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THE MAIN METHODS OF RADIOACTIVE MATERIAL MANAGEMENT

Abstract.
The important and topical issues regarding the radioactive material management are considered. The modern methods and innovative approaches for the processing and disposal of radiation-hazardous materials are described. For methods of radioactive material management, the advantages and disadvantages are shown. The procedures required for the preliminary preparation of nuclear material for conditioning are described. Some methods necessary for determining and controlling the main characteristics of nuclear material are defined. Based on the obtained results, the important conclusions and scientific substantiated recommendations are given.

Keywords*: nuclear power plant, radioactive material, management, processing, storage, disposal, environment, nuclear safety, radiation safety.*

The projects of today operating Ukrainian nuclear power plants (NPPs) are characterized by the lack of modern high-tech approaches to radioactive materials management, and the resolution of these issues has been postponed indefinitely. However, the current legislation provides for the construction and commissioning of Complex for the Processing of Solid Radioactive Waste at the Ukrainian NPPs [1]. Therefore, the issue of choosing and optimizing the most modern and effective methods for the radioactive materials management is more relevant than ever.

In countries with the developed nuclear energy (taking into account the safety requirements), the most common methods of radioactive materials processing are the following [2]:

1. The pressing of solid radioactive waste with the high-pressure hydraulic presses (force 15.000–20.000 tons). For such processing, the metal shavings, thermal insulation materials, fire-resistant braiding of electrical cables, etc. are suitable. Depending on the radioactive waste type, this makes it possible to reduce the initial volume up to 5 times. Pressed solid radioactive waste can subsequently be immobilized and sent for disposal [3, 4, 5].

2. The incineration of flammable solid radioactive waste and liquid radioactive waste. Organic waste and other flammable radioactive waste are the subject to incineration. The purpose of incineration is to convert the radioactive waste into an inert state (ash residue), which improves the safety conditions of temporary storage and subsequent disposal, and also significantly reduces the initial volume of radioactive waste (up to 50 times). As a rule, the ash residue is sent for pressing and immobilization. For the most part, due to the financial and technological factors, as an immobilizing substance, the cement mortar is used [3, 5].

3. The conversion of liquid radioactive waste into a solid state by incorporating them into an immobilizing matrix. For obtain the final cementation product with the specified radiological and physicochemical characteristics, the radioactive waste (cube residue, ion-exchange resins, perlite-wash filters) are mixed in certain proportions with the cement mortar and special additives. After solidification, the resulting compound can be sent for temporary storage or disposal [6]. For converting the liquid radioactive waste into a solid state, another common method is bituminization. In this case, the radioactive waste is evaporated to a dry residue (powder substance) at the high temperature on the walls of the bituminizer and mixed with the molten bitumen mass. Other liquid radioactive waste types can also be immobilized (ion-exchange resins and perlite-wash filters). The certain characteristics of bitumen compound, in particular resistance to the leaching of radionuclides, are the higher than those of cement compound. On the other hand, in terms of manufacturability and economic costs, the cementation is more acceptable.

Some methods of hazardous radioactive materials management involve the direct geological disposal (near-surface sites or deep geological repositories). However, the large accumulated quantities of radioactive materials require the high-capacity repositories [7]. Direct geological disposal is well studied by scientists [8], but has not attracted public enthusiasm. Doubts about disposal usually focus on the release of long-lived isotopes ^{36}Cl and ^{14}C through the groundwater. Since 1949, some hazardous radioactive materials were also dumped into the ocean in the form of packaged waste. But now, the sea disposal of radioactive materials is prohibited by the «Convention for the Protection of the Marine Environment and Coastal Area of the North-East Atlantic».

Preliminary preparation for disposal (conditioning) of radiation-hazardous material includes operations for the manufacture of material packaging, the ultimate goal of which is to convert the nuclear material into a form suitable for transportation, storage and disposal. Conditioning includes, in particular, the radioactive material processing. Conditioning methods depend on the characteristics of nuclear material, the manufac-

turability and cost-effectiveness of the selected processing method, the conditions and duration of temporary storage of containers, and the conditions of transportation and disposal [9]. Other things being equal, the preference is given to the method that ensures the minimum risk of exposure to personal at all subsequent stages of radioactive material management.

As a result of conditioning, the volume of radioactive material should be reduced to the required minimum (which is especially important for solidifying the high activity level waste, when the permissible volume is limited by the specific heat release, heat removal conditions and other storage and/or disposal conditions). The radioactive waste must be in the solid aggregate state, have the necessary resistance to the mechanical factors and temperature effects in accordance with the state standards regulating the requirements for solidified radioactive waste.

At the final stage of conditioning, the containerization of processed radioactive material is required for:

temporary storage of waste in the above-based engineering structure;

transportation of waste within the enterprise or beyond boundaries of the enterprise, in or without a transport packaging kit;

long-term storage in engineering structures or waste disposal.

The conditioned radioactive material for disposal must meet acceptance criteria taking into account a number of characteristics, including the restrictions on the total activity of radiation-hazardous material package, the specific activity, the structural stability and water resistance of the solidified form of radioactive waste, the content of corrosive substances, and heat release.

When storing in the above-ground structures, the service life of container is determined by the time until the final disposal of radioactive material in the geological formation and should be at least 50 years. For reduce the radioactive material volume and immobilization of radioactive material, the various technologies are used [9].

However, despite progress in the development of disposal solutions, more and more irradiated materials await the final fate in the temporary storage facilities [10]. The search for effective conservants is in progress. The final decisions have been delayed for many decades, and the consequences of such delays are not fully understood. In most cases, the radiation-hazardous materials contain radioactive isotopes with the long half-lives, making such materials hazardous for millennia. The long half-lives of radionuclides may exceed the time required for the protective barriers to retain the necessary properties. At the same time, the interaction of radioactive isotopes with other substances during the storage and treatment can lead to unpredictable chemical reactions, which complicates the radiation-hazardous materials management. For example, the effect of oxygen on some irradiated materials can cause the release of radioactive gases. Disposal is unlikely to provide a final solution to the problem in the long term.

When selecting and optimizing the methods for radioactive materials management, it should be taken into account that radioactive materials from the different parts of reactor may have the different levels of contamination. In particular, the management methods depend on the characteristics of nuclear material, the manufacturability and cost-effectiveness of the selected processing method. In this case, the radioactive materials disposal will require the different technologies and preliminary sorting with the help of non-destructive measurement and control methods. So, it is impossible to recommend only one method for the processing of hazardous radioactive materials, due to the varying levels of radioactive materials contamination in the different parts of reactors. From the data above, it is clear that the choice of technology for treatment and decontamination of radioactive materials is influenced by a number of factors, including the level of radioactive contamination and available radionuclides. And the need for scientific substantiation of methods for radioactive materials management becomes obvious. Therefore, the characterization of radioactive materials is an important stage for scientific substantiation of methods for radioactive materials management [11].

Conclusions

For storage the large amount of hazardous radioactive materials, the construction of high-capacity repositories is accompanied by a significant financial burden even for the most developed countries. Therefore, the development of methods for effective treatment of radioactive materials with a reduction in the total volume does not lose the relevance.

It is impossible to recommend only one method for the processing of hazardous radioactive materials, due to the varying levels of radioactive materials contamination in the different parts of reactors. The choice of technology for treatment and decontamination of radioactive materials is influenced by a number of factors, including the level of radioactive contamination and available radionuclides. Therefore, the characterization of radioactive materials is an important stage for scientific substantiation of methods for radioactive materials management.

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ECONOMIC SCIENCES

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INTEGRATED MODEL FOR ASSESSING THE EFFECTIVENESS OF THE INNOVATION-DRIVEN DIGITAL TRANSFORMATION OF CONSTRUCTION DEVELOPMENT ENTERPRISES

Abstract.
The article investigates the theoretical and methodological foundations for assessing the effectiveness of the innovation-driven digital transformation of construction development enterprises under conditions of increasing requirements for management digitalization and enhanced competitiveness of real estate market participants. The relevance of the study is determined by the need to develop a comprehensive toolkit for measuring the effectiveness of digital and innovative transformations capable of reflecting their impact on the economic, organizational, and market performance of enterprises. The purpose of the article is to develop an integrated model for assessing the effectiveness of the innovation-driven digital transformation of construction development enterprises. The methodological framework of the study is based on the systems approach, methods of structural and functional analysis, integrated assessment, indicator aggregation, and multicriteria analysis. The proposed model provides for the integration of a system of partial indicators into interconnected functional blocks of digital maturity, innovation activity, organizational and managerial adaptability, economic efficiency, and market performance. An approach to the formation of an integrated index has been developed, enabling the quantitative measurement of the synergistic effects generated by digital and innovative changes. It has been proven that the application of the proposed model creates an information and analytical basis for strategic monitoring, evaluation of digital investment efficiency, identification of development reserves, and substantiation of managerial decision-making. Prospects for further research are associated with testing the model at construction development enterprises, integrating ESG criteria, risk-analytical indicators, and artificial intelligence tools into the system for assessing transformation processes.

Keywords: *construction development enterprises; digital transformation; innovative development; digital maturity; integrated assessment; innovation-driven digital transformation; economic efficiency; competitiveness; development project management; integrated index.*

Introduction. Construction development, as a complex organizational and economic system, integrates investment, project, production, marketing, financial, legal, and operational processes, thereby creating a need for their informational coherence and digital integration. Unlike traditional construction activities, development operations encompass a broader value-creation management framework, ranging from the identification of market opportunities, assessment of land assets, development of project concepts and financial models to design, construction, sales, property management, and post-project support. Therefore, the level of digital maturity of a development enterprise is determined not only by the extent of software utilization or the availability of individual digital services but also by the enterprise's ability to establish a unified information environment, provide data-driven managerial decisions, coordinate project participants, forecast risks, optimize resource flows, and enhance the economic performance of the development cycle.

The current stage of construction development is characterized by the growing influence of digital transformation on all key parameters of enterprise functioning, ranging from the strategic planning of investment and construction projects and lifecycle management of real estate assets to stakeholder interaction, cost control, schedule management, risk management, quality assurance, and operational efficiency of the created product. Under these conditions, digitalization is no longer perceived merely as an auxiliary tool for automating individual business processes; instead, it is becoming a systemic factor of competitiveness, innovation capacity, and economic resilience of construction development enterprises.

The relevance of this issue is further intensified by the increasing complexity of the market environment, rising resource costs, the necessity of improving the transparency of development processes, attracting investments, ensuring the adaptability of managerial decisions, and transitioning to more integrated models for implementing construction projects.

Problem Statement. In contemporary academic discourse, the digital maturity of an enterprise is considered an integral characteristic of its readiness, capability, and actual ability to utilize digital technologies for transforming its business model, managerial architecture, operational processes, and value-creation mechanisms. At the same time, for construction development enterprises, this category possesses distinct industry-specific features, since digital maturity is

formed at the intersection of Building Information Modeling (BIM) technologies, project management systems, financial and analytical platforms, CRM and ERP solutions, geoinformation tools, digital twins, electronic document management systems, cloud-based collaborative environments, predictive analytics tools, and construction production monitoring systems. Consequently, the assessment of digital maturity cannot be limited to recording the implementation of individual digital products; rather, it must involve a comprehensive analysis of the extent to which these tools are integrated into the enterprise's managerial, investment, production, and communication processes.

The methodological assessment of the digital maturity of construction development enterprises acquires particular importance due to the uneven pace of digital development among market participants, the fragmented implementation of information systems, the limited interoperability of digital platforms, the insufficient level of data-driven culture, and the absence of unified industry-adapted criteria for measuring digital transformation. In practice, enterprises may declare a high level of digitalization while actually using digital solutions primarily for administrative accounting or project visualization without their full integration into strategic management, financial controlling, risk management, and investment decision-making systems. This creates a methodological contradiction between the formal level of technological equipment and the actual level of digital maturity as the enterprise's ability to transform data, technologies, and digital interaction into tangible economic outcomes.

Analysis of Recent Research and Publications. The theoretical foundations of research on digital transformation and enterprise digital maturity have been established in the works of prominent international scholars, including T. Davenport [1–2], G. Westerman [3], M. Kane [4], J. Ross [5], A. McAfee, and E. Brynjolfsson, who substantiated the influence of digital technologies on the transformation of business models, managerial processes, and organizational competitiveness. Significant contributions to the development of the theory of economic systems digitalization and innovation management have been made by Ukrainian scholars, including V. Heyets, L. Fedulova, V. Fedorenko, P. Kulikov [11], V. Pokolenko, G. Ryzhakova [7], O. Bielienkova [8], R. Trach, Yu. Chupryna [6], and Kh. Chupryna. Their studies investigate mechanisms of digital transformation, the development of digital ecosystems, innovation support for the construction industry, and the digitalization of investment and construction management processes. However, issues related to the comprehensive assessment of the digital maturity level of construction development enterprises remain insufficiently explored and require further advancement of methodological tools taking into account industry-specific characteristics.

Purpose of the Article. The purpose of this article is to develop an integrated model for assessing the effectiveness of the innovation-driven digital transformation of construction development enterprises, providing a comprehensive measurement of its impact on digital development, innovation activity, economic efficiency, and market competitiveness.

Main Body. The integrated model for assessing the effectiveness of the innovation-driven digital transformation of construction development enterprises is based on the concept of multidimensional measurement of the effects of digitalization and innovative development as interconnected processes that create a new quality of management, improve resource utilization efficiency, and ensure the long-term competitiveness of the enterprise. Unlike traditional approaches focused primarily on evaluating the implementation level of individual digital technologies or the volume of innovation investments, the proposed model provides for the comprehensive consideration of economic, organizational, technological, managerial, institutional, and market outcomes of transformation processes. This makes it possible to assess not only the scale of digitalization but also its actual impact on the operational effectiveness of a development company.

The structure of the integrated model involves the aggregation of a system of partial indicators into several interconnected functional blocks. The first block characterizes the level of enterprise digital maturity and includes indicators of business process digitalization, corporate information system integration, BIM technology utilization, digital project management platforms, electronic document management, cloud services, artificial intelligence technologies, and digital twins. The second block reflects the enterprise's innovation activity through indicators of investment in innovation, the intensity of new technology implementation, the degree of business model renewal, the share of innovative projects within the enterprise portfolio, and the speed of innovation commercialization. The third block characterizes the organizational and managerial outcomes of transformation and includes indicators of management structure flexibility, decision-making speed, the level of integration among participants in the development cycle, employees' digital competencies, and the development of an innovation-oriented corporate culture. The fourth block comprises the economic outcomes of digital transformation, including changes in labor productivity, profitability, project implementation costs, capital turnover rate, operating expenses, resource utilization efficiency, and investment attractiveness. The fifth block reflects market outcomes and encompasses indicators of competitiveness, customer loyalty, time-to-market, brand positioning, and adaptability to changes in the external environment (Figure 1).

