yuzaga keladigan pedagogik-psixologik xavf omillarini tavsiflash; to‘rtinchidan, pedagoglar va ta’lim muassasalari uchun amaliy tavsiyalar shaklida ilmiy-uslubiy takliflar ishlab chiqish.

Tadqiqotning ilmiy yangiligi, unda raqamli texnologiyalar va sun’iy intellektning ta’lim jarayoniga ta’siri faqat texnologik yoki faqat pedagogik nuqtayi nazardan emas, balki pedagogika va psixologiya fanlari kesishmasida, ya’ni ikki tomonlama – imkoniyat va xavf tahlili nuqtayi nazaridan yoritilgan. Maqolaning keyingi qismlari quyidagicha tashkil etilgan: ikkinchi bo‘limda tadqiqot materiallari va metodlari, uchinchi bo‘limda tahlil natijalari, to‘rtinchi bo‘limda ularning muhokamasi, so‘nggi bo‘limda esa xulosa va amaliy tavsiyalar keltirilgan.

MATERIALLAR VA METODLAR

Tadqiqot nazariy-analitik xarakterga ega bo‘lib, uning metodologik asosini ilmiy adabiyotlarni tizimli tahlil qilish (systematic literature analysis)

tashkil etadi. Manbalarni tanlashda quyidagi mezonlardan foydalanildi: (a) nashr yili 2015-yildan keyin bo‘lishi; (b) mavzu bevosita raqamli ta’lim texnologiyalari, sun’iy intellekt asosidagi o‘qitish tizimlari yoki ularning pedagogik-psixologik ta'siriga oid bo‘lishi; (v) manba taqrizlangan ilmiy jurnal, monografiya yoxud xalqaro tashkilot (UNESCO, OECD kabi) hisoboti shaklida bo‘lishi. Ushbu mezonlarga ko‘ra xalqaro ilmiy bazalarda (Scopus, Web of Science, Google Scholar) hamda O‘zbekiston Oliy attestatsiya komissiyasi ro‘yxatidagi jurnallarda e'lon qilingan manbalar tanlab olindi.

Tadqiqot uch bosqichda amalga oshirildi. Birinchi – tayyorgarlik bosqichida mavzuga oid kalit so‘zlar (raqamli ta’lim, sun’iy intellekt, adaptiv o‘qitish, kognitiv faollik, ta'limni individuallashtirish) asosida manbalar qidirildi va dastlabki saralash o‘tkazildi. Ikkinchi – tahlil bosqichida tanlangan manbalar mazmun-mohiyati bo‘yicha tematik guruhlarga ajratildi: (1) ta’limni individuallashtirish va moslashuvchan tizimlar; (2) motivatsiya va qayta aloqa mexanizmlari; (3) pedagogning kasbiy faoliyati transformatsiyasi; (4) psixologik xavf omillari. Uchinchi – sintez bosqichida har bir tematik guruh bo‘yicha umumlashtirilgan xulosalar shakllantirildi va ular o‘zaro qiyosiy tahlil qilindi.

Tadqiqotda qo‘llanilgan asosiy metodlar quyidagilardan iborat: ilmiy adabiyotlarni tahlil qilish va umumlashtirish metodi, qiyosiy-tipologik tahlil metodi, tematik kontent-tahlil hamda mavhumlashtirish va tizimlashtirish metodlari. Bundan tashqari, xulosalarni shakllantirishda induktiv mulohaza yuritish usulidan foydalanildi – ya’ni alohida manbalarda keltirilgan xususiy holatlar umumlashtirilib, mavzu bo‘yicha yaxlit pedagogik-psixologik manzara hosil qilindi. Tadqiqot chegaralari sifatida shuni ta’kidlash lozimki, ushbu ish empirik (so‘rovnoma yoki pedagogik eksperiment asosidagi) tadqiqot emas, balki nazariy-analitik xususiyatga ega bo‘lib, uning natijalari kelgusi empirik tadqiqotlar uchun nazariy asos bo‘lib xizmat qilishi mo‘ljallangan.

NATIJALAR

O‘tkazilgan tizimli tahlil natijalari to‘rtta asosiy tematik yo‘nalish bo‘yicha guruhlashtirildi. Quyida har bir yo‘nalish bo‘yicha aniqlangan natijalar keltiriladi.

1. Ta’limni individuallashtirish va moslashuvchan tizimlar. Tahlil qilingan manbalarda ta’kidlanishicha, sun’iy intellekt asosidagi moslashuvchan (adaptiv) o‘quv platformalari har bir o‘quvchining bilim darajasi, o‘zlashtirish sur’ati va individual ehtiyojlariga mos ravishda o‘quv materialini taqdim etish imkoniyatiga ega. Bunday tizimlar o‘quvchining oldingi natijalarini tahlil qilib, keyingi topshiriqlar murakkablik darajasini avtomatik tarzda moslashtiradi, bu

esa an’anaviy “barchaga bir xil” yondashuvdan farqli o‘laroq, har bir o‘quvchi uchun alohida ta’lim traektoriyasini shakllantirish imkonini beradi [10].

2. Motivatsiya va qayta aloqa mexanizmlari. Tahlil natijalari shuni ko‘rsatadiki, raqamli ta’lim vositalarining muhim pedagogik afzalliklaridan biri – o‘quvchiga tezkor va aniq qayta aloqa (fikr-mulohaza) berish qobiliyatidir. Bu o‘z navbatida, o‘quvchida o‘z xatolarini darhol anglash va tuzatish imkoniyatini yaratadi, natijada o‘quv faoliyatiga bo‘lgan ichki motivatsiya kuchayadi. Bir qator manbalarda, ayniqsa generativ sun’iy intellekt vositalari (masalan, matn va til modellariga asoslangan yordamchilar) yordamida amalga oshirilgan yozma ishlarni tahlil qilish va shaxsiylashtirilgan tavsiyalar berish amaliyoti alohida ta’kidlangan [4].

3. Pedagogning kasbiy faoliyatining qayta shakllanishi. Adabiyotlar tahliliga ko‘ra, raqamli texnologiyalarning ta’lim jarayoniga kirib kelishi pedagogning kasbiy funksiyalarini butunlay bekor qilmaydi, balki uning mazmunini o‘zgartiradi. Rutina xarakterdagi nazorat, baholash va ma’lumot uzatish vazifalarining bir qismi avtomatlashtirilgan tizimlarga yuklatilishi natijasida o‘qituvchi tarbiyaviy ishlarga, individual maslahat berishga hamda o‘quvchilarning ijtimoiy-emotsional rivojlanishiga ko‘proq e’tibor qaratish imkoniyatiga ega bo‘lmoqda. Shu bilan birga, manbalarda o‘qituvchilarning raqamli savodxonlik darajasi hali yetarli emasligi va bu borada maxsus kasbiy tayyorgarlik zarurligi alohida qayd etilgan [2].

4. Psixologik xavf omillari. Tahlil qilingan manbalarning muhim qismida raqamli texnologiyalardan foydalanish bilan bog‘liq salbiy psixologik oqibatlar ham yoritilgan. Xususan, ekran oldida o‘tkaziladigan vaqtning ortishi natijasida diqqatning barqarorligi pasayishi, raqamli vositalarga haddan ziyod tayanish oqibatida mustaqil tanqidiy fikrlash va muammoni hal qilish ko‘nikmalarining sustlashishi, shuningdek, o‘quvchi-o‘qituvchi o‘rtasidagi bevosita shaxslararo muloqotning kamayishi natijasida ijtimoiy-emotsional ko‘nikmalarning zaiflashishi xavfi ta’kidlangan. Bundan tashqari, sun’iy intellekt tizimlarida ma’lumotlar maxfiyligi, algoritmik shaffoflikning yetishmasligi va ta’lim natijalarini pedagogik nazorat qilish imkoniyatining cheklanganligi kabi muammolar ham aniqlandi [11; 12].

Umumlashtirilgan tahlil natijalari raqamli texnologiyalar va sun’iy intellekt vositalarining ta’lim jarayoniga ta’siri ikki qutbli xarakterga ega ekanligini ko‘rsatadi: bir tomondan individuallashtirish, motivatsiya va samaradorlikni oshirish imkoniyatlari, ikkinchi tomondan kognitiv mustaqillik va ijtimoiy-emotsional rivojlanishga nisbatan potensial xavflar mavjud.

MUHOKAMA

Olingan natijalarga ko‘ra, raqamli texnologiyalar va sun’iy intellekt vositalarining pedagogik samaradorligi ularning texnik imkoniyatlaridan ko‘ra, ko‘proq ulardan foydalanishning metodik jihatdan qanday tashkil etilishiga bog‘liq. Boshqacha aytganda, texnologiyaning o‘zi emas, balki uni qo‘llashning pedagogik strategiyasi hal qiluvchi ahamiyatga ega. Bu xulosa xalqaro tadqiqotchilar tomonidan ilgari surilgan fikr bilan mos keladi — ularning ta'kidlashicha, sun’iy intellektning ta’limnatijalariga ta'siri nazariy pedagogik asoslar bilan uzviy bog‘lanmagan holatlarda beqaror va prognoz qilib bo‘lmaydigan xarakterga ega bo‘ladi [8].

Individuallashtirish va psixologik xavflar o‘rtasidagi ziddiyatli munosabat alohida muhokamaga loyiq. Bir tomondan, moslashuvchan tizimlar o‘quvchining o‘ziga xos ehtiyojlariga mos ta’lim taqdim etadi, bu esa L.S.Vigotskiyning “yaqin rivojlanish zonasi” g‘oyasi bilan nazariy uyg‘unlikka ega [13]. Ikkinchi tomondan, ushbu tizimlarga haddan ziyod tayanish o‘quvchining mustaqil qaror qabul qilish va muammoni mustaqil hal qilish tajribasini kamaytirishi mumkin. Demak, moslashuvchan texnologiyalardan foydalanishda “qo‘llab-quvvatlash” bilan “mustaqillikni cheklash” o‘rtasidagi nozik chegarani pedagogik jihatdan to‘g‘ri belgilash zarurati yuzaga keladi.

Shuningdek, tahlil natijalari o‘qituvchi kasbiy faoliyatining o‘zgarishi masalasida ham muhim amaliy xulosalarga olib keladi. Agar pedagoglar raqamli vositalarni qo‘llashning metodik asoslaridan yetarli xabardor bo‘lmasa, bu texnologiyalar samarali pedagogik vosita o‘rniga, o‘quv jarayonini murakkablashtiruvchi omilga aylanishi mumkin. Shu sababli, malaka oshirish tizimida sun’iy intellekt asosidagi vositalardan foydalanish metodikasiga alohida e’tibor qaratish zaruriyatini yuzaga keltiradi [1].

O‘zbekiston sharoitida ushbu masalaning yana bir muhim jihati – milliy til va madaniy xususiyatlarni hisobga oluvchi raqamli ta’lim resurslarining yetarli darajada rivojlanmaganligidir. Ko‘pgina xalqaro sun’iy intellekt tizimlari asosan boshqa tillar va boshqa ta’lim kontekstlari uchun mo‘ljallangan bo‘lib, ularni mahalliy ta’lim tizimiga mexanik tarzda joriy etish kutilgan pedagogik natijani bermasligi mumkin. Shu boisdan, milliy ta’lim ehtiyojlariga moslashtirilgan raqamli platformalar va tilga oid modellarni rivojlantirish alohida ilmiy-amaliy ahamiyat kasb etadi [7].

Tadqiqotning cheklovlari sifatida shuni ta’kidlash lozimki, mazkur ish nazariy-analitik xarakterga ega bo‘lganligi sababli, aniqlangan tendensiyalarni miqdoriy jihatdan tasdiqlash uchun kelgusida pedagogik eksperiment yoki so‘rovnoma asosidagi empirik tadqiqotlar o‘tkazilishi maqsadga muvofiqdir. Xususan, turli yosh guruhlari, ta’limbosqichlari va fan yo‘nalishlari bo‘yicha

raqamli vositalarning uzoq muddatli pedagogik-psixologik ta’sirini o‘rganish istiqbolli tadqiqot yo‘nalishi bo‘lib qolmoqda.

XULOSA VA TAVSIYALAR

O‘tkazilgan tadqiqot natijalariga asoslanib, quyidagi xulosalarga kelish mumkin:

1. Raqamli texnologiyalar va sun’iy intellekt vositalari zamonaviy ta’lim jarayonida ta’limni individuallashtirish, o‘quvchi motivatsiyasini oshirish va pedagogik faoliyat samaradorligini ta’minlashning muhim vositasi hisoblanadi, biroq ularning pedagogik samaradorligi avtomatik ravishda kafolatlanmaydi.

2. Ushbu vositalarni qo‘llashda ijobiy pedagogik natijalar bilan bir qatorda, diqqat barqarorligining pasayishi, mustaqil tanqidiy fikrlash ko‘nikmalarining sustlashishi va ijtimoiy-emotsional aloqaning zaiflashishi kabi psixologik xavflar ham mavjud bo‘lib, bu holatlar pedagogik jarayonni loyihalashda albatta hisobga olinishi zarur.

3. Raqamli ta’lim vositalarining samaradorligi, avvalambor, pedagoglarning kasbiy-metodik tayyorgarligi darajasiga, ularning texnologiyani aniq pedagogik maqsadlarga muvofiq qo‘llay olish mahoratiga bog‘liq bo‘lib, texnologiya o‘qituvchini emas, balki uning pedagogik faoliyatini kuchaytiruvchi vosita sifatida qaralishi lozim.

4. Milliy ta’lim tizimida raqamli vositalarni joriy etishda mahalliy til va madaniy xususiyatlarni hisobga oluvchi platformalarni rivojlantirish alohida strategik ahamiyat kasb etadi.

5. Kelgusi tadqiqotlar sun’iy intellekt asosidagi ta’lim tizimlarini turli yosh guruhlari va ta’lim bosqichlarida qo‘llashning uzoq muddatli pedagogik-psixologik oqibatlarini empirik (eksperimental va so‘rovnoma asosidagi) tarzda o‘rganishga qaratilishi maqsadga muvofiqdir.

Amaliy tavsiya sifatida quyidagilar taklif etiladi: (a) ta’lim muassasalarida raqamli texnologiyalarni joriy etish jarayonida o‘qituvchilar uchun maxsus metodik-malaka oshirish kurslarini tashkil etish; (b) o‘quvchilarning raqamli vositalardan foydalanish madaniyatini shakllantirishga qaratilgan pedagogik-psixologik monitoring tizimini yo‘lga qo‘yish; (v) sun’iy intellekt vositalaridan foydalanishning maqbul me’yorlarini (ekran vaqti, mustaqil ishlash ulushi) belgilovchi metodik ko‘rsatmalar ishlab chiqish; (g) milliy tilga moslashtirilgan ta’lim platformalarini yaratish bo‘yicha ilmiy-amaliy loyihalarni qo‘llab-quvvatlash.

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COMPOSITIONAL SOLUTIONS FOR THE USE OF NATIONAL DECORATIVE ELEMENTS IN MODERN INTERIORS

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Abstract: *This article analyzes the compositional possibilities of using national decorative elements in modern interior design. Particular attention is paid to the integration of geometric and floral ornaments, traditional plaster and wood carving, and other decorative elements of Uzbek applied arts into modern interior environments. The study examines the relationship between national decorative elements and such compositional principles as color harmony, rhythm, symmetry, proportion, and compositional balance. The article also discusses several approaches to adapting traditional decorative elements to the requirements of modern interior design. The results of the study demonstrate that the purposeful and balanced use of national decorative elements can enhance both the aesthetic and cultural expression of modern interiors.*

Annotatsiya: *Ushbu maqolada zamonaviy interyer dizaynida milliy dekorativ elementlardan foydalanishning kompozitsion imkoniyatlari tahlil qilinadi. Geometrik va o'simliksimon naqshlar, an'anaviy ganch va yog'och o'ymakorligi hamda o'zbek amaliy san'atining boshqa dekorativ elementlarini zamonaviy interyer muhitiga uyg'unlashtirishga alohida e'tibor qaratiladi. Tadqiqotda milliy dekorativ elementlarning rang uyg'unligi, ritm, simmetriya, proporsiya va kompozitsion muvozanat kabi kompozitsion tamoyillar bilan o'zaro bog'liqligi o'rganiladi. Shuningdek, an'anaviy dekorativ elementlarni zamonaviy interyer dizayni talablariga moslashtirishning bir qancha yondashuvlari ko'rib chiqiladi. Tadqiqot natijalari milliy dekorativ elementlardan maqsadli va muvozanatli foydalanish zamonaviy interyerlarning nafaqat estetik, balki madaniy ifodaliligini ham oshirishga xizmat qilishini ko'rsatadi.*

Аннотация: *В статье анализируются композиционные возможности использования национальных декоративных элементов в современном дизайне интерьера. Особое внимание уделяется интеграции геометрических и растительных орнаментов, традиционной гипсовой и*

деревянной резьбы, а также других элементов узбекского прикладного искусства в современную интерьерную среду. Исследуется взаимосвязь национальных декоративных элементов с такими композиционными принципами, как цветовая гармония, ритм, симметрия, пропорция и композиционное равновесие. В статье также рассматриваются различные подходы к адаптации традиционных декоративных элементов в соответствии с требованиями современного дизайна интерьера. Результаты исследования показывают, что целенаправленное и сбалансированное использование национальных декоративных элементов способствует повышению как эстетической, так и культурной выразительности современных интерьеров.

Keywords: *interior design, national decorative elements, national ornament, composition, Uzbek patterns, modern design, color, rhythm, proportion.*

Kalit so‘zlar: *interyer dizayni, milliy dekorativ elementlar, milliy ornament, kompozitsiya, o‘zbek naqshlari, zamonaviy dizayn, rang, ritm, proporsiya.*

Ключевые слова: *дизайн интерьера, национальные декоративные элементы, национальный орнамент, композиция, узбекские узоры, современный дизайн, цвет, ритм, пропорция.*

INTRODUCTION

Contemporary interior design is developing through the interaction of functionality, aesthetics, technology, materials, and cultural identity. In this context, the use of national decorative elements provides an opportunity to create interior environments that are visually expressive while maintaining a connection with cultural heritage. Interior design is not limited to the arrangement of furniture and decorative objects; it also involves the organization of space, the selection of materials, the relationship between visual elements, and the creation of an appropriate aesthetic environment (Ching & Binggeli, 2018). Uzbekistan has a rich tradition of decorative and applied arts. Its artistic heritage includes geometric and vegetal ornaments, architectural decoration, ganch carving, wood carving, textile patterns, ceramics, and other forms of decorative art. Uzbek architectural ornament has developed through different historical periods and demonstrates a variety of compositional structures, geometric systems, vegetal motifs, and decorative techniques (Rempel, 1961). These characteristics provide a significant artistic basis for the contemporary interpretation of national decorative elements.

Traditional Uzbek ornament is valuable not only because of its visual appearance but also because of its compositional organization. Geometric and vegetal motifs are often arranged according to principles of repetition, symmetry, proportion, rhythm, and balance. Historical examples of Uzbek decorative art demonstrate how floral and geometric forms can be organized within a unified ornamental structure (Rempel, 1961). A carved wooden door panel associated with the Timurid period and produced in present-day Uzbekistan, for example, contains both floral and geometric decorative zones, demonstrating the coexistence of different ornamental structures within a single composition (The Metropolitan Museum of Art, n.d.).

However, the introduction of national decorative elements into a contemporary interior requires careful adaptation. A traditional ornament cannot always be transferred directly into a modern space because contemporary interiors often use simplified forms, restrained color schemes, new materials, and different spatial requirements. Therefore, the main problem is not simply how to place a national ornament in an interior, but how to establish a harmonious relationship between traditional decoration and contemporary spatial composition.The purpose of this study is to examine compositional solutions for the use of national decorative elements in modern interiors. Particular attention is given to color harmony, rhythm, symmetry, proportion, balance, scale, material, and the relationship between decorative elements and the surrounding spatial environment.

MATERIALS AND METHODS

The research is based on the analysis of traditional Uzbek decorative art and contemporary principles of interior design. Historical and artistic examples of geometric and vegetal ornaments, ganch decoration, wood carving, and other forms of applied art were considered as sources for identifying compositional principles relevant to modern interiors.The study applies qualitative, comparative, and compositional methods of analysis. Qualitative analysis was used to identify the artistic characteristics of national decorative elements. Comparative analysis was applied to examine the relationship between traditional decorative principles and contemporary interior design requirements. Compositional analysis focused on rhythm, symmetry, proportion, balance, color, scale, and visual emphasis.

The research also considers the relationship between decorative elements and the spatial environment. Walls, partitions, ceilings, furniture, textiles, lighting, and finishing materials were considered as components that influence the perception of a decorative composition. This approach corresponds to the

understanding of interior design as an integrated process in which spatial organization, materials, furnishings, lighting, and visual elements interact with one another (Ching & Binggeli, 2018).

Historical examples were also used to understand the relationship between national decorative techniques and architectural space. Research on Central Asian artistic traditions documents the continued importance of wood carving in places such as Bukhara, Kokand, and Khiva (UNESCO, 1996). Such examples provide a cultural and artistic basis for considering traditional craftsmanship within contemporary design.

RESULTS

The analysis demonstrates that national decorative elements can be effectively incorporated into modern interiors when they are treated as components of the overall composition rather than as isolated decorative objects. One of the principal compositional solutions is the use of national ornament as a visual accent. Instead of covering an entire interior surface with complex patterns, a geometric or vegetal motif can be concentrated on a particular wall, decorative panel, partition, furniture element, ceiling detail, or textile surface. This approach allows the cultural character of the interior to be emphasized while maintaining visual clarity.

Another solution is the adaptation of traditional ornamental structures to contemporary geometric forms. Complex patterns can be simplified while retaining their characteristic rhythm and structural relationships. In this way, traditional motifs can be transformed into decorative panels, screens, wall compositions, furniture details, or repeated linear patterns.

The relationship between traditional ornament and modern materials is also important. Wood carving and ganch decoration can be used selectively in combination with contemporary materials such as glass, metal, stone, and modern finishing surfaces. Historical evidence demonstrates the artistic development of carved wood decoration in Central Asia, while contemporary interior design emphasizes the importance of selecting materials according to their visual, functional, and spatial characteristics (UNESCO, 1996; Ching & Binggeli, 2018).

Color is another important compositional factor. Traditional Uzbek decorative art contains a broad range of colors, but the direct transfer of an entire traditional color palette into a contemporary interior may produce excessive visual activity. A more controlled approach is to select one or several characteristic colors and combine them with neutral tones. This allows the national character of the interior to remain visible while supporting the restrained

aesthetic commonly associated with contemporary spaces.Rhythm is particularly important when national patterns are repeated. Repetition of a geometric or vegetal motif can establish visual continuity and organize the perception of space. However, the size and frequency of repetition should correspond to the scale of the room. Excessive repetition may dominate the composition, whereas controlled repetition can create order and visual movement.Symmetry and proportion provide additional possibilities for integrating traditional ornament. Many historical ornamental compositions demonstrate structured relationships between individual motifs and the whole composition (Rempel, 1961). In a contemporary interior, these relationships can be preserved without reproducing the entire historical form. Partial symmetry or balanced asymmetry may be used when it better corresponds to the spatial arrangement of furniture and architectural elements.

Scale is also significant. The dimensions of an ornamental motif should correspond to the size of the surface on which it is placed and to the scale of surrounding architectural and furniture elements. A small motif may lose its visual significance on a large surface, while an excessively large pattern may disturb the visual balance of the room. The research further demonstrates the importance of empty or relatively neutral space. A decorative element becomes more visually expressive when it is surrounded by sufficient visual space. Therefore, the relationship between decorated and undecorated surfaces should be considered as part of the overall composition.

DISCUSSION

The results indicate that the successful integration of national decorative elements depends on their thoughtful adaptation rather than their mechanical reproduction. The aim of contemporary interpretation is not to recreate a historical interior completely, but to preserve significant artistic characteristics while adapting them to present-day spatial and functional requirements. Three main approaches can be distinguished. The first is direct adaptation, in which a traditional motif remains recognizable while its scale, material, or location is modified. The second is stylistic simplification, in which a complex ornamental structure is reduced to its basic geometric or vegetal characteristics. The third is selective accentuation, in which one or several national elements become focal points within an otherwise restrained contemporary interior. The use of national decoration as an accent is particularly compatible with contemporary interior principles. A carved wooden panel, a ganch decorative element, a patterned textile, or a simplified national ornament can provide cultural identity without dominating the entire interior. Historical examples of Uzbek wood carving

demonstrate that floral and geometric motifs can coexist within carefully organized decorative zones (The Metropolitan Museum of Art, n.d.).