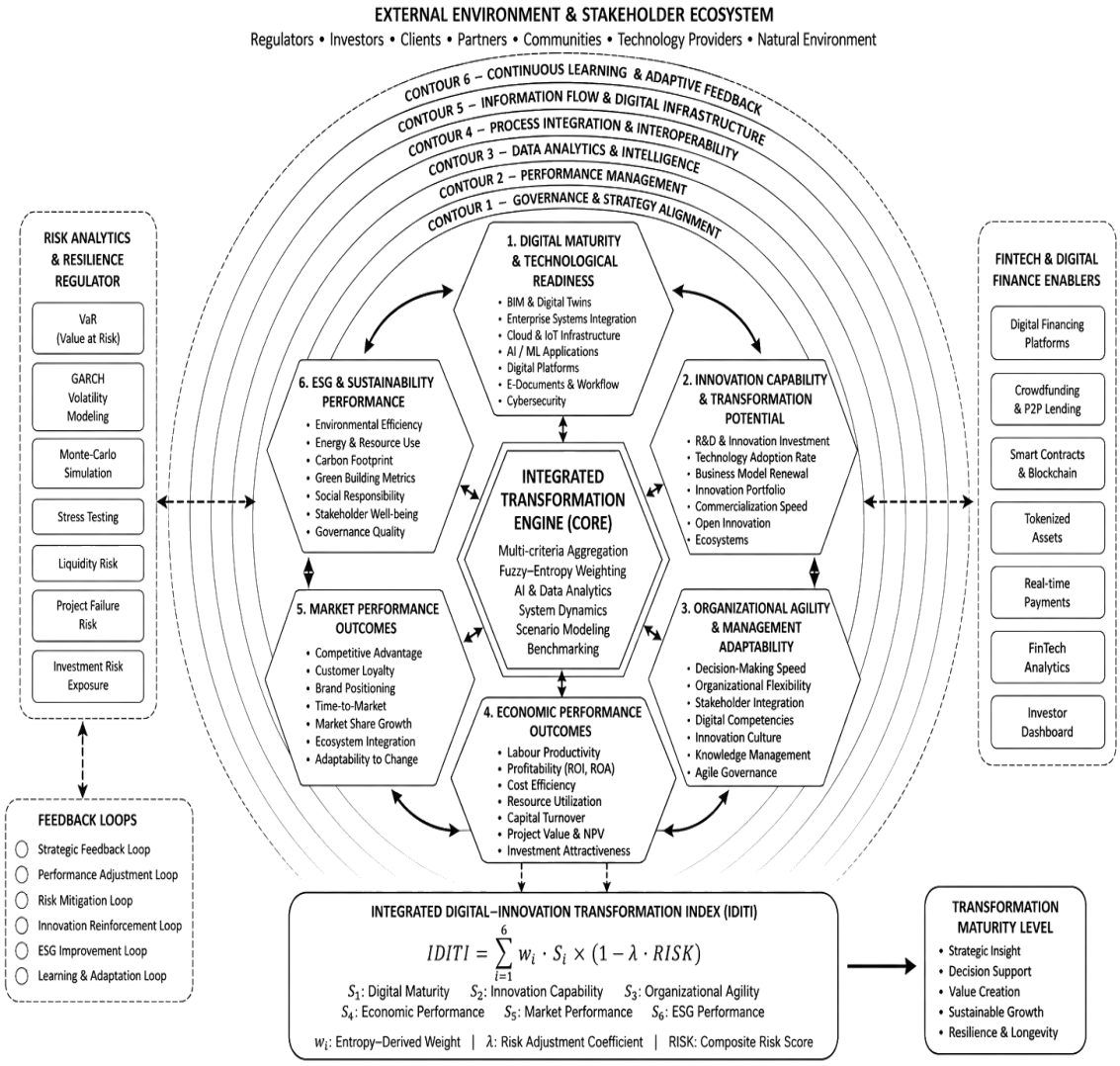

Figure 1. Conceptual architecture of an integrated framework for assessing the effectiveness of innovation-driven digital transformation in construction development enterprises.

The methodological foundation of the model is the systems approach, according to which a construction development enterprise is viewed as an open socio-economic system operating through continuous interaction with investors, clients, contractors, financial institutions, government regulators, and end-users of the development product. In this context, the effectiveness of innovation-driven digital transformation is determined by the degree to which strategic objectives are achieved through the application of digital technologies, innovative management practices, integrated information platforms, and modern data analytics tools. A distinctive feature of the proposed model is the use of an integrated index of innovation-driven digital transformation effectiveness, which is formed through the normalization of indicators, the determination of their weighting coefficients, and their subsequent aggregation into a single synthetic assessment. Such an approach makes it possible to eliminate the problem of indicator heterogeneity, ensure their comparability, and develop a generalized representation of the effectiveness of transformation processes. Weighting coefficients may be determined using expert evaluation methods, the Analytic Hierarchy Process (AHP), the entropy approach, or combined multicriteria procedures, which ensures the adaptability of the model to the specific characteristics of a particular enterprise and the features of implemented development projects.

The economic essence of the integrated indicator lies in its ability to reflect the synergistic effect arising from the interaction of innovative and digital development factors. Unlike local assessments of individual aspects of digitalization, the integrated index makes it possible to account for the cumulative effects of increased business process transparency, reduced information asymmetry, accelerated managerial procedures, lower transaction costs, improved coordination among construction project participants, and enhanced quality of data-driven managerial decision-making. As a result, it becomes possible to quantitatively measure the contribution of digital transformation to value creation and to ensuring the long-term economic sustainability of an enterprise. It has been demonstrated that the application of the integrated index enables not only the quantitative assessment of the achieved level of transformation but also the identification of the most problematic development areas, the evaluation of managerial decision effectiveness, and the creation of an information basis for strategic planning.

The practical significance of the integrated model lies in its applicability as a tool for strategic monitoring, assessment of digital investment efficiency, development of digital transformation programs, and substantiation of managerial decisions regarding further enterprise modernization. The model enables the identification of critical areas of digital development, determination of priority directions for innovative transformation, assessment of reserves for improving operational efficiency, and forecasting of competitive development prospects for construction development enterprises in the digital economy. Through the integration of technological, organizational, innovative, and economic parameters, the model creates an analytical foundation for the transition from fragmented digitalization to a systemic management of innovation-driven digital transformation processes based on the principles of sustainable development and the maximization of economic performance.

Conclusions. The article justifies the need for a comprehensive approach to assessing the effectiveness of the innovation-driven digital transformation of construction development enterprises, given the multidimensional nature of transformation processes and their influence on the economic, organizational, technological, and market performance of enterprises. It has been found that existing assessment approaches primarily focus on isolated aspects of digitalization or innovation activity, which constrains the formation of an integrated view of the results and impacts of transformational change. An integrated model for assessing the effectiveness of the innovation-driven digital transformation of construction development enterprises has been proposed. The model is based on the aggregation of indicators into interconnected functional blocks, including digital maturity, innovation activity, organizational and managerial adaptability, economic performance, and market effectiveness. Unlike existing approaches, the proposed model provides a comprehensive representation of the interrelationships between digital technologies, innovation processes, and the final outcomes of enterprise activities.

Prospects for further research are associated with testing the model on a sample of development enterprises, improving the mechanisms for determining indicator weighting coefficients, and integrating ESG criteria, risk analytics indicators, and artificial intelligence tools into the model for forecasting the effectiveness of transformation processes.

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ECONOMIC AND ANALYTICAL SUPPORT FOR THE MODERNIZATION OF OPERATIONAL AND PRODUCTION SYSTEMS OF CONSTRUCTION ENTERPRISES UNDER DIGITAL TRANSFORMATION

Abstract.

The article examines the theoretical and methodological foundations of economic and analytical support for the modernization of operational and production systems of construction development enterprises in the context of digital transformation. It is substantiated that contemporary digitalization processes necessitate a transition from fragmented automation of individual business processes to the formation of an integrated platform-ecosystem management model, in which the enterprise's operational system becomes a key driver of innovative development and long-term competitiveness. The conceptual principles of the digital ecosystem in construction development are identified, demonstrating its role in integrating stakeholders of the investment and construction process, digital platforms, information resources, and managerial mechanisms within a unified digital environment.

The study substantiates the operational and organizational imperatives of the innovative development of construction enterprises in a platform-ecosystem environment. These include the digital integration of the operational system, platform-based coordination of interactions among construction stakeholders, adaptive business process architecture, knowledge management, the application of data-driven management principles, and the establishment of a continuous digital monitoring system. It is demonstrated that the integrated implementation of these imperatives ensures synchronization of production, organizational, financial, and information processes, contributes to reducing operational costs, improving productivity, increasing innovation activity, enhancing organizational adaptability, and strengthening the overall economic performance of construction development enterprises.

Keywords: *enterprise; construction development; digital transformation; operational and production system; innovative development; business process; economic diagnostics; management; operational efficiency.*

Introduction and problem statement. The transformational processes taking place in the modern construction sector necessitate a fundamental rethinking of the economic and organizational foundations of construction enterprises as open, adaptive, and innovation-oriented operational systems. In the digital environment, a construction enterprise can no longer be viewed merely as a set of production, resource, and managerial subsystems aimed at implementing individual construction projects. Instead, it is increasingly evolving into an integrated economic and organizational platform that combines project management, digital technologies, logistics flows, financial and investment mechanisms, information and analytical tools, partnership networks, and innovative business processes. Consequently, the operational system of a construction enterprise becomes the key object of strategic modernization, whose effectiveness determines the enterprise's ability to ensure competitiveness, economic resilience, technological flexibility, and sustainable innovative development.

The distinctive feature of a construction enterprise lies in the complex project-oriented nature of its activities, the high capital intensity of production processes, the extended duration of the investment and construction cycle, and its dependence on external stakeholders, the regulatory environment, resource markets, and the spatial conditions of project implementation. Under such circumstances, traditional models of operational management, primarily based on hierarchical governance, fragmented digitalization, and functional division of responsibilities, prove insufficient to support the enterprise's innovation dynamics. These approaches often fail to ensure the timely integration of new technologies, effective risk management, optimization of life-cycle costs of construction products, transparency of information flows, and the establishment of a unified digital framework for managerial decision-making.

In this context, the economic and organizational transformation of a construction enterprise's operational system should be regarded not as a local improvement of individual business processes but as a comprehensive transformation of the enterprise's operational logic. Its essence lies in the transition from fragmented management of resources, operations, costs, and schedules to an integrated model of operational interaction based on digital synchronization of processes, economically justified managerial decision-making, flexible organizational architecture, analytical support of projects, and the enterprise's capability for continuous innovation. Such transformation encompasses not only technological modernization but also changes in organizational structures, managerial regulations, economic incentives, accountability systems, stakeholder interaction models, and mechanisms for creating added value. The digital environment further reinforces the role of the operational system as the core of innovative development in construction enterprises. The application of Building Information Modeling (BIM), Digital Twins (DT), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), Project Man-

agement Information Systems (PMIS), cloud platforms, predictive analytics, data management tools, and automated monitoring of construction processes creates new opportunities for increasing productivity, reducing transaction costs, minimizing operational losses, improving the quality of design solutions, and strengthening control over construction execution. However, the mere implementation of digital technologies does not automatically guarantee innovative development unless these technologies are fully integrated into the enterprise's economic model, supported by appropriate organizational changes, and aligned with strategic objectives. Therefore, digitalization should be viewed not as an end in itself but as an instrument for the economic and organizational transformation of the enterprise's operational system.

The research problem arises from the fact that both academic literature and management practice tend to examine the transformation of operational systems in construction enterprises in a fragmented manner—either from the perspective of production digitalization, organizational development, or innovation activity. The interrelationships among the economic parameters of operational performance, organizational configuration, digital maturity of managerial processes, and the enterprise's capacity for innovative development remain insufficiently explored. This creates the need for a comprehensive scientific approach that considers the economic and organizational transformation of the operational system not merely as a consequence of digital change but as a fundamental determinant of the innovative development of construction enterprises.

Literature review. The issue of the economic and organizational transformation of an enterprise's operational system has been extensively developed within the contemporary concepts of operations management, digital transformation, innovative development, and project management. The theoretical foundations of operational systems management were established in the works of Michael Porter [1], Michael Hammer [2], James Champy [3], Michael Tushman [4], David Teece [5], and Henry Chesbrough [6], while the integration of digital technologies into enterprise management systems has been comprehensively addressed in the studies of Erik Brynjolfsson [7], Andrew McAfee [8], and other scholars.

In the construction sector, the methodological foundations of the digital transformation of operational activities have been advanced by leading international professional organizations, including buildingSMART International, the Lean Construction Institute, the International Group for Lean Construction (IGLC), and ISO Technical Committee ISO/TC 59/SC 13, which developed the ISO 19650 series of international standards for information management throughout the life cycle of built assets. These approaches are aimed at integrating Building Information Modeling (BIM), digital platforms, Common Data Environments (CDE), data management technologies, and Digital Twins into construction project delivery processes. A significant contribution to the development of the theoretical and methodological foundations of the digital transformation of construction enterprises has also been made by Ukrainian scholars, including Olha Bielienkova [9], Petro Kulikov [13], Vadym Pokolenko [10], Galyna Ryzhakova [10], Yurii Chupryna, and Roman Trach [12], whose research focuses on construction development, project-oriented management, business process digitalization, economic resilience, and the innovative development of construction enterprises.

At the same time, an analysis of the existing scientific literature indicates that the majority of studies concentrate on specific aspects of digitalization, the implementation of BIM technologies, project management, or the improvement of information systems. Considerably less attention has been devoted to the economic and organizational transformation of the operational system of a construction enterprise as an integrated mechanism linking digital maturity, operational efficiency, innovation activity, and overall economic performance. Furthermore, the theoretical and methodological provisions for developing a comprehensive model of the economic and organizational transformation of operational systems capable of ensuring the long-term innovative development of construction enterprises in a digital environment remain insufficiently substantiated. This research gap determines both the relevance and the scientific significance of the present study.

The purpose of this article is to develop the conceptual foundations of the economic and organizational transformation of the operational system of a construction enterprise aimed at ensuring its innovative development in the context of digital transformation.

Main material. The digital ecosystem in construction development represents an integrated organizational and economic environment that facilitates interaction among developers, investors, designers, contractors, suppliers, financial institutions, public authorities, and end users. Its functioning is supported by a unified digital platform, a shared information environment, and seamless data exchange throughout the entire life cycle of a real estate asset. Unlike traditional management models, the digital ecosystem is based on network architecture, platform-based coordination, digital integration of business processes, and the continuous use of data as a strategic resource for value creation. Its conceptual foundation is formed through the synthesis of ecosystem, platform, resource-based, competency-based, process-oriented, and stakeholder approaches, generating a synergistic effect through the integration of **Building Information Modeling (BIM), Digital Twins (DT), Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Geographic Information Systems (GIS),** thereby creating a unified digital environment for data exchange and decision support throughout the entire project life cycle. Under these conditions, the managerial imperatives of transformation involve a shift from hierarchical administration to ecosystem-based management founded on the coordination of digital platforms, data flow management, digital competencies, innovation partnerships, cybersecurity, and adaptive decision-making mechanisms. Such a model enhances investment attractiveness, operational efficiency, and organizational resilience of construction

development enterprises while creating the prerequisites for their long-term competitive growth within the digital economy.

The development of digital indicators and business procedures for assessing the innovative development of a construction enterprise requires a transition from fragmented measurement of individual performance outcomes to the establishment of a comprehensive analytical system capable of reflecting the dynamics of technological, organizational, economic, and managerial changes. In this context, digital indicators function not only as quantitative measures but also as instruments for formalizing the enterprise's innovation capacity and its ability to generate, implement, and scale innovative solutions throughout the investment and construction cycle. The system of digital indicators should encompass the level of the enterprise's digital maturity, the intensity of BIM implementation, the degree of integration of project, cost estimation, production, and financial information, the speed of managerial data processing, the proportion of automated business processes, the level of analytical decision support, the effectiveness of digital stakeholder interaction, and innovation performance measured by cost, schedule, quality, productivity, and risk resilience. Particular importance should be assigned to indicators that capture not merely the existence of digital technologies but also the depth of their actual impact on the enterprise's economic performance, including reductions in project duration, transaction costs, planning errors, project deviations, as well as improvements in profitability and resource management efficiency.

Business procedures for assessing innovative development should be organized as a sequential managerial and analytical framework comprising data identification, digital verification, indicator normalization, weighting, aggregation of assessment results, and interpretation of the obtained values to support managerial decision-making. Such an approach transforms innovation assessment from a one-time diagnostic exercise into a continuous mechanism for monitoring, forecasting, and adjusting the enterprise's development strategy. Given the specific characteristics of construction enterprises, innovative development should be assessed not in isolation but in relation to the project portfolio, the life cycle of construction assets, contractual arrangements, resource availability, digital collaboration among project participants, and investment performance. From a methodological standpoint, it is advisable to combine **absolute, relative, integrated, and dynamic indicators** in assessing the innovative development of construction enterprises. Absolute indicators characterize the volume of investments in digital solutions, the number of implemented technologies, and the size of the workforce possessing digital competencies. Relative indicators measure the proportion of digitalized business processes, the share of innovation expenditures in total revenue, and the degree of automation of managerial operations. Dynamic indicators reflect productivity growth rates, the pace of digital transformation, and changes in the duration of the construction cycle over time. Integrated indicators provide a comprehensive assessment of the overall level of innovation and digital development by aggregating multiple dimensions into a single composite measure. Such an integrated assessment makes it possible not only to evaluate the enterprise's current state of development but also to identify the gap between its existing and target levels of innovation capability, thereby providing an analytical basis for strategic planning and managerial decision-making (table 1).

Table-1

Digital indicators and business procedures for assessing the innovative development of a construction enterprise

Digital Indicator	Economic Meaning of the Indicator	Business Assessment Procedure	Managerial Purpose
Digital Maturity Index	Comprehensively characterizes the level of digital transformation of production, organizational, and management activities.	Conducting a digital audit, assessing digital competencies and information infrastructure.	Determining the enterprise's readiness for implementing an innovation strategy.
Digital Platform Integration Level	Reflects the degree of integration among BIM, ERP, CRM, GIS, PMIS, and other information systems.	Analysis of information flows and audit of interoperability among digital platforms.	Improving information exchange efficiency and coordination of business processes.
Business Process Digitalization Coefficient	Characterizes the share of automated managerial, production, and logistics processes.	Business process mapping and assessment of automation levels.	Identifying reserves for productivity improvement and operational cost reduction.
Innovation Activity Index	Reflects the intensity of implementing technological, organizational, and digital innovations.	Monitoring innovation projects and analyzing investments in digital technologies.	Establishing priorities for the enterprise's innovative development.
Managerial Analytics Support Level	Determines the extent of using Business Intelligence, Big Data, and predictive analytics systems.	Assessment of digital decision-support systems.	Enhancing the validity of strategic and operational management decisions.

Digital Stakeholder Interaction Coefficient	Characterizes the effectiveness of digital communication among all participants in the investment and construction process.	Analysis of electronic document management and collaborative digital platforms.	Increasing transparency, responsiveness, and coordination among project participants.
Digital Investment Efficiency Index	Reflects the economic return on digital technology implementation through cost savings, productivity growth, and profitability improvement.	Comparative analysis of investment costs and achieved economic outcomes.	Assessing the feasibility of digital investments and selecting promising modernization initiatives.
Integrated Innovation and Digital Development Index	Aggregates technological, economic, organizational, and digital characteristics of enterprise development.	Normalization of indicators, determination of weighting coefficients, and integrated aggregation.	Comprehensive assessment of innovation performance and information support for strategic management.

Source: developed by the author

The scientific significance of this approach lies in establishing a measurable framework for innovative development, in which digital indicators serve as informational markers of transformation, while business procedures function as the organizational mechanism for converting data into managerial decisions. From a practical perspective, this approach enables the early identification of weaknesses in the enterprise's digital architecture, assessment of the effectiveness of innovation investments, comparison of projects according to their technological performance, justification of modernization priorities, and enhancement of management transparency. Therefore, the development of digital indicators and business procedures for assessing innovative development constitutes a necessary prerequisite for the transition of construction enterprises toward an adaptive, data-driven, and innovation-oriented operating model.

The transformation of the construction industry under the influence of digitalization and the emergence of the platform economy necessitates a fundamental revision of the traditional principles governing the operational activities of construction enterprises. While the conventional operating model was based on the linear coordination of production processes, hierarchical management structures, and local optimization of individual functional units, the platform-ecosystem environment establishes a fundamentally new value creation logic based on integrated information flow management, digital interaction among economic actors, and continuous synchronization of business processes within a unified digital space. Under these conditions, the innovative development of construction enterprises is determined not so much by the scale of implementing individual technological innovations as by the operational system's ability to adapt to dynamic environmental changes while maintaining a high level of integration, flexibility, and digital governance across all elements of the production and management cycle. The operational and organizational imperatives of innovative development become strategic requirements that define the directions for transforming enterprise structures, business process architecture, and managerial decision-making mechanisms. Their essence lies in the transition from a function-oriented organizational model to a process- and platform-based system, in which end-to-end business processes, information flows, and digital interconnections among all participants in the construction development cycle become the primary objects of management. Such an approach ensures the integration of design, cost estimation, procurement, construction operations, financial control, logistics, facility operation, and post-project support into a unified value creation system.

A fundamental imperative is the digital integration of the operational system, which ensures the continuity of information exchange among all functional subsystems of the enterprise. Information ceases to be merely a supporting resource and becomes the primary factor coordinating operational activities, making it possible to synchronize production schedules, optimize resource utilization, reduce time lags between managerial decisions and their implementation, minimize transaction costs, and improve the predictability of construction project outcomes. An equally important imperative is the platform-based coordination of stakeholder interaction, according to which the construction enterprise acts as the central integrator of a network of interconnected economic actors. Under such conditions, organizational performance depends not only on internal productivity but also on the degree of coordination among designers, investors, contractors, suppliers, consulting organizations, financial institutions, and public authorities. Digital platforms facilitate real-time information exchange, standardization of procedures, transparency of contractual execution, and rapid responses to changes in the external environment. Another important direction of organizational transformation is the development of an adaptive operational architecture capable of rapidly restructuring business processes in response to changes in investment conditions, technological requirements, regulatory frameworks, or project implementation risks. Such adaptability is achieved through modular process design, digital management scenarios, automated resource reallocation, intelligent production planning, and continuous monitoring of key performance indicators. Particular importance is attached to knowledge management and the development of employees' digital competencies. Within the platform-ecosystem environment, innovative development depends not only on the level of technological infrastructure but also on the workforce's ability to generate innovative managerial solutions, employ digital analytical tools, process large-scale datasets, integrate interdisciplinary

knowledge, and support continuous organizational learning. Consequently, human capital becomes the principal source of the enterprise's dynamic organizational capabilities.

Another strategic imperative is the implementation of **data-driven management**, whereby operational, tactical, and strategic decisions are made on the basis of integrated analytical information generated in real time. This approach enables the timely detection of deviations, risk forecasting, modeling of alternative project implementation scenarios, and prompt adjustment of operational programs. At the same time, continuous digital monitoring establishes an uninterrupted feedback mechanism between organizational performance and managerial decision-making, thereby ensuring the self-adaptation of the enterprise's operational system. Within the platform-ecosystem environment, the criteria for evaluating organizational performance undergo substantial transformation. Alongside traditional indicators such as cost, productivity, and profitability, increasing importance is attached to digital integration, information exchange speed, stakeholder interaction, business process adaptability, innovation activity, digital infrastructure resilience, and the efficiency of information resource utilization. Consequently, enterprise performance is assessed as the integrated outcome of the interaction among economic, organizational, technological, and digital dimensions.

Conclusions. The innovative development of construction development enterprises in the digital economy is determined not only by the scale of digital technology implementation but, above all, by the level of the economic and organizational transformation of their operational systems. The digital ecosystem establishes a new value creation model based on the integration of project, production, financial, and information-analytical processes within a unified platform environment, thereby enhancing operational efficiency, organizational adaptability, and the enterprise's innovation capability. A conceptual approach to developing a system of digital indicators and business procedures for the economic assessment of innovative development has been proposed. Unlike existing approaches, it provides for the integrated evaluation of digital maturity, the level of platform integration, innovation activity, the efficiency of digital investments, the effectiveness of digital stakeholder interaction, and the performance of managerial processes. The proposed system enables a transition from the local control of individual indicators to comprehensive monitoring of transformation processes and establishes an information-analytical foundation for strategic managerial decision-making.

The study identifies the key operational and organizational imperatives of innovative development, including the digital integration of the operational system, platform-based coordination of interactions among participants in the construction development process, adaptive business process architecture, knowledge management, data-driven management, and continuous digital performance monitoring. Their integrated implementation creates the prerequisites for the development of an intelligent operational system capable of ensuring sustainable economic growth, enhancing competitiveness, reducing operational costs, and improving the efficiency of construction project delivery within a platform-ecosystem environment. Future research should focus on the development of integrated quantitative models for assessing the effectiveness of the economic and organizational transformation of operational systems in construction enterprises and on their practical validation within construction development companies.

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ЭТНО-ДЕМОГРАФИЧЕСКИЕ ПРОЦЕССЫ В РЕСПУБЛИКАХ СЕВЕРНОГО КАВКАЗА И ИХ ВЛИЯНИЕ НА СОЦИАЛЬНО-ЭКОНОМИЧЕСКОЕ РАЗВИТИЕ ТЕРРИТОРИИ

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ETHNO-DEMOGRAPHIC PROCESSES IN THE REPUBLICS OF THE NORTH CAUCASUS AND THEIR IMPACT ON THE SOCIO-ECONOMIC DEVELOPMENT OF THE TERRITORY

Аннотация

В статье анализируются современные этно-демографические процессы, протекающие в республиках Северного Кавказа и их воздействие на социально-экономическое положение региона. Рассматриваются ключевые тенденции: высокий естественный прирост населения при сохранении традиционной семейной модели, миграционный отток русскоязычного и квалифицированного персонала, а также изменения в возрастно-половой структуре населения. Особое внимание уделяется противоречиям между быстрым ростом численности молодёжи и ограниченными возможностями региональных экономик по её трудоустройству, что провоцирует социальную напряжённость и стимулирует маятниковую и внешнюю миграцию. В заключении предлагаются подходы к синхронизации демографической и экономической политики как условия устойчивого развития северокавказских республик.

Abstract

This article analyzes current ethnodemographic processes occurring in the North Caucasus republics and their impact on the region's socioeconomic status. Key trends are examined: high natural population growth with the preservation of the traditional family model, the outflow of Russian-speaking and skilled personnel, and changes in the age and sex structure of the population. Particular attention is paid to the contradictions between the rapid growth of the youth population and the limited employment opportunities of regional economies, which provokes social tensions and stimulates pendulum and external migration. The article concludes by proposing approaches to synchronizing demographic and economic policies as a prerequisite for the sustainable development of the North Caucasus republics.

Ключевые слова: *Северный Кавказ, этно-демографические процессы, естественный прирост, миграция, социально-экономическое развитие, безработица, демографическая нагрузка, рынок труда.*

Keywords: *North Caucasus, ethnodemographic processes, natural population growth, migration, socioeconomic development, unemployment, demographic burden, labor market.*

Республики Северного Кавказа представляют собой уникальный полиэтничный регион Российской Федерации с исторически сложившейся сложной этнодемографической структурой. Республика Дагестан, Чеченская Республика и Республика Ингушетия являются наиболее характерными примерами территорий, где этнодемографические процессы оказывают определяющее влияние на все аспекты социально-экономического развития.

Во-первых, эти республики демонстрируют наиболее высокие показатели рождаемости в России при одновременно высоком уровне безработицы.

Во-вторых, сложная этническая структура населения требует учета культурных особенностей при разработке региональной экономической политики.

В-третьих, данные территории характеризуются значительной долей федеральных трансфертов в бюджете, что актуализирует вопрос эффективности использования демографического потенциала.

Согласно данным Всероссийской переписи населения 2025-2026 годов, в Дагестане проживает 3 182 054 человека, в Чечне — 1 510 824 человека, в Ингушетии — 509 541 человек. Эти три республики объединяет ряд общих демографических характеристик: высокая рождаемость, молодая возрастная структура населения, значительная роль традиционных семейных ценностей.

Цель исследования – выявить специфику этнодемографических процессов в Республике Дагестан, Чеченской Республике и Республике Ингушетия и определить механизмы их влияния на социально-экономическое развитие данных территорий.

Исследование базируется на официальных статистических данных Федеральной службы государственной статистики РФ и территориальных органов Росстата по Республике Дагестан, Чеченской Республике и Республике Ингушетия за период 2023-2026 годы. Использованы материалы Всероссийской переписи населения 2023-2024 годов, статистические сборники "Регионы России. Социально-экономические показатели" за 2025-2026

годы, данные единой межведомственной информационно-статистической системы (ЕМИСС), а также аналитические материалы региональных министерств экономики [4; 5; 6].

В работе применялись следующие методы: статистический анализ демографических и экономических показателей, сравнительно-географический метод для выявления региональных особенностей, корреляционный анализ для установления взаимосвязей между демографическими и экономическими переменными, системный подход для комплексной оценки влияния этнодемографических процессов на социально-экономическое развитие.

Анализ динамики численности населения в исследуемых республиках за период 2023-2026 годы показывает устойчивую тенденцию к росту, что существенно отличает эти территории от большинства регионов России (таблица 1).

Таблица 1

Численность постоянного населения в республиках Северного Кавказа, тыс. человек

Регион	2023	2024	2025	2026	Прирост 2023-2026, %
Республика Дагестан	3 120,2	3 154,9	3 176,4	3 198,7	+2,5
Чеченская Республика	1 478,7	1 493,4	1 505,9	1 518,2	+2,7
Республика Ингушетия	507,1	510,8	512,6	514,9	+1,5
Российская Федерация	146 748,6	146 447,4	146 424,7	146 447,4	-0,2

Как видно из таблицы 1, все три республики демонстрируют положительную динамику численности населения. Наиболее высокие темпы роста отмечаются в Чеченской Республике (+2,7% за три года), что связано как с высоким естественным приростом, так и с возвратной миграцией. Дагестан показывает прирост на уровне 2,5%, Ингушетия — 1,5%. Для сравнения, население России в целом за этот период сократилось на 0,2% [7, с. 23].

Абсолютные показатели также демонстрируют различия: если Дагестан является крупным регионом с населением более 3 млн человек, то Ингушетия — один из самых малонаселенных субъектов РФ. При этом плотность населения в Ингушетии составляет 143,1 чел./км², в Чечне — 95,2 чел./км², в Дагестане — 63,4 чел./км², что значительно превышает среднероссийский показатель 8,6 чел./км² [8, с. 45].

Этническая структура населения исследуемых республик характеризуется различной степенью мозаичности. Согласно данным Всероссийской переписи населения 2023-2024 годов, наиболее полиэтничным является Дагестан, где проживают представители более 30 коренных народов (таблица 2).

Таблица 2

Этническая структура населения республик по данным Всероссийской переписи населения 2023-2024 годов, %

Этнос	Республика Дагестан	Чеченская Республика	Республика Ингушетия
Аварцы	29,4	1,2	0,3
Даргинцы	17,0	0,4	—
Кумыки	14,9	0,9	—
Лезгины	13,3	—	—
Лакцы	5,6	—	—
Табасараны	4,3	—	—
Русские	3,6	1,9	0,8
Чеченцы	3,2	95,3	0,8
Ингуши	—	0,2	96,7
Другие	8,7	0,1	1,4

Данные таблицы 2 свидетельствуют о принципиальных различиях в этнической структуре. Дагестан представляет собой уникальный полиэтничный регион, где ни один этнос не составляет абсолютного большинства. Крупнейшие народы — аварцы (29,4%), даргинцы (17,0%), кумыки (14,9%) и лезгины (13,3%) — суммарно составляют около 75% населения [3, с. 89].

В отличие от Дагестана, Чеченская Республика и Ингушетия являются моноэтничными регионами: чеченцы составляют 95,3% населения Чечни, ингуши — 96,7% населения Ингушетии. Доля русского населения во всех трех республиках остается низкой и продолжает сокращаться: в Дагестане с 4,7% в 2010 году до 3,6% в 2024 году, в Чечне — с 2,7% до 1,9%, в Ингушетии — с 1,4% до 0,8% [10, с. 156].