Material selection also influences the perception of national decoration. Wood can introduce natural texture and warmth, while ganch can provide a sculptural and relief-based character. Textiles contribute softness and color, whereas glass and metal can establish a visual contrast between traditional ornamental forms and contemporary materials. The selection and combination of materials should therefore be considered together with the functional requirements of the interior (Ching & Binggeli, 2018).

The functional purpose of the interior should also influence the intensity of national decoration. Residential spaces may permit a more expressive use of ornamental elements, while educational, administrative, commercial, or other public spaces may require a more restrained approach. Consequently, the same national motif may require different compositional treatment depending on the function, scale, and visual character of the interior. An important aspect of contemporary interpretation is the preservation of cultural identity. National decorative elements should not be treated merely as fashionable visual symbols. Their structural characteristics, ornamental principles, and historical associations can provide deeper cultural meaning. The long development of Uzbek architectural ornament demonstrates that decorative forms are closely connected with architectural space and artistic traditions (Rempel, 1961).

At the same time, contemporary technologies provide new possibilities for interpreting traditional ornament. Digital modelling, computer-controlled cutting, laser technologies, and modern printing methods can make it possible to reproduce or transform ornamental structures in new materials and forms. Such technologies can change the method of production while maintaining the recognizable visual principles of traditional ornament. Thus, the most productive approach is a dialogue between tradition and contemporary design. Traditional ornamental structures can provide cultural and compositional foundations, while modern materials, technologies, spatial planning, and simplified forms can provide new methods of expression.

CONCLUSION

The study demonstrates that national decorative elements have significant potential for enriching contemporary interior design. Uzbek geometric and vegetal ornaments, ganch decoration, wood carving, textiles, and other forms of applied art can be incorporated into modern interiors through carefully planned compositional solutions.The analysis shows that color harmony, rhythm, symmetry, proportion, scale, balance, and visual emphasis are important

principles for achieving a harmonious relationship between national decoration and contemporary interior space. The effectiveness of a decorative element depends not only on its artistic qualities but also on its relationship with architectural space, materials, furniture, lighting, and the functional purpose of the interior.

The study also demonstrates that contemporary interpretation does not require the complete reproduction of traditional interiors. Simplification of ornamental forms, modification of scale, selective use of decorative accents, combination with modern materials, and controlled color relationships can create a balance between cultural heritage and contemporary design. Consequently, national decorative elements can function simultaneously as aesthetic components and as carriers of cultural identity. Their thoughtful integration into modern interiors can contribute to the preservation of traditional artistic values while creating new possibilities for contemporary design expression.

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BO‘LAJAK O‘QITUVCHILARDA PEDAGOGIK QAROR QABUL QILISH KOMPETENSIYASINING MAZMUNI VA TARKIBIY KOMPONENTLARI

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Annotatsiya. *Maqolada bo‘lajak o‘qituvchilarda pedagogik qaror qabul qilish kompetensiyasining pedagogik mohiyati, mazmuni va strukturaviy tarkibi nazariy-metodologik jihatdan asoslangan. Pedagogik qaror qabul qilish o‘qituvchining vaziyatni diagnostika qilish, muhim dalillarni ajratish, muqobil yechimlarni ishlab chiqish, ularning ehtimoliy oqibatlarini prognozlash, etik va didaktik jihatdan maqbul variantni tanlash hamda natijani refleksiv baholashini birlashtiruvchi integrativ kasbiy kompetensiya sifatida talqin qilinadi. Sun’iy intellekt vositalari qaror uchun axborot va alternativalar taklif qilishi mumkinligi, biroq yakuniy pedagogik hukm, javobgarlik va etik nazorat o‘qituvchida qolishi zarurligi ko‘rsatiladi. Mualliflik yondashuvida kompetensiyaning motivatsion-qadriyatli, kognitiv-analitik, diagnostik-interpretativ, prognostik-qaroriy va refleksiv-etik komponentlari ajratilgan.*

Kalit so‘zlar: *pedagogik qaror, bo‘lajak o‘qituvchi, kompetensiya, pedagogik hukm, diagnostika, refleksiya, sun’iy intellekt, professional agentlik.*

Аннотация. *В статье теоретико-методологически обоснованы педагогическая сущность, содержание и структурные компоненты компетенции принятия педагогических решений у будущих учителей. Данная компетенция рассматривается как интегративная профессиональная способность диагностировать педагогическую ситуацию, выделять значимые данные, разрабатывать альтернативные решения, прогнозировать их последствия, выбирать этически и дидактически обоснованный вариант и рефлексивно оценивать результат. Показано, что инструменты искусственного интеллекта могут расширять информационную основу и предлагать альтернативы, однако итоговое педагогическое суждение, ответственность и этический контроль должны сохраняться за учителем. Выделены мотивационно-ценностный, когнитивно-аналитический, диагностико-интерпретационный, прогностико-решенческий и рефлексивно-этический компоненты.*

Ключевые слова: *педагогическое решение, будущий учитель, компетенция, педагогическое суждение, диагностика, рефлексия, искусственный интеллект, профессиональная агентность.*

Abstract. *The article provides a theoretical and methodological justification of the pedagogical essence, content and structural components of pedagogical decision-making competence in pre-service teachers. This competence is interpreted as an integrative professional capacity to diagnose a pedagogical situation, identify relevant evidence, generate alternative solutions, anticipate possible consequences, select an ethically and didactically justified option, and reflectively evaluate the outcome. Artificial intelligence tools may broaden the information base and suggest alternatives, but final pedagogical judgment, accountability and ethical control should remain with the teacher. The proposed structure includes motivational-axiological, cognitive-analytical, diagnostic-interpretive, prognostic-decisional, and reflective-ethical components.*

Keywords: *pedagogical decision, pre-service teacher, competence, pedagogical judgment, diagnosis, reflection, artificial intelligence, professional agency.*

Zamonaviy o‘qituvchi faoliyatining murakkabligi faqat bilimni yetkazish bilan emas, balki doimiy ravishda qaror qabul qilish zarurati bilan belgilanadi. Dars maqsadini aniqlash, metod va topshiriqlarni tanlash, o‘quvchi javobini talqin qilish, o‘zlashtirishdagi qiyinchilik sabablarini aniqlash, baholash usulini belgilash, sinfdagi konfliktni boshqarish yoki individual yondashuvni tanlashning har biri pedagogik qaror hisoblanadi. Shavelson va Stern o‘qituvchining fikrlashi, hukmi va qarorlari ta’lim jarayonidagi xatti-harakatlar bilan uzviy bog‘liqligini ko‘rsatgan [3]. Demak, qaror qabul qilish o‘qituvchilik kasbining epizodik emas, balki uzluksiz funksiyasidir. Raqamli va sun’iy intellekt texnologiyalarining ta’limga kirib kelishi bu funksiyani yanada murakkablashtirmoqda. UNESCOning sun’iy intellekt bo‘yicha o‘qituvchilar kompetensiyasi doirasi inson markazliligi, etik mas’uliyat, AI asoslari, AI pedagogikasi va professional rivojlanishni bir butun tizim sifatida ko‘rsatadi [1]. Generativ sun’iy intellekt o‘qituvchiga dars ssenariysi, savol, baholash mezoni yoki muqobil metodlar taklif qilishi mumkin, biroq u konkret sinfning ijtimoiy-emotsional konteksti, o‘quvchining individual ehtiyoji va pedagogik qarorning uzoq muddatli oqibatlarini avtomatik tarzda to‘liq anglay olmaydi [2]. Shu sababli bo‘lajak o‘qituvchining vazifasi AI tavsiyasini qabul qilish emas, balki uni dalil, kontekst, maqsad va kasbiy qadriyatlar asosida baholashdir.

Mazkur maqolaning maqsadi bo‘lajak o‘qituvchilarda pedagogik qaror qabul qilish kompetensiyasining mazmunini aniqlashtirish, uning tarkibiy komponentlarini tizimlashtirish hamda sun’iy intellekt bilan qo‘llab-quvvatlanadigan pedagogik faoliyat sharoitida ushbu kompetensiyaning funksional chegaralarini asoslashdan iborat.

Pedagogik qaror qabul qilishni tadqiq etish o‘qituvchi tafakkuri haqidagi klassik ishlarga borib taqaladi. Shavelson va Stern pedagogik hukm, rejalashtirish qarorlari va interaktiv qarorlarning o‘zaro bog‘liq modelini taklif qilgan [3]. Calderhead esa real dars jarayonida o‘qituvchi ko‘pincha tayyor variantlardan birini tanlashdan ko‘ra, vaziyatni tez talqin qilish va odatiy professional sxemalarni ishga tushirish orqali harakat qilishini ta’kidlagan [4]. Bu yondashuv pedagogik qaror qabul qilishni faqat mantiqiy tanlov emas, balki professional ko‘rish, talqin, tajriba va refleksiya birligi sifatida tushunishga asos beradi. Schönning refleksiv amaliyot konsepsiyasi mutaxassisning noaniq vaziyatlarda “harakat jarayonida fikrlashi” va keyinchalik o‘z qarorini qayta tahlil qilishi muhimligini ko‘rsatadi [5]. O‘qituvchi uchun bunday refleksiya ikki vazifani bajaradi: birinchidan, qabul qilingan qarorning natijasini baholaydi; ikkinchidan, keyingi o‘xshash vaziyatlar uchun professional bilimni boyitadi. Shu ma’noda pedagogik qaror kompetensiyasi yakuniy tanlov bilan tugamaydi, balki qaror natijasi haqida yangi bilim hosil qilish bilan davom etadi.

So‘nggi tadqiqotlar qaror qabul qilishni video-vaziyatlar, professional ko‘rish va ma’lumotlarga tayangan tahlil bilan bog‘lamoqda. Weyers va hammualliflar bo‘lajak o‘qituvchilarning sinfni boshqarish bo‘yicha qaror qabul qilishini video asosidagi topshiriqlar yordamida o‘lchash mumkinligini ko‘rsatgan; bunday qarorlar pedagogik bilim va vaziyatni idrok etish–talqin qilish ko‘nikmalari bilan bog‘liq [6]. Villeneuve va Bouchamma pedagogik qarorlarning ko‘p manbali ma’lumotlar, refleksiya va professional hamkorlikka tayanishini ochib bergan [7]. Becherning tadqiqotida esa o‘qituvchilar hukmi vaziyat, kontekstual asos, mulohaza va vositalar tuzilmasida namoyon bo‘lishi ko‘rsatilgan [8]. Metodologik jihatdan mazkur maqolada tizimli, kompetensiyaviy, faoliyatga yo‘naltirilgan va refleksiv yondashuvlardan foydalanildi. Ilmiy manbalar kontent-tahlil qilinib, “qaror qabul qilish”, “pedagogik hukm”, “professional ko‘rish”, “AI pedagogikasi” va “teacher agency” tushunchalarining funksional kesishmalari qiyoslandi. Natijada kompetensiya tarkibini belgilash uchun uch mezon qo‘llandi: komponent qaror jarayonining alohida funksiyasini ifodalashi; kuzatiladigan xatti-harakat bilan namoyon bo‘lishi; o‘qituvchi tayyorlash jarayonida maqsadli rivojlantirilishi va baholanishi mumkin bo‘lishi.

Tahlil natijasida “pedagogik qaror qabul qilish kompetensiyasi” tushunchasiga quyidagi ishchi ta’rif taklif etiladi: bu o‘qituvchining pedagogik vaziyatni maqsad va qadriyatlar nuqtayi nazaridan diagnostika qilish, relevant dalillarni tahlil etish, muqobil yechimlar ishlab chiqish, ularning ehtimoliy pedagogik va etik oqibatlarini prognozlash, asoslangan variantni tanlash, amalga oshirish va natijani refleksiv qayta baholashga imkon beruvchi integrativ kasbiy kompetensiyadir. Ta’rifda kompetensiyaning natijasi “to‘g‘ri javob” emas, balki kontekstga mos, dalillangan, mas’uliyatli va qayta ko‘rib chiqilishi mumkin bo‘lgan professional qaror ekanligi muhimdir. Kompetensiyaning tarkibiy modeli besh komponentdan iborat. Motivatsion-qadriyatli komponent o‘qituvchining nega va kim manfaatida qaror qilayotganini belgilaydi. Kognitiv-analitik komponent pedagogik bilimni vaziyatga safarbar etish, dalilni ajratish va muammoni to‘g‘ri formulalashga xizmat qiladi. Diagnostik-interpretativ komponent o‘quvchi xatti-harakati, sinf dinamikasi va ta’lim natijalaridagi muhim signallarni ko‘rish hamda ularning ehtimoliy sabablarini izohlashni qamrab oladi. Prognostik-qaroriy komponent muqobil yechimlar, oqibatlar va risklarni taqqoslab, amaliy harakat rejasini tanlashni ifodalaydi. Refleksiv-etik komponent esa qaror natijasini tahlil qilish, xatoni tan olish, qarorni tuzatish, shuningdek, algoritmik yoki ijtimoiy tarafkashlikni nazorat qilish vazifasini bajaradi.

1-jadval.

Pedagogik qaror qabul qilish kompetensiyasining tarkibiy komponentlari

Komponent	**Mazmuni**	**Kuzatiladigan namoyon bo‘lishi**
Motivatsion-qadriyatli	Pedagogik qarorni o‘quvchi manfaatlari, kasbiy mas’uliyat, adolat va insonparvarlik mezonlari asosida qabul qilishga ichki tayyorlik.	Qarorning maqsadini anglaydi; o‘quvchi manfaatini ustuvor qo‘yadi; javobgarlikni o‘z zimmasiga oladi.
Kognitiv-analitik	Pedagogik nazariya, metodika, baholash va sinf boshqaruvi bo‘yicha bilimlarni vaziyat tahliliga safarbar qilish.	Muammoni ajratadi; dalil va ma’lumotlarni solishtiradi; tegishli pedagogik bilimni qo‘llaydi.

Komponent	Mazmuni	Kuzatiladigan namoyon bo‘lishi
Diagnostik-interpretativ	Pedagogik vaziyatdagi muhim signallarni sezish, sabablarni kontekst bilan bog‘lab talqin qilish va ehtiyojlarni aniqlash.	Muhim faktlarni tanlaydi; sabab–oqibatni izohlaydi; biryoqlama xulosadan qochadi.
Prognostik-qaroriy	Muqobil yechimlarni ishlab chiqish, oqibatlarni oldindan baholash, optimal variantni tanlash va harakat rejasini belgilash.	Kamida ikki muqobil yaratadi; risk va foydani baholaydi; tanlovini dalillaydi; amalga oshirish ketma-ketligini tuzadi.
Refleksiv-etik	Qabul qilingan qaror natijasini tahlil qilish, xatolar va kognitiv og‘ishlarni tan olish, zarur bo‘lsa qarorni tuzatish.	Natijani mezon asosida baholaydi; AI yoki boshqa tashqi tavsiyalarni tanqidiy tekshiradi; etik cheklovlarni hisobga oladi.

Jadvaldagi komponentlar ketma-ket bosqichlar sifatida emas, balki o‘zaro bog‘langan funksional tizim sifatida talqin qilinishi lozim. Masalan, diagnostik tahlil qadriyatsiz bo‘lsa, o‘quvchi “muammo” sifatida stigmatizatsiya qilinishi mumkin; kognitiv tahlil refleksiyasiz bo‘lsa, o‘qituvchi avvalgi tajribasini mutlaq haqiqat deb qabul qilishi ehtimoli kuchayadi; muqobil yechimlar prognozsiz tanlansa, qisqa muddatli intizom uzoq muddatli motivatsiyaga zarar yetkazishi mumkin. Shu bois kompetensiya sifati bir komponentning kuchi bilan emas, ular o‘rtasidagi muvofiqlashuv bilan belgilanadi.

Pedagogik mahorat fanida ushbu kompetensiyani rivojlantirish uchun mikroo‘qitish, videovinyetka, keys-stadi, etik dilemma, muqobil ssenariy yaratish va “qarorni dalilla” topshiriqlari samarali metodik format bo‘la oladi. Masalan, bo‘lajak o‘qituvchiga bir xil vaziyat bo‘yicha uch xil AI tavsiyasi berilib, ulardan qaysi biri pedagogik maqsadga mosligini dalillar bilan asoslash, keyin tavsiyalarning yashirin farazlari va ehtimoliy risklarini aniqlash topshirilishi mumkin. Bu jarayon nafaqat texnologik savodxonlikni, balki professional hukm va javobgarlikni rivojlantiradi.

Taklif etilgan struktura pedagogik qaror qabul qilishni “metodni tanlash” darajasidan kengroq tushunishga imkon beradi. Qaror sifati avvalo vaziyatni qanday ko‘rish va izohlashga bog‘liq. Karabon bo‘lajak o‘qituvchilarning

shaxsiy tajribasi va “funds of knowledge”i pedagogik qarorlariga ta’sir qilishini ko‘rsatadi [9]. Demak, bo‘lajak o‘qituvchi o‘zining oldindan shakllangan stereotiplari va intuitiv taxminlarini refleksiv tekshirmasa, uning qarori nazariy bilimga ega bo‘lgan taqdirda ham biryoqlama bo‘lishi mumkin. Generativ AI bu muammoni ikki tomonlama kuchaytiradi: bir tomondan, u muqobil nuqtayi nazar va tezkor tahlil beradi; ikkinchi tomondan, ishonchli ohangdagi xato, tarafkash yoki kontekstsiz tavsiya orqali qaror sifatini pasaytirishi mumkin. Til o‘qituvchilarining GenAI bo‘yicha qarorlariga bag‘ishlangan tizimli tahlil ham pedagogik hukm va professional agentlikning texnologik integratsiyada muhimligini ko‘rsatadi [10]. Shu sababli bo‘lajak o‘qituvchilar uchun AI bilan ishlash ko‘nikmasi “texnologiyani qo‘llash” bilan cheklanmay, tavsiyani rad etish yoki qayta formulalash huquqi va mas’uliyatini ham o‘z ichiga olishi kerak. Komponentlar modeli keyingi empirik tadqiqotlar uchun diagnostik asos yaratadi. Har bir komponentga mos vaziyatli topshiriqlar, kuzatuv indikatorlari va refleksiv protokollar ishlab chiqilishi mumkin. Bunda faqat deklarativ bilim testlari yetarli emas; pedagogik qaror real yoki simulyatsion vaziyatda namoyon bo‘lishi lozim. 2024-yildagi video asosidagi baholash tadqiqoti aynan shu zaruratni ko‘rsatadi [6]. Shuningdek, baholashda qarorning “to‘g‘ri/noto‘g‘ri” natijasidan ko‘ra, qarorga olib kelgan mulohaza, dalil va etik asosni ham hisobga olish maqsadga muvofiq.

“Pedagogik mahorat” fanida ushbu modelni o‘quv mazmuniga singdirish uchun pedagogik vaziyatlarni faqat muhokama qilish emas, balki qaror sikli bo‘yicha qayta ishlash tavsiya etiladi. Birinchi bosqichda talaba vaziyatdagi muhim faktlarni ajratadi va yetishmayotgan ma’lumotlarni belgilaydi. Ikkinchi bosqichda muammoning kamida ikki ehtimoliy sababini ko‘rsatib, ularni pedagogik nazariya bilan bog‘laydi. Uchinchi bosqichda bir nechta harakat variantlarini ishlab chiqadi va ularning qisqa hamda uzoq muddatli oqibatlarini taqqoslaydi. To‘rtinchi bosqichda tanlangan qarorni o‘quvchi manfaatlari, ta’lim maqsadi va etik me’yorlar bilan asoslaydi. Beshinchi bosqichda yangi ma’lumot yoki natija paydo bo‘lsa, dastlabki qarorni qayta ko‘rib chiqadi. Bunday sikl talabani “tayyor metodni eslab qolish”dan “vaziyatga mos professional hukm qurish”ga olib o‘tadi. Kompetensiyaning shakllanishida o‘qituvchi-mentorning roli ham o‘zgaradi. Mentor talabaning qarorini darhol to‘g‘rilab bermasdan, uning fikrlash izini ochadigan savollar bilan yo‘naltirishi maqsadga muvofiq: “Qaysi dalilga tayandingiz?”, “Qaysi ma’lumot yetishmayapti?”, “Boshqa izoh bo‘lishi mumkinmi?”, “Bu qaror kimga qanday ta’sir qiladi?”, “AI taklifi qaysi farazga asoslangan?”. Mazkur savollar pedagogik hukmning yashirin bosqichlarini verbalizatsiya qiladi va refleksiv nazoratni kuchaytiradi. Natijada

bo‘lajak o‘qituvchi faqat qaror mahsulini emas, qaror hosil bo‘lish jarayonini ham boshqarishni o‘rganadi. Bu esa sun’iy intellektdan foydalanish sharoitida ayniqsa muhim, chunki texnologik tavsiya tezkor bo‘lsa-da, uning pedagogik maqbulligi faqat professional tahlil orqali aniqlanadi.

Bo‘lajak o‘qituvchilarning pedagogik qaror qabul qilish kompetensiyasi murakkab pedagogik vaziyatlarda kasbiy bilim, dalil, qadriyat, prognoz va refleksiyani birlashtiradigan integrativ sifatdir. Uning motivatsion-qadriyatli, kognitiv-analitik, diagnostik-interpretativ, prognostik-qaroriy va refleksiv-etik komponentlarga ajratilishi mazkur kompetensiyani maqsadli rivojlantirish va baholash imkonini beradi. Sun’iy intellekt pedagogik qarorni avtomatlashtiruvchi subyekt emas, balki qaror uchun axborot va alternativalar taklif qiluvchi vosita sifatida ko‘rilishi lozim. Shu sababli o‘qituvchi tayyorlashda AI tavsiyasini verifikatsiya qilish, pedagogik kontekstga moslashtirish, etik risklarni aniqlash va yakuniy qaror uchun shaxsiy-professional javobgarlikni saqlash markaziy metodik tamoyil bo‘lishi kerak.

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PHILOSOPHICAL FOUNDATIONS OF THE EDUCATIONAL TRANSFORMATION PROCESS

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Abstract. *This thesis analyzes the philosophical foundations of educational transformation amid the social, technological, and axiological changes of contemporary society. Transformation is interpreted not merely as an organizational or technological modernization of the education system, but as a qualitative change in its aims, content, values, and conceptions of the human person. Drawing on human-centered development, communicative action, pragmatism, the axiological approach, and synergetics, the dialectical relationship between education, the individual, and society is examined.*

Keywords: *educational transformation, philosophical foundations, human capital, axiological approach, digital education, creative thinking, communicative action, synergetics.*

INTRODUCTION

In the twenty-first century, globalization, the digital economy, artificial intelligence, and the accelerating flow of information require a reconsideration of the aims and content of education. The principles of the traditional educational model, based on the transmission of knowledge in a ready-made form, can no longer fully meet the demands of a rapidly changing labour market or the individual's need for continuous development. Therefore, educational transformation has moved beyond the framework of a purely pedagogical or technological problem and has become a philosophical issue encompassing the relationship among the human being, society, values, and development.

The relevance of the topic lies in the fact that educational renewal cannot be limited to the introduction of new technical tools. It requires an integrated concept aimed at developing the individual's cognitive activity, social responsibility, spiritual character, and creative potential. In this context, education functions as a strategic institution for developing human capital, a

mechanism for transmitting cultural experience from one generation to another, and a means through which society renews itself.

The purpose of the study is to reveal the socio-philosophical essence of educational transformation, identify its substantive, technological, and axiological dimensions, and substantiate its significance for human-centered development. Dialectical, systemic, axiological, comparative, and synergetic approaches were employed to achieve this purpose. These approaches make it possible to analyze education not as an isolated institution, but as an open social system developing in close interaction with the individual, the state, culture, and the labour market.