Важной особенностью является территориальное расселение этносов. В Дагестане каждый народ исторически занимает определенную территорию,

что создает сложную систему внутрирегиональных этнических ареалов. Это влияет на социально-экономическое развитие: существуют различия в уровне развития между равнинными районами, где проживают кумыки и русские, и горными территориями, населенными аварцами, даргинцами и другими народами [11, с. 78].

Все три исследуемые республики характеризуются наиболее высокими показателями рождаемости в Российской Федерации (таблица 3).

Таблица 3

Показатели естественного движения населения в 2025 году

Показатель	Республика Дагестан	Чеченская Республика	Республика Ингушетия	Российская Федерация
Число родившихся на 1000 человек населения	16,7	20,4	18,2	9,2
Число умерших на 1000 человек населения	5,8	4,1	3,8	14,5
Естественный прирост на 1000 человек	+10,9	+16,3	+14,4	-5,3
Суммарный коэффициент рождаемости	1,98	2,38	2,21	1,42
Ожидаемая продолжительность жизни при рождении, лет	76,8	76,1	82,4	72,8

Как показывают данные таблицы 3, коэффициенты рождаемости в республиках в 1,8-2,2 раза превышают среднероссийский уровень. Особенно выделяется Чеченская Республика, где в 2025 году родилось 20,4 ребенка на 1000 человек населения — это максимальный показатель среди всех регионов России. Суммарный коэффициент рождаемости в Чечне (2,38) и Ингушетии (2,21) превышает уровень простого воспроизводства населения (2,1-2,15) [12, с. 90].

Показатели смертности в республиках значительно ниже среднероссийских: 3,8-5,8 против 14,5 на 1000 человек. Это обусловлено молодой возрастной структурой населения, традиционным образом жизни, а также особенностями учета демографических событий. В результате естественный прирост населения составляет от +10,9 в Дагестане до +16,3 в Чечне, в то время как в целом по России наблюдается естественная убыль -5,3 на 1000 человек [5, с. 34].

Обращает на себя внимание исключительно высокая ожидаемая продолжительность жизни в Ингушетии — 82,4 года, что на 9,6 года превышает среднероссийский показатель и является максимальным значением среди всех субъектов РФ. В Дагестане и Чечне этот показатель также выше среднего по стране (76,8 и 76,1 года соответственно) [13, с. 45].

Детальный анализ структуры рождаемости показывает сохранение традиционной многодетной модели семьи. По данным Территориального органа Росстата по Чеченской Республике, в 2025 году доля третьих и последующих рождений составила 42,3%, что в 2,8 раза выше среднероссийского уровня. В Ингушетии этот показатель достигает 45,1%, в Дагестане — 38,7% [15, с. 23].

Миграционная ситуация в республиках характеризуется сложной динамикой внутренних и внешних потоков (таблица 5).

Таблица 5

Миграционное движение населения в 2025 году, человек

Показатель	Республика Дагестан	Чеченская Республика	Республика Ингушетия
Прибывшие в регион	38 456	19 872	8 234
Выбывшие из региона	44 123	18 045	9 567
Миграционный прирост (убыль)	-5 667	+1 827	-1 333
Коэффициент миграционного прироста на 10 000 населения	-17,9	+12,2	-26,0
Доля внутрирегиональной миграции, %	67,4	72,8	68,9

Данные таблицы 5 показывают, что Дагестан и Ингушетия испытывают миграционный отток населения, в то время как Чечня имеет положительное миграционное сальдо. В 2025 году из Дагестана выбыло на 5 667 человек больше, чем прибыло, из Ин-

гушетии — на 1 333 человека. Коэффициент миграционной убыли особенно высок в Ингушетии (-26,0 на 10 000 населения), что частично нивелирует высокий естественный прирост [19, с. 135].

Чеченская Республика, напротив, сохраняет положительное миграционное сальдо (+1 827 человек в 2025 году), что связано с продолжающимися процессами возвратной миграции после завершения контртеррористической операции и активным жилищным строительством [20, с. 78].

Важной особенностью является высокая доля внутрирегиональной миграции (67-73%), что отражает процессы урбанизации и переселения из горных районов в равнинные и предгорные территории. В Дагестане основными центрами притяжения являются Махачкала и Каспийск, где сосредоточено около 40% городского населения республики. В Чечне доминирует Грозный, население которого выросло с 271 тыс. человек в 2010 году до 328 тыс. в 2026 году.

Межрегиональная миграция направлена преимущественно в другие субъекты РФ. По экспертным оценкам, численность трудовых мигрантов из республик, работающих в других регионах России, составляет от 250 до 400 тыс. человек [12, с. 156]. Основными центрами притяжения являются Москва, Московская область, Санкт-Петербург, Тюменская область, Краснодарский край. Денежные переводы мигрантов играют значительную роль в доходах семей: по данным исследований, до 35-40% домохозяйств в горных районах Дагестана имеют членов семьи, работающих в других регионах [13, с. 89].

Молодая возрастная структура населения и высокая рождаемость создают значительное давление на региональный рынок труда. Ежегодный прирост трудоспособного населения требует создания десятков тысяч новых рабочих мест, что является серьезным вызовом для экономики республик (таблица 6).

Таблица 6

Показатели рынка труда в 2026 году

Показатель	Республика Дагестан	Чеченская Республика	Республика Ингушетия	Российская Федерация
Численность рабочей силы, тыс. человек	1 456,3	687,4	243,6	75 348,9
Уровень участия в рабочей силе, %	62,8	64,1	61,3	62,4
Уровень занятости, %	54,1	56,2	47,4	59,2
Уровень безработицы, %	13,8	12,3	22,7	3,2
Численность безработных, тыс. человек	201,2	84,6	55,3	2 432,1

Как видно из таблицы 6, уровень безработицы в исследуемых республиках в 4-7 раз превышает среднероссийский показатель. Особенно критическая ситуация сложилась в Ингушетии, где уровень безработицы составляет 22,7% — это максимальный показатель среди всех субъектов РФ. В Дагестане безработица достигает 13,8%, в Чечне — 12,3%.

Высокая безработица обусловлена несколькими факторами. Во-первых, ежегодно на рынок труда выходит значительное количество молодежи, превышающее возможности экономики по созданию новых рабочих мест. Во-вторых, структура экономики республик характеризуется преобладанием государственного сектора и бюджетных организаций при слабом развитии обрабатывающей промышленности [6, с. 167].

В-третьих, существует структурное несоответствие между спросом и предложением рабочей силы. По данным региональных служб занятости, до 60% вакансий приходится на низкоквалифицированные рабочие специальности (строительные рабочие, водители, продавцы), в то время как значительная часть молодежи имеет высшее образование и претендует на другие позиции [7, с. 89].

Особенностью рынка труда является высокая доля неформальной занятости. По экспертным оценкам, в неформальном секторе (розничная торговля, услуги, строительство, сельское хозяйство) занято от 40% до 55% работающего населения [8, с. 134]. Это создает проблемы для социального обеспечения и налоговых поступлений в бюджет.

В ходе работы были решены следующие задачи:

1. Проанализирована этническая структура населения республик СКФО. Установлено, что регион характеризуется высокой степенью этнической мозаичности: на территории семи субъектов проживает более 50 коренных этносов. По данным Всероссийской переписи населения 2024 года, численность населения СКФО составила 10 059 563 человека. Крупнейшими республиками по численности населения являются Дагестан (3 182 054 человека), Чеченская Республика (1 510 824 человека) и Республика Ингушетия (528 546 человек). В этнической структуре Дагестана преобладают аварцы (29,4%), даргинцы (17,0%), кумыки (14,9%), лезгины (13,3%); в Чеченской Республике — чеченцы (95,3%); в Ингушетии — ингуши (94,1%).

2. Исследованы демографические показатели республик СКФО. Анализ статистических данных Росстата за 2023–2026 годы показал, что республики Северного Кавказа демонстрируют наиболее

высокие показатели естественного прироста населения в России. В 2025 году суммарный коэффициент рождаемости в Чеченской Республике составил 2,58 детей на одну женщину, в Ингушетии — 2,35, в Дагестане — 1,98, что значительно превышает среднероссийский показатель (1,42). Одновременно регион характеризуется относительно молодой возрастной структурой населения: доля лиц моложе трудоспособного возраста в Ингушетии достигает 32,8%, в Чечне — 31,4%, в Дагестане — 28,7% (при среднероссийском значении 19,8%).

3. Выявлены основные миграционные тренды. Республики СКФО в 2010-х — начале 2023-х годов испытывали устойчивый миграционный отток населения. По данным Росстата, в 2025 году миграционная убыль Дагестана составила −12 847 человек, Чечни — −5 423 человека, Ингушетии — −1 089 человек. Основными направлениями миграции являются крупные города Центральной России и Южного федерального округа. Миграционные потоки формируются преимущественно молодёжью трудоспособного возраста, что создаёт риски утраты демографического и интеллектуального потенциала регионов.

4. Определены факторы, влияющие на этнодемографические процессы. К ключевым факторам относятся: культурно-религиозные традиции (влияние ислама на репродуктивное поведение), социально-экономическая ситуация (уровень безработицы в республиках СКФО в 2026 году варьировался от 13,2% в Ингушетии до 8,9% в Дагестане при среднероссийском 3,2%), уровень урбанизации (доля городского населения в Дагестане — 45,7%, в Чечне — 36,4%, в Ингушетии — 41,3%), а также политика федеральных и региональных властей в области демографического развития.

Республики СКФО сохраняют статус регионов с наиболее высоким естественным приростом населения в Российской Федерации, что обусловлено традиционной моделью демографического поведения, характеризующейся высокой рождаемостью и относительно низкой смертностью в молодых возрастах.

Этническая структура населения республик отличается устойчивостью и преобладанием коренных этносов. В Чечне и Ингушетии доля титульных народов превышает 94%, что является одним из самых высоких показателей этнической гомогенности в России. Дагестан демонстрирует уникальную полиэтничность с представительством десятков автохтонных народов.

Миграционный отток населения является главным демографическим вызовом для республик СКФО. Отток преимущественно молодого и образованного населения снижает качество человеческого капитала и создаёт препятствия для инновационного развития регионов.

Демографический потенциал республик СКФО может стать значимым ресурсом для общероссийского демографического развития при условии реализации эффективной политики социально-экономического развития территорий, создания рабочих мест и улучшения качества жизни населения.

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ФАКТОРИ РИЗИКУ, ДІАГНОСТИЧНІ КРИТЕРІЇ ТА СТАНДАРТИ ЛІКУВАННЯ ПЕРЕДЧАСНОЇ НЕДОСТАТНОСТІ ЯЄЧНИКІВ

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RISK FACTORS, DIAGNOSTIC CRITERIA AND TREATMENT STANDARDS OF PREMATURE OVARIAN FAILURE

Анотація

Проведений огляд літератури показав, що в умовах сьогодення спостерігається стійка тенденція до зростання частоти передчасної недостатності яєчників. Розвитку передчасного виснаження яєчників сприяють ятрогенні фактори, аутосомні захворювання, генетичні чинники та тютюнопаління.

Діагностичними критеріями передчасної недостатності яєчників є порушення менструального циклу та підвищення рівня ФСГ у жінок до 40 років.

Сучасні підходи до лікування зосереджені на призначенні замісної гормональної терапії, відновленні гормональної функції яєчників із використанням клітинної терапії (різних типів стовбурових клітин, збагаченої тромбоцитами плазми), збереженні фертильності у онкохворих пацієнток, лікуванні безпліддя шляхом використання допоміжних репродуктивних технологій із донацією яйцеклітин, застосуванні тестостерону при сексуальній дисфункції та покращення якості життя.

Abstract.

The conducted review of the literature showed that in today's conditions there is a steady trend towards an increase in the frequency of premature ovarian failure. Iatrogenic factors, autosomal diseases, genetic factors and smoking contribute to the development of premature ovarian failure.

Diagnostic criteria for premature ovarian failure are menstrual cycle disorders and increased FSH levels in women under 40 years of age.

Modern approaches to treatment are focused on the appointment of hormone replacement therapy, the restoration of hormonal function of the ovaries using cell therapy (different types of stem cells, platelet-rich plasma), the preservation of fertility in cancer patients, the treatment of infertility through the use of assisted reproductive technologies with egg donation, the use of testosterone in sexual dysfunction, and improving the quality of life.

Ключові слова: *передчасне виснаження яєчників, передчасна яєчникова недостатність, остеопороз, рання менопауза, безпліддя, діагностика.*

Key words: *treatment, osteoporosis, premature menopause, oligomenorrhea, fertility, diagnostics, hormone replacement therapy, premature ovarian failure (POI).*

Вступ: Передчасна недостатність яєчників (ПНЯ), втрата гормональної активності яєчників до 40 років, зустрічається у 1 із 250 жінок молодше 35 років і у 1 із 100 жінок молодше 40 років [1, 2, 3]. Результати мета аналізу, здійсненого Li M. і співавт. [1], показали, що глобальна поширеність ПНЯ становить 3,5%. Найвищий показник ПНЯ зареєст-

ровано у Північній Америці (11,3%), у два рази рідше (5,4%) у Південній Америці. У країнах, що розвиваються, поширеність ПНЯ є вищою, ніж у розвинених країнах (5,3% проти 3,1% відповідно). За останні 20 років спостерігається тенденція до зростання поширеності ПНЯ [1].

ПНЯ асоціюють не тільки із симптомами естрогенної недостатності. ПНЯ є провідною причиною безпліддя, сексуальної дисфункції і системного старіння [4]. ПНЯ небезпечна віддаленими наслідками, а саме, зростанням ризику серцево-судинних захворювань (ССЗ), діабету 2 типу, остеопорозу, неврологічної патології, які знижують якість життя і є причиною передчасної смерті [5]. Незважаючи на чисельні наукові дослідження, передчасна недостатність яєчників через зростання її поширеності, залишається у центрі уваги медичної спільноти [1 - 5].

Мета дослідження: Висвітлити сучасні дані літератури про фактори ризику, діагностичні критерії і лікування передчасної недостатності яєчників.

Матеріали та методи: Для досягнення мети дослідження, проведено бібліометричний аналіз наукових досліджень, висвітлених у статтях, опублікованих у журналах за період 2020–2025 років, які індексуються у наукометричних базах PubMed, Scopus, Medline, із використанням ключових слів: передчасне виснаження яєчників, передчасна яєчникова недостатність, остеопороз, рання менопауза, безпліддя, діагностика.

Результати дослідження. ПНЯ розглядають як гетерогенне захворювання, причини якого у 75% є не відомими [5, 10]. 11,2% випадків ПНЯ мають ятрогенну етіологію (хіміотерапія, променева терапія, хірургічне видалення додатків матки (сальпінгооофоректомія)), 10,5% випадків ПНЯ зумовлена аутоімунними процесами [10]. Такі аутоімунні захворювання, як тиреоїдит Хашимото, хвороба Аддісона, системний червоний вовчак, целіакія, антифосфоліпідний синдром і ревматоїдний артрит, діагностують у 4–30% випадках ПНЯ [10]. Аутоімунний генез ПНЯ може проявлятися як частина аутоімунного полігландулярного синдрому (АПС) – стану, при якому аутоімунна активність викликає ураження специфічних ендокринних органів. У своїй найбільш поширеній формі АПС (тип 3) пов'язаний із антитілами до щитовидної залози (тиреоїдит Хашимото). У зв'язку із АПС при хворобі Аддісона (ХА) можуть формуватися 21 ОН-антитіла [10].

Генетичні порушення, а саме, синдром Тернера, порушення Х-хромосоми, синдром ламкої Х – хромосоми та аутосомні генні мутації, виявляють у 20–30% жінок із ПНЯ [11, 12].

До посиленого виснаження фолікулів та ПНЯ призводять хронічний стрес, галактоземія, вірусні інфекції, такі як паротит, токсичний вплив факторів оточуючого середовища, а саме, мікропластику, фталатів, бісфенолу А, пестицидів та тютюнопаління [13].

Діагностичними критеріями ПНЯ є порушення менструального циклу (спонтання вторинна аменорея або нерегулярні менструації), упродовж щонайменше 4 місяців і більше, та підвищення рівня фолікулостимулюючого гормону (ФСГ) у сироватці крові понад 25 МО/л у віці до 40 років [5].

Сучасні керівництва не рекомендують використовувати АМГ як основний діагностичний тест для визначення та прогнозування ПНЯ [5].

Усім жінкам із неятрогенною ПНЯ рекомендується [5] хромосомний аналіз, зокрема тестування на премутацію FMR1 (ген синдрому ламкої Х-хромосоми).

За відсутності геномних порушень, рекомендовано здійснити скринінг на аутоантитіла до 21-гідроксилази (21OH-Abs), визначення тиреотропного гормону (ТТГ). Жінок із ПНЯ та позитивними антитілами до 21OH-Abs, аномальними рівнями ТТГ слід скерувати до ендокринолога.

Сучасні підходи до лікування ПНЯ зосереджені на призначенні замісної гормональної терапії (ЗГТ) та методах збереження фертильності, особливо, у пацієнток, що проходять хіміотерапію [14].

Основним та ефективним підходом у лікуванні симптомів гіпоестрогенізму при ПНЯ є призначення ЗГТ до настання природної менопаузи з метою зниження ризику хронічних захворювань, таких як серцево-судинні захворювання, остеопороз та нейрокогнітивні порушення [15]. Вибір препаратів ЗГТ повинен максимально точно імітувати нормальне синтез стероїдних гормонів яєчниками та забезпечувати достатній рівень естрадіолу для зменшення симптомів менопаузи, підтримки щільності кісткової тканини, мінімізації психологічних наслідків дефіциту естрогену та захисту від раннього прогресування серцево-судинних захворювань. При призначенні ЗГТ необхідно враховувати особливості кожного компонента ЗГТ щодо наявності протипоказів і можливих способу та методу їх введення [5, 15].

Проте ЗГТ не повністю відновлює функцію яєчників. Тому, в даний час розглядаються різні нові способи вирішення цієї проблеми. До таких методів відносяться активація стовбурових клітин, активація in vitro (AIV), активація мітохондрій, екзосомна терапія, стратегії із використанням біоматеріалів та внутрішньояєчникова перфузія збагаченої тромбоцитами плазми (ЗТП).

Активація стовбурових клітин може відбуватися за допомогою вивільнення біоактивних паракринних молекул, таких як цитокіни, регуляторні фактори, фактори росту і сигнальні пептиди. Ці молекули можуть позитивно впливати на сусідні клітини, покращуючи функцію яєчників за рахунок виконання протизапальних, антиапоптичних, антиангіогенних, антифібротичних та імунорегулюючих функцій [16]. У дослідженнях стовбурових клітин основна увага приділяється різним типам стовбурових клітин, включаючи стовбурові клітини кісткового мозку (BMSC) [17], мезенхімальні стовбурові клітини (МСК) пуповини (UC-MSC) [18], мезенхімальні клітини (MenSC) [19], стовбурові клітини амніотичної рідини людини (AFSC) [20], МСК плаценти (PMSC) [21], МСК жирової тканини

(ADSC) [22]. Крім того, деякі дослідники припустили, що індуковані оогоніальні стовбурові клітини (iOSC) можуть відкрити новий напрямок у лікуванні ПНЯ [23]. Хоча використання МСК демонструють багатообіцяючі біологічні ефекти in vitro, їх довгострокова ефективність та безпека in vivo вимагають подальшої перевірки під час великих клінічних випробувань за участю великих груп пацієнтів [16].

Новим метод лікування ПНЯ, що знаходиться в стадії дослідження, є внутрішньояєчникове введення збагаченої тромбоцитами плазми (PRP) [24]. Доведено, що активовані тромбоцити стимулюють ангіогенез, контролюють запалення та сприяють анаболізму, вивільняючи безліч гормонів та факторів росту.

Сьогодні важливим підходом у профілактиці ПНЯ є застосування методів збереження фертильності (кріоконсервація ооцитів, ембріонів і яєчникової тканини, гетеротопічна трансплантація яєчників) перед початком хіміо-, променевої терапії у жінок із онкопатологією [26].

У жінок із безпліддям на тлі ПНЯ настання вагітності забезпечує використання донорських ооцитів.

Для нівелювання зниженого лібідо жінкам із ПНЯ бажання призначають трансдермальну терапію тестостероном у дозах, що наближаються до фізіологічних пременопаузальних концентрацій тестостерону.

ПНЯ може бути пов'язана зі зниженням м'язової маси, сили та працездатності, що може збільшити ризик саркопенії. Тому жінкам із ПНЯ рекомендовано здорове харчування, фізична активність, відмова від куріння для сприяння здоров'ю м'язів і покращення якості життя.

Висновки. Проведений огляд літератури показав, що в умовах сьогодення спостерігається стійка тенденція до зростання частоти передчасної недостатності яєчників. Провідними факторами ризику втрати гормональної активності яєчників у жінок до 40 років є ятрогенні причини (хірургічне видалення яєчників, хіміо-, променева терапія), аутосомні захворювання, генетичні чинники та тютюнопаління. Сучасні підходи до лікування ПНЯ зосереджені на нівелюванні гіпоестрогенії шляхом призначення замісної гормональної терапії та використання клітинної терапії (різних типів стовбурових клітин і збагаченої тромбоцитами плазми). Особливої уваги заслуговують питання збереження фертильності у онкохворих пацієнток, лікування безпліддя шляхом використання допоміжних репродуктивних технологій із донацією яйцеклітин, застосування тестостерону при сексуальній дисфункції та покращення якості життя.

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HORMONAL CHARACTERISTICS OF OSTEOPOROSIS DURING ANDROPAUSE

Abstract.
Age-related declines in testosterone levels in men are an important factor in the development of osteoporosis and an increased risk of low-energy fractures. Andropause, or age-related hypogonadism, is accompanied by impaired bone remodeling, a decrease in bone mineral density, and deterioration of bone microarchitecture. A key role in the pathogenesis is played not only by testosterone deficiency but also by a reduction in estradiol production resulting from the aromatization of androgens. This article reviews current understanding of the hormonal mechanisms underlying the development of osteoporosis during andropause, the role of androgens and estrogens in maintaining bone homeostasis, as well as prospects for the diagnosis and treatment of male osteoporosis.

Key words: *andropause, osteoporosis, testosterone, hypogonadism, estradiol, bone mineral density, men, fractures.*

Introduction. Osteoporosis is one of the most common metabolic diseases of the skeleton, characterized by a decrease in bone mineral density (BMD), impaired bone microarchitecture, and an increased risk of fractures. Although osteoporosis is traditionally associated with postmenopausal women, this condition also poses a significant problem for the male population. According to current estimates, approximately one in five men over the age of 50 will experience an osteoporotic fracture during their lifetime [1]. Moreover, mortality following a femoral neck fracture is higher in men than in women, underscoring the medical and social significance of this condition [2].

One of the leading causes of secondary osteoporosis in men is age-related hypogonadism, or andropause. Unlike menopause, which is characterized by a sudden cessation of ovarian function, andropause develops gradually and is accompanied by a slow but steady decline in blood testosterone levels [3]. It has been established that after the age of 30–40, total testosterone levels decrease by approximately 1% annually, while the concentration of bioavailable testosterone declines even more rapidly due to an increase in sex hormone-binding globulin (SHBG) levels [4].

For a long time, it was believed that testosterone was the primary hormone responsible for maintaining bone mass in men. However, recent studies have demonstrated the important role of estradiol, which is formed through the aromatization of testosterone in peripheral tissues. It is estradiol deficiency that is now considered one of the key factors in accelerated bone loss and an increased risk of fractures in older men [5].

Hormonal changes during andropause are accompanied by disruptions in bone remodeling processes. A decrease in androgen levels leads to reduced osteoblast activity, increased osteoclast differentiation, and a predominance of resorption over bone formation. Age-related changes in the secretion of insulin-like growth factor-1 (IGF-1), vitamin D, and other regulators of bone metabolism also play a role [6].

Given the high prevalence of age-related hypogonadism and its impact on the development of osteoporosis, it is important to study the hormonal mechanisms of bone mass loss in men, improve approaches to early diagnosis, and identify effective methods for preventing osteoporotic fractures.

Results. Testosterone helps maintain the normal structure and functional state of bone tissue throughout a man's life. Its effects are mediated through androgen receptors located on the surface of osteoblasts, osteocytes, and bone marrow cells. Activation of these receptors stimulates osteoblast proliferation, type I collagen synthesis, and the formation of the intercellular bone matrix [4].

In addition to its direct effects, testosterone promotes increases in muscle mass and strength, which places additional mechanical stress on the skeleton and stimulates bone formation processes. When testosterone levels decrease due to age-related hypogonadism, a gradual reduction in bone mineral density is observed, particularly in the trabecular structures of the vertebral bodies [3].

The results of numerous clinical studies have shown that men with hypogonadism have significantly

lower BMD values compared to individuals with normal hormonal status. The most pronounced changes are observed in the lumbar spine and the proximal femur, which are the primary sites of osteoporotic fractures [1].

One of the most important discoveries in recent years has been the identification of estradiol's key role in maintaining bone mass in men. Approximately 80% of circulating estradiol is produced through the aromatization of testosterone in adipose tissue, the liver, and bones [5].

Estradiol regulates osteoclast activity through the RANK/RANKL/OPG system. Under normal conditions, it inhibits the expression of the receptor activator of nuclear factor kappa-B ligand (RANKL) and stimulates the synthesis of osteoprotegerin, which blocks osteoclast formation. When estradiol levels decrease, this mechanism is disrupted, leading to the activation of bone resorption [5].

Recent studies show that low estradiol levels are often a better predictor of osteoporotic fractures in men than testosterone levels. This explains cases of osteoporosis even in patients with relatively normal androgen levels [5].

Bone remodeling is a continuous process that ensures the renewal of the skeleton and maintains its mechanical strength. Under physiological conditions, there is a dynamic equilibrium between resorption and bone formation.

During andropause, due to androgen deficiency, there is an increase in the production of pro-inflammatory cytokines, particularly interleukin-1, interleukin-6, and tumor necrosis factor-α. These mediators stimulate osteoclast differentiation and enhance bone resorption [6].

At the same time, there is a decrease in the synthesis of IGF-1, which plays an important role in osteoblast proliferation. Reduced osteoblast activity leads to insufficient formation of new bone tissue and the development of a negative bone balance [6].

Osteoporosis associated with andropause can remain asymptomatic for a long time. The first clinical manifestations are often vertebral compression fractures, fractures of the femoral neck, or fractures of the distal radius following minimal trauma [7].

The diagnostic algorithm includes measuring levels of total and free testosterone, SHBG, estradiol, luteinizing hormone, and follicle-stimulating hormone. Dual-energy X-ray absorptiometry (DXA) is used to assess bone health and remains the "gold standard" for diagnosing osteoporosis [7].

In men with laboratory-confirmed hypogonadism, testosterone replacement therapy can improve bone mineral density. This positive effect is associated with the stimulation of osteoblastic activity and an increase in estradiol concentration resulting from the aromatization of testosterone [8].

However, current guidelines emphasize that testosterone should be prescribed only in the presence of clinical symptoms of hypogonadism and a laboratory-confirmed androgen deficiency. To prevent fractures, this therapy is often combined with bisphosphonates, denosumab, and calcium and vitamin D supplements [8].

In recent years, approaches to the treatment of osteoporosis in men with age-related hypogonadism have evolved significantly. Whereas previously the primary focus was exclusively on correcting testosterone deficiency, the current approach involves a comprehensive strategy targeting all aspects of impaired bone remodeling [7].

One of the most promising areas is a personalized treatment approach that takes into account not only testosterone levels but also estradiol concentrations, markers of bone remodeling, bone mineral density, and individual fracture risk. Accumulated data indicate that assessing testosterone in isolation does not always allow for a complete prediction of bone mass loss, whereas measuring estradiol levels may be a more informative marker of the risk of osteoporotic fractures in elderly men [5].

An important area of research remains the study of the effectiveness of testosterone replacement therapy in preventing fractures. Although numerous studies confirm its positive effect on bone mineral density, current data indicate that an increase in bone mineral density is not always accompanied by a proportional reduction in fracture rates. For this reason, testosterone replacement therapy is considered a component of comprehensive treatment rather than the sole method for preventing osteoporotic complications [3,8].

According to the 2024 international guidelines, in men at high risk for fractures, preference should be given to medications with proven anti-fracture efficacy. These include bisphosphonates (alendronate, risedronate, zoledronic acid), the monoclonal antibody denosumab, and the anabolic agents teriparatide and abaloparatide [7]. A systematic review and meta-analysis demonstrated a statistically significant reduction in the risk of new fractures in men receiving specific anti-osteoporotic therapy [9].

Of particular interest is the use of osteoanabolic drugs, which stimulate the formation of new bone tissue. Unlike antiresorptive agents, they not only slow bone loss but also help restore impaired bone microarchitecture. That is why patients with severe osteoporosis and multiple fractures are increasingly being considered candidates for first-line anabolic therapy [7,9].

A promising area of basic research is the study of the molecular mechanisms underlying the interaction of androgen and estrogen receptors in bone tissue. It has been established that a deficiency of both testosterone and estradiol leads to the activation of the RANK/RANKL signaling pathway and enhanced osteoclastogenesis. Further investigation of these mechanisms could lay the groundwork for the development of new targeted drugs aimed at treating hormone-induced osteoporosis [10].

Studies on the role of sarcopenia in the development of fractures during andropause deserve special attention. The modern concept of osteosarcopenia views bone and muscle tissue as a single functional system. Age-related declines in testosterone simultaneously contribute to the loss of muscle mass and bone tissue,

which significantly increases the risk of falls and fractures. In this regard, treatment programs that combine hormone replacement therapy, strength training, adequate protein intake, and anti-osteoporotic pharmacotherapy are considered promising [11].

Conclusions. Thus, current research indicates the need for a comprehensive approach to the management of men with osteoporosis associated with andropause. Further study of the role of sex hormones, the mechanisms of bone remodeling, and new therapeutic targets opens up prospects for more effective fracture prevention and improved quality of life for patients.

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ВПЛИВ СЕМАГЛУТИДУ НА ЗНИЖЕННЯ РИЗИКУ ПЕРЕЛОМІВ У ПАЦІЄНТІВ ІЗ ЦУКРОВИМ ДІАБЕТОМ 2 ТИПУ

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THE EFFECT OF SEMAGLUTIDE ON REDUCING THE RISK OF FRACTURES IN PATIENTS WITH TYPE 2 DIABETES

Анотація.

Цукровий діабет 2 типу (ЦД2) асоціюється з підвищеним ризиком переломів та порушенням якості кісткової тканини навіть за нормальних або підвищених показників мінеральної щільності кісткової тканини (МЩК). У статті узагальнено сучасні дані щодо впливу агоніста рецепторів глюкагоноподібного пептиду-1 (арГПП-1) семаглутиду на кістковий метаболізм та ризик переломів. Наведено результати клінічних досліджень і метааналізів, які свідчать про можливий сприятливий вплив семаглутиду на стан кісткової тканини та зниження ризику переломів у пацієнтів із ЦД2. Розглянуто потенційні механізми дії препарату, зокрема вплив на процеси ремоделювання кістки, системне запалення, глікемічний контроль та метаболічні фактори, що визначають якість кісткової тканини. Отримані дані свідчать про доцільність подальшого вивчення ролі семаглутиду в профілактиці діабетичної остеопатії та оптимізації терапії пацієнтів із високим ризиком остеопоротичних переломів.

Abstract.