In the development of New Uzbekistan, improving the quality of education and cultivating young people who possess modern knowledge and professional skills, think independently, and demonstrate spiritual responsibility have become priority tasks. From this perspective, studying the philosophical foundations of educational transformation contributes to understanding the humanistic content of the ongoing reforms, establishing a balance between digitalization and national and universal human values, and identifying the conceptual directions of future education.

MAIN PART

Under conditions of globalization, the digital economy, artificial intelligence, and cultural pluralism, the task of education is no longer limited to providing knowledge; it also involves guiding individuals toward self-understanding and a sense of social responsibility. The American pragmatist J. Dewey advanced a similar idea:

Thus, transformative education is a system aimed at developing the individual as a socially active and spiritually mature person capable of consciously directing his or her own life.

In philosophy, the concept of social determinism refers to the dependence of changes in society on socio-economic factors. Educational transformation likewise unfolds within this framework: economic modernization, labour-market requirements, and the digital environment shape the form of the education system.

Thus, the philosophical essence of educational transformation is grounded in the concept of human-centered development. In this approach, the human being is both the purpose and the means of the education system. Transformative education manifests itself in the following three principal directions:

Content transformation — the transition from knowledge to competence and the development of practical and creative thinking;

Technological transformation — digital teaching, online education, and education models based on artificial intelligence;

Axiological transformation — integrating education with the values of spirituality, morality, and diligence.

In the educational process, the individual not only acquires knowledge but also develops his or her social essence. Accordingly, the relationship between education and personal development is based on the principle of dialectical unity: the individual creates the self through education, while education transforms society through the individual.

Personal development, in turn, constitutes the philosophical foundation for cultivating professional culture and the virtue of diligence. Labour, education, and culture are interconnected dimensions of human existence.

Transformational changes in education are not only technical but also spiritual and ideological processes, because every educational system serves particular ideas, values, and purposes.

From a philosophical perspective, this approach combines axiological and humanistic paradigms. The essence of education lies not simply in providing knowledge, but in cultivating in the individual a sense of goodness, creativity, and responsibility.

From this perspective, educational transformation is a mechanism through which the social system renews itself. It emerges as a result of the complex interaction among teachers, students, public policy, and cultural values.

In general, educational transformation:

enhances the quality of human capital;

renews social consciousness;

promotes cultural stability and spiritual harmony.

As a result, the philosophy of transformative education establishes as its principal objective the development of the human being as a “creative subject rather than a consumer.”

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TEACHING FOLKLORE WORKS IN PRIMARY SCHOOLS THROUGH MODERN EDUCATIONAL TECHNOLOGIES

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***Abstract**: This article examines the pedagogical potential of using modern educational technologies in teaching folklore works in primary schools. Particular attention is given to the role of folklore in developing pupils' independent thinking, creativity, communication skills, and understanding of national cultural values. The article discusses the use of interactive methods, information and communication technologies, problem-based learning, didactic games, role-playing, and project-based learning in folklore education. Practical approaches to integrating modern educational technologies into primary folklore lessons are also proposed.*

***Keywords**: Folklore, primary education, modern educational technologies, interactive methods, national values, oral tradition, pupils, pedagogical technology, folklore education.*

INTRODUCTION

Contemporary education increasingly focuses not only on the acquisition of knowledge but also on the development of pupils' independent thinking, creativity, communication skills, cultural awareness, and ability to apply knowledge in practical situations. These objectives are particularly important in primary education, as this stage plays a significant role in shaping children's worldview, moral values, aesthetic perceptions, and attitudes towards their cultural heritage.

Folklore represents an important component of a nation's cultural heritage. It reflects the historical experience, worldview, traditions, customs, moral principles, hopes, and aspirations of people. Folklore genres such as fairy tales, proverbs, riddles, legends, myths, tongue twisters, and epic narratives can therefore serve not only as literary materials but also as valuable educational and cultural resources.

In primary education, folklore works are especially appropriate because their content is often based on vivid characters, imaginative events, moral conflicts, and situations that are accessible to children. However, merely reading folklore texts or asking pupils to retell their content may not always provide sufficient opportunities for active learning. The integration of modern educational technologies can make the learning process more interactive, engaging, and learner-centred.

The purpose of this article is to examine effective ways of teaching folklore works in primary schools through modern educational technologies and to identify their pedagogical possibilities for developing pupils' cognitive, communicative, creative, and cultural competencies.

MAIN PART

The Educational Potential of Folklore in Primary Education

Folklore is a significant form of oral cultural heritage transmitted from generation to generation. It contains the collective experience and cultural memory of society and provides children with opportunities to become familiar with traditional values, social norms, moral concepts, and national identity.

In primary education, folklore can contribute to the development of reading comprehension, oral communication, vocabulary, imagination, critical thinking, and creativity. For example, fairy tales introduce pupils to concepts such as kindness, honesty, friendship, courage, responsibility, and justice. Proverbs encourage pupils to interpret concise expressions of social and moral experience, while riddles develop logical thinking and observation.

Therefore, folklore should not be regarded merely as additional reading material. It can be used as an educational resource that combines intellectual, moral, aesthetic, and cultural development.

Interactive Learning Technologies

Interactive teaching methods provide opportunities for pupils to participate actively in the learning process. Instead of simply receiving information from the teacher, pupils discuss, analyse, compare, ask questions, express opinions, and work collaboratively.

Methods such as brainstorming, clustering, the Venn diagram, "Think-Pair-Share", questioning, and reflective activities can be effectively applied to folklore lessons.

For instance, after reading a fairy tale, the teacher may ask: What qualities does the main character demonstrate? What would you do if you were in the character's situation? Which character's actions do you agree or disagree with? What lesson can we learn from the story? Such questions encourage pupils to

move beyond simple recall and develop interpretation and personal responses to literary material.

The "Cluster" method can also be used to analyse a central character. Pupils can identify the character's personality traits, actions, relationships, and decisions and represent them graphically. This activity facilitates a more systematic understanding of the literary character.

Information and Communication Technologies

Information and communication technologies (ICT) provide additional opportunities for making folklore education more engaging and multimodal. Digital presentations, illustrations, audio recordings, animations, educational videos, interactive exercises, and digital storytelling can be integrated into lessons.

For example, before reading a fairy tale, the teacher may show several images related to the story and ask pupils to predict its content. After reading, pupils can compare their predictions with the actual events in the text.

Audio recordings of folklore performances can also help pupils understand pronunciation, intonation, rhythm, and expressive language. Digital storytelling can combine text, images, sound, and animation, allowing pupils to reconstruct or retell a folklore narrative in a creative format.

However, technology should not replace pedagogical interaction. Digital resources are most effective when they serve a clearly defined educational purpose and are integrated into the structure of the lesson.

Problem-Based Learning

Problem-based learning can be effectively applied when teaching folklore because many folklore works contain conflicts, moral choices, and situations requiring decisions.

For example, after reading a fairy tale, the teacher may present the following problem: "Why do two characters living in similar circumstances make completely different choices?" Pupils can analyse the characters' actions, identify the reasons for their decisions, and formulate their own conclusions. This approach encourages independent reasoning and allows pupils to connect the events of the folklore text with real-life situations.

Problem-based tasks also help transform pupils from passive recipients of information into active participants in the learning process.

Didactic Games and Role-Playing

Didactic games are particularly appropriate for younger learners because play is closely connected with their cognitive and social development. Folklore lessons can include activities such as "Complete the Proverb", "Guess the

Riddle", "Identify the Character", "Continue the Story", "Find the Moral", and "Who Am I?"

For example, in the "Complete the Proverb" activity, the teacher gives the first part of a proverb and pupils identify its continuation. They can then explain its meaning and provide examples from everyday life.

Role-playing and dramatization are also effective approaches. Pupils can perform the roles of characters from fairy tales, legends, or other folklore works. Through dramatization, pupils develop oral language, emotional expression, cooperation, confidence, and understanding of character motivation.

Project-Based Learning

Project-based learning creates opportunities for pupils to explore folklore beyond the classroom. Small projects may include: "Folklore in My Family"; "Proverbs Used by My Grandparents"; "My Favourite Fairy Tale"; "Traditional Riddles"; and "Folklore of My Community".

For example, pupils can collect several proverbs or riddles from family members and present them to their classmates. Such activities establish a connection between school learning, family experience, and cultural heritage.

Project activities can also be supported by digital tools. Pupils may prepare a short presentation, digital poster, illustrated story, or audio recording based on the folklore material they have collected.

A Modern Model for Teaching Folklore

The integration of modern educational technologies can be organised through a structured sequence: Motivation → Introduction to the folklore text → Interactive activity → Problem situation → Collaborative learning → Creative task → Reflection → Assessment.

At the motivation stage, the teacher creates interest through a question, image, short audio fragment, or situation. Pupils then become familiar with the folklore text. Interactive and problem-based activities are subsequently used to analyse the content and characters.

Collaborative activities allow pupils to exchange ideas, while creative tasks encourage them to transform or reinterpret the material. Finally, reflection enables pupils to identify what they have learned and how their understanding has changed.

This approach makes the lesson more learner-centred and creates opportunities for cognitive, communicative, creative, and cultural development.

CONCLUSION

Teaching folklore works through modern educational technologies provides significant pedagogical opportunities for primary education. The

combination of folklore materials with interactive methods, ICT, problem-based learning, didactic games, role-playing, and project-based learning can increase pupils' active participation and support the development of independent thinking, creativity, communication skills, and cultural awareness.

Folklore should therefore be considered not only as a literary resource but also as an important educational and cultural resource. Its effective integration into modern teaching practices can help pupils understand national cultural values while simultaneously developing skills required for contemporary learning.

The effectiveness of modern technologies depends largely on their purposeful pedagogical application. Teachers should select appropriate methods according to pupils' age characteristics, learning objectives, the specific folklore genre, and the content of the lesson. A balanced combination of traditional literary education and modern learner-centred technologies can create meaningful and engaging learning experiences in primary folklore education.

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МЕХАНИЗМ РАЗВИТИЯ КРЕАТИВНОЙ КОМПЕТЕНТНОСТИ СТУДЕНТОВ В ПРОЦЕССЕ ВНЕАУДИТОРНОЙ ОБРАЗОВАТЕЛЬНОЙ ДЕЯТЕЛЬНОСТИ

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Аннотация. *В статье рассматривается педагогический механизм развития креативной компетентности студентов в процессе внеаудиторной образовательной деятельности. Обосновываются виды деятельности, педагогические условия и фасилитирующая роль преподавателя, а также представлены критерии оценки.*

Ключевые слова: *креативная компетентность, внеаудиторная образовательная деятельность, педагогический механизм, фасилитатор, студент.*

Abstract. *The paper describes a pedagogical mechanism for developing students' creative competence in extracurricular education. It substantiates activity types, pedagogical conditions and the facilitating role of the instructor, and outlines assessment criteria.*

Keywords: *creative competence, extracurricular education, pedagogical mechanism, facilitator, student.*

ВВЕДЕНИЕ

Современный рынок труда предъявляет высокие требования к специалистам, способным принимать решения в нестандартных ситуациях и проявлять инициативу. В системе высшего образования реализация данного требования в основном осуществляется посредством аудиторных занятий, тогда как потенциал внеаудиторной образовательной деятельности в развитии креативности используется недостаточно. Это определяет актуальность рассматриваемой проблемы.

Цель статьи заключается в обосновании педагогического механизма развития креативной компетентности студентов в процессе внеаудиторной образовательной деятельности.

ОСНОВНАЯ ЧАСТЬ

Креативная компетентность рассматривается как интегративное качество личности студента, характеризующее его готовность выдвигать новые идеи, находить оригинальные решения в нестандартных ситуациях и реализовывать их на практике. В ее структуре выделяются когнитивный, мотивационно-ценностный и деятельностный компоненты. Креативность связана с беглостью, гибкостью и оригинальностью мышления (Guilford, 1950; Torrance, 1974), при этом внутренняя мотивация имеет решающее значение в ее развитии (Amabile, 1996).

Механизм развития креативной компетентности реализуется в четыре этапа. На первом, мотивационно-диагностическом этапе, определяются интересы студентов и уровень их креативности. На втором, содержательно-технологическом этапе, используются творческие кружки, дебаты, метод «мозгового штурма», научно-творческие клубы и методика коллективной творческой деятельности. На третьем, проектно-практическом этапе, студенты работают в командах над социальными, научными или культурными проектами. На четвертом, рефлексивно-оценочном этапе результаты представляются, формируется портфолио, а произошедшие изменения анализируются по определенным критериям.

Эффективность механизма зависит от ряда педагогических условий. Во-первых, студенту необходимо предоставить возможность свободного выбора вида деятельности, поскольку добровольность способствует усилению внутренней мотивации. Во-вторых, поскольку развитие креативности связано с индивидуальными особенностями личности (самостоятельностью мышления, любознательностью, толерантностью к неопределенности), необходим дифференцированный подход. В-третьих, органы студенческого самоуправления должны участвовать в планировании и оценивании проектов. В-четвертых, необходимо создать психологически безопасную среду, в которой студент не боится допускать ошибки.

В данном процессе преподаватель выступает не в качестве контролера, а в роли фасилитатора: создает проблемные ситуации, задает вопросы, не предоставляет готовых решений и поддерживает инициативу студентов. Поэтому собственная креативная компетентность преподавателя также определяет качество данного процесса. Важное значение имеет и взаимосвязь аудиторной и внеаудиторной деятельности: знания, полученные на аудиторных занятиях, применяются в проектах, а проектный опыт возвращается в последующее аудиторное обсуждение.

Для оценки уровня развития креативной компетентности предлагаются четыре критерия (когнитивный, мотивационно-ценностный, деятельностный и рефлексивный) и три уровня (низкий, средний и высокий). В качестве диагностических средств могут использоваться анкетирование, педагогическое наблюдение, портфолио и экспертная оценка.

При реализации механизма целесообразно поэтапно усложнять виды деятельности в зависимости от уровня подготовки студентов. На начальном этапе применяются краткосрочные задания с низким уровнем риска (дебаты, оперативная генерация идей, мини-конкурсы), что способствует повышению уверенности студентов в собственных силах. На последующих этапах внедряются долгосрочные командные проекты, научно-творческие клубы и открытые презентации. Такая последовательность позволяет постепенно превратить студента из пассивного участника в активного создателя.

При внедрении механизма необходимо учитывать следующие риски: формальный и демонстративный характер внеаудиторных мероприятий; ограничение круга участников только активными студентами; сосредоточение оценки исключительно на конечном продукте при недостаточном внимании к процессу и личностному росту. Для снижения данных рисков рекомендуется обеспечить возможность свободного участия для всех студентов, отслеживать уровень участия посредством портфолио и сделать рефлексию обязательным элементом образовательного процесса.

ЗАКЛЮЧЕНИЕ

Внеаудиторная образовательная деятельность благодаря возможности свободного выбора и созданию творческой среды представляет собой эффективное пространство для развития креативной компетентности студентов. Предложенный четырехэтапный механизм, совокупность педагогических условий и критериев оценки позволяют системно организовать данный процесс. Экспериментальная проверка эффективности предложенного механизма является задачей дальнейших исследований.

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THE ROLE OF TEACHERS IN ENHANCING SOCIOPRAGMATIC COMPETENCE IN INDEPENDENT EDUCATION

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Annotation. *Sociopragmatic competence, understood as the ability to select language that is socially and contextually appropriate, is a decisive component of communicative competence for EFL/ESL learners. As independent education — self-access study, distance and blended courses, and learner-managed modules — becomes a standard mode of language instruction, the conditions under which sociopragmatic competence develops have changed considerably. This article examines how the teacher's role is being redefined in independent-education settings: not as a constant corrective presence, but as a designer of noticing tasks, a curator of authentic materials, and a mediator of feedback that allows learners to internalise sociopragmatic norms while working autonomously. Drawing on recent empirical studies of teacher preparedness, autonomy-supportive pedagogy, and pragmatic instruction, the article argues that the disappearance of the teacher from the immediate learning moment does not reduce the teacher's importance; it relocates that importance to the design stage, the feedback stage, and the professional-development stage.*

Key words: *sociopragmatic competence, pragmalinguistic competence, independent education, learner autonomy, teacher facilitation, self-directed learning, communicative competence, pragmatic instruction*

INTRADUCTION

Sociopragmatic competence refers to learners' capacity to judge which linguistic choices are appropriate given a particular social context, relationship, or degree of imposition, as distinct from pragmalinguistic competence, which concerns the linguistic forms available for realising a given communicative intention (Leech, 1983; Thomas, 1983). Because sociopragmatic norms are culturally embedded and often invisible in a textbook exercise, they have traditionally been taught through direct, in-the-moment teacher mediation —

modelling, correction, and explanation delivered inside the classroom. The steady expansion of independent education, in which learners complete a significant share of their language study through self-access platforms, distance modules, or autonomously managed portfolios, removes much of that immediate mediation. This shift raises a central pedagogical question: how can teachers continue to shape sociopragmatic development when they are no longer physically present at the point where a learner makes a socially consequential language choice?

Research on learner autonomy suggests that the answer lies less in withdrawing the teacher than in relocating the teacher's function. Little (1995) observed that learner autonomy is conditioned on teacher autonomy: teachers who understand what autonomous learning requires are better placed to design conditions that make it possible. Applied to sociopragmatic development, this means teachers move from being the source of every correction to being the architect of tasks that train learners to notice social meaning on their own — comparing register across contexts, identifying politeness strategies in authentic input, and reflecting on the social consequences of alternative wordings. Benson (2013) similarly frames the teacher's role in autonomous learning as one of building the learner's capacity for self-management rather than substituting for it.

In practice, this reorientation is visible in the materials teachers select and design for independent study. Instruction built around authentic audio-visual input, such as extracts from film and television, has been shown to strengthen learners' command of speech acts and their sensitivity to situational variation even when much of the practice occurs outside direct instruction (Omar & Rai, 2022). Likewise, structured role-play frameworks embedded in self-study units allow learners to rehearse socially calibrated language independently while still following a sequence the teacher has deliberately built for that purpose (Li, Razali, Ismail, Muhamad, & Ma, 2024). In both cases, the teacher's decisive contribution occurs before the learner ever begins the independent task: in the selection of input, the sequencing of noticing activities, and the design of reflection prompts that make implicit norms explicit.

This design work is especially important because sociopragmatic competence does not appear to develop as readily from unguided exposure as pragmalinguistic competence does. Cross-sectional research has repeatedly found that learners acquire the linguistic forms needed to perform a speech act well before they reliably match those forms to the social situation at hand (Rose, 2000), a pattern later confirmed in other instructional contexts. For learners

working independently, who may encounter authentic input without a teacher on hand to flag a social misjudgement, this asymmetry raises the stakes for explicit, teacher-designed noticing tasks: without them, independent exposure risks reinforcing pragmalinguistic fluency while leaving sociopragmatic misjudgements uncorrected.

Teachers can only design such tasks well if their own sociopragmatic and pragmatic knowledge is secure, yet recent studies suggest this is not guaranteed. A survey of EFL instructors at tertiary level found only a moderate level of awareness of pragmatics and its instruction, despite general recognition of its importance (Korkmaz, 2023). Complementary research on the barriers to teaching pragmatics identifies limited teacher preparation and a scarcity of pragmatically informed materials as recurring obstacles (Berutu & Daulay, 2023). These findings indicate that continuing professional development in pragmatics and sociopragmatics is a precondition, not an optional extra, for teachers who are expected to design independent-learning materials that can carry sociopragmatic instruction in the teacher's physical absence.

The relational dimension of teaching also persists in independent-education contexts, even though direct contact is reduced. Studies grounded in self-determination theory show that learners who perceive their teacher as autonomy-supportive — acknowledging their perspective, explaining the rationale for tasks, and providing meaningful feedback — report stronger self-regulation and motivation in their independent work (Siacor, Ng, & Liu, 2024). Similarly, research on teachers' relationship skills highlights that the strategies instructors use to build rapport and respond to learners shape classroom and self-study engagement alike (Salimi & Najjarpour, 2024). For sociopragmatic competence specifically, this suggests that periodic, targeted feedback on a learner's self-recorded interactions or written reflections remains an indispensable point of teacher contact within an otherwise independent course of study.

Taken together, these strands point toward a redesigned division of labour rather than a diminished teacher role. Teachers curate authentic, socially rich materials for self-access use; build explicit noticing and reflection tasks around them, since sociopragmatic norms are less likely than linguistic forms to be acquired through exposure alone; maintain feedback cycles that substitute for in-the-moment correction; and continue their own professional development so that the materials they design are pragmatically sound. Institutions that support independent education can reinforce this work by embedding sociopragmatic tasks into learning-management platforms, allowing asynchronous teacher

feedback, and recognising material design and mediated feedback as core teaching functions rather than as secondary to classroom contact hours.

The development of sociopragmatic competence within independent education therefore remains dependent on the teacher, but on a teacher whose contribution is concentrated at different points in the learning cycle: before the learner begins an independent task, and after the learner has attempted it. For learners, this redesigned mediation offers the flexibility of self-paced study without sacrificing guided access to socially appropriate language use. For teachers, it calls for stronger pragmatic knowledge, deliberate materials design, and sustained attention to feedback — investments that ultimately determine whether independent education produces learners who are linguistically fluent but socially miscalibrated, or learners equipped to communicate appropriately across the social contexts they will actually encounter.

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IMPROVING THE EDUCOLOGICAL MECHANISM FOR MANAGING THE EDUCATIONAL PROCESS IN HIGHER EDUCATION IN THE CONTEXT OF DIGITAL TRANSFORMATION

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Abstract. *This thesis examines the improvement of the educological mechanism for managing the educational process in higher education institutions in the context of digital transformation. The study analyzes the role of the digital learning environment, data-driven management, internal quality assurance, and effective collaboration with stakeholders in the management of the educational process. In addition, an educological management mechanism based on the use of the capabilities of HEMIS, Learning Management Systems (LMS), and analytical platforms is conceptually substantiated. The findings of the study are intended to contribute to enhancing management efficiency in higher education institutions, improving the quality of education, and providing a scientific basis for managerial decision-making.*

Keywords: *educological management, digital transformation, higher education, educational process, HEMIS, Learning Management System (LMS), quality of education, data-driven management, internal quality assurance, monitoring.*

Digital transformation has become one of the key factors influencing the development of the modern higher education system. The rapid advancement of digital technologies requires substantial improvement in the mechanisms used to organize, manage, and evaluate the educational process. As a result, management practices in higher education institutions are shifting from traditional administrative approaches toward data-driven, responsive, and flexible management models. In international practice, this process is recognized as an important factor in enhancing the quality of education, strengthening internal quality assurance, and improving management efficiency **[2:8; 5:18].**

Consistent reforms are also being implemented in the higher education system of Uzbekistan to accelerate digital transformation, digitize the educational process, and modernize university management. The expansion of academic autonomy in higher education institutions, the improvement of the

credit-module system, and the introduction of HEMIS and other digital platforms are placing new demands on management processes **[7]**. Under these conditions, developing a management mechanism that integrates the capabilities of digital technologies with an educological approach is both scientifically and practically relevant.

The purpose of this thesis is to analyze the theoretical foundations for improving the educological mechanism of educational process management in higher education under conditions of digital transformation and to substantiate a conceptual approach aimed at enhancing the quality of education and management efficiency.

Digital transformation is not merely a process of equipping the education system with information and communication technologies; rather, it is a factor that contributes to the formation of a new concept for organizing, managing, and evaluating education. In modern higher education institutions, digital technologies are becoming essential tools for planning the educational process, monitoring learning outcomes, analyzing academic activities, and making managerial decisions. Therefore, improving the management system on the basis of an educological approach under conditions of digital transformation is recognized as one of the priority areas for ensuring educational quality **[2; 5]**.

The primary objective of the educological approach is to manage all components of the educational process as an integrated system and to make management decisions based on scientifically grounded data. Within this approach, the integration of learning outcomes, teaching methods, assessment systems, digital platforms, and stakeholders is regarded as one of the key factors determining management efficiency. In this respect, the principles of Outcome-Based Education and internal quality assurance standards constitute the methodological foundation of the digital management mechanism **[1; 2]**.