Type 2 diabetes mellitus is associated with an increased risk of fractures and impaired bone quality even when bone mineral density (BMD) levels are normal or elevated. This article summarizes current data on the effects of the glucagon-like peptide-1 (GLP-1) receptor agonist semaglutide on bone metabolism and fracture risk. The results of clinical trials and meta-analyses are presented, indicating a possible beneficial effect of semaglutide on bone health and a reduction in fracture risk in patients with type 2 diabetes. The potential mechanisms of action of the drug are discussed, including its effects on bone remodeling processes, systemic inflammation, glycemic control, and metabolic factors that determine bone quality. The data obtained indicate the need for further study of the role of semaglutide in the prevention of diabetic osteopathy and the optimization of therapy for patients at high risk of osteoporotic fractures.

Ключові слова: *цукровий діабет 2 типу, семаглутид, агоністи рецепторів глюкагоноподібного пептиду-1, остеопороз, переломи, кістковий метаболізм, діабетична остеопатія.*

Key words: *type 2 diabetes mellitus, semaglutide, glucagon-like peptide-1 receptor agonists, osteoporosis, fractures, bone metabolism, diabetic osteopathy.*

Вступ. Цукровий діабет 2 типу є одним із найпоширеніших хронічних метаболічних захворювань, поширеність якого невпинно зростає в усьому світі. Окрім добре відомих мікро- та макросудинних ускладнень, дедалі більше уваги приділяється впливу ЦД2 на стан кісткової тканини та ризик розвитку переломів. Сучасні дослідження свідчать, що пацієнти з ЦД2 мають підвищений ризик низькоенергетичних переломів, незважаючи на те, що показники мінеральної щільності кісткової тканини часто залишаються в межах норми або перевищують її [1].

Такий феномен пояснюється погіршенням якості кісткової тканини, що включає порушення мікроархітектоніки, зміну властивостей колагенового матриксу та зниження механічної міцності кістки. Важливу роль у цих процесах відіграють хронічна гіперглікемія, накопичення кінцевих продуктів глікування (advanced glycation end products, AGEs), оксидативний стрес і системне низькоінтенсивне запалення [2]. Сукупність зазначених змін формує так звану діабетичну остеопатію, яка розглядається як окремий компонент ураження опорно-рухового апарату при ЦД2.

Питання впливу цукрознижувальної терапії на кістковий метаболізм залишається актуальним, оскільки окремі групи препаратів можуть змінювати процеси ремоделювання кісткової тканини. Зокрема, застосування тіазолідиндіонів асоціюється зі збільшенням ризику переломів, що обмежує їх використання в пацієнтів із супутнім остеопорозом або високою ймовірністю падінь. У зв'язку з цим особливий інтерес викликають препарати, здатні забезпечувати ефективний глікемічний контроль без негативного впливу на кісткову тканину.

Семаглутид — представник класу агоністів рецепторів глюкагоноподібного пептиду-1, ефективність якого доведена щодо контролю глікемії, зниження маси тіла та зменшення серцево-судинного ризику. Останні експериментальні та клінічні дослідження свідчать про можливий вплив семаглутиду на процеси ремоделювання кісткової тканини та ризик переломів. Це обумовлює необхідність узагальнення наявних даних щодо потенційної ролі препарату у профілактиці діабетичної остеопатії та збереженні структурно-функціонального стану скелета в пацієнтів із ЦД2.

Основна частина. Кісткова тканина перебуває у стані постійного ремоделювання, яке забезпечується балансом між активністю остеобластів, відповідальних за формування нової кістки, та остеокластів, які здійснюють її резорбцію. При цукровому діабеті 2 типу цей баланс порушується внаслідок хронічної гіперглікемії, накопичення кінцевих продуктів глікування (AGEs), оксидативного стресу та системного запалення [1,2].

Одним із найважливіших регуляторів формування кісткової тканини є сигнальний шлях Wnt/β-catenin. У нормальних умовах активація цього шляху стимулює диференціювання мезенхімальних стовбурових клітин у зрілі остеобласти та посилює синтез компонентів кісткового матриксу, насамперед колагену I типу. За умов ЦД2 активність Wnt/β-catenin пригнічується під впливом гіперглікемії та запальних цитокінів, що призводить до зниження остеобластогенезу і сповільнення утворення нової кісткової тканини [3].

Експериментальні дослідження показали, що агоністи рецепторів ГПП-1 здатні посилювати активність сигнального шляху Wnt/β-catenin, сприяючи підвищенню експресії остеогенних факторів RUNX2, остеокальцину та лужної фосфатази. У результаті покращуються процеси формування кісткової тканини та підтримується її структурна цілісність [4].

Не менш важливим є вплив семаглутиду на систему RANK/RANKL/OPG, яка контролює процеси кісткової резорбції. У фізіологічних умовах остеобласти продукують ліганд рецептора активатора ядерного фактора каппа-B (RANKL), який зв'язується з рецепторами RANK на поверхні попередників остеокластів і стимулює їх дозрівання. Одночасно синтезується остеопротегерин (OPG), що виконує роль природного інгібітора RANKL. Співвідношення між RANKL та OPG визначає інтенсивність резорбції кісткової тканини [5].

Для пацієнтів із ЦД2 характерним є зміщення рівноваги в бік підвищення експресії RANKL та зниження продукції OPG, що сприяє активації остеокластів. Дані експериментальних моделей свідчать, що терапія агоністами рецепторів ГПП-1 може збільшувати співвідношення OPG/RANKL, тим самим пригнічуючи надмірну резорбцію кісткової тканини та сприяючи збереженню кісткової маси [4,5].

Інкретинові гормони, зокрема глюкагоноподібний пептид-1 (ГПП-1), беруть участь не лише у регуляції вуглеводного обміну, але й впливають на функціонування кісткової тканини. Результати експериментальних досліджень свідчать про наявність рецепторів ГПП-1 у клітинах кісткової тканини та їх участь у регуляції процесів ремоделювання [5].

Активація сигнального каскаду ГПП-1 може стимулювати проліферацію та диференціацію остеобластів, посилювати синтез колагену I типу та підвищувати експресію генів, відповідальних за формування кісткового матриксу. Одночасно відзначається пригнічення активності остеокластів через модифікацію системи RANKL/OPG, що сприяє зменшенню резорбції кісткової тканини [5,6].

Крім прямого впливу на клітини скелета, агоністи рецепторів ГПП-1 чинять непрямі остеопротективні ефекти шляхом покращення глікемічного контролю, зменшення системного запалення, зниження оксидативного стресу та покращення метаболічного профілю пацієнтів [6].

Семаглутид є одним із найбільш вивчених представників класу агоністів рецепторів ГПП-1. Його ефективність щодо контролю глікемії, зниження маси тіла та серцево-судинної профілактики була продемонстрована у серії досліджень SUSTAIN та SELECT [7,8].

В останні роки зростає інтерес до вивчення впливу препарату на стан кісткової тканини. У доклінічних дослідженнях було показано, що семаглутид може сприяти активації остеобластогенезу через стимуляцію сигнального шляху Wnt/β-catenin та підвищення експресії факторів, залучених до формування нової кістки [5].

Також встановлено, що покращення контролю глікемії на тлі терапії семаглутидом супроводжується зменшенням утворення AGEs та зниженням рівня прозапальних медіаторів, які негативно впливають на ремоделювання кісткової тканини [1,5].

Окрім впливу на клітини кісткової тканини, важливе значення має здатність семаглутиду усувати метаболічні фактори, які лежать в основі розвитку діабетичної остеопатії.

Тривала гіперглікемія призводить до накопичення AGEs у колагеновому матриксі кістки. Утворення додаткових поперечних зв'язків між волокнами колагену зменшує еластичність кістки та підвищує її ламкість навіть за нормальної МЩК. Саме тому у пацієнтів із ЦД2 ризик переломів може бути підвищеним за відсутності денситометричних ознак остеопорозу [1].

Семаглутид забезпечує стійке зниження рівня глікованого гемоглобіну та покращує показники добового глікемічного профілю. Це супроводжується зменшенням утворення AGEs та послабленням їх негативного впливу на колагеновий каркас кістки. Одночасно спостерігається зниження концентрацій прозапальних цитокінів, зокрема інтерлейкіну-6 та фактора некрозу пухлини α, які беруть участь в активації остеокластів та прогресуванні кісткової резорбції [6].

Додатковим механізмом може бути покращення мікроциркуляції та функції ендотелію. Відомо, що мікроангіопатія при ЦД2 погіршує кровопостачання кісткової тканини, що негативно впливає на процеси ремоделювання та репарації. Покращення метаболічного контролю на тлі терапії семаглутидом потенційно сприяє нормалізації цих процесів [7].

Вплив семаглутиду на кісткову тканину в умовах зниження маси тіла є предметом активного вивчення. Традиційно втрата маси тіла розглядається як фактор ризику зниження мінеральної щільності кісткової тканини та розвитку остеопорозу через зменшення механічного навантаження на скелет і посилення процесів кісткової резорбції.

Водночас результати сучасних клінічних досліджень свідчать, що зниження маси тіла на тлі терапії семаглутидом не супроводжується пропорційним збільшенням частоти переломів. Дані окремих метааналізів вказують на можливе зниження ризику переломів у пацієнтів, які отримують агоністи рецепторів ГПП-1 [8,9].

Одним із можливих пояснень є вплив препарату на процеси ремоделювання кісткової тканини, що може частково компенсувати наслідки зменшення механічного навантаження. Крім того, зниження маси тіла асоціюється з покращенням рухливості пацієнтів, зменшенням навантаження на суглоби нижніх кінцівок та потенційним зниженням ризику падінь [10].

Дані клінічних досліджень серій SUSTAIN та SELECT показали, що незважаючи на суттєве зниження маси тіла (у середньому на 10–15 % від вихідної), у пацієнтів не спостерігалося клінічно значущого зменшення мінеральної щільності кісткової тканини в ділянці шийки стегнової кістки та поперекового відділу хребта [8].

Отримані результати узгоджуються з даними щодо біохімічних маркерів кісткового метаболізму. При зниженні маси тіла внаслідок обмеження калорійності харчування або після баріатричних втручань зазвичай відзначається підвищення рівня С-кінцевого телопептиду колагену I типу (CTX), що свідчить про активацію кісткової резорбції. У пацієнтів, які отримували семаглутид, рівень CTX залишався відносно стабільним, а в окремих дослідженнях реєструвалося помірне підвищення маркерів кісткоутворення, зокрема N-кінцевого пропептиду проколагену I типу (P1NP) та остеокальцину [9].

Крім того, результати клінічних спостережень свідчать, що терапія семаглутидом асоціюється переважно зі зменшенням вісцеральної та ектопічної жирової тканини при відносному збереженні безжирової маси тіла (lean mass) [10]. Збереження м'язової маси має важливе значення для підтримання функціональної взаємодії між м'язовою та кістковою тканинами, що забезпечує необхідне механічне навантаження на кістку та регуляцію процесів ремоделювання. До механізмів такої взаємодії належить дія міокінів і факторів росту, зокрема інсуліноподібного фактора росту-1 (IGF-1) та інтерлейкіну-15 (IL-15), які беруть участь у підтриманні структури кісткового матриксу [11].

Таким чином, наявні клінічні дані свідчать, що зниження маси тіла на тлі терапії семаглутидом не супроводжується вираженим негативним впливом на стан кісткової тканини. Це може бути пов'язано з поєднанням змін у процесах кісткового ремоделювання, збереженням м'язової маси та покращенням функціонального стану пацієнтів. Проте для остаточного визначення довгострокового впливу семаглутиду на кістковий метаболізм необхідні подальші дослідження.

Висновки. Цукровий діабет 2 типу асоціюється з порушенням якості кісткової тканини та підвищеним ризиком переломів, що не завжди відображається показниками мінеральної щільності кісткової тканини.

Наявні експериментальні та клінічні дані свідчать про потенційно сприятливий вплив семаглутиду на кістковий метаболізм. Імовірними механізмами такого впливу є модифікація процесів ремоделювання кісткової тканини, покращення глікемічного контролю, зменшення системного запалення та зниження накопичення кінцевих продуктів глікування.

Результати сучасних метааналізів і досліджень реальної клінічної практики свідчать про від-

сутність негативного впливу семаглутиду на кісткову тканину та можливе зниження ризику переломів у пацієнтів із ЦД2. Однак для остаточного підтвердження остеопротективних властивостей препарату необхідні великі проспективні дослідження з оцінкою впливу тривалості терапії, дозозалежних ефектів, змін мікроархітектури кісткової тканини за даними денситометрії, а також реальної частоти остеопоротичних переломів у різних когортах пацієнтів.

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ФУНКЦІОНАЛЬНА ГІПОТАЛАМІЧНА АМЕНОРЕЯ ЯК ПРОЯВ НЕЙРОЕНДОКРИННОЇ АДАПТАЦІЇ ДО СТРЕСУ ТА ЕНЕРГЕТИЧНОГО ДЕФІЦИТУ

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FUNCTIONAL HYPOTHALAMIC AMENORRHEA AS A MANIFESTATION OF NEUROENDOCRINE ADAPTATION TO STRESS AND ENERGY DEFICIT

Анотація.
У роботі розглянуто сучасні уявлення про функціональну гіпоталамічну аменорею як нейроендокринний синдром, що виникає внаслідок хронічного психоемоційного стресу, надмірних фізичних навантажень або тривалого енергетичного дефіциту. Узагальнено сучасні дані щодо ролі гіпоталамо-гіпофізарно-яєчникової осі, KNDy-нейронів, лептину, інсуліну та кортизолу в патогенезі захворювання. Висвітлено особливості гормональної діагностики та диференційної діагностики із синдромом полікістозних яєчників. Окрему увагу приділено системним наслідкам тривалої гіпоестрогенії, зокрема порушенню мінеральної щільності кісткової тканини та ризику розвитку остеопенії й остеопорозу. Наведено сучасні підходи до лікування, спрямовані на відновлення енергетичного балансу, нормалізацію нейроендокринної регуляції та профілактику віддалених ускладнень.

Abstract.
This paper examines current understanding of functional hypothalamic amenorrhea as a neuroendocrine syndrome resulting from chronic psychoemotional stress, excessive physical exertion, or prolonged energy deficit. The paper summarizes current data on the role of the hypothalamic-pituitary-ovarian axis, KNDy neurons, leptin, insulin, and cortisol in the pathogenesis of the disease. It highlights the characteristics of hormonal diagnosis and differential diagnosis with polycystic ovary syndrome. Special attention is given to the systemic consequences of prolonged hypoestrogenism, particularly impaired bone mineral density and the risk of developing osteopenia and osteoporosis. Current treatment approaches aimed at restoring energy balance, normalizing neuroendocrine regulation, and preventing long-term complications are presented.

Ключові слова: *функціональна гіпоталамічна аменорея, нейроендокринна дисфункція, гіпоестрогенія, KNDy-нейрони, лептин, кортизол, гіпогонадотропний гіпогонадизм, остеопороз.*

Key words*: functional hypothalamic amenorrhea, neuroendocrine dysfunction, hypoestrogenism, KNDy neurons, leptin, cortisol, hypogonadotropic hypogonadism.*

Вступ. Функціональна гіпоталамічна аменорея (ФГА) є однією з найпоширеніших причин вторинної аменореї у жінок репродуктивного віку та становить до 35% її випадків. На відміну від органічних уражень гіпоталамо-гіпофізарної системи, ФГА розвивається як адаптивна відповідь організму на хронічний психоемоційний стрес, надмірні фізичні навантаження або тривалий енергетичний дефіцит. У сучасних умовах поширення інтенсивних спортивних тренувань, харчових обмежень та високого рівня стресового навантаження частота цього стану має тенденцію до зростання [1].

В основі розвитку ФГА лежить порушення нейроендокринної регуляції гіпоталамо-гіпофізарно-яєчникової осі. Зниження пульсативної секреції гонадотропін-рилізинг-гормону призводить до розвитку гіпогонадотропного гіпогонадизму та гіпоестрогенії. Важливу роль у цих процесах відіграють сигнали енергетичного обміну, зокрема лептин та інсулін, а також активація гіпоталамо-гіпофізарно-наднирникової осі з підвищенням рівня кортизолу. Останніми роками особливу увагу дослідників привертає роль KNDy-нейронів як центральної ланки інтеграції метаболічних, гормональних та репродуктивних сигналів [2].

Клінічне значення ФГА не обмежується лише порушенням менструальної та репродуктивної функції. Тривала гіпоестрогенія асоціюється зі зниженням мінеральної щільності кісткової тканини, підвищеним ризиком остеопенії та остеопорозу, а також низкою метаболічних порушень. Водночас діагностика захворювання нерідко ускладнюється подібністю окремих клініко-лабораторних проявів до синдрому полікістозних яєчників, що може призводити до помилок у веденні пацієнток.

У зв'язку з цим актуальним є узагальнення сучасних даних щодо нейроендокринних механізмів розвитку функціональної гіпоталамічної аменореї, її діагностичних критеріїв, системних наслідків та сучасних підходів до лікування.

Основний текст. Функціональна гіпоталамічна аменорея (ФГА) є класичним прикладом адаптивного нейроендокринного синдрому, що виникає у відповідь на хронічний психоемоційний стрес, надмірні фізичні навантаження або тривалий енергетичний дефіцит. Центральною ланкою патогенезу є пригнічення пульсативної секреції гонадотропін-рилізинг-гормону (ГнРГ) у гіпоталамусі, що призводить до розвитку гіпогонадотропного гіпогонадизму [3].

Ключову роль у регуляції репродуктивної функції відіграють KNDy-нейрони, які інтегрують сигнали про енергетичний стан організму через лептин, інсулін та інші метаболічні фактори. При дефіциті енергії або тривалому стресі знижується концентрація лептину та інсуліну, тоді як активність гіпоталамо-гіпофізарно-наднирникової осі зростає із розвитком гіперкортизолемії. Сукупність цих змін пригнічує активність KNDy-нейронів та секрецію ГнРГ, що супроводжується зниженням рівнів лютеїнізуючого гормону (ЛГ), фолікулостимулюючого гормону (ФСГ) та естрадіолу [4].

Гормональний профіль пацієнток із ФГА характеризується низькими або низько-нормальними концентраціями ЛГ і ФСГ, вираженою гіпоестрогенією, зниженими рівнями лептину, інсуліну та трийодтироніну. Важливою особливістю є відсутність біохімічного гіперандрогенізму, що дозволяє проводити диференційну діагностику із синдромом полікістозних яєчників (СПКЯ). На відміну від СПКЯ, для ФГА характерні нормальна або підвищена чутливість до інсуліну, відсутність інсулінорезистентності та знижений індекс HOMA [5].

Особливе клінічне значення має тривала гіпоестрогенія. Естрогени є ключовими регуляторами ремоделювання кісткової тканини, тому їх дефіцит супроводжується активацією кісткової резорбції та поступовим зниженням мінеральної щільності кісток. У молодому віці це становить особливу небезпеку через ризик недосягнення пікової кісткової маси та формування ранньої остеопенії чи остеопорозу [6].

Сучасні підходи до лікування ФГА базуються насамперед на усуненні причин нейроендокринної дисрегуляції. Провідне значення має відновлення енергетичного балансу шляхом корекції харчування, оптимізації фізичних навантажень та зниження рівня стресу. Доведено, що нормалізація енергетичної доступності сприяє відновленню пульсативної секреції ГнРГ та фізіологічної функції гіпоталамо-гіпофізарно-яєчникової осі. За наявності тривалої гіпоестрогенії та зниження мінеральної щільності кісткової тканини може розглядатися призначення фізіологічної замісної гормональної терапії трансдермальним естрадіолом у поєднанні з мікронізованим прогестероном [1,7].

Таким чином, ФГА слід розглядати не лише як порушення менструальної функції, а як системний нейроендокринний синдром, що відображає адаптацію організму до несприятливих метаболічних та стресових впливів. Своєчасна діагностика та корекція ендокринних порушень є необхідною умовою профілактики довгострокових репродуктивних і метаболічних ускладнень.

Висновки. Було розглянуто сучасні уявлення про функціональну гіпоталамічну аменорею як мультифакторний нейроендокринний синдром, що виникає внаслідок хронічного стресу, надмірних фізичних навантажень та енергетичного дефіциту. Узагальнено дані щодо ролі гіпоталамо-гіпофізарно-яєчникової осі, KNDy-нейронів, лептину, інсуліну та кортизолу в механізмах розвитку захворювання.

Було встановлено, що провідною патогенетичною ланкою ФГА є пригнічення пульсативної секреції гонадотропін-рилізинг-гормону з подальшим розвитком гіпогонадотропного гіпогонадизму та стійкої гіпоестрогенії. Показано, що тривалий дефіцит естрогенів асоціюється не лише з порушенням репродуктивної функції, а й зі зниженням мінеральної щільності кісткової тканини та підвищеним ризиком розвитку остеопенії й остеопорозу.

Отримані дані свідчать про необхідність ранньої діагностики ФГА, своєчасної диферен-

ційної діагностики із синдромом полікістозних яєчників та комплексного підходу до лікування, спрямованого насамперед на відновлення енергетичного балансу, нормалізацію нейроендокринної регуляції та профілактику довгострокових метаболічних і репродуктивних ускладнень.

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ОСОБЛИВОСТІ ВТОРИННОГО ОСТЕОПОРОЗУ У ОСІБ З ПЕРВИННИМ ГІПЕРПАРАТИРЕОЗОМ

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CHARACTERISTICS OF SECONDARY OSTEOPOROSIS IN PATIENTS WITH PRIMARY HYPERPARATHYROIDISM

Анотація.

Остеопороз є одним із найпоширеніших метаболічних захворювань скелета та важливою медико-соціальною проблемою, що асоціюється з підвищеним ризиком переломів і погіршенням якості життя. У молодому віці зниження мінеральної щільності кісткової тканини потребує ретельного пошуку вторинних причин, серед яких важливе місце посідає первинний гіперпаратиреоз. Особливу клінічну складність становлять безсимптомні та нормокальціємічні форми цього захворювання, які тривалий час залишаються недіагностованими, незважаючи на прогресуюче ураження кісткової тканини. Метою статті став аналіз сучасних літературних даних щодо ролі первинного гіперпаратиреозу у розвитку вторинного остеопорозу в молодому віці, а також висвітлення патогенетичних механізмів, сучасних підходів до діагностики та лікування. Проаналізовано вплив хронічно підвищеного рівня паратиреоїдного гормону, що призводить до посилення остеокластичної резорбції, втрати кортикальної кісткової маси та порушення мікроархітектури скелета. Показано, що нормокальціємічний первинний гіперпаратиреоз є недооціненою причиною раннього остеопорозу. Своєчасна лабораторна діагностика та хірургічне лікування сприяють стабілізації кісткового ремоделювання, підвищенню мінеральної щільності кісткової тканини та зниженню ризику остеопоротичних ускладнень.

Abstract.

Osteoporosis is one of the most common metabolic diseases of the skeleton and a significant medical and social problem associated with an increased risk of fractures and a reduced quality of life. In young people, a decrease in bone mineral density requires a thorough investigation of secondary causes, among which primary hyperparathyroidism plays a significant role. Asymptomatic and normocalcemic forms of this disease pose particular clinical challenges, as they often remain undiagnosed for long periods despite progressive bone damage. The aim of this article is to analyze current literature data on the role of primary hyperparathyroidism in the development of secondary osteoporosis at a young age, as well as to highlight the pathogenetic mechanisms and current approaches to diagnosis and treatment. The impact of chronically elevated parathyroid hormone levels, which leads to increased osteoclastic resorption, loss of cortical bone mass, and disruption of skeletal microarchitecture, is analyzed. It is demonstrated that normocalcemic primary hyperparathyroidism is an underestimated

cause of early-onset osteoporosis. Timely laboratory diagnosis and surgical treatment help stabilize bone remodeling, increase bone mineral density, and reduce the risk of osteoporotic complications.

***Ключові слова**: первинний гіперпаратиреоз, вторинний остеопороз, паратиреоїдний гормон, мінеральна щільність кісткової тканини, нормокальціємічний первинний гіперпаратиреоз, молодий вік.*

***Key words:** primary hyperparathyroidism, secondary osteoporosis, parathyroid hormone, bone mineral density, normocalcemic primary hyperparathyroidism, young adult.*

Вступ. Остеопороз є одним із найпоширеніших метаболічних захворювань скелета та важливою медико-соціальною проблемою сучасності. За визначенням Всесвітньої організації охорони здоров'я, остеопороз характеризується зниженням мінеральної щільності кісткової тканини та порушенням її мікроархітектоніки, що призводить до підвищення крихкості кісток і ризику переломів [1]. Незважаючи на те, що переважна більшість випадків остеопорозу асоціюється з віковими змінами та дефіцитом статевих гормонів, у молодому віці виявлення низької мінеральної щільності кісткової тканини потребує пошуку вторинних причин.

Серед ендокринних захворювань особливе місце займає первинний гіперпаратиреоз (ПГПТ) — патологія, що виникає внаслідок автономної гіперсекреції паратиреоїдного гормону прищитоподібними залозами. Поширеність ПГПТ у загальній популяції становить близько 0,1–1%, проте завдяки широкому впровадженню біохімічного скринінгу кількість діагностованих випадків постійно зростає. Сучасні дослідження демонструють, що клінічна картина ПГПТ суттєво змінилася за останні десятиліття. Якщо раніше захворювання проявлялося тяжкими кістковими ураженнями та нефролітіазом, то сьогодні дедалі частіше виявляються безсимптомні та нормокальціємічні форми [2].

Особливу клінічну значущість має вплив надлишкового паратиреоїдного гормону на ремоделювання кісткової тканини. Тривала стимуляція резорбції кістки призводить до втрати кісткової маси, погіршення мікроархітектури скелета та зростання ризику низькоенергетичних переломів. При цьому у молодих пацієнтів остеопороз нерідко стає першим або єдиним проявом захворювання, що суттєво ускладнює своєчасну діагностику [3].

Останніми роками особливу увагу привертає феномен нормокальціємічного первинного гіперпаратиреозу, при якому рівень кальцію крові залишається в межах референтних значень, тоді як підвищений рівень паратиреоїдного гормону вже спричиняє структурні зміни кісткової тканини. Саме ця форма захворювання може бути однією з найбільш недооцінених причин вторинного остеопорозу серед молодих осіб [4].

Метою даної статті є аналіз сучасних літературних даних щодо ролі первинного гіперпаратиреозу в розвитку вторинного остеопорозу у молодому віці, висвітлення патогенетичних механізмів ураження кісткової тканини та оцінка сучасних можливостей діагностики й лікування даного захворювання.

Виклад основного тексту. У здоровому організмі паратгормон (ПТГ) є одним із центральних регуляторів кальцій-фосфорного гомеостазу, забезпечуючи підтримання стабільної концентрації іонізованого кальцію в позаклітинній рідині. Його секреція прищитоподібними залозами регулюється переважно кальцій-чутливими рецепторами (CaSR), які швидко реагують на навіть незначні коливання рівня кальцію в крові. При зниженні концентрації кальцію секреція ПТГ зростає, що активує комплекс компенсаторних механізмів: посилення резорбції кісткової тканини, підвищення канальцевої реабсорбції кальцію в нирках, зниження реабсорбції фосфатів, а також стимуляцію 1α-гідроксилази в нирках із подальшим підвищенням синтезу кальцитріолу, який збільшує кишкову абсорбцію кальцію та фосфору [5].

Біологічний вплив ПТГ на кісткову тканину значною мірою залежить від характеру його секреції. Інтермітуючий, тобто пульсуючий, вплив ПТГ активує анаболічні механізми кісткового ремоделювання, стимулюючи диференціювання остеобластів, пригнічуючи їх апоптоз, що сприяє новоутворенню кісткової тканини. Саме цей ефект лежить в основі застосування аналогів ПТГ у лікуванні тяжкого остеопорозу. Натомість хронічно підвищений рівень ПТГ, характерний для первинного гіперпаратиреозу (ПГПТ), зміщує баланс ремоделювання в бік резорбції, формуючи катаболічний тип кісткового обміну, який є провідним механізмом розвитку вторинної втрати кісткової маси та остеопорозу.

На клітинному рівні ПТГ реалізує свій вплив через рецептори паратиреоїдного гормону 1-го типу, локалізовані переважно на остеобластах та остеоцитах. Хронічна стимуляція цих рецепторів призводить до підвищеної експресії ліганду рецептора-активатора ядерного фактора каппа-В (RANKL) та одночасного зниження продукції остеопротегерину (OPG), який у нормі виконує роль природного інгібітора остеокластогенезу. Надлишок RANKL взаємодіє з відповідними рецепторами на поверхні преостеокластів, стимулюючи їх проліферацію, дозрівання та функціональну активацію. Унаслідок цього посилюється остеокластична резорбція, яка починає переважати над процесами остеобластичного кісткоутворення.

При ПГПТ ураження кісткової тканини має характерну селективність. Найбільш виражені структурні зміни спостерігаються в компактній речовині кістці, де надлишок ПТГ спричиняє витончення кортикального шару, збільшення кістково-мозкових просторів та погіршення мікроархітектури. Водночас трабекулярна кісткова тканина, зокрема в ділянці тіл хребців, на ранніх стадіях захворювання може залишатися відносно неушкодженою, хоча

сучасні методи діагностики показують,що структурні порушення в цій кістці можуть виникати раніше, ніж вважалося раніше [6].

Хронічний надлишок ПТГ зумовлює особливості ураження кісткової тканини у молодих пацієнтів. На відміну від осіб похилого віку, у яких остеопороз формується на тлі вікових інволютивних змін і дефіциту статевих стероїдних гормонів, у молодих людей надлишок ПТГ впливає на кісткову тканину в період, коли скелет ще формується або щойно досяг піку кісткової маси [7]. Тривала активація остеокластів виснажує структурний резерв молодої кістки та поступово порушує архітектоніку скелета. Оскільки системне зниження міцності кісток у молодому віці зазвичай не очікується, захворювання може тривалий час перебігати безсимптомно або проявлятися неспецифічними симптомами, такими як міалгії, артралгії чи хронічна втома. У низці випадків першим клінічним проявом стає низькоенергетичний перелом, що виникає при мінімальній травмі або звичайному фізичному навантаженні.

У цьому контексті нормокальціємічний первинний гіперпаратиреоз є однією з прихованих причин остеопорозу в молодому віці. Ця форма захворювання характеризується стабільно нормальними рівнями загального та іонізованого кальцію в крові при стійкому підвищенні концентрації ПТГ за відсутності причин вторинного гіперпаратиреозу [8]. Складність діагностики полягає в тому, що стандартний біохімічний скринінг часто обмежується визначенням лише загального кальцію, що може не викликати підозри щодо ендокринної патології. Унаслідок цього пацієнти можуть тривалий час отримувати лікування з приводу інших станів, тоді як підвищений рівень ПТГ продовжує негативно впливати на кісткову тканину. Саме відсутність гіперкальціємії часто є причиною пізньої діагностики, через що ця форма ПГПТ залишається недооціненою серед причин ранньої втрати кісткової маси [6, 8].

Сучасні підходи до діагностики цієї патології потребують чіткої лабораторно-інструментальної стратегії. Початковий етап включає одночасне визначення рівнів паратгормону, загального кальцію, іонізованого кальцію, фосфору, 25(OH) вітаміну D та креатиніну сироватки крові для виключення вторинного гіперпаратиреозу ниркового або аліментарного генезу [2]. Оскільки рівень загального кальцію залежить від концентрації білків плазми, обов'язковим є розрахунок скоригованого за альбуміном кальцію.