Today, HEMIS, Learning Management Systems (LMS), electronic document management systems, and analytical platforms generate large volumes of data in higher education institutions. However, the extent to which these data are effectively used in managerial decision-making remains insufficient. In many cases, digital platforms are primarily employed as tools for data collection, while their analytical capabilities are not fully utilized. As a result, the available information potential is not used comprehensively in processes such as educational quality monitoring, early identification of academic risks, and strategic planning **[3; 4; 6]**.

Therefore, improving the educological management mechanism under conditions of digital transformation requires the establishment of an

interconnected system for data collection, analysis, forecasting, and managerial decision-making. Such an approach ensures the transparency of the educational process, improves the responsiveness of management, and creates the analytical foundation necessary for the continuous improvement of educational quality.

Effective management of the educational process in higher education institutions under conditions of digital transformation is not limited to the introduction of digital platforms and information systems. Management efficiency depends on the ability to analyze the data generated within these systems, make scientifically grounded managerial decisions based on such data, and establish mechanisms for the continuous improvement of the educational process. From this perspective, the educological management mechanism involves managing the full potential of the digital environment in an integrated manner with educational quality **[3; 5; 6]**.

Within the framework of this study, it is proposed that the educological mechanism for managing the educational process under conditions of digital transformation be improved on the basis of four interrelated stages. At the first stage, data related to the educational process are generated through HEMIS, Learning Management Systems (LMS), and other digital platforms. At the second stage, these data are processed using analytical methods, and analytical indicators related to educational quality, academic achievement, attendance, and teaching workload are identified. At the third stage, managerial decisions are developed and implemented on the basis of the obtained results. At the fourth stage, the effectiveness of the adopted decisions is monitored, and the management process is continuously improved through a feedback mechanism.

An important feature of the proposed mechanism is that it enables management to be carried out not merely on the basis of static statistical data, but on analytical information generated in real time. As a result, opportunities are expanded for the early identification of problems in the educational process, the prediction of academic risks, the rational use of resources, and the continuous monitoring of educational quality. This, in turn, contributes to the strategic development of higher education institutions and improves the effectiveness of internal quality assurance systems.

Digital transformation is shaping new approaches to the management of the educational process in higher education institutions. Under these conditions, improving the educological management mechanism is closely linked to the analysis of data generated on digital platforms, the adoption of scientifically grounded managerial decisions, and the continuous monitoring of educational quality.

The educological management mechanism proposed as a result of this study makes it possible to integrate the stages of planning, monitoring, analyzing, and improving the educational process within a unified system. This approach can serve as a scientific and practical foundation for enhancing management efficiency in higher education institutions, organizing digital transformation processes systematically, and advancing the quality of education to a new level.

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KOGNITIV AUTSORSING VA TALABALARNING MUSTAQIL FIKRLASHINI RIVOJLANTIRISH DOLZARB PEDAGOGIK MUAMMO SIFATIDA

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Annotatsiya. *Maqolada kognitiv autsorsing va talabalarning mustaqil fikrlashini rivojlantirish o‘rtasidagi munosabat zamonaviy oliy ta’limning dolzarb pedagogik muammosi sifatida tahlil qilinadi. Kognitiv autsorsingning tashqi vositalar orqali aqliy yuklamani kamaytirish imkoniyati bilan birga, tahlil, baholash, argumentatsiya va qaror qabul qilish operatsiyalarini tashqi tizimga ortiqcha topshirish xavfi ochib beriladi. Generativ sun’iy intellekt sharoitida mazkur muammoning yangi ko‘rinishlari asoslanib, mustaqil fikrlashni saqlash va rivojlantirishga xizmat qiluvchi pedagogik boshqaruv tamoyillari, indikatorlar va konseptual sxema taklif etiladi.*

Kalit so‘zlar: *kognitiv autsorsing, mustaqil fikrlash, tanqidiy fikrlash, generativ sun’iy intellekt, metakognitsiya, kognitiv mustaqillik, refleksiya, pedagogik boshqaruv.*

Аннотация. *В статье взаимосвязь когнитивного аутсорсинга и развития самостоятельного мышления студентов рассматривается как актуальная проблема современного высшего образования. Раскрывается двойственная природа когнитивного аутсорсинга: снижение умственной нагрузки при помощи внешних средств, с одной стороны, и риск чрезмерной передачи внешним системам операций анализа, оценки, аргументации и принятия решений – с другой. Обосновываются особенности данной проблемы в условиях генеративного искусственного интеллекта, предлагаются педагогические принципы, индикаторы и концептуальная схема сохранения интеллектуальной самостоятельности студентов.*

Ключевые слова: *когнитивный аутсорсинг, самостоятельное мышление, критическое мышление, генеративный искусственный интеллект, метакогниция, когнитивная автономия, рефлексия.*

Abstract. *The article examines the relationship between cognitive offloading and the development of students’ independent thinking as a current problem of higher education. It reveals the dual nature of cognitive offloading: external tools can reduce cognitive load, but excessive delegation of analysis,*

evaluation, argumentation and decision-making may weaken intellectual autonomy. The paper substantiates new manifestations of this problem in the context of generative artificial intelligence and proposes pedagogical principles, indicators and a conceptual scheme aimed at preserving and developing students' independent thinking.

Keywords: *cognitive offloading, independent thinking, critical thinking, generative artificial intelligence, metacognition, cognitive autonomy, reflection, pedagogical regulation.*

KIRISH

Raqamli transformatsiya ta'limning mazmuni, vositalari va o‘quv faoliyatining ichki tuzilishini o‘zgartirmoqda. Elektron qidiruv tizimlari, aqlli qurilmalar, bulutli servislar va generativ sun'iy intellekt vositalari talabaning axborotni izlash, saqlash, qayta ishlash va taqdim etish jarayoniga tobora chuqur kirib bormoqda. Natijada bilim olish jarayonining bir qismi insonning ichki kognitiv resurslaridan tashqi texnologik muhitga ko‘chmoqda. Ilmiy adabiyotda bunday holat "cognitive offloading" – kognitiv autsorsing sifatida talqin qilinadi. Risko va Gilbert ushbu tushunchani vazifaning axborotni qayta ishlash talablarini kamaytirish maqsadida tashqi harakat yoki vositalardan foydalanish deb izohlaydi [3]. Kognitiv autsorsing inson faoliyatining yangi hodisasi emas. Qog‘ozga qayd yozish, formulani jadvalga joylashtirish, kalkulyator, xarita yoki eslatmalardan foydalanish ham kognitiv yuklamaning bir qismini tashqi muhitga ko‘chirishga xizmat qilgan. Biroq generativ AI ushbu jarayonning sifat jihatdan yangi bosqichini yuzaga keltirdi. Chunki zamonaviy tizimlar nafaqat ma'lumotni saqlaydi yoki topadi, balki matn yaratadi, tahlil qiladi, umumlashtiradi, argument tuzadi, yechim taklif qiladi va qaror variantlarini ishlab chiqadi. Shu bois oliy ta'limda asosiy masala texnologiyadan foydalanishning o‘zi emas, balki tashqi kognitiv yordam talabaning qaysi fikrlash operatsiyalarini qo‘llab-quvvatlayotgani yoki qaysilarini almashtirayotganini aniqlashdan iborat. Mustaqil fikrlash oliy ta'limning asosiy natijalaridan biri bo‘lib, u talabaning muammoni mustaqil anglash, dalillarni tahlil qilish, axborotni baholash, muqobil qarashlarni solishtirish, asoslangan xulosa chiqarish va o‘z qaroriga javobgarlikni o‘z zimmasiga olish qobiliyatini anglatadi. Agar texnologik vosita aynan shu operatsiyalarni talaba o‘rniga bajarsa, o‘quv faoliyatining tashqi natijasi yaxshilangan taqdirda ham fikrlash jarayonining ichki rivojlanishi kafolatlanmaydi. Shuning uchun kognitiv autsorsing va mustaqil fikrlash o‘rtasidagi nisbat zamonaviy pedagogikaning dolzarb muammosiga aylanmoqda.

Kognitiv autsorsingning nazariy asoslarini tushuntirishda Clark va Chalmersning “kengaytirilgan ong” konsepsiyasi muhim o‘rin tutadi. Ularning fikriga ko‘ra, ayrim tashqi vositalar shaxsning ichki kognitiv jarayonlari bilan funksional yaxlitlik hosil qilishi mumkin [1]. Bu g‘oya zamonaviy ta’limga tatbiq etilganda, talaba nafaqat o‘z xotirasi va tafakkuri orqali, balki raqamli qaydlar, qidiruv tizimlari, ma’lumotlar bazasi va AI yordamchilari bilan ham fikrlashi mumkinligi kelib chiqadi. Demak, pedagogik muammo tashqi vositani taqiqlashda emas, uning kognitiv faoliyatdagi maqomini aniq belgilashdadir. Sparrow, Liu va Wegner tomonidan o‘tkazilgan tadqiqotlar internetda axborotga keyinchalik qayta kirish imkoniyati mavjud bo‘lsa, odamlar ma’lumotning o‘zidan ko‘ra uni qayerdan topishni yaxshiroq eslab qolishga moyil bo‘lishini ko‘rsatgan [2]. Ushbu “Google effect” raqamli vosita inson xotirasi bilan raqobatlashmasdan, uning funksiyalarini qayta taqsimlashini ko‘rsatadi. Generativ AI sharoitida esa bu tendensiya xotiradan tashqari tahlil, umumlashtirish va matn yaratish kabi operatsiyalarni ham qamrab olmoqda.

Risko va Gilbert kognitiv autsorsingga murojaat qilish metakognitiv baholashga bog‘liqligini qayd etadi: inson vazifaning qiyinligini, o‘z imkoniyatlarini va tashqi vosita samaradorligini baholab, qaysi operatsiyani tashqariga ko‘chirishni tanlaydi [3]. Ammo bunday baholash har doim ham to‘g‘ri bo‘lmasligi mumkin. Talaba o‘z kuchiga nisbatan ishonchsizlik sabab oddiy vazifalarda ham AI yordamiga murojaat qilishi yoki aksincha, murakkab vazifada tashqi vositadan maqsadli foydalana olmasligi mumkin. Shuning uchun kognitiv autsorsingning pedagogik boshqaruvi metakognitiv nazorat va refleksiyani rivojlantirishni talab qiladi.

Nazariy tahlil kognitiv autsorsingning pedagogik muammo sifatidagi dolzarbligini uchta o‘zaro bog‘liq ziddiyat orqali ifodalash mumkinligini ko‘rsatdi. Birinchi ziddiyat – kognitiv samaradorlik va kognitiv rivojlanish o‘rtasidagi ziddiyat. Tashqi vosita vazifani tez va sifatli bajarishga yordam beradi, biroq natijaga tez erishish har doim ham talabaning tegishli fikrlash operatsiyasini o‘zlashtirganini anglatmaydi. Ikkinchi ziddiyat texnologik qulaylik va intellektual mustaqillik o‘rtasidagi ziddiyat. Qulay vosita ortiqcha yuklamani kamaytirishi mumkin, ammo uning doimiy mavjudligi talabaning mustaqil rejalashtirish va qaror qabul qilishga ehtiyojini qisqartiradi. Uchinchi ziddiyat – tashqi yordam va shaxsiy javobgarlik o‘rtasidagi ziddiyat. AI tavsiyasi qaror qabul qilishni yengillashtiradi, lekin ilmiy va akademik faoliyatda yakuniy xulosa, dalil va xatolik uchun mas’uliyat talabada qolishi kerak. Shu asosda kognitiv autsorsingni ikki pedagogik rejimga ajratish mumkin. Strategik kognitiv autsorsingda talaba tashqi vositani ikkilamchi va yordamchi vazifalar

uchun qo‘llaydi: axborot izlash, variantlar yaratish, hisoblash, matnni strukturaviy tartibga solish yoki dastlabki xulosani tekshirish. Bunda muammoni qo‘yish, mezon tanlash, dalillarni baholash va yakuniy qaror talabaning o‘zida qoladi. Almashtiruvchi kognitiv autsorsingda esa talaba aynan rivojlanishi lozim bo‘lgan tahliliy operatsiyalarni ham tashqi tizimga topshiradi. Pedagogik muammo ikkinchi rejimning nazoratsiz kuchayishi bilan bog‘liq.

2025-yilgi ikki meta-tahlil mazkur farqlashning dolzarbligini bilvosita tasdiqlaydi. Chen va Cheung 57 tadqiqotni umumlashtirib, GenAI oliy ta’limdagi umumiy o‘quv natijalari va yuqori darajali fikrlashga sezilarli ijobiy ta’sir ko‘rsatishini, biroq metakognitsiyaga ta’siri statistik jihatdan ahamiyatli emasligini aniqlagan [6]. Zhao va hammualliflar 29 eksperimental va kvazieksperimental tadqiqot bo‘yicha GenAI yuqori darajali fikrlashga o‘rtacha ijobiy ta’sir ko‘rsatishini, eng katta o‘sish muammoni hal etish, undan keyin tanqidiy fikrlashda kuzatilganini qayd etgan [7]. Demak, AI vositasining mavjudligi fikrlashni rivojlantirish uchun imkoniyat yaratadi, ammo bu imkoniyat pedagogik topshiriq, nazorat va refleksiya orqali real rivojlanishga aylantirilishi kerak. Kognitiv autsorsingning pedagogik muammosi faqat AIga bog‘liqlik bilan cheklanmaydi. U talabaning axborot bilan ishlash madaniyati, o‘z bilimiga ishonchi, vazifa murakkabligini baholashi, vaqt bosimi, baholash tizimi va o‘qituvchi tomonidan qo‘yilgan talablar bilan ham bog‘liq. Masalan, topshiriqda faqat yakuniy mahsulot baholansa, talaba jarayonni imkon qadar ko‘proq tashqi vositaga topshirishga intiladi. Agar baholashda fikrlash yo‘li, dalillar sifati, manba tekshiruvi va refleksiv izoh ham hisobga olinsa, tashqi vositadan foydalanishning tabiati o‘zgaradi. Shu sababli mustaqil fikrlashni rivojlantirish diagnostikasi faqat “talaba javobni mustaqil bajardimi?” savoliga tayanmasligi kerak. Kognitiv autsorsing sharoitida quyidagi indikatorlar muhim: 1) muammoni mustaqil formulalash; 2) axborotga ehtiyojni aniqlash; 3) manba va dalil ishonchliligini baholash; 4) sabab-oqibat bog‘lanishlarini tahlil qilish; 5) muqobil nuqtayi nazarlarni solishtirish; 6) o‘z pozitsiyasini argumentlash; 7) mustaqil qaror chiqarish; 8) tashqi yordamning o‘z fikrlashiga ta’sirini refleksiv baholash. Ushbu indikatorlar talabaning texnologiya bilan ishlashini taqiqlamaydi, aksincha, texnologiya mavjud sharoitda intellektual subyektlikni aniqlashga xizmat qiladi.

1-sxema.

Kognitiv autsorsing va mustaqil fikrlash o‘rtasidagi pedagogik bog‘lanish

Tashqi kognitiv	Kognitiv autsorsing	Pedagogik boshqaruv	Mustaqil fikrlash	**Natija (kognitiv**

resurslar (AI, qidiruv tizimi, raqamli vositalar)	rejimi (strategik yoki almashtiruvchi)	(maqsad, topshiriq, verifikatsiya, refleksiya)	indikatorlari (tahlil, baholash, argument, qaror)	**mustaqillik va mas’uliyat)**

Tashqi yordam → pedagogik tartibga solish → fikrlashni qo‘llab-quvvatlash → intellektual mustaqillik

Sxemada tashqi kognitiv resurslar mustaqil fikrlashga bevosita emas, balki kognitiv autsorsing rejimi va pedagogik boshqaruv orqali ta’sir qilishi ko‘rsatilgan. Bir xil AI vositasi bir vaziyatda talabaning fikrlashini kuchaytirishi, boshqa vaziyatda esa uni almashtirishi mumkin. Farq pedagogik dizayn, topshiriqning kognitiv murakkabligi, talabaning dastlabki pozitsiyasi, verifikatsiya talabi va refleksiyaning mavjudligida yuzaga keladi. Mustaqil fikrlashni rivojlantirish uchun “avval o‘yla – keyin tashqi yordam ol – tekshir – asosla – refleksiya qil” ketma-ketligi samarali pedagogik tamoyil bo‘lishi mumkin. Bunda talaba vazifa bilan tanishgach, dastlabki gipoteza yoki javobini mustaqil shakllantiradi; undan keyin tashqi vositalardan muqobil ma’lumot yoki yechim oladi; olingan natijani ishonchli manbalar bilan tekshiradi; o‘z yakuniy qarorini dalillar bilan asoslaydi va dastlabki hamda yakuniy pozitsiyasi o‘rtasidagi o‘zgarishni izohlaydi. Shu tarzda tashqi yordam fikrlashning o‘rnini egallamaydi, balki fikrni sinash va takomillashtirish vositasiga aylanadi.

Pedagogik jarayonni tashkil etishda topshiriq dizayni hal qiluvchi omildir. Tayyor javobni qayta bayon qilishga qaratilgan topshiriqlar generativ AI sharoitida past kognitiv qiymatga ega. Aksincha, dalillarni taqqoslash, xatoni topish, qarama-qarshi pozitsiyalarni baholash, bir yechimni boshqasidan ustun deb asoslash, manbaning ishonchliligini aniqlash, AI javobidagi mantiqiy bo‘shliqni ko‘rsatish kabi topshiriqlar mustaqil fikrlashni faollashtiradi. Bu topshiriqlarda tashqi vosita javob beruvchi emas, tahlil qilinuvchi obyekt yoki intellektual hamkor rolida namoyon bo‘ladi. Baholash tizimi ham kognitiv autsorsingning sifatini boshqaradi. Agar faqat yakuniy matn yoki to‘g‘ri javob baholansa, talaba tashqi vosita yordamida yuqori natijaga tez erishishi mumkin. Shu bois jarayon ko‘rsatkichlarini – dastlabki fikr, foydalanilgan manbalar, tekshiruv yo‘li, keltirilgan dalillar, rad etilgan variantlar va refleksiv izohni ham baholash maqsadga muvofiq. Bu yondashuv akademik halollikni nazorat qilishdan tashqari, fikrlash faoliyatini ko‘rinadigan va baholanadigan jarayonga aylantiradi. Shuningdek, o‘qituvchining roli “tayyor bilim beruvchi”dan kognitiv faoliyatni loyihalovchi va fikrlash sifatini kuzatuvchi mutaxassisga

o‘zgaradi. O‘qituvchi qaysi operatsiyalarni tashqi vositaga topshirish mumkinligini, qaysilari esa talabaning o‘zi tomonidan bajarilishi zarurligini didaktik maqsadga muvofiq belgilashi kerak. Masalan, katta hajmdagi ma’lumotni dastlabki tasniflash AI yordamida bajarilishi mumkin, biroq tasnif mezonini tanlash, natijani talqin qilish va pedagogik xulosani chiqarish talabaning o‘z faoliyati bo‘lib qolishi kerak. Shu tariqa, kognitiv autsorsing sharoitida mustaqil fikrlashni rivojlantirishning markaziy pedagogik masalasi texnologiyani cheklash emas, balki inson va texnologiya o‘rtasidagi kognitiv mehnat taqsimotini maqsadli boshqarishdir. Talaba tashqi vositadan foydalanayotgan bo‘lsa ham, maqsadni aniqlash, mezon tanlash, dalilni baholash, qaror chiqarish va natija uchun javobgarlikni o‘zida saqlashi kerak. Ana shu holat kognitiv autsorsingni pedagogik xavfdan rivojlantiruvchi resursga aylantiradi.

Mazkur muammoni hal etishda uchta ustuvor yo‘nalish alohida ahamiyat kasb etadi. Birinchidan, o‘quv topshiriqlarini kognitiv operatsiyalar bo‘yicha qayta loyihalash zarur: talaba qaysi bosqichda mustaqil fikrlashi, qaysi bosqichda tashqi vositadan foydalanishi va qaysi natijani albatta o‘zi asoslab berishi oldindan belgilanadi. Ikkinchidan, baholash mezonlariga yakuniy mahsulot bilan birga fikrlash jarayonini ham kiritish lozim. Dastlabki gipoteza, foydalanilgan manbalar, verifikatsiya yo‘li, qarama-qarshi dalillar va refleksiv izohni baholash talabaning kognitiv mehnatini ko‘rinadigan qiladi. Uchinchidan, talabalarda AI va boshqa raqamli vositalardan foydalanish madaniyatini shakllantirish mustaqil fikrlash kompetensiyasining tarkibiy qismi sifatida ko‘rilishi kerak. Pedagogik jihatdan samarali yondashuv tashqi yordamni taqiqlash emas, balki uni bosqichma-bosqich me’yorlash va ongli tanlash ko‘nikmasini rivojlantirishdir. O‘quv jarayonining dastlabki bosqichlarida o‘qituvchi verifikatsiya savollari, dalillar xaritasi, qaror matritsasi, fikrlash kundaligi kabi tayanch vositalarni taklif etishi mumkin. Keyinchalik mazkur tayanchlar qisqarib, talabaning o‘z-o‘zini nazorat qilishi va qaror uchun mas’uliyati ortib boradi. Natijada kognitiv autsorsing “tayyor javob olish” strategiyasidan “fikrni tekshirish va kengaytirish” strategiyasiga aylantiriladi. Aynan shu o‘zgarish mustaqil fikrlashning raqamli muhitdagi yangi pedagogik mazmunini belgilaydi.

Kognitiv autsorsingning strategik shakli tashqi resurslarni yordamchi vosita sifatida qo‘llab, tahlil, baholash, argumentatsiya va qaror qabul qilishni talabada saqlaydi; almashtiruvchi shakl esa aynan rivojlanishi zarur bo‘lgan kognitiv operatsiyalarni tashqi tizimga ko‘chiradi. Mustaqil fikrlash kognitiv autsorsing sharoitida muammoni formulalash, axborotni tanlash, dalilni

baholash, muqobil fikrlarni solishtirish, argumentatsiya, qaror qabul qilish va refleksiv nazorat indikatorlari orqali baholanishi maqsadga muvofiq.

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BOSHLANG‘ICH SINF TEXNOLOGIYA DARSLARIDA O‘QUVCHILAR KREATIV FAOLIYATINI INTENSIV RIVOJLANTIRISH USULLARI

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Surxondaryo viloyati Sho‘rchi tumani 54-maktabning Boshlang‘ich ta’lim fani o‘qituvchisi

Annotatsiya. *Mazkur maqolada boshlang‘ich sinf o‘quvchilarining kreativ faoliyatini texnologiya darslari jarayonida intensiv rivojlantirishning pedagogik imkoniyatlari, metodik yondashuvlari va samarali usullari tadqiq etiladi. Zamonaviy ta’lim tizimida o‘quvchidan nafaqat tayyor bilimlarni o‘zlashtirish, balki muammoli vaziyatlarni mustaqil tahlil qilish, yangi g‘oyalar ishlab chiqish, nostandart qarorlar qabul qilish va amaliy faoliyat orqali o‘z ijodiy salohiyatini namoyon etish talab qilinmoqda. Shu nuqtayi nazardan texnologiya fani boshlang‘ich ta’lim bosqichida kreativ tafakkurni shakllantirish uchun alohida pedagogik imkoniyatlarga ega. Tadqiqotda kreativ faoliyat tushunchasining mazmuni, uning tarkibiy komponentlari hamda boshlang‘ich sinf o‘quvchilarida kreativlikni rivojlantirishga ta’sir etuvchi pedagogik omillar tahlil qilinadi. Shuningdek, muammoli ta’lim, loyiha metodi, dizayn-fikrlash, ochiq topshiriqlar, “aqliy hujum”, modellashtirish, eksperiment va refleksiv yondashuv kabi metodlarning texnologiya darslaridagi didaktik imkoniyatlari yoritiladi. Tadqiqot natijalari texnologiya darslarini reproduktiv faoliyatdan ijodiy-amaliy faoliyatga yo‘naltirish o‘quvchilarning mustaqil fikrlashi, tasavvuri, muammoni hal qilish qobiliyati va amaliy kompetensiyalarini rivojlantirishga xizmat qilishini ko‘rsatadi.*

Kalit so‘zlar: *boshlang‘ich ta’lim, texnologiya darsi, kreativlik, kreativ faoliyat, ijodiy tafakkur, muammoli ta’lim, loyiha metodi, dizayn-fikrlash, innovatsion pedagogika, amaliy faoliyat.*

Kirish

XXI asr ta’lim tizimida shaxsning kreativ salohiyatini rivojlantirish ta’lim sifatini belgilovchi muhim mezonlardan biriga aylanmoqda. Raqamli texnologiyalarning jadal rivojlanishi, mehnat bozoridagi o‘zgarishlar, yangi kasblarning paydo bo‘lishi va ijtimoiy muammolarning murakkablashuvi o‘quvchilarda tayyor bilimlarni o‘zlashtirish bilan cheklanib qolmaydigan

kompetensiyalarni shakllantirishni talab qilmoqda. Ayniqsa, boshlang‘ich ta’lim bosqichida kreativ tafakkur, mustaqil qaror qabul qilish, tasavvur qilish, muammoni turli nuqtayi nazardan ko‘ra olish va yangi mahsulot yaratish qobiliyatlarini rivojlantirish keyingi ta’lim bosqichlari uchun muhim poydevor vazifasini bajaradi.

Boshlang‘ich sinf texnologiya darslari mazkur vazifalarni amalga oshirish uchun katta didaktik imkoniyatlarga ega. Chunki ushbu fan doirasida o‘quvchilar qog‘oz, karton, tabiiy va sun’iy materiallar, mato, yog‘och elementlari hamda boshqa vositalar bilan ishlash, buyumlarni loyihalash, modellashtirish, bezash va amaliy mahsulot yaratish orqali o‘z g‘oyalarini moddiy shaklga keltiradilar. Bunday jarayonda o‘quvchi faqat o‘qituvchi ko‘rsatmasini takrorlamaydi, balki materialning xususiyatini anglaydi, muammoni hal qilish yo‘lini izlaydi, o‘z variantini taklif qiladi va natijani baholaydi.

An’anaviy texnologiya darslarida ko‘pincha o‘qituvchi tomonidan berilgan namunani aynan takrorlashga asoslangan faoliyat ustunlik qiladi. Bunday yondashuv ma’lum amaliy ko‘nikmalarni shakllantirishga yordam bersa-da, o‘quvchining divergent tafakkuri, mustaqil qaror qabul qilishi va individual ijodiy yondashuvini yetarli darajada rag‘batlantirmasligi mumkin. Shu sababli texnologiya darslarining metodik mazmunini kreativ topshiriqlar, ochiq muammolar va loyihaviy faoliyat bilan boyitish zarur.

Tadqiqot metodologiyasi

Tadqiqotning metodologik asosini kreativ ta’lim, konstruktivistik pedagogika, faoliyatga yo‘naltirilgan ta’lim va kompetensiyaviy yondashuvning nazariy tamoyillari tashkil etadi. Tadqiqot davomida pedagogik va psixologik adabiyotlarni nazariy tahlil qilish, ilmiy manbalarni qiyosiy o‘rganish, pedagogik kuzatuv, umumlashtirish, tizimlashtirish hamda texnologiya darslarining metodik imkoniyatlarini tahlil qilish usullaridan foydalanildi.

Kreativ faoliyatni baholashda uning bir nechta o‘zaro bog‘liq jihatlarini hisobga olish maqsadga muvofiq: g‘oyalar xilma-xilligi, yangilik darajasi, mustaqillik, muammoni hal qilish strategiyalarining xilma-xilligi, amaliy mahsulot yaratish qobiliyati va o‘z faoliyatini refleksiv baholash. Bunday yondashuv kreativlikni faqat tayyor mahsulotning estetik ko‘rinishi bilan cheklab qo‘ymasdan, ijodiy jarayonning o‘zini ham pedagogik jihatdan baholash imkonini beradi.

Loyiha metodining imkoniyatlari

Loyiha metodi texnologiya darslarida kreativ faoliyatni rivojlantirish uchun eng samarali yondashuvlardan biridir. Loyiha asosida o‘qitishda o‘quvchi

real yoki o‘quv-amaliy muammoni hal qilish uchun mustaqil ravishda ma’lumot to‘playdi, g‘oya ishlab chiqadi, mahsulot yaratadi va natijani taqdim etadi.

Boshlang‘ich sinflarda kichik loyihalarni tashkil etish mumkin. Masalan, “Mening ekologik maktabim”, “Qayta ishlanadigan materiallardan foydali buyum”, “Maktab bog‘i modeli”, “Kelajak shahri”, “Milliy naqshlar asosida zamonaviy dizayn” kabi loyihalar o‘quvchilarning ijodiy va amaliy faoliyatini birlashtiradi.

Loyihaviy faoliyatning muhim jihati shundaki, bunda yakuniy mahsulotning yagona to‘g‘ri varianti mavjud emas. Har bir o‘quvchi o‘z tajribasi, tasavvuri va imkoniyatlariga asoslangan individual yechim taklif qilishi mumkin. Bu esa kreativlikning individuallik komponentini rivojlantiradi.

Guruhli ijodiy faoliyat

Kreativlik faqat individual faoliyatda emas, balki guruhli hamkorlik jarayonida ham rivojlanadi. Texnologiya darslarida kichik guruhlar tashkil etilib, ularga umumiy muammoni turli usullar bilan hal qilish vazifasi berilishi mumkin.

Guruhli loyihalarda rollarni taqsimlash muhim ahamiyatga ega. Bir o‘quvchi loyiha g‘oyasini ishlab chiqishi, ikkinchisi materiallarni tanlashi, uchinchisi chizma yoki model bilan ishlashi, to‘rtinchisi esa tayyor mahsulotni taqdim etishi mumkin. Keyingi loyihalarda rollarni almashtirish orqali barcha o‘quvchilarning turli faoliyat turlarida ishtirok etishi ta’minlanadi.

Bunday yondashuv kreativlik bilan birga kommunikativ kompetensiya, jamoada ishlash, o‘z fikrini asoslash va boshqa fikrlarga hurmat bilan munosabatda bo‘lish ko‘nikmalarini shakllantiradi.

Raqamli texnologiyalardan foydalanish

Bugungi kunda texnologiya darslarini raqamli vositalar bilan integratsiyalash o‘quvchilarning kreativ imkoniyatlarini yanada kengaytiradi. Oddiy grafik dasturlar, raqamli modellashtirish vositalari, interaktiv taqdimotlar va vizual loyihalash platformalari o‘quvchilarga o‘z g‘oyalarini avval raqamli muhitda sinab ko‘rish imkonini beradi.

Biroq raqamli vositalar kreativ faoliyatning maqsadi emas, balki vositasi sifatida qaralishi kerak. Texnologiya o‘quvchining mustaqil fikrlashini almashtirmasligi, aksincha, uning g‘oyasini rivojlantirishga xizmat qilishi lozim.

O‘qituvchining roli

Kreativ ta’lim muhitini yaratishda o‘qituvchining roli alohida ahamiyatga ega. O‘qituvchi tayyor yechimni ko‘rsatadigan shaxsdan ko‘ra, o‘quvchining izlanishini tashkil etuvchi fasilitator sifatida faoliyat yuritishi maqsadga muvofiq.

O‘qituvchi “Bu noto‘g‘ri” deyish o‘rniga “Bu variantni yana qanday takomillashtirish mumkin?”, “Boshqa qanday yechim mavjud?”, “Agar materialni o‘zgartirsak nima bo‘ladi?”, “Sizning fikringizcha, qaysi variant samaraliroq?” kabi savollardan foydalanishi o‘quvchilarning fikrlash jarayonini rag‘batlantiradi.

Kreativ muhitda xato qilish ta’lim jarayonining tabiiy qismi sifatida qabul qilinishi kerak. Agar o‘quvchi xato qilishdan qo‘rqsa, u yangi g‘oya taklif qilishdan ham cho‘chiydi. Shu sababli psixologik xavfsiz muhit kreativ ta’limning asosiy shartlaridan biridir.

Kreativ faoliyatni baholash

Kreativ faoliyatni baholash an’anaviy “5 ballik” yoki faqat yakuniy mahsulotga asoslangan baholashdan farq qilishi lozim. Baholash jarayonning o‘zini ham qamrab olishi kerak.

Bunda quyidagi mezonlar muhim hisoblanadi: o‘quvchining mustaqilligi, g‘oyaning yangiligi, bir nechta yechim variantlarini taklif qila olishi, materiallardan samarali foydalanishi, muammoni hal qilish strategiyasi, tayyor mahsulotning funksionalligi, o‘z faoliyatini tushuntira olishi va refleksiya qilishi.

Ayniqsa, o‘quvchini boshqa o‘quvchilar bilan emas, o‘zining avvalgi natijasi bilan taqqoslash kreativ rivojlanishni qo‘llab-quvvatlaydi. Chunki kreativlik individual xususiyatga ega bo‘lib, barcha o‘quvchilardan bir xil natijani kutish pedagogik jihatdan to‘g‘ri emas.

Natijalar va muhokama

Nazariy tahlil shuni ko‘rsatadiki, boshlang‘ich sinf texnologiya darslarida kreativ faoliyatni rivojlantirishning samaradorligi, avvalo, ta’lim mazmunining ochiqligi va o‘quvchining mustaqil faoliyat darajasiga bog‘liq. O‘quvchiga tayyor namunani takrorlashdan ko‘ra, muammoni mustaqil hal qilish, bir nechta variantlarni ishlab chiqish va o‘z g‘oyasini amaliy mahsulotga aylantirish imkoniyati berilganda kreativ faoliyatning pedagogik samaradorligi oshadi.

Shuningdek, kreativ topshiriqlarni muntazam qo‘llash alohida bir dars bilan cheklanmasligi kerak. Kreativlikni rivojlantirish tizimli jarayon bo‘lib, u texnologiya fanining turli mavzulariga bosqichma-bosqich integratsiya qilinishi lozim. Dastlab o‘quvchilarga sodda ochiq topshiriqlar berilib, keyinchalik muammoli vaziyat, loyiha, prototiplash va mustaqil dizayn topshiriqlariga o‘tilishi mumkin.

Muhim jihatlardan biri shundaki, kreativ faoliyatni rivojlantirish faqat ijodiy mahsulot yaratish bilan cheklanmaydi. O‘quvchining muammoni qanday tushungani, qanday g‘oyalarni ko‘rib chiqqani, nima sababdan ma’lum yechimni

tanlagani va natijani qanday takomillashtirgani ham kreativ rivojlanishning muhim ko‘rsatkichlaridir.

Shu nuqtayi nazardan texnologiya darsi boshlang‘ich ta’limda STEAM yondashuvining tabiiy platformalaridan biri sifatida qaralishi mumkin. Chunki amaliy mahsulot yaratish jarayonida fanlararo bilimlar, texnologik ko‘nikmalar, muhandislik tafakkuri, san’at va dizayn elementlari hamda matematik hisob-kitoblar birlashadi.

Xulosa

Boshlang‘ich sinf texnologiya darslarida o‘quvchilarning kreativ faoliyatini intensiv rivojlantirish zamonaviy ta’limning muhim vazifalaridan biridir. Texnologiya fani o‘quvchilarning abstrakt g‘oyalarini amaliy mahsulotga aylantirish imkonini bergani sababli kreativ tafakkurni rivojlantirish uchun alohida pedagogik imkoniyatlarga ega.

Tadqiqot natijalari asosida texnologiya darslarida kreativ faoliyatni rivojlantirish uchun reproduktiv topshiriqlardan ochiq va muammoli topshiriqlarga bosqichma-bosqich o‘tish, loyiha va dizayn-fikrlash metodlarini joriy etish, “aqliy hujum”, modellashtirish, prototiplash va refleksiya usullaridan foydalanish maqsadga muvofiq ekanligi aniqlandi. Shuningdek, guruhli ijodiy faoliyat va fanlararo integratsiya o‘quvchilarning kreativ, kommunikativ va amaliy kompetensiyalarini birgalikda rivojlantirish imkonini beradi.

O‘qituvchi esa kreativ jarayonda nazorat qiluvchi emas, balki yo‘naltiruvchi va fasilitator sifatida faoliyat yuritishi kerak. O‘quvchiga xato qilish, qayta urinib ko‘rish, turli variantlarni sinash va o‘z g‘oyasini himoya qilish imkoniyatining berilishi kreativ ta’lim muhitining muhim shartidir.

Shunday qilib, boshlang‘ich sinf texnologiya darslarini “namunani takrorlash” modelidan “muammoni aniqlash – g‘oya yaratish – loyihalash – yaratish – sinash – takomillashtirish – taqdim etish” modeliga o‘tkazish o‘quvchilarning kreativ faoliyatini tizimli va intensiv rivojlantirishning istiqbolli yo‘nalishi sifatida baholanishi mumkin.

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BOSHLANG‘ICH TA’LIM JARAYONIDA O‘QUVCHILARNING KREATIV KOMPETENSIYALARINI RIVOJLANTIRISHNING PEDAGOGIK IMKONIYATLARI

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Annotatsiya. *Mazkur maqolada boshlang‘ich ta’lim jarayonida o‘quvchilarning kreativ kompetensiyalarini rivojlantirishning pedagogik imkoniyatlari, samarali metodlari va didaktik shart-sharoitlari tahlil qilinadi. Zamonaviy ta’lim tizimida o‘quvchining faqat tayyor bilimlarni o‘zlashtirishi emas, balki mustaqil fikrlashi, yangi g‘oyalarni ilgari surishi, muammoli vaziyatlarda nostandart yechimlar topishi va o‘z faoliyatini ijodiy tashkil eta olishi muhim kompetensiyalardan biri sifatida qaralmoqda. Ayniqsa, boshlang‘ich ta’lim bosqichi bolaning kreativ tafakkuri, tasavvuri, qiziquvchanligi va mustaqil faoliyatini shakllantirish uchun muhim davr hisoblanadi. Tadqiqotda kreativ kompetensiya tushunchasining mazmuni, uning tarkibiy komponentlari va boshlang‘ich ta’lim sharoitida rivojlantirish mexanizmlari yoritilgan. Muammoli ta’lim, loyiha metodi, STEAM yondashuvi, dizayn-fikrlash, interfaol metodlar, ochiq topshiriqlar va refleksiv faoliyatning kreativ kompetensiyani shakllantirishdagi imkoniyatlari tahlil qilinadi. Tadqiqot natijalari boshlang‘ich ta’lim jarayonini reproduktiv faoliyatdan ijodiy va tadqiqotchilik faoliyatiga yo‘naltirish o‘quvchilarning kreativ fikrlashi, mustaqilligi, motivatsiyasi va amaliy kompetensiyalarini rivojlantirishga xizmat qilishini ko‘rsatadi.*

Kalit so‘zlar: *boshlang‘ich ta’lim, kreativ kompetensiya, kreativ fikrlash, ijodkorlik, pedagogik imkoniyat, innovatsion ta’lim, STEAM, loyiha metodi, muammoli ta’lim, dizayn-fikrlash, interfaol metodlar.*

Kirish

Bugungi globallashuv va raqamli transformatsiya sharoitida ta’lim tizimining oldiga qo‘yilayotgan talablar tubdan o‘zgarib bormoqda. Zamonaviy jamiyatda muvaffaqiyatli faoliyat yuritish uchun shaxsdan faqat muayyan bilimlar majmuasiga ega bo‘lish emas, balki mavjud bilimlarni yangi vaziyatlarda qo‘llash, muammolarni mustaqil tahlil qilish, turli muqobil

yechimlarni ishlab chiqish, yangilik yaratish va o‘z faoliyatini takomillashtirib borish qobiliyati ham talab etiladi.

Shu nuqtayi nazardan kreativ kompetensiyani rivojlantirish zamonaviy ta’limning ustuvor yo‘nalishlaridan biri sifatida namoyon bo‘lmoqda. Kreativlik insonning mavjud bilim, tajriba va tasavvurlarini yangi kombinatsiyalarda qo‘llashi, muammolarga noodatiy yondashishi hamda yangi va maqsadga muvofiq g‘oyalar yaratish qobiliyatini ifodalaydi.

Boshlang‘ich ta’lim bosqichi kreativ kompetensiyalarni shakllantirish uchun alohida ahamiyatga ega. Chunki aynan ushbu davrda bolaning bilishga qiziqishi, tasavvuri, obrazli va mantiqiy tafakkuri, savol berishga moyilligi hamda mustaqil faoliyatga bo‘lgan ehtiyoji faol rivojlanadi. Agar mazkur tabiiy imkoniyatlar to‘g‘ri pedagogik muhit orqali qo‘llab-quvvatlansa, o‘quvchining keyingi ta’lim bosqichlaridagi kreativ salohiyati uchun mustahkam asos yaratiladi.

An’anaviy ta’lim modelida o‘quvchi ko‘pincha tayyor bilimni qabul qiluvchi subyekt sifatida namoyon bo‘ladi. Bunday yondashuv ma’lum bilim va ko‘nikmalarni shakllantirishda samarali bo‘lsa-da, o‘quvchining mustaqil fikrlashi va kreativ imkoniyatlarini to‘liq namoyon etishga har doim ham yetarli sharoit yaratmaydi. Shu sababli zamonaviy boshlang‘ich ta’limda o‘quvchini bilimning passiv iste’molchisi emas, balki bilimni izlab topuvchi, qayta ishlovchi va yangi g‘oyalar yaratuvchi faol subyekt sifatida shakllantirish zarur.

Tadqiqot metodologiyasi

Tadqiqotning metodologik asosini kompetensiyaviy, shaxsga yo‘naltirilgan, faoliyatga asoslangan va konstruktivistik ta’lim yondashuvlari tashkil etadi. Tadqiqot jarayonida pedagogik, psixologik va metodik adabiyotlarni tahlil qilish, ilmiy manbalarni qiyosiy o‘rganish, pedagogik jarayonni umumlashtirish va tizimlashtirish usullaridan foydalanildi.

Kreativ kompetensiyaning rivojlanishini tahlil qilishda o‘quvchining yangi g‘oya yaratishi, muammoga turli nuqtayi nazardan yondashishi, bir nechta yechim variantlarini taklif qilishi, mustaqil qaror qabul qilishi, o‘z fikrini asoslay olishi va yaratilgan mahsulot yoki g‘oyani takomillashtirishi kabi mezonlar asos qilib olindi.

Kreativ kompetensiyani faqat yakuniy mahsulot bilan baholash emas, balki kreativ jarayonning barcha bosqichlarini hisobga olish muhimdir. O‘quvchining muammoni qanday tushungani, qanday g‘oyalar ishlab chiqqani, qanday qaror qabul qilgani va xatolaridan qanday xulosa chiqargani uning kreativ rivojlanish darajasini aniqlashda muhim pedagogik indikatorlar hisoblanadi.

Kreativ kompetensiya tushunchasining pedagogik mazmuni

“Kreativ kompetensiya” tushunchasi zamonaviy ta’limda shaxsning yangi g‘oyalarni ishlab chiqish, muammoli vaziyatlarda mustaqil va nostandart yechimlar topish, mavjud bilimlarni yangi sharoitlarda qo‘llash hamda ijodiy mahsulot yaratish qobiliyatini ifodalovchi kompleks sifatida qaraladi.

Kreativ kompetensiya bir nechta tarkibiy qismlarning o‘zaro birligidan tashkil topadi. Birinchidan, motivatsion komponent mavjud bo‘lib, u o‘quvchining yangi narsalarni bilishga, izlanishga va ijod qilishga bo‘lgan ichki ehtiyojini ifodalaydi. Ikkinchidan, kognitiv komponent o‘quvchining muammoga oid bilimlarni egallashi va ularni yangi vaziyatlarda qo‘llay olish qobiliyatini anglatadi. Uchinchidan, operatsion komponent g‘oyalarni amaliy faoliyatga aylantirish, rejalashtirish va natijaga erishish bilan bog‘liq. To‘rtinchidan, refleksiv komponent o‘quvchining o‘z faoliyatini tahlil qilishi, xatolarini aniqlashi va faoliyatini takomillashtirishini ifodalaydi.

Boshlang‘ich ta’limda ushbu komponentlarni alohida emas, balki yagona pedagogik jarayon doirasida rivojlantirish zarur. Masalan, o‘quvchi muayyan buyumni loyihalash jarayonida avval muammoni anglaydi, g‘oya ishlab chiqadi, materiallarni tanlaydi, mahsulot yaratadi va yakunda o‘z ishini baholaydi. Shu tariqa kreativ kompetensiyaning bir nechta komponentlari bir vaqtning o‘zida rivojlanadi.

Boshlang‘ich ta’limda kreativ kompetensiyani rivojlantirishning pedagogik imkoniyatlari

Boshlang‘ich ta’lim jarayoni kreativ kompetensiyani rivojlantirish uchun keng imkoniyatlarga ega. Buning asosiy sababi shundaki, boshlang‘ich sinf fanlarining aksariyati o‘quvchining kuzatish, taqqoslash, tasavvur qilish, savol berish va amaliy faoliyatini tashkil etishga imkon beradi.

Ona tili va o‘qish savodxonligi darslarida hikoyaning davomini mustaqil yaratish, matnga boshqa nom berish, qahramonning xatti-harakatiga muqobil yechim taklif qilish yoki voqeani boshqa nuqtayi nazardan tasvirlash mumkin. Matematika darslarida esa bir masalani bir nechta usul bilan yechish, yangi masala tuzish yoki matematik vaziyatni real hayot bilan bog‘lash kreativ tafakkurni rivojlantiradi.

Tabiiy fanlar darslarida kuzatish, tajriba, gipoteza ishlab chiqish va natijalarni izohlash o‘quvchilarning tadqiqotchilik va kreativ faoliyatini kuchaytiradi. Texnologiya darslarida esa o‘quvchilar g‘oyani amaliy mahsulotga aylantirish orqali kreativ kompetensiyani bevosita namoyon etadilar.

Demak, kreativ kompetensiyani rivojlantirish alohida bir fan doirasidagi vazifa emas. U butun boshlang‘ich ta’lim mazmuniga integratsiyalashgan tizimli pedagogik jarayon sifatida tashkil etilishi lozim.

STEAM yondashuvining imkoniyatlari

STEAM yondashuvi fanlararo integratsiya orqali o‘quvchilarning kreativ va amaliy tafakkurini rivojlantirishga qaratilgan. Mazkur yondashuvda tabiiy fanlar, texnologiya, muhandislik, san’at va matematika o‘zaro bog‘langan holda o‘qitiladi.

Boshlang‘ich ta’limda STEAM topshiriqlari o‘quvchilarning yoshiga mos ravishda sodda va amaliy shaklda tashkil etilishi mumkin. Masalan, “Qog‘ozdan eng mustahkam ko‘prik yaratish”, “Suvni tozalashning oddiy modelini yaratish”, “Shamol energiyasidan foydalanadigan model ishlab chiqish” kabi topshiriqlar o‘quvchilardan bir vaqtning o‘zida bilim, tasavvur, loyihalash va amaliy ko‘nikmalarni talab qiladi.

STEAM yondashuvining muhim jihati shundaki, bunda o‘quvchi faqat bilimni o‘zlashtirmaydi, balki bilimdan foydalanib real yoki shartli muammoni hal qiladi. Natijada ta’lim mazmuni amaliy faoliyat bilan bog‘lanadi.

Dizayn-fikrlash va kreativ kompetensiya

Dizayn-fikrlash o‘quvchini muammoni inson ehtiyojlari nuqtayi nazaridan ko‘rishga, g‘oyalar yaratishga, prototip tayyorlashga va uni takomillashtirishga yo‘naltiradi. Boshlang‘ich sinflarda bu metod soddalashtirilgan shaklda qo‘llanilishi mumkin.

Masalan, “Sinfdoshlar uchun qulay kitob javoni yaratish” topshirig‘ida o‘quvchilar avval muammoni aniqlaydilar, keyin turli variantlarni taklif qiladilar, chizma yoki maket yaratadilar va o‘z loyihalarini muhokama qiladilar. Keyingi bosqichda takliflar asosida loyiha takomillashtiriladi.

Bu jarayon o‘quvchida kreativlik bilan birga empatiya, tanqidiy fikrlash, hamkorlik va muammoni hal qilish kompetensiyalarini ham rivojlantiradi.