Наступним важливим кроком є оцінка добової екскреції кальцію із сечею, що дозволяє провести диференційну діагностику із сімейною гіпокальціуричною гіперкальціємією, при якій хірургічне лікування є неефективним [7].

Інструментальна оцінка стану скелета базується на проведенні двохенергетичної рентгенівської абсорбціометрії (DXA). Зважаючи на переважний вплив ПТГ на кортикальну кістку, денситометрію рекомендовано виконувати у трьох ділянках: поперековому відділі хребта, проксимальному відділі стегнової кістки та дистальній третині променевої кістки, яка вважається найбільш інформативною для оцінки паратиреоїдної остеопатії. У пацієнтів молодого віку (чоловіки до 50 років і жінки до менопаузи) результати інтерпретують за Z-критерієм; значення ≤ –2,0 SD свідчить про патологічно низьку кісткову масу для відповідної вікової групи [8].

Після біохімічної верифікації процесу для топічної діагностики аденоми застосовують ультразвукове дослідження шиї та сцинтиграфію [9].

Оцінюючи лікування та вплив паратиреоїдектомії на мінеральну щільність кісткової тканини, сучасні клінічні рекомендації підтримують активну хірургічну тактику. Відповідно до консенсусних настанов П'ятого міжнародного семінару з ведення безсимптомного ПГПТ, вік пацієнта молодше 50 років є самостійним абсолютним показанням до хірургічного втручання навіть за відсутності вираженої клінічної симптоматики або інших системних ускладнень [3, 10].

Такий підхід у молодих пацієнтів є обґрунтованим, оскільки тривале збереження автономної гіперсекреції ПТГ асоціюється з прогресуванням остеопорозу та підвищеним ризиком нефролітіазу. Консервативна терапія, включаючи антирезорбтивні препарати (бісфосфонати або деносумаб), може розглядатися лише як тимчасова альтернатива у пацієнтів із протипоказаннями до оперативного лікування.

Радикальне видалення патологічно зміненої прищитоподібної залози усуває основну причину захворювання та сприяє відновленню кісткового ремоделювання [3]. Уже в перші місяці після успішної операції відзначається закриття резорбційних порожнин і поступове зростання мінеральної щільності кісткової тканини. Протягом перших років після втручання приріст мінеральної щільності кісткової тканини є значно вищим порівняно з тактикою динамічного спостереження. Це свідчить, що своєчасна діагностика та паратиреоїдектомія дозволяють зупинити втрату кісткової маси, покращити структурний стан скелета та знизити ризик остеопоротичних ускладнень [10].

Висновки. Первинний гіперпаратиреоз є важливою, проте нерідко недооціненою причиною вторинного остеопорозу у молодому віці. Хронічна гіперсекреція паратиреоїдного гормону спричиняє дисбаланс кісткового ремоделювання зі зміщенням у бік остеокластичної резорбції, що призводить до втрати кісткової маси, насамперед у кортикальних відділах скелета, та погіршення мікроархітектури кістки.

Особливу клінічну значущість має нормокальціємічний первинний гіперпаратиреоз, оскільки відсутність гіперкальціємії часто ускладнює раннє виявлення захворювання. У молодих пацієнтів патологія може тривалий час перебігати безсимптомно або маніфестувати лише неспецифічними скаргами, а інколи першим проявом стають низькоенергетичні переломи.

Діагностика вторинного остеопорозу, асоційованого з первинним гіперпаратиреозом, повинна включати комплексну оцінку рівнів паратгормону, загального та іонізованого кальцію, фосфору, 25(OH) вітаміну D, функціонального стану нирок, а також денситометричне дослідження з акцентом на оцінку кортикальної кісткової тканини.

Своєчасне виявлення первинного гіперпаратиреозу має вирішальне значення для запобігання прогресуванню втрати кісткової маси. Паратиреоїдектомія залишається методом вибору у молодих пацієнтів, оскільки забезпечує усунення етіологічного чинника, нормалізацію кісткового ремоделювання та суттєве зниження ризику остеопоротичних переломів. Підвищення настороженості лікарів щодо безсимптомних і нормокальціємічних форм захворювання є важливою передумовою ранньої діагностики та покращення прогнозу пацієнтів.

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ENDOMETRITIS: CLINICAL PRESENTATION, DIAGNOSIS AND IMPACT ON FERTILITY

Abstract:
The current review highlights topical issues related to the etiology, pathogenesis, clinical manifestations, diagnosis, and treatment of acute and chronic endometritis. Special attention is given to complications, particularly the impact of the disease on female fertility. Modern approaches to medical therapy are presented. The provided data are of practical significance for improving gynecological care.

Key words: *acute endometritis, chronic endometritis, infertility, immunohistochemistry, CD138, antibiotic therapy.*

Introduction: Endometritis is an inflammatory disease of the uterine mucosa, which plays an important role in the structure of gynecological pathology. Depending on the course, there are acute and chronic endometritis, each of which has its own characteristics of clinical course, diagnosis and treatment.

Acute endometritis stands out as the most common postnatal infection, contributing to 27% of all postnatal complications [1]. The etiological factors are mainly sexually transmitted bacterial infections or opportunistic microflora, which is introduced during invasive gynecological interventions and childbirth [1, 9].

Chronic endometritis (XE) is a persistent inflammation of the endometrium, which is often asymptomatic or with nonspecific complaints, but has a significant impact on fertility, especially in patients with repeated implantation failures and habitual miscarriage [7, 8, 10].

Endometritis acquires special clinical and social significance due to its negative impact on a woman's reproductive health. Despite the availability of modern diagnostic methods, the chronic form of the disease often has erased symptoms, which complicates its timely detection [4, 7].

Research objective: To highlight current literature data on the etiology, pathogenesis, clinic, diagnosis, treatment of endometritis, as well as its effect on fertility.

Materials and methods: In order to fully disclose the topic and highlight all aspects of this problem, we used the method of system analysis. For the analysis of all data, the works of modern researchers published in professional publications indexed in scientometric databases were used. Key words: acute endometritis, chronic endometritis, infertility, immunohistochemistry, CD138, antibiotic therapy.

Results of the study and their discussion: Acute postpartum EM occurs as a result of the penetration of bacteria from the cervix and vagina into the uterine cavity. Normally, the uterus does not contain microorganisms until the amniotic sac ruptures, which creates conditions for the upward penetration of bacteria. Microorganisms usually settle in the damaged endometrium after a cesarean section or surgery on the uterus with natural childbirth [1].

Patients with risk factors incidence increase to 5-6%. Risk factors of postpartum EM include being a young female from a lower socioeconomic status, having a high BMI (body mass index), prolonged rupture of membranes, repeated per-vaginal examinations, fetal scalp sampling/monitoring, chorioamnionitis, meconium-stained amniotic fluid, and undiagnosed untreated vaginal infection [5].

The route of delivery is the most important risk factor. Caesarean deliveries have higher risk of EM than normal vaginal delivery [3].

Manual placenta removal (MPR) is associated with associated with a threefold risk of postpartum EM [4].

The incidence of EM increases to 40.0% in parturients after arterial embolization (AE) as a management strategy for uncontrolled postpartum hemorrhage (PPH) [4].

Acute endometritis, according to histopathological signs, is characterized by the presence of microabscesses in the endometrium, as well as the presence of neutrophils in the superficial epithelium and in the lumens of the endometrial glands [1]. Symptoms of acute EM include fever, pelvic pain, increased foul-smelling vaginal discharge, abnormal uterine bleeding, and general malaise [1, 5]. Acute infections can be caused by both aerobic and anaerobic bacteria [2].

To diagnose acute EM, a complete blood count (determination of the level of leukocytes), bacterial culture of a cervical smear and microscopic examination of vaginal discharge are used. Ultrasound helps in diagnosing postpartum patients with abdominal pain and fever. Signs of endometritis on ultrasound are thickened, heterogeneous endometrium, the presence of fluid or gas accumulation in the uterine cavity [1].

Treatment should cover a wide range of microorganisms that are most likely to cause the infection. The earlier therapy is started, the higher the chances of avoiding complications. According to a systematic review, alternative oral and intramuscular treatment regimens for early postpartum EM have been proposed for conditions with limited resources [2]. Parenteral therapy includes cefotetan or cefoxitin in combination with doxycycline. After improvement, oral doxycycline is continued for 24–48 hours until the completion of the 14-day course [5, 6]. In the presence of placental tissue residues, uterine curettage may be required after initiation of antibiotic therapy [1].

Chronic endometritis (CE) is a disease characterized by prolonged, persistent, mild inflammation of the endometrium, accompanied by infiltration of plasma cells into the stromal layer of the endometrium [3, 7]. According to studies, the prevalence of CE in the general population ranges from 2.8% to 46%, but among women with reproductive problems it is much higher: in 2.8% to 56.8% of patients with infertility, in 9.3 - 67.6% - with habitual miscarriage, and in 14 - 67.5% - with repeated implantation failures [4, 7, 8, 10].

Risk factors for CE in infertile women include a history of pregnancy, prolonged infertility of more than 6 years, sequelae of pelvic inflammatory diseases, and endometrial hyperplasia [10].

Prolonged menstruation and intermenstrual bleeding are risk factors associated with CE [7].

Histopathologically, CE is characterized by edema of the endometrial surface layer, abnormal density of stromal cells, asynchronous maturation between the stroma and epithelium, and infiltration by plasma cells [3]. An immunohistochemical staining finding of ≥5 plasma cells per high-power field is considered CE positive [3].

The most reliable method for diagnosing chronic endometritis is immunohistochemistry to the CD138 marker (syndecan-1), which is a transmembrane heparan sulfate proteoglycan and a plasma cell marker [3, 4]. Literature data indicate that the diagnosis of CE is more often possible when sampling in the proliferative phase of the menstrual cycle [3, 4]. At the same time, according to macroscopic signs during hysteroscopy, accurate identification of XE is possible only in 16–35% of cases [4].

Bacterial culture is one of the important methods for diagnosing CE. This technique allows you to identify the causative agents of the disease and prescribe targeted antibiotic therapy. In a study by Moreno I. et al. (2018), it was found that 58% of patients with confirmed XE were found to have representatives of opportunistic flora: Escherichia coli, Enterococcus faecalis, Streptococcus spp., Staphylococcus spp., Mycoplasma/Ureaplasma [4, 9].

The use of PCR can remove some of the limitations of bacteriological culture, providing faster and more accurate microbiological analysis, including the detection of both cultured and uncultured forms of bacterial DNA [4, 7].

Treatment of CE is mostly based on the use of oral antibiotics selected according to the results of bacterial culture. The main regimen is doxycycline 100 mg 2 times a day for 14 days, the effectiveness of which is 68.5–71.3% after one course and up to 88.3% after two courses [9].

Alternative regimens are a combination of levofloxacin and tinidazole [2, 6]. It has been established that successful therapy significantly improves the frequency of clinical pregnancy and childbirth in patients with chronic endometritis during in vitro fertilization [7, 8, 10]. At the same time, the growth of antibiotic resistance limits the effectiveness of antibiotic therapy, which requires the search for new approaches [2, 9].

Conclusion: The analysis of scientific data showed that endometritis have a negative effect on fertility, in particular through impaired implantation and an increased risk of infertility. Timely diagnosis of chronic endometritis (using an immunohistochemical test with CD138) and effective treatment (use of antibiotics according to sensitivity) are the key to preserving a woman's reproductive health and improving fertility.

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ХРОНІЧНИЙ ЕНДОМЕТРИТ: СТАНДАРТИ ДІАГНОСТИКИ І ЛІКУВАННЯ

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CHRONIC ENDOMETRITIS: STANDARDS OF DIAGNOSTIC AND TREATMENT

Анотація.
Здійснений огляд літератури засвідчив, що хронічний ендометрит порушує репродуктивну функцію жінки, впливаючи як на якість її життя, так і на право пацієнтки на батьківство. Сучасні стратегії діагностики засновані на гістероскопії, імуногістохімії та молекулярних методах, які дозволяють точно встановити діагноз. Відновленню репродуктивного потенціалу сприяє антибактеріальна та імуногормональна терапія.

Abstract.
A review of the literature proved that chronic endometritis disrupts a woman's reproductive function, affecting both her quality of life and the patient's right to parenthood. Modern diagnostic strategies are based on hysteroscopy, immunohistochemistry, and molecular methods that allow accurate diagnosis. Restoration of reproductive potential is facilitated by antibacterial and immunohormonal therapy.

Ключові слова: *хронічний ендометрит, безпліддя, імплантація, гістероскопія, лікування.*
Keywords: *chronic endometritis, infertility, implantation, hysteroscopy, treatment.*

Вступ. Хронічний ендометрит характеризується персистуючим запаленням ендометрію, на тлі якого порушується структурна організація слизової оболонки матки та виникає її дисфункція [1]. ХЕ негативно впливає на здоров'я жінки, сприяючи таким станам як аномальна маткова кровотеча, ендометріоз; порушує репродуктивну функцію, і є однією із причин рецидивуючих втрат вагітності, безпліддя і повторних невдалих імплантацій ембріона під час екстракорпорального запліднення (ЕКЗ) [2, 3]. Поширеність ХЕ серед жінок із безпліддям варіює від 10,4% до 56,8%, і у пацієнток із рецидивуючою не вдалою імплантацією при проведенні ЕКЗ зростає до 67,5% [4, 5]. Вищою є поширеність ХЕ у безплідних пацієнток із внутрішньоматковою патологією [6, 7]. У пацієнток із поліпом ендометрію частота ХЕ вища у 5,2 разів, при наявності внітрішньоматкових сінехій гістологічні ознаки ХЕ діагностують у 4,6 разів частіше [8]. У зв'язку із цим висвітлення питань сучасних підходів до діагностики і лікування ХЕ є актуальним.

Мета дослідження. Висвітлити сучасні дані літератури про сучасні підходи до діагностики і лікування хронічного ендометриту.

Матеріали і методи дослідження. Для досягнення мети дослідження використано метод системного аналізу баз даних фахових медичних журналів за період 2020–2025 років., які індексуються в наукометричних базах даних PubMed, Scopus, Medline та клінічних рекомендацій ESHRE, ACOG, ASRM та національних клінічних протоколів. із використанням ключових слів: хронічний ендометрит, безпліддя, повторний викидень, імплантація, лікування хронічного ендометриту.

Результати дослідження. Хронічний ендометрит здебільшого розвивається як наслідок бактеріальної або вірусної інфекції, аутоімунних захворювань або раніше проведених маніпуляцій у матці, у тому числі, на тлі внутрішньоматкової спіралі [7].

Серед безплідних жінок, особливо тих, у кого повторна невдача імплантації, повторні викидні та ідіопатичне безпліддя, ХЕ діагностують із частотою 57,5%, 56% і 56,8% відповідно [11].

Патогенез ХЕ включає мікробні інфекції, які викликають імунну дисрегуляцію через сигнальні шляхи TLR/NLR, метаболічне перепрограмування імунних клітин, опосередковані мікроРНК запальні реакції та зміни метилювання ДНК. Активація прозапальних медіаторів та інфламасоми NLRP3 ще більше посилює дисфункцію ендометрію [9, 10], порушує його рецептивність [9], збільшення молекул BCL2, BAX и Ki-67 створює несприятливе середовище для імплантації запліднені яйцеклітини і сприяє безпліддю [3].

Симптоми ХЕ здебільшого не специфічні - мажучі виділення, міжменструальні кровотечі, незначний дискомфорт, хронічні тазові болі або взагалі симптоми відсутні [9]. Виключення наявності ХЕ потребують пацієнтки, які стикаються із безпліддям і повторними викиднями [21].

Саме тому діагностика ХЕ потребує ретельної стратегії, а саме, клінічного оцінювання, застосування методів візуалізації і гістопатологічного дослідження ендометрію [12].

До гістероскопічних ознак