Ochiq topshiriqlar orqali kreativ fikrlashni rivojlantirish

Kreativ kompetensiyani rivojlantirishda ochiq topshiriqlar alohida ahamiyatga ega. Bunday topshiriqlarning o‘ziga xos jihati shundaki, ularda yagona to‘g‘ri javob mavjud emas.

Masalan, “Berilgan uchta geometrik shakldan foydalanib, imkon qadar ko‘p tasvir yarating” yoki “Ushbu hikoyaga boshqa yakun o‘ylab toping” kabi topshiriqlar o‘quvchini mavjud bilim va tasavvurlarini yangi kombinatsiyalarda qo‘llashga undaydi.

Ochiq topshiriqlar o‘quvchilarning ravonlik, moslashuvchanlik, originallik va elaboratsiya kabi kreativ fikrlash jihatlarini rivojlantirish imkonini beradi.

Interfaol metodlarning pedagogik imkoniyatlari

Interfaol metodlar o‘quvchini ta’lim jarayonining faol subyektiga aylantiradi. “Aqliy hujum”, “Klaster”, “Insert”, “B-B-B”, “Case-study”, “Rolga

kirish”, “Debat” va boshqa metodlardan yosh xususiyatlariga mos holda foydalanish o‘quvchilarning fikrlash faolligini oshiradi.

“Aqliy hujum” yangi g‘oyalarni ko‘paytirishga xizmat qilsa, “Klaster” mavjud bilimlarni tizimlashtirish va ular o‘rtasidagi aloqalarni aniqlash imkonini beradi. Rolga kirish usuli esa o‘quvchining vaziyatni boshqa shaxs nuqtayi nazaridan ko‘rib chiqishiga yordam beradi.

Interfaol metodlarning samaradorligi ularning o‘z-o‘zidan qo‘llanishida emas, balki aniq didaktik maqsad bilan bog‘langanligida namoyon bo‘ladi. Shu sababli o‘qituvchi metod tanlashda o‘quvchilarning yoshi, mavzu mazmuni va kutilayotgan natijani hisobga olishi kerak.

Raqamli ta’lim muhiti va kreativ kompetensiya

Raqamli texnologiyalar boshlang‘ich ta’limda kreativ faoliyatni tashkil etish uchun yangi imkoniyatlarni yaratmoqda. Interaktiv taqdimotlar, ta’limiy platformalar, raqamli rasm chizish, virtual modellashtirish va multimedia vositalari o‘quvchilarning g‘oyalarini turli shakllarda ifodalashiga yordam beradi.

Biroq raqamli vositalardan foydalanishda pedagogik muvozanatni saqlash zarur. Texnologiya o‘quvchining mustaqil fikrlashi o‘rnini egallamasligi kerak. Aksincha, u o‘quvchining g‘oyasini vizuallashtirish, sinab ko‘rish va takomillashtirish uchun vosita bo‘lib xizmat qilishi lozim.

Kreativ kompetensiyani baholash

Kreativ kompetensiyani baholash an’anaviy reproduktiv bilimlarni baholashdan farq qiladi. O‘quvchining faqat yakuniy javobi emas, balki uning fikrlash jarayoni ham hisobga olinishi kerak.

Baholashda quyidagi mezonlardan foydalanish mumkin: yangi g‘oya yaratish, bir nechta yechim variantlarini taklif qilish, mustaqillik, muammoni turli nuqtayi nazardan ko‘ra olish, g‘oyani amaliyotga tatbiq etish, mahsulotni takomillashtirish va o‘z faoliyatini tahlil qilish.

Formativ baholash bu jarayonda ayniqsa muhimdir. O‘qituvchining konstruktiv fikr-mulohazasi o‘quvchiga o‘z ishining kuchli va takomillashtirilishi zarur bo‘lgan jihatlarini anglashga yordam beradi.

Natijalar va muhokama

Tahlillar shuni ko‘rsatadiki, boshlang‘ich ta’limda kreativ kompetensiyani rivojlantirishning samaradorligi, avvalo, o‘quvchining faol ta’lim jarayoniga jalb etilish darajasiga bog‘liq. O‘quvchi tayyor bilimni qabul qiluvchi emas, balki bilimni izlovchi, tahlil qiluvchi va amaliyotda qo‘llovchi subyekt sifatida faoliyat yuritganda kreativ imkoniyatlar kengayadi.

Muammoli ta’lim o‘quvchini mustaqil yechim izlashga undaydi. Loyiha metodi g‘oyani amaliy mahsulotga aylantirish imkonini beradi. STEAM yondashuvi fanlararo bilimlarni birlashtiradi. Dizayn-fikrlash esa muammoni inson ehtiyojlari asosida tahlil qilish va prototip yaratish ko‘nikmasini rivojlantiradi. Ochiq topshiriqlar va interfaol metodlar esa divergent fikrlashni faollashtiradi.

Shuningdek, kreativ kompetensiyani rivojlantirishda ta’lim muhitining psixologik xususiyatlari ham muhim. O‘quvchi o‘z fikrini erkin bildira oladigan, xato qilishdan qo‘rqmaydigan va yangi g‘oyalariga hurmat bilan munosabatda bo‘linadigan muhitda faolroq ijod qiladi.

Shu sababli kreativ kompetensiyani rivojlantirish faqat metod tanlash masalasi emas. Bu ta’lim mazmuni, o‘qituvchi pozitsiyasi, topshiriqlar xarakteri, baholash mezonlari va sinfdagi psixologik muhitni o‘zaro uyg‘unlashtirishni talab qiladigan kompleks pedagogik jarayondir.

Xulosa

Boshlang‘ich ta’lim jarayonida o‘quvchilarning kreativ kompetensiyalarini rivojlantirish zamonaviy pedagogikaning muhim yo‘nalishlaridan biri hisoblanadi. Kreativ kompetensiya o‘quvchining yangi g‘oyalarni yaratishi, muammolarni nostandart usullarda hal qilishi, mavjud bilimlarni yangi vaziyatlarda qo‘llashi va o‘z g‘oyalarini amaliy faoliyatga tatbiq eta olishini qamrab oluvchi kompleks kompetensiyadir.

Tadqiqot natijalari boshlang‘ich ta’limda kreativ kompetensiyani rivojlantirish uchun muammoli ta’lim, loyiha metodi, STEAM yondashuvi, dizayn-fikrlash, ochiq topshiriqlar, interfaol metodlar va refleksiv faoliyatdan tizimli foydalanish samarali ekanligini ko‘rsatadi.

Kreativ ta’limning muhim sharti o‘quvchiga mustaqil tanlash, tajriba qilish, xato qilish, qayta urinib ko‘rish va o‘z g‘oyasini takomillashtirish imkoniyatini berishdan iborat. Bunda o‘qituvchi bilim beruvchi funksiyasi bilan bir qatorda fasilitator, motivator va pedagogik jarayon dizayneri sifatida faoliyat yuritishi lozim.

Umuman olganda, boshlang‘ich ta’limni kreativ faoliyatga yo‘naltirish o‘quvchilarning nafaqat ijodiy tafakkurini, balki mustaqillik, tanqidiy fikrlash, muammoni hal qilish, kommunikativ hamkorlik va amaliy faoliyat kompetensiyalarini ham kompleks rivojlantirish imkonini beradi. Shu jihatdan kreativ kompetensiyani shakllantirish boshlang‘ich ta’limning alohida elementi emas, balki uning strategik pedagogik maqsadlaridan biri sifatida qaralishi lozim.

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BO‘LAJAK PEDAGOGLARNING KASBIY MADANIYATINI RIVOJLANTIRISHNING PEDAGOGIK-PSIXOLOGIK XUSUSIYATLARI

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Annotatsiya. *Maqolada bo‘lajak pedagoglar kasbiy madaniyatini rivojlantirishning pedagogik-psixologik xususiyatlari nazariy tahlil va konseptual modellashtirish asosida yoritilgan. Kasbiy madaniyat qadriyatlar, bilimlar, pedagogik harakatlar, etik munosabatlar va refleksiyaning yaxlit tizimi sifatida talqin etilgan. Uning rivojlanishi qadriyatlarning ichkilashuvi, bilimning vaziyatli qo‘llanishi, emotsional-etik o‘zini boshqarish, refleksiv korreksiya hamda mustaqil kasbiy tanlov bilan izohlangan. Besh komponentning psixologik mexanizmlari, pedagogik namoyonlari va diagnostik dalillari jadvalda tizimlashtirilib, ularni bog‘lovchi olti bosqichli rivojlanish sxemasi taklif etilgan. Xulosalar empirik samaradorlikni tasdiqlash emas, keyingi tajriba-sinovni loyihalash uchun nazariy asos vazifasini bajaradi.*

Kalit so‘zlar: *kasbiy madaniyat, bo‘lajak pedagog, ichkilashtirish, pedagogik tafakkur, motivatsiya, empatiya, refleksiya, o‘zini boshqarish.*

Аннотация. *На основе теоретического анализа и концептуального моделирования раскрыты педагогико-психологические особенности развития профессиональной культуры будущих педагогов. Она рассматривается как единство ценностей, знаний, педагогических действий, этических отношений и рефлексии. Выделены механизмы интериоризации ценностей, контекстного применения знаний, эмоционально-этической саморегуляции, рефлексивной коррекции и самостоятельного профессионального выбора. Предложены таблица характеристик пяти компонентов и шестиступенчатая схема развития. Выводы имеют теоретический характер и не являются доказательством эмпирической эффективности.*

Ключевые слова: *профессиональная культура, будущий педагог, интериоризация, педагогическое мышление, мотивация, эмпатия, рефлексия, саморегуляция.*

Abstract. *The article examines the pedagogical and psychological characteristics of developing pre-service teachers' professional culture through theoretical analysis and conceptual modelling. Professional culture is viewed as an integration of values, knowledge, pedagogical action, ethical relationships, and reflection. The proposed mechanisms include value internalisation, contextual knowledge application, emotional and ethical self-regulation, reflective adjustment, and independent professional choice. A table maps five components to their mechanisms and observable indicators, while a six-stage diagram connects them in a developmental cycle. The findings provide a theoretical basis for subsequent empirical testing rather than evidence of effectiveness.*

Keywords: *professional culture, pre-service teacher, internalisation, pedagogical reasoning, motivation, empathy, reflection, self-regulation.*

KIRISH

Bo‘lajak pedagogning kasbiy tayyorgarligini faqat bilim hajmi va metodik usullarni egallashi bilan tavsiflash yetarli emas. Shulman pedagogik faoliyatni tushunish, fikriy asoslash, bilimni o‘qitish mazmuniga aylantirish va refleksiya birligida izohlaydi [1]. Korthagen esa universitetda o‘zlashtirilgan nazariya bilan amaliy vaziyatdagi harakat o‘rtasidagi tafovutni pedagog tayyorlashning muhim muammosi sifatida ko‘rsatadi [2]. Ushbu qarashlar kasbiy madaniyatni nafaqat bilimga egalik, balki bilim, qadriyat va mas’uliyatni bir qarorda uyg‘unlashtirish nuqtayi nazaridan o‘rganishga asos bo‘ladi. Mazkur maqolada muammo quyidagicha qo‘yiladi: pedagogik qadriyatni bilish qaysi psixologik mexanizmlar orqali madaniyatli kasbiy harakatga aylanadi? “Xususiyat” rivojlanishning ichki tabiati va namoyon bo‘lish usulini, “shart-sharoit” esa bu jarayonni qo‘llab-quvvatlovchi ta’lim muhitini anglatadi. Ularni farqlash metodlarni sanash bilan cheklanmay, talaba shaxsida sodir bo‘ladigan o‘zgarishlarni tushuntirish imkonini beradi. Tadqiqot maqsadi bo‘lajak pedagoglar kasbiy madaniyatining rivojlanishini belgilovchi pedagogik-psixologik xususiyatlarni aniqlashtirish hamda ularning komponentlar va kuzatiladigan faoliyat belgilariga aloqasini konseptual jihatdan asoslashdan iborat.

TADQIQOT METODLAR

Tadqiqot nazariy-tahliliy dizaynda bajarildi. Manba bazasini pedagogik bilim, nazariya va amaliyot aloqasi, motivatsiya, ijtimoiy-emotsional kompetentlik hamda o‘zini boshqarishga bag‘ishlangan, 1987–2024-yillarda nashr etilgan oltita ilmiy ish tashkil etdi [1–6]. Manbalar mavzuga bevosita aloqadorligi, tushunchalarning nazariy ochib berilishi va bibliografik

ma’lumotlarini tekshirish imkoniyati asosida maqsadli tanlandi. Nashriyot sahifalari va mualliflarning ochiq materiallaridan foydalanildi. Ushbu tanlanma sohadagi barcha tadqiqotlarni qamrab oluvchi tizimli sharh yoki meta-tahlil sifatida taqdim etilmaydi. Tahlil birligi sifatida kasbiy xulqni tushuntiruvchi nazariy fikr va mexanizmlar olindi. Dastlab tushunchaviy tahlil orqali kasbiy madaniyat bilim, kompetentlik va etika bilan chegaradosh, ammo ulardan birortasiga tenglashtirilmaydigan hodisa sifatida belgilandi. Keyin qiyosiy tahlilda “qadriyat va motiv”, “bilim va qaror”, “faoliyat”, “muloqot va etika”, “refleksiya” yo‘nalishlari ajratildi. Konseptual sintezda bu yo‘nalishlar “komponent – psixologik mexanizm – pedagogik namoyon – diagnostik dalil” zanjiriga birlashtirildi. Tizimli, aksiologik, madaniyatshunoslik, faoliyatli, kompetensiyaviy va refleksiv yondashuvlar o‘zaro to‘ldiruvchi asos sifatida qo‘llandi. Jadval va sxema mazkur sintezning mualliflik mahsulidir. Talabalar bilan alohida tajriba o‘tkazilmadi; shu sababli foizlar, statistik farqlar va samaradorlik koeffitsiyentlari keltirilmaydi. Taklif etilgan indikatorlar tayyor standartlashtirilgan test emas, keyingi diagnostikani ishlab chiqish uchun mazmuniy yo‘nalish hisoblanadi.

NATIJALAR

Mualliflik talqinida bo‘lajak pedagogning kasbiy madaniyati – pedagogik qadriyatlar va bilimlarni vaziyatga mos, etik jihatdan maqbul harakatga aylantirish, uning oqibatlari uchun mas’uliyatni qabul qilish hamda tajribani refleksiv qayta ko‘rib chiqishni ta’minlovchi integrativ shaxsiy-kasbiy sifatdir. Bu ta’rifda bilim resurs, qadriyat tanlov mezoni, faoliyat namoyon shakli, muloqot etik munosabat muhiti, refleksiya esa rivojlanishni boshqarish mexanizmi bo‘lib xizmat qiladi.

Birinchi xususiyat – qadriyatli-motivatsion ichkilashuvdir. Ryan va Deci avtonomiya, kompetentlikni his etish va boshqalar bilan aloqadorlik ehtiyojlarining qo‘llab-quvvatlanishini sifatli motivatsiya bilan bog‘laydi [3]. Maqolada bu g‘oya pedagogik talabning tashqi majburiyatdan anglangan kasbiy mas’uliyatga aylanishi sifatida talqin qilinadi. Masalan, adolatli baholashning qiymati qoidani takrorlashda emas, talabaning bahsli vaziyatda o‘z mezonini ochiq asoslashida namoyon bo‘lishi taklif etiladi.

Ikkinchi xususiyat – bilimning kontekstual yaxlitlashuvidir: pedagogik tushuncha vaziyat tahlili, muqobil qaror va harakatga bog‘lanadi [1; 2]. *Uchinchi xususiyat* emotsional va etik boshqaruv birligi. Jennings va Greenberg o‘qituvchining ijtimoiy-emotsional kompetentligini qo‘llab-quvvatlovchi munosabatlar va sinfni boshqarish bilan bog‘laydi [4]. Ushbu asoslardan kelib

chiqib, kasbiy madaniyatning tarkibi va uni kuzatish yo‘nalishlari 1-jadvalda umumlashtirildi.

1-jadval.

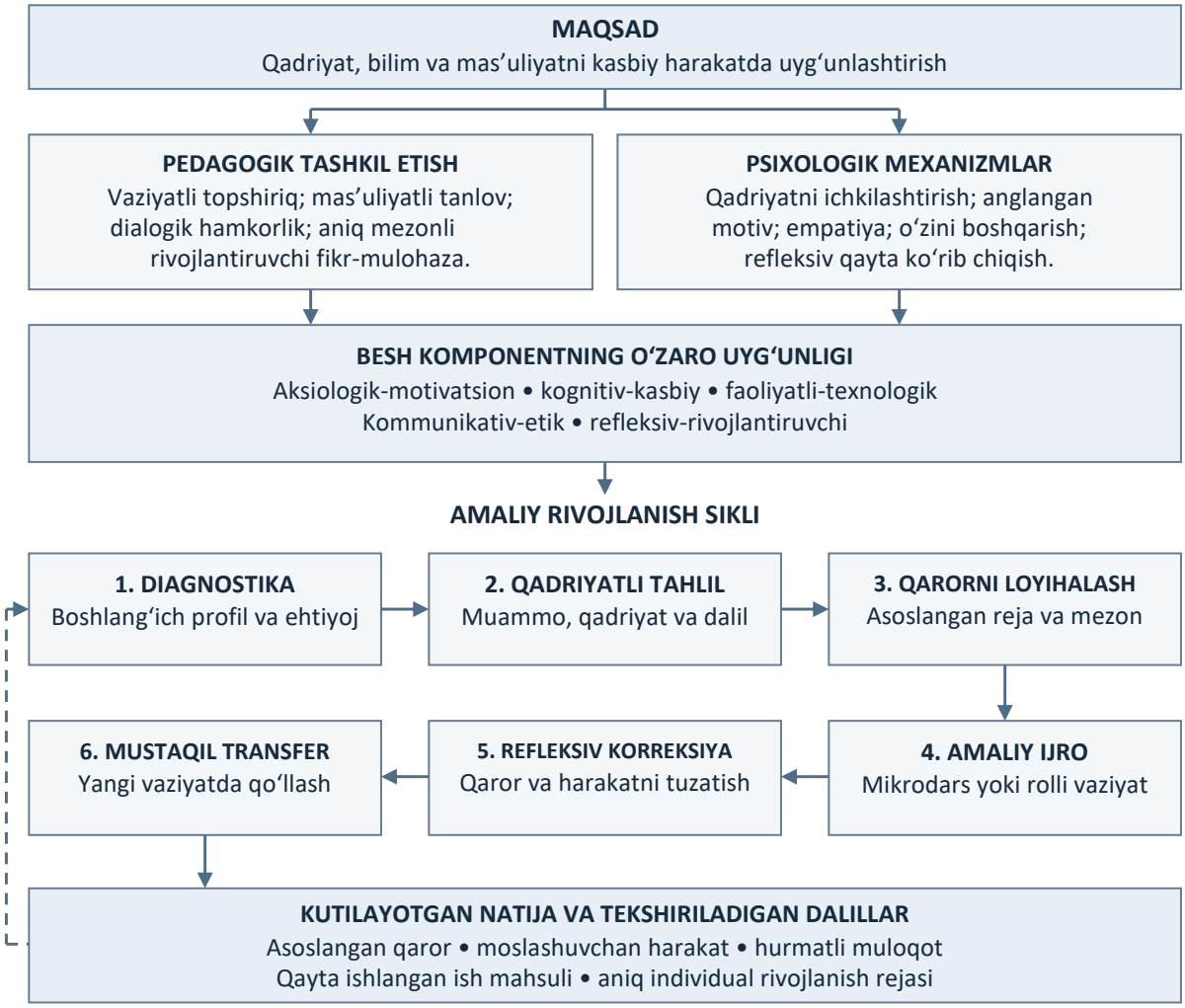
Kasbiy madaniyat komponentlari, rivojlanish mexanizmlari va diagnostik dalillar

Tarkibiy komponent	Psixologik mexanizm	Pedagogik namoyon	Kuzatiladigan dalil
Aksiologik-motivatsion	Kasbiy qadriyatni ichkilashtirish; anglangan motiv va mas’uliyat.	Etik dilemmada tanlov qilish; qarorning ta’lim oluvchiga ta’sirini izohlash.	Tanlovni qadriyat bilan asoslaydi; qulaylikdan ko‘ra adolatni ustun qo‘yadi.
Kognitiv-kasbiy	Vaziyatni anglash; bilimlar va sabab-oqibat aloqalarini birlashtirish.	Pedagogik holatni nazariya orqali tushuntirish; muqobil yechimlarni qiyoslash.	Dalilni taxmindan ajratadi; metod tanlovining sababini ko‘rsatadi.
Faoliyatli-texnologik	Maqsad qo‘yish; harakatni rejalashtirish va vaziyatga moslashtirish.	Mikrodarsni loyihalash; usulni sinash; pedagogik jarayonni tuzatish.	Reja va ijro mosligini ko‘rsatadi; kutilmagan holatda usulni moslashtiradi.
Kommunikativ-etik	Empatiya; o‘z hissiyotini boshqarish; boshqa nuqtayi nazarni hisobga olish.	Hurmatli muloqot; nizoni keskinlashtirmaslik; shaxs va xatti-harakatni farqlash.	Faol tinglaydi; kamsitmay fikr bildiradi; baholash mezonini ochiq tushuntiradi.
Refleksiv-rivojlantiruvchi	O‘zini kuzatish; metakognitiv tahlil; qayta aloqa asosida korreksiya.	Qaror sabablarini tekshirish; xatoni aniqlash; keyingi vazifani belgilash.	Dastlabki va qayta ishlangan ishni qiyoslaydi; aniq tuzatish va rivojlanish rejasini beradi.

To‘rtinchi xususiyat – rivojlanishning refleksiv-siklik xarakteridir. Panadero tahlilida o‘zini boshqarish rejalashtirish, bajarishni kuzatish va baholash jarayonlari bilan izohlanadi [5]. Bu yondashuv asosida refleksiya

“mashg‘ulot yoqdi” kabi taassurot bilan emas, qaror sababi, natija dalili va keyingi tuzatish orasidagi bog‘lanish bilan tavsiflanadi. Shuning uchun kundalik, qayta ishlangan dars rejasi va kuzatuv qaydi bir-birini to‘ldiruvchi dalillar sifatida taklif etiladi. *Beshinchi xususiyat* mualliflik sxemasida rivojlanishning individual va notekis kechishi haqidagi ishchi faraz bilan ifodalanadi: talaba nazariy tahlilda kuchli, lekin ziddiyatli muloqotda yordamga muhtoj bo‘lishi mumkin. Shuning uchun bitta umumiy ballga emas, komponentlar profiliga tayanish maqsadga muvofiq. Bilimdagi yuqori natija etik xatoni “qoplamasligi” lozim; muloqotdagi jiddiy muammo alohida tahlil va qayta mashqni talab qiladigan belgi sifatida qaraladi.

1-sxemada pedagogik tashkil etish va psixologik mexanizmlar alohida, lekin o‘zaro bog‘langan qatlamlar sifatida ko‘rsatilgan. Ular besh komponent uyg‘unligida olti bosqichli amaliy siklga birlashtiriladi. Sxemadagi yo‘nalishlar statistik isbotlangan sababiy bog‘lanishni emas, keyingi tadqiqotda tekshirilishi lozim bo‘lgan konseptual aloqalarni ifodalaydi.



Punktir chiziq: natija dalillari asosida qayta diagnostika va individual vazifani belgilash.

1-sxema. Kasbiy madaniyat rivojlanishining pedagogik-psixologik mexanizmlari.

Siklning metodik talabi – har bir bosqich mahsulotining keyingi bosqichga o‘tishidir: diagnostik profil vaziyat tanlashga, tahlil qaror loyihasiga, loyiha amaliy ijroga, kuzatuv dalili korreksiyaga asos bo‘ladi. Mustaqil transferda esa avvalgi yechim aynan takrorlanmaydi, yangi sharoitga moslashtiriladi. Masalan, baholashdagi adolatlilik avval rolli vaziyatda, keyin boshqa mazmundagi mikrodarsda tekshirilishi mumkin. Topshiriq yakunida “qanday qaror qildim?”, “qaysi dalil va qadriyatga tayandim?”, “munosabatim kimga qanday ta’sir etdi?” hamda “keyingi safar nimani o‘zgartiraman?” savollari qo‘yilishi tavsiya etiladi. Bunda talabani ochiq tanqidga majburlash emas, aniq harakatni hurmat bilan tahlil qilish nazarda tutiladi. Qayta aloqa natijasi keyingi diagnostik vazifaga aylangandagina sxema yopiq baholash emas, davomli rivojlanish sikli sifatida ishlashi kutiladi.

Taklif etilgan talqinning asosiy farqi kasbiy madaniyatni alohida fazilatlar yig‘indisi sifatida emas, qadriyat, bilim va harakatning muvofiqligi orqali

tushuntirishidadir. Masalan, bilimli, ammo kamsituvchi muloqot qiladigan talabaning kasbiy madaniyatini faqat nazariy test natijasiga ko‘ra yuqori deb baholash mazkur ta’rifga mos kelmaydi. Bu yondashuv Shulmanning pedagogik asoslash g‘oyasi [1] va Korthagenning nazariya-amaliyot aloqasi [2] bilan uyg‘un, lekin ularning modellari aynan takrorlangani emas, mazkur mavzu uchun konseptual birlashtirilganini anglatadi. Ortube, Panadero va Dignathning bo‘lajak pedagoglarga oid tizimli sharhida o‘zini boshqarishni o‘rganish bilan uni o‘qitishga tayyorlanishni birlashtirishning ahamiyati ko‘rsatiladi [6]. Bu maqoladagi amaliy siklni asoslashga yordam beradi, biroq taklif etilgan olti bosqichli sxemaning samaradorligini avtomatik tasdiqlamaydi. Xuddi shuningdek, talabaning fikrini tinglash talabchanlikdan voz kechish emas: mustaqil tanlov vazifa maqsadi, etik chegara va oldindan ma’lum baholash mezonlari doirasida tashkil etilishi taklif qilinadi. Amaliy jihatdan pedagogika mashg‘ulotlariga etik dilemma, mikrodars, kuzatuv qaydi va refleksiv portfolioni bir topshiriq zanjiri sifatida kiritish tavsiya etiladi. Cheklov manbalarning maqsadli tanlangani va sxemaning mahalliy talabalar guruhida tekshirilmaganidir. Keyingi tadqiqotda indikatorlar ekspert bahosidan o‘tkazilib, baholovchilar kelishuvi, takroriy vaziyatlardagi barqarorlik va natijalarning amaliyotga ko‘chishi tekshirilishi zarur. O‘zini baholash, kuzatuv hamda ish mahsulini qiyoslash taklif etiladi; tajriba va taqqoslash guruhlari o‘rtasidagi farqlar esa boshlang‘ich ko‘rsatkichlar hisobga olingan holda tahlil qilinishi lozim.

XULOSA

Bo‘lajak pedagoglar kasbiy madaniyatini rivojlantirishning pedagogik-psixologik xususiyatlari qadriyatlarning ichkilashuvi, bilimning kontekstual qo‘llanishi, emotsional-etik boshqaruv va refleksiv korreksiya birligida talqin qilindi. Besh komponentning o‘zaro uyg‘unligi kasbiy qarorni faqat samaradorlik emas, mas’uliyat va inson qadriga hurmat mezonida baholashga imkon beradi. Taklif etilgan jadval mazmuniy-diagnostik yo‘nalishlarni, sxema esa ularni faoliyatga tatbiq etish mantig‘ini belgilaydi. Asosiy metodik xulosa bilimni tanlovga, tanlovni harakatga, harakatni dalilli refleksiya va yangi vaziyatdagi mustaqil qo‘llashga izchil bog‘lashdir. Ushbu konseptual yechimning samaradorligi keyingi empirik tadqiqotda aniqlanishi kerak.

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REFLECTION AS A MEDIATING PROCESS IN DAVID KOLB'S EXPERIENTIAL LEARNING CYCLE: IMPLICATIONS FOR TEACHER EDUCATION

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Abstract: *The article deals with the issues based on analyzing the reflection as a mediating process within David Kolb's experiential learning cycle and discusses its significance for teacher education. While Kolb's model traditionally presents learning through four interconnected modes—concrete experience, reflective observation, abstract conceptualization, and active experimentation—the present study argues that reflection should not be viewed merely as an isolated stage of this sequence. Instead, reflection performs a mediating function by transforming pedagogical experience into meaningful professional knowledge and informed action. Through reflective analysis, pre-service teachers interpret classroom events, examine the relationship between their decisions and outcomes, connect experience with pedagogical theory, and formulate alternative strategies for subsequent practice.*

Keywords: *experiential learning, reflection, reflective mediation, Kolb's learning cycle, teacher education, pre-service teachers, reflective practice, professional development.*

INTRODUCTION

Modern teacher education does not only provide teachers with disciplinary and pedagogical knowledge but is expected to prepare teachers for understanding complex classroom situations, for making well-informed decisions, for assessing the effects of their actions and for continuously improving their professional practice. Teaching is inherently experiential. Teachers work with students with different needs, employing instructional strategies, observing responses, making changes, and reframing assumptions. But experience does not necessarily translate into professional learning. Much of the educational value of experience is dependent upon the learner's ability to analyze, understand, conceptualize and then transform that experience. As well as the process of explaining this link of experience and learning, David Kolb's Experiential Learning Theory is a significant theoretical framework. Learning

was defined by Kolb (1984) as a process of knowledge creation through transformation of experience. His experiential learning cycle consists of four interconnected modes of learning. These are: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE). Experiencing, reflecting, thinking and acting are terms often used in later expositions of the paradigm to describe this process. Learning is therefore not a simple reception of knowledge but is created through a continuous movement between experience, reflection, conceptual understanding and deliberate action. Reflection has a special role in this process. Learners need time to reflect on what happened, judge what aspects of the scenario are important, analyze how well they did and think about other possible interpretations. Thus, reflection provides an important link between experience and conceptualization. Experience, without such assessment, may stay episodic and not evolve into transferable professional knowledge. This is especially important for teacher education.

Pre-service teachers engage themselves in microteaching, classroom observation, methodology courses, teaching practicum, collaborative work, lesson design, assessment and contact with learners. These are rich pedagogical experiences, but their professional value is multiplied when future teachers are asked to reflect on why things happened, what assumptions guided their choices, what evidence points to success or struggle, and how their future practice might change.

Moreover, experiential learning has intellectual foundations extending beyond Kolb's model. Earlier educational and psychological traditions emphasized the relationship among experience, inquiry, action, and the construction of meaning. Kolb (1984) integrated several of these traditions into a systematic theory in which learning is understood as a process rather than simply an outcome. This distinction is essential because experiential learning does not assume that knowledge is transmitted intact from teacher to learner. Knowledge develops as individuals encounter experiences, interpret them, construct conceptual understandings, and test those understandings through further action.

Kolb's experiential learning model identifies two related dimensions: ways of grasping experience and ways of transforming experience. Concrete Experience and Abstract Conceptualization represent different modes of grasping experience, whereas Reflective Observation and Active Experimentation represent modes through which experience is transformed. Effective experiential learning therefore involves movement among all four

modes rather than exclusive reliance on a single learning preference (Kolb, 1984; Kolb & Kolb, 2018).

There is a longer theoretical history of reflection in professional education. Dewey's idea of reflective cognition was of conscious inquiry not of automatic activity. One reflects when one is faced with uncertainty, difficulty, contradiction, or a situation that cannot be successfully dealt with by one's established habits. Schön (1983) then further extended the concepts of reflection-in-action and reflection-on-action, pointing out how professionals are able to reflect on their activity both as they are acting and in retrospect.

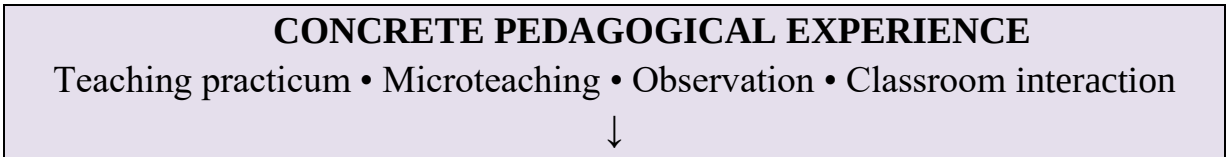
These viewpoints are especially relevant while teaching, as classroom practice is not usually a wholly predictable process. Teachers are continually interpreting learners' responses, judging understanding, altering explanations, managing interaction and making decisions in response to unfolding situations. Therefore, reflective practice enables teachers to bring to the surface latent assumptions and to explore the connections between beliefs, decisions, actions and classroom outcomes.

However, the presence of reflecting activities does not necessarily lead to deep reflection. The journal may turn into a register of happenings and not an analytical tool. Previous research has demonstrated that pre-service teachers may function at different levels of reflection, and that movement toward comparative and critical reflection requires pedagogical assistance (Cohen-Sayag & Fischl, 2012). Hence teacher education requires not just opportunities for reflection but also systematic scaffolding to take learners from description to interpretation, conceptualisation and informed action.

Reflection also operates between conceptualization and subsequent action. Once the teacher identifies a possible explanation, the next question becomes: *What should I change when I teach this type of activity again?* The answer may involve simplifying instructions, modelling the task, using pair work before whole-class interaction, changing time allocation, or checking understanding more systematically. Reflection therefore helps transform conceptual knowledge into intentional pedagogical experimentation.

This interpretation can be represented as follows.

Figure 1. Reflection as a Mediating Process in Kolb's Experiential Learning Cycle for Teacher Education



REFLECTIVE OBSERVATION

What happened? What did I observe? What worked or did not work?

↓

REFLECTIVE MEDIATION

Experience → Analysis → Interpretation → Meaning-making → Professional awareness

↓

ABSTRACT CONCEPTUALIZATION

Why did it happen? How can pedagogical theory explain the experience?

↓

REFLECTIVE MEDIATION

Theory → Reconsideration → Alternative strategies → Informed decision-making

↓

ACTIVE EXPERIMENTATION

What will I change? How will I apply the new understanding?

↓

NEW PEDAGOGICAL EXPERIENCE

↓

↻ CONTINUOUS REFLECTIVE PROFESSIONAL LEARNING

Source: Conceptualized by the author based on Kolb's Experiential Learning Theory.

The figure deliberately represents reflective mediation at more than one transition. Reflection first facilitates the movement from experience toward conceptual understanding and then supports the translation of conceptual understanding into future pedagogical decisions. This interpretation does not replace Kolb's four modes; rather, it emphasizes the functional contribution of reflective thinking to movement across the cycle.

CONCLUSION

Meaningful learning can be explained as interrelated stages of concrete experience, reflective observation, abstract conceptualisation and active experimentation (Kolb's cycle). In this sequence, reflection is of special interest as it allows learners to analyse experience rather than amass it.

The paradigm provided has practical significance for teaching practice, micro teaching, reflective journaling, peer observation, feedback and critical incident analysis. Such techniques are most educationally beneficial when they take pre-service teachers from describing experience to interpreting, understanding theoretically, deciding, and experimenting anew.

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PEDAGOGIKANING YOSHLAR TARBIYASIDAGI O'RNI

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Annotatsiya: *Pedagogika fani bu - tarbiya, ta'lim hamda ma'lumot berishning nazariy va amaliy jihatlarini o'rganuvchi fanlar majmuasi. Pedagogika institutlari va ayrim boshqa o'quv yurtlarida mutaxassislik dasturi asosida o'rganiladigan o'quv predmeti ham pedagogika deb yuritiladi. Zamonaviy pedagogika bolalar bilan birgalikda kattalarning ham o'quv-tarbiyaviy, madaniy hamda ma'naviy-ma'rifiy tarbiyasi bilan shugullanishni ko'zda tutadi. Anglaganingizdek, ushbu maqolada pedagogika xususida so'z yuritiladi. Kalit so'zlar: pedagogika; tadqiqot metodlari; maktabshunoslik, siyosatshunoslik; demografiya; paydogogos, didaktika.*

Аннотация: *Педагогика - это совокупность дисциплин, изучающих теоретические и практические аспекты воспитания, обучения и преподавания. В педагогических институтах и некоторых других учебных заведениях предмет, изучаемый по программе специализации, также называется педагогикой. Современная педагогика предполагает образовательное, культурное и духовнопросветительское воспитание как взрослых, так и детей. Как видите, эта статья о педагогике. Ключевые слова: педагогика; методы исследования; школьное обучение, политология; демография; пайдогого, дидактика.*

Abstract*: Pedagogy is a set of disciplines that study the theoretical and practical aspects of upbringing, education and information. In pedagogical institutes and some other educational institutions, the subject studied on the basis of the specialization program is also called pedagogy. Modern pedagogy involves the educational, cultural, and spiritual-educational upbringing of children as well as adults. As you can see, this article is about pedagogy.*

Keywords: pedagogy*; research methods; school studies, political science; demography; paydogogos, didactics*

KIRISH

Barchamizga ma'lumki, pedagogika atamasi qadimiy bo'lib, „bola yetaklovchi" degan ma'noni bildiruvchi grekcha „paydogogos" so'zidan kelib chiqqan. Tarixiy manbalarning ko'rsatishicha, qadimgi Yunonistonda o'z

xo‘jayinining bolalarini sayr qildirgan, ehtiyot qilgan, harbiy mahoratni o‘rgatgan tarbiyachini „pedagog“ deb atashgan. Keyinchalik esa, maxsus o‘qitilgan va pedagoglikni o‘ziga kasb qilib olgan kishilarni pedagog deb atay boshlashgan. Pedagogika tarbiya jarayonining qonuniyatlari, tarkibi va uni tashkil etish mexanizmlarini tadqiq etadi, tarbiyaviy va o‘quv ishlarining mazmuni, tamoyillari, ularni tashkil etish shakl, usul hamda yo‘sinlarini belgilab beradi. Shaxsni tarbiyalash, o‘qitish va shakllantirish pedagogikaning asosiy funksiyasi hisoblanadi. Shaxsni tarbiyalash pedagogikadagi asosiy tushuncha sanalib, oila va jamiyatning barkamol shaxsni shakllantirishga yo‘naltirilgan birgalikdagi faoliyatini anglatadi. Tarbiya yordamida inson shaxsining ma’naviy jihatlarini qaror toptirish ko‘zda tutiladi. Dunyoqarash, e’tiqod, ezgulik, go‘zallik, yaxshilik, adolatga doir qarash va ko‘nikmalarning shaxs sifatiga aylantirilishi tarbiya yordamidagina amalga oshiriladi. Insonlar orasida yashash, hayotda turmush kechirish va faoliyat ko‘rsatish uchun zarur bo‘lgan bilim, ko‘nikma va malakalar yig‘indisini o‘zlashtirishga qaratilgan faoliyat o‘qitish tushunchasini ifoda etadi.

MUHOKAMA VA NATIJALAR

Xozirgi kunda o‘qitish natijasida shaxs zaruriy bilimlar bilan ta’minlanib, kelgusida turli darajadagi maxsus ma’lumotni olish imkoniga ega bo‘ladi. Tarbiyalash va o‘qitish natijasida odamda muayyan shaxs sifatlari shakllantiriladi. Shaxs tarbiyalash va o‘qitish orqali o‘zida oldin bo‘lmagan ma’naviy-intellektual sifatlarga ega bo‘ladi. Bu hol shaxsning umri mobaynida uzluksiz davom etadi va uning rivojlanishiga sabab bo‘ladi. Shuningdek, inson va uni shakllantirishga doir fan sifatida pedagogika falsafa, etika, estetika, madaniyatshunoslik, psixologiya, iqtisodiyot, siyosatshunoslik, demografiya, tarix, adabiyot, tibbiyot, matematika va boshqa fanlar bilan uzviy bog‘liq. Pedagogika fani va amaliyoti taraqqiyotida bu fanlarning nazariy asoslari, tadqiqot metodlari, ilmiy xulosalarni aniqlash, tahlil qilish hamda umumlashtirish usullaridan foydalanadi. Pedagogikada ta’lim va tarbiya jarayonlarining qaysi jihatlarini o‘rganishdan kelib chiqadigan bir qancha soha va bo‘limlar mavjud. O‘qitishning maqsadi, vazifalari, tamoyillari, usullari bilan shug‘ullanadigan sohasi didaktikadir. Shaxsning axloqiy sifatlarini tarkib toptirish, unda e’tiqod, dunyoqarash, axloq singari ma’naviy jihatlarni shakllantirish masalalarini pedagogikaning tarbiya nazariyasi va amaliyoti tarmog‘i o‘z ichiga oladi. Ayrim o‘quv fanlarini o‘qitish qonuniyatlari va usullarini o‘rgatuvchi metodika fanlari ham pedagogikaning sohalari hisoblanadi. Bularga nisbatan didaktika umumiy metodika hisoblanadi va har bir alohida predmeti metodikasi xususiy didaktika sanaladi. Ammo bu xil

chegaralanish anchagina shartlidir. Chunonchi, adabiyot o‘qitish metodikasi didaktikaga nisbatan xususiy didaktika hisoblanadi, ayni vaqtda, u mumtoz adabiyot tarixini o‘rganish metodikasi, chet el adabiyotini o‘rganish metodikasi, xalq og‘zaki ijodini o‘rganish metodikasiga nisbatan umumiy metodika vazifasini bajaradi. Xususiy metodikalar umumiy didaktikaga tayangan va uning nazariy umumlashmalariga asoslangan holdagina rivojlana oladi. Ayni vaqtda, har bir aniq fanga tatbiq etilgan didaktik qonuniyatlar o‘sha o‘quv predmetini o‘qitish tajribasidagi o‘ziga xoslik bilan boyitiladi, umumiy jihatlarni konkretlashtiradi, har bir o‘ziga xoslikda o‘qitishning universal jihatlarini namoyon etadi. XX asr boshlaridan qiyosiy pedagogika fani pedagogikaning alohida tarmog‘i sifatida dunyoga keldi. Unda jahondagi turli xalqlarning pedagogik qarashlari va ta’lim-tarbiya tizimi qiyosiy-genetik yo‘sinda bir-biriga solishtirilgan holda o‘rganildi. Pedagogikaning bu tarmog‘i ta’lim-tarbiya borasidagi eng ilgor usul va yondashuvlarni solishtirish, maqsadga muvofiqlarini muayyan milliy pedagogik fan va amaliyotga tatbiq qilish imkonini beradi. Mamlakatimizda hozircha qiyosiy pedagogika alohida fan sifatida shakllanmagan bo‘lsada, bu borada jiddiy izlanishlar amalga oshirilgan. Odamzodning hayotiy va aqliy tajribasi ortib, turmush kechirish tarzi xilma-xillashib, mehnat taqsimoti yuzaga kelib turli fanlar paydo bo‘la boshlashi bilan pedagogika ham inson faoliyatining alohida sohasiga aylandi. Ta’lim va tarbiyaga doir qarashlar tizimi shakllandi. Lekin bular darhol pedagogik nazariy tizimlar sifatida emas, balki milliy fikr tarbiyaga daxldor qarashlar, aqidalar, hikmatlar tarzida namoyon bo‘ldi. Yozuv paydo bo‘lishi bilan pedagogik qarashlar yozuvga ko‘chiriladigan bo‘ldi. Antik davrdagi mutafakkirlarning ta’lim-tarbiya borasidagi fikrlari markazida yetuk insonni shakllantirishga intilish istagi turardi. Shumer, Misr, Xitoy, Hindiston va O‘rta Osiyodagi turli madaniy-ma’rifiy obidalar moddiy madaniyat namunalarigina bo‘lib qolmay, o‘z davridagi buyuk pedagogik meros hamdir. Qadim zamonlarda paydo bo‘lgan pedagogik qarashlar ko‘proq amaliy xususiyatga ega bo‘lsada, keyinchalik pedagogikaning alohida fan sifatida shakllanishiga ulkan hissa qo‘shdi. Pedagogika insoniyatning axloq-odobi va ma’naviyatigagina emas, balki aqliy rivojiga ham hal qiluvchi ta’sir ko‘rsatgani sababli uning taraqqiyot darajasi jamiyatning ravnaqiga muvofiq tarzda ro‘y berdi. Bir qancha mamlakatlarning rivojiga ham, boshqalarining esa qoloqligiga ham ko‘pincha o‘sha mamlakatdagi pedagogikaning holati sabab bo‘lgan. Xususan, Sharq xalqlari o‘z vaqtida eng qadimiy va ilg‘or pedagogik qarashlar tizimini yaratgan bo‘lishlariga qaramay, shu tizimni zamona talablariga muvofiq tarzda takomillashtirib bormaganliklari uchun keyinchalik ilm-fan taraqqiyoti jihatidan

qoloq holga tushib qoldilar. O‘zbek pedagogikasi juda qadimiy tarixga ega bo‘lib, uning dastlabki ildizlari Avesto,, Urxun-Yenisey bitiklariga, Selung'ur madaniyatiga borib taqaladi. Avestodagi ezgu fikr, ezgu so‘z va ezgu amal haqidagi, kishilarga ko‘ngil ma’rifati berish borasidagi qarashlar yozma milliy pedagogik qarashlarning dastlabki namunasi bo‘lib, yetuk insonni shakllantirishga yo‘naltirilgan. Milliy pedagogikaning taraqqiyotida islom dini va tasavvuf ta’limoti hal qiluvchi o‘rin tutadi. Chunki Qur’oni karim, Hadisi sharif va tasavvuf ta’limotining markazida axloq, komil inson ma’naviyatini shakllantirish turardi. Komil inson ta’lim-tarbiya yordamida, ya’ni pedagogika vositasida tarkib toptirilishi mumkin edi. Forobiyning fozil odamlari, Beruniy, Ibn Sino falsafiy qarashlaridan o‘rin olgan yetuk shaxslar, Yusuf Xos Hojib, Ahmad Yugnakiy asarlarida tasvirlangan benuqson odamlar, Abduxoliq G‘ijduvoniy, Ahmad Yassaviy, Bahouddin Naqshband, Alisher Navoiy, Bobur, Mashrab orzulagan komil inson o'zbek pedagogikasining markazida turardi. XVII asrdan boshlab, milliy pedagogikada ta’lim-tarbiyaning mohiyatiga emas, balki tashqi jihatlariga e’tibor kuchaydi, turmush talablarini hisobga olmay, hayotiy zamindan uzilish sodir bo‘ldi. Natijada, jamiyat taraqqiyoti susaydi, ijtimoiy-siyosiy hayotda ham tanazzulga yuz tutildi. Pedagogikadagi biqiqlik, biryoqlamalik kishilar ruhiyatiga ko‘chdi, undan ijtimoiy tartibotlar va siyosiy qurilmalarga o‘tdi. Butun bir davlat xonliklarga bo‘linib ketdi. Xonliklarning har birining ichida bir-biri bilan kelishmovchilik hamda o‘zaro janjallar avj oldi. Negaki, jamiyat va unda yashaydigan insonlarning ma’naviy o‘rnaklari puxta tayin etilmagan edi.

XULOSA

Xulosa qilib aytganda O‘zbekistonning mustaqillikka erishishi natijasida milliy ong mafkuraviy qolipdan qutuldi. Bu hol pedagogikaning sog‘lom aql, milliy ruhiyat va an’analarga mone tarzda yo‘lga qo‘yilishiga imkon yaratdi. Bugungi o‘zbek pedagogikasi millat ruhiyatidagi nozik jihatlarni hisobga olgan va dunyo tarbiyashunosligidagi eng so‘nggi yutuqlarga tayangan holda taraqqiy etmoqda. Zamonaviy o‘zbek pedagogikasida barkamol insonni shakllantirish rasmiy ravishda bosh maqsad qilib belgilangan. Bu pedagogika ta’lim-tarbiya jarayonida ta’lim oluvchi va tarbiyalanuvchilarning faol ishtirok etishlarini ko‘zda tutadi. Bolalar, yoshlar pedagogik jarayonning obyektigina emas, balki subyekti, ya’ni ijrochisi ham ekanligiga alohida e’tibor qaratilmoqda. Ayni vaqtda, barcha pedagogik tadbirlar ta’lim-tarbiya oluvchilarning mustaqil fikrlashlarini ta’minlash, ularda tarbiyalanish va o‘qishga ehtiyoj uyg‘otishga yo‘naltirilgan holda tashkil etilmoqda. Bugungi o‘zbek pedagogikasi uchun muayyan bilimlar yig'indisi emas, balki bola shaxsi bosh qadriyatga aylangan.

Shuning uchun ham milliy pedagogikada faqat bilimli o‘quvchilar tayyorlashga emas, balki izlanuvchan, tashabbuskor shaxsni shakllantirishga asosiy e’tibor berilmoqda.

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ILM-FAN, TA’LIM VA ISHLAB CHIQARISHNI INTEGRATSIYA QILISH ORQALI SIFAT VA SAMARADORLIKNI OSHIRISH MUAMMOLARI

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Annotatsiya. *Mazkur maqolada ta’lim tizimida olib borilayotgan iqtisodiy islohotlar, hukumatimiz tomonidan mazkur sohada qabul qilingan me’yoriy hujjatlar tahlili va ularning natijalari o‘rganilgan. Shuningdek, ilm-fan, ta’lim va ishlab chiqarish integratsiyasini ta’minlash, fan, ta’lim va ishlab chiqarish integratsiya borasidagi pedagog olimlarning fikr-mulohazalari nazariy tahlil qilingan.*

Tayanch so‘zlar: *shaxs, davlat va jamiyat, uzluksiz fan va ishlab chiqarish, integratsiya, ta’lim sifati, samaradorlik, ta’lim.*

Аннотация. *В данной стате изучены экономические реформы, проведенные в системе аграрного образования, анализ нормативных документов, принятых нашим правителством в этой сфере и их результаты. Также теоретически проанализированы мнения педагогов относительно интеграции науки, образования и производства, интеграции науки, образования и производства.*

Ключевые слова: *личност, государство и общество, непрерывная наука и производство, интеграция, качество образования, эффективност, образование.*

Annotation. *This article examines the economic reforms carried out in the system of agricultural education, analysis of the regulations adopted by our government in this area and their results. Also theoretically analyzed are the opinions of teachers regarding the integration of science, education and production, the integration of science, education and production.*

Key words: *personality, state and society, continuous science and production, integration, quality of education, efficiency, education.*

KIRISH

Bugungi oliy ta’lim muassasalari oldiga qo‘yilayotgan asosiy vazifalardan biri bu, ilm-fan, ta’lim va ishlab chiqarishni integratsiyasini ta’minlashdan

iborat. Shu sababli so‘nggi yillarda mamlakatimizda ta’lim tizimining barcha bosqichlariga, jumladan, oliy ta’lim tizimiga ham alohida e’tibor qaratilmoqda. Bu borada O‘zbekiston Respublikasining “Ta’lim to‘g‘risida” Qonuni [1], O‘zbekiston Respublikasi Prezidentining 2019-yil 8-oktyabrdagi “O‘zbekiston Respublikasi oliy ta’lim tizimini 2030 yilgacha rivojlantirish konsepsiyasini tasdiqlash to‘g‘risida”gi PF-5847-sonli [2], 2022-yil 28-yanvardagi “2022 - 2026 yillarga mo‘ljallangan Yangi O‘zbekistonning taraqqiyot strategiyasi to‘g‘risida”gi PF-60-son farmonlari [3], O‘zbekiston Respublikasi Prezidentining 2023-yil 3-iyuldagi “Ma’muriy islohotlar doirasida oliy ta’lim, fan va innovatsiyalar sohasida davlat boshqaruvini samarali tashkil qilish chora-tadbirlari to‘g‘risida” PQ-200-sonli [4] qarorlari qabul qilindi. Mazkur me’yoriy huquqiy hujjatlarda oliy ta’lim muassasalarida ilmiy-tadqiqot ishlari natijadorligini oshirish, yoshlarni ilmiy faoliyatga keng jalb etish, ilm-fanning innovatsion infratuzilmasini shakllantirish, oliy ta’lim tizimini ijtimoiy soha va iqtisodiyot tarmoqlari ehtiyojlaridan kelib chiqqan holda, fan-ta’lim va ishlab chiqarishning mustahkam integratsiyasini ta’minlash asosida ta’lim sifatini yaxshilash, raqobatbardosh kadrlar tayyorlash, ilmiy va innovatsion faoliyatni samarali tashkil etish, xalqaro hamkorlikni rivojlantirish kabi dolzarb, o‘z yechimini kutayotgan vazifalar belgilangan.

Eng quvonarlisi, “Tarmoq - korxona - oliy ta’lim tashkiloti - ilmiy tashkilot” zanjiri asosida ilmiy hajmdor, innovatsion mahsulotlar ishlab chiqarishni tashkil etish, oliy ta’lim va ilmiy tashkilotlar tomonidan amalga oshirilayotgan ilmiy, ratsionalizatorlik va startap ishlanmalarni tijoratlashtirishni kengaytirish, mamlakatning olis va borish qiyin bo‘lgan hududlarida yoshlarning xorijiy tillarni o‘rganishlari uchun qulay shart-sharoitlar yaratilishini qo‘llab-quvvatlash maqsadida 2026-yil 4-aprelda O‘zbekiston Respublikasi Prezidentining “Mamlakatda yangi ishlanmalar asosida ishlab chiqarishni tashkil etish tizimini joriy qilish hamda ilm-fanni qo‘llab-quvvatlashning qo‘shimcha chora-tadbirlari to‘g‘risida”gi PF – 54-sonli Farmoni [5] qabul qilinganligi yuqoridagi islohotlarning mantiqiy davomiyligidan dalolatdir.

Tadqiqot metodologiyasi. Mazkur tadqiqot davomida tahlil, sintez va analogiya usullaridan foydalanildi. Aniqlangan tendensiyalar oliy ta’lim muassasalarida ilm-fan, ta’lim va ishlab chiqarishni integratsiya qilish orqali sifat va samaradorlikni oshirish muammolarini hal qilish orqali mehnat bozorida raqobatbardosh kadrlar tayyorlashga bo‘lgan talab yuqoriligini ko‘rsatadi. Bu borada oliy ta’lim muassasalarida fan, ta’lim va ishlab chiqarishning uzviyligi,

uzluksizligini ta’minlash orqali integratsiya qilish davlat tomonidan amalga oshiriladigan ta’lim islohotlarini uyg‘unligini ta’minlashga yordam beradi.

Adabiyotlar tahlili. Fan, ta’lim va ishlab chiqarish integratsiyasi masalasi bugungi oliy ta’lim tizimi oldida turgan asosiy vafalardan hisoblanadi-ki, mazkur masala yuzasidan hukumatimiz tomonidan oliy ta’limni yanada rivojlantirish borasida amalga oshirilayotgan islohotlar zamirida, shuningdek faoliyat olib borayotgan barcha oliy ta’lim muassasalari, oliy ta’lim muassasalarida faoliyat olib borayotgan pedagog-olimlarning ilmiy tadqiqotlarida ko‘rishimiz mumkin.

B.Usmonov oliy ta’lim, fan va ishlab chiqarish integratsiyasini klasterli yondashuv asosida innovatsion rivojlantirish masalasini o‘rgangan bo‘lib, u “Oliy ta’lim muassasasi generator rolini bajarishi ifodalangan «Uchlik spiral» modeli (davlat-OTM-ishlab chiqarish) mexanizmini qo‘llash asosida «ta’lim, fan va ishlab chiqarish»ning simbiotik innovatsion rivojlantirishga asos bo‘ladi” [6] deb ta’kidlaydi.

T.Teshaboyevning “Oliy ta’lim muassasasi va ishlab chiqarish korxonalari integratsiyasi” [7] nomli maqolasida Toshkent moliya instituti misolida fan, ta’lim va ishlab chiqarish integratsiyasi borasidagi tajribalari yoritilgan. F.Rahimovning “Ta’lim, fan va ishlab chiqarish integratsiyasi va innovatsion hamkorlik” [8] ilmiy-uslubiy qo‘llanmasida innovatsion korporativ hamkorligini samarali tashkil etish borasidagi fikr-mulohazalar, innovatsiyalarning falsafiy mohiyati, vorisiyligi, innovatsion jarayonlarning jadallashuvida ularni yaratuvchi va ushbu faoliyatni fan yoki oliy ta’lim muassasasida muvofiqlashtiruvchi tuzilmalar, ular faoliyati bilan bog‘liq o‘quv-ilmiy markazlar, o‘quv-ilmiy komplekslarning o‘rni, ta’lim, fan va amaliyotning uzviyligi va uzluksizligida ichki hamda tashqi integratsiyalashuv bilan bog‘lab tahlil etilgan. O.Bazarovning “Fan, ta’lim va ishlab chiqarish integratsiyasini rivojlantirish oliy ta’limning ustuvor masalasi” [9] nomli maqolasida Qarshi muhandislik-iqtisodiyot institutining tajribasi yoritilgan.

O.Abduraxmonov “Fan, ta’lim va ishlab chiqarish integratsiyasi” nomli kitobida fan, ta’lim va ishlab chiqarish sub’yektlari o‘zaro manfaatli integratsiyasining ilmiy-nazariy asoslari, uning modellari, bu yo‘nalishda jahonda to‘plangan tajriba tahlil etiladi, O‘zbekiston iqtisodiyotini modernizatsiyalash, milliy innovatsiya tizimini yaratish va rivojlantirishda ilmiy va ta’lim muassasalari, biznesning roli va o‘rniga baho beriladi, fan yutuqlarini ishlab chiqarishga joriy qilish mexanizmlarini takomillashtirish vazifalariga to‘xtaladi. Shuningdek, u “Fan, ta’lim va ishlab chiqarishning integratsiyalashgan tuzilmasida davlat darajasida bevosita ta’lim ushbu

sheriklikning hal qiluvchi bo‘g‘inidir. Shuning uchun ham taraqqiy etgan davlatlarda innovatsiyaviy iqtisodiyotni rivojlantirishda ilmiy tadqiqot markazlariga aylangan universitetlar asosiy rol o‘ynaydi. Shu bilan birga oliy ta’lim muassasalarida yuqori texnologiyalarga asoslangan ishlab chiqarishlar uchun mutaxassislar tayyorlashda bilim berish (ta’lim – fan) va ko‘nikma hosil qilish (ta’lim – amaliyot) an’anaviy tizimi amal etishining o‘zi kifoya qilmay qoldi. Bugungi kunda innovatsiyaviy ta’lim berish, ya’ni fan, ta’lim va amaliyotning integratsiyalashtirilishi ham talab qilinmoqda” [10] deb, ta’kidlaydi.

B.Qo‘chqorov o‘zining “O‘zbekistonda fan, ta’lim va ishlab chiqarish integratsiyasini ta’minlash bo‘yicha chiqarilgan me’yoriy-huquqiy asoslari” nomli maqolasida ilm-fanni rivojlantirish, innovatsion faoliyatni qo‘llab-quvvatlash, sohaning huquqiy bazasini mustahkamlashni taqozo etib, fan, ta’lim va ishlab chiqarish integratsiyasini ta’minlash borasida bir qator me’yoriy-huquqiy hujjatlar mavjudligiga to‘xtaladi va unda “Bugungi kunda fan va ta’lim tobora kuchliroq tarzdajamiyatning ishlab chiqaruvchi kuchiga aylanmoqda. Fan va ta’lim har qanday davlatning qudrati ijtimoiy-iqtisodiy va siyosiy resursi hisoblanadi. Iqtisodiy o‘sish sur’atlari endilikda faqat jismoniy kapital yoki insonlar malakasi bilangina emas, balki, bilimni ishlab chiqarishga tadbiq eta olish qobiliyati bilan belgilanmoqda” [11] degan fikrni ilgari suradi.

Tahlil va natija. Pedagogikada shaxs, davlat va jamiyat, uzluksiz ta’lim, fan va ishlab chiqarish tushunchalari amal qiladi. Shaxs - kadrlar tayyorlash jarayonining bosh sub’yekti va ob’yekti, ta’lim sohasidagi xizmatlarning iste’molchisi va ularni amalga oshiruvchisi sifatida namo‘yon bo‘lsa, davlat va jamiyat - ta’lim va kadrlar tayyorlash tizimining faoliyatini tartibga soladi, nazorat qiladi va uni amalga oshiradi. Uzluksiz ta’limda esa, har tamonlama rivojlangan, barkamol va raqobatbardosh kadrlar tayyorlashning asosi hisoblanadi. Fan bu oliy ta’limdan keyingi ta’lim ta’lim turi hisoblanib, yuqori malakali mutaxassislar tayyorlovchi va ulardan foydalanuvchi, ilg‘or g‘oya va ishlanmalarni ishlab chiquvchisi hisoblandi. Shuningdek, ishlab chiqarish kadrlarga bo‘lgan ehtiyojni, shuningdek ularning tayyorgarlik sifati va saviyasiga nisbatan qo‘yiladigan talablarni belgilovchi asosiy buyurtmachi, kadrlar tayyorlash tizimini moliya va moddiy-texnika jihatidan ta’minlash jarayonining qatnashchisidir.

Shunday ekan, fan, ta’lim va ishlab chiqarishning integratsiyasi yuqoridagi tushunchalarning o‘zaro bog‘liqligida amalga oshiriladigan jarayondir. Bu borada, O‘zbekiston Respublikasi Prezidentining PF-60-son Farmoni bilan “2022 - 2026 yillarga mo‘ljallangan yangi O‘zbekistonning

taraqqiyot strategiyasi”da 4 ta maqsadning oliy ta’lim tizimiga bag‘ishlanganligi oliy ta’lim tizimida olib borilayotgan islohotlarni yanada tezlashishiga zamin yaratdi. Shuningdek, O‘zbekiston Respublikasi Prezidenti Sh.Mirziyoyev tomonidan 2022 yil 4 mart kuni o‘tkazilgan “*talabalarni bandligini ta’minlash*”ga qaratilgan video selektorning asosiy maqsadi ham fan, ta’lim va ishlab chiqarishning integratsiyasini ta’minlashga qaratilgandir.

“Oliy ta’lim muaaasasasi va ishlab chiqarish korxonalari integratsiyasi” nomli maqola muallifi iqtisodiyot fanlari doktori, professor T.Teshaboyev integratsiya jarayonlarini ta’minlashda birinchi navbatda oliy ta’lim muassasasi bilan mehnat bozori o‘rtasida hamkorlik bo‘lishini, hamkorlik asosida korxonalar uchun raqobatbardosh mutaxassislarni tayyorlashni, ikkinchidan zamonaviy innovatsion texnoparklarni tashkil etish va ularga mos ravishda innovatsion guruhlarni shakllashtirishni hamda uchinchidan o‘zaro innovatsion hamkorlikni tashkil etish asosida innovatsion maxsus korxonalar uchun mutaxassislarni tayyorlashni nazarda tutadi. Shuningdek, korxonalar uchun raqobatbardosh mutaxassislarni tayyorlash, innovatsion hamkorlikni tashkil etish hamda innovatsion maxsus korxonalar uchun mutaxassislarni tayyorlash natijasida innovatsion loyihalarini joriy etadigan guruhlar shallanishini ta’kidlaydi (1-rasm).



1-rasm. Oliy ta’lim muassasalari, fan va ishlab chiqarish integratsiyasi [12]

Iqtisodchi olim iqtisodiyot fanlari doktori, professor B.Xodiyev oliy fan, ta’lim va ishlab chiqarish o‘zaro innovatsion hamkorligining zamonaviy modelida quyidagilarga e’tibor qaratadi (2-rasm) [12]:



2-rasm. Oliy fan, ta’lim va ishlab chiqarish o‘zaro innovatsion hamkorligining zamonaviy modeli [12].

Modeldan ko‘rinib turibdiki, integratsiya jarayonlari oliy ta’lim muassasasi bilan korxona va tashkilotlar o‘rtasida hamkorlik shartnomasi tuzish birinchi navbatdagi masala ekanligi, bu jarayonda kafedraning funksiyasiga innovatsion kichik guruhlarni shakllantirish, soha korxonalari to‘g‘risida ma’lumotlar bankini yaratish, har bir korxonalardagi ilmiy texnik muammolarining yagona elektron bazasini yaratish, mavjud muammolarni tahlil qilish, ekspertizadan o‘tkazish orqali saralash ishlarini olib borish natijasida korxona va tashkilotlarning muammolarini yechimiga qaratilgan namunaviy mavzular ro‘yxatini shakllantirish, shakllantirilgan namunaviy mavzular asosida bitiruv malakaviy ishi, magistrlik va doktorlik dissertatsiyalari tayyorlash hamda xo‘jalik shartnomalar asosida ishlarni bajarish nazarjda tutilgan. Olib borilgan ilmiy tadqiqot natijalari asosida kadrlar buyurtmachilari talab va ehtiyojlaridan kelib chiqib, o‘quv me’yoriy hujjatlarni takomillashtirish, vazirlik, idora va korxonalarning muammolari asosida investitsion loyihalar tayyorlash, shuningdek, natijada yangilanib boriladigan ish o‘rinlar bankini shakllantirish nazarda tutilgan .

Fan va texnika jadal rivojlanayotgan bugungi kunda oliy ta’lim tizimida mustaqil ta’lim jarayonini rivojlantirish va “Ilm orqali bilim” texnologiyalariga asoslangan tizimni shakllantirish asosida “ta’lim-fan-ishlab chiqarish kompleksi”ni tashkil etish va ular o‘rtasida innovatsion-integratsion mexanizmni takomillashtirib borish muhim ahamiyatga ega. Chunki, birinchidan, fanda yuzaga kelayotgan yangi-yangi kashfiyotlar asosidagi ilmiy

axborotlarni talaba qisqa muddatli o‘qishi davrida o‘zalashtirish imkoniyatiga ega emas.

Ikkinchidan, hayotiy talablar juda tez o‘zgarayotgan bir paytda ishlab chiqarishda ham yangi-yangi muammolar yuzaga kelmoqdaki, bu yaratilayotgan ilmiy kashfiyotlarga yana ham jiddiyroq yondashishni talab etmoqda.

XULOSA

“Fan – ta’lim – ishlab chiqarish” integratsiyasi ta’lim islohotlari jarayonlarida davlat ahamiyatidagi omillardan hisoblanib, uning natijasida quyidagilarga erishiladi:

birinchidan, fan, ta’li va ishlab chiqarish integratsiyalashuvi natijasida ta’lim sifati va samaradorligi ta’minlanadi;

ikkinchidan, ta’lim yo‘nalishlari va mutaxassisliklarning malaka talabi, o‘quv reja va fan dasturlarini ishlab chiqish jarayonlarida kadrlar iste’molchilari hisoblangan korxona va tashkilotlarning talab va ehtiyojlari inobatga olingan holda takomillashtirilib boriladi;

uchinchidan, talabalarning ish bilan ta’minlanishi va moddiy manfaatdorligi yuzaga keladi;

to‘rtinchidan, oliy ta’lim muassasalari va ishlab chiqarish korxonalari hamkorligida raqobatbardosh va jahon ta’lim sitandartlariga javob bera oladigan mutaxassis kadrlar tayyorlanadi;

beshinchidan, bitiruvchilarga nisbatan korxona va tashkilotlarning talabi ortadi;

oltinchidan, amaliy, laboratoriya mashg‘ulotlarini korxona va tashkilotlarida o‘tkazish imkoniyatlari yaratiladi;

yettinchidan, oliy ta’lim muassasalari tomonidan korxona va tashkilotlarda faoliyat olib borayotgan tajribali mutaxassislarni o‘quv jarayonlariga jalb etiladi;

sakkizinchidan, talabalar loyihaviy ishlarga va xo‘jalik shartnomalarga jalb qilish orqali ularning manfaatdorligi ortishiga hamda ish o‘rinlariga ega bo‘lish imkoniyatlari yaratiladi.

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KEY COMPONENTS OF PRESERVICE TEACHER PREPARATION FOR INCLUSIVE EDUCATION: INTERNATIONAL EXPERIENCE

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Abstract. *This study examines key components of preservice teacher preparation for inclusive education through a comparative analysis of international experience in Scotland, Germany, Canada, Italy, and Spain. The analysis identifies several recurring elements across national contexts, including the integration of inclusive content into teacher education, readiness to work with learner diversity, professional attitudes and self-efficacy, connections between theoretical preparation and teaching practice, and professional reflection. Their implementation, however, varies according to national and institutional contexts. These results provide relevant reference points for strengthening preservice teacher preparation for inclusive education in Uzbekistan.*

Keywords: *inclusive education; preservice teacher preparation; inclusive pedagogy; professional readiness; self-efficacy; international experience; teacher education.*

INTRODUCTION

The development of inclusive education has placed new demands on the professional preparation of preservice teachers. Future teachers need to be prepared to work with learners who differ in their educational needs, abilities, and approaches to learning. Accordingly, inclusive competence is increasingly viewed not as a specialized area of preparation for particular groups of teachers, but as an integral component of teacher education.

The work of L. Florian and H. Linklater is particularly relevant to this perspective, as they conceptualize inclusive pedagogy as an approach that extends opportunities for the participation of all learners. This perspective requires a shift in how preservice teachers understand their professional role: rather than being prepared primarily to teach particular categories of learners,

they need to learn how to respond to learner diversity when planning and delivering instruction.

This study aims to identify key components of preservice teacher preparation for inclusive education through a comparative analysis of international experience.

MAIN PART

A comparative pedagogical approach was used to examine research representing five national contexts: Scotland, Germany, Canada, Italy, and Spain. The selected studies were compared according to four dimensions: the content of teacher preparation, the professional characteristics developed, the relationship between theoretical preparation and teaching practice, and the reported empirical outcomes. Particular attention was given to recurring components across national contexts, context-dependent approaches to their implementation, and available empirical evidence of changes in the professional characteristics of preservice teachers.

In Scotland, inclusive pedagogy has been systematically embedded in initial teacher education. Through the *Inclusive Practice Project*, L. Florian and M. Rouse, followed by L. Florian, K. Young, and M. Rouse, developed an approach in which preparation for inclusive education is not treated as a separate specialization but is integrated into the broader teacher education programme. The Scottish experience therefore highlights the integration of inclusive content into professional preparation as a key component of teacher education for inclusion.

A different dimension emerges from the comparison of preservice teacher preparation in Germany and Canada. S. Miesera, L. Sokal, and N. Kimmelmann examined changes in the attitudes, intentions, concerns, and self-efficacy of 132 preservice teachers after they completed a course on inclusive education. Self-efficacy increased significantly in both national samples, whereas a change in intentions to implement inclusive practices was identified in the Canadian group but not in the German group. These findings indicate that the inclusion of a course on inclusive education does not necessarily lead to the same professional outcomes across countries; its effects are associated with both programme content and the broader educational context.

The comparative study of Italy and Spain conducted by V. Nistal-Anta, M. López-Aguado, and L. Gutiérrez-Provecho further illustrates the importance of national context. Differences between the two countries were identified in initial teacher education, the distribution of professional roles, and the organization of support for learners with special educational needs. Thus, similar components of

teacher preparation may be implemented through different organizational arrangements depending on the structure of the national education system.

The comparative analysis identified a common content base for preparing preservice teachers for inclusive education. Key components include the integration of inclusive content into professional preparation, readiness to work with learner diversity, the development of professional attitudes and self-efficacy, the connection between theoretical preparation and teaching practice, and professional reflection. However, their recurrence across national systems is not, in itself, evidence of effectiveness. Claims regarding effectiveness require empirical evidence of changes in preservice teachers' professional characteristics.

At the same time, the analysis distinguishes between common content components and context-dependent approaches to their implementation. Similar professional goals may be addressed differently depending on the organization of teacher education and the characteristics of the national inclusive education system. This distinction is particularly important when considering the applicability of international experience beyond the contexts in which particular approaches were developed and examined.

For teacher education in Uzbekistan, the identified international experience provides relevant reference points for strengthening preservice teacher preparation. The applicability of these components should be considered in relation to the structure of national teacher education, the content of teacher education programmes, the organization of teaching practice, and the conditions shaping the development of inclusive education.

CONCLUSION

The comparative analysis shows that preservice teacher preparation for inclusive education is characterized by both recurring content components and nationally specific forms of implementation. The evidence examined also indicates that the presence of a component across different systems should not be equated with its effectiveness unless corresponding professional changes are empirically demonstrated. These findings provide a basis for developing context-sensitive approaches to preservice teacher preparation for inclusive education in Uzbekistan.

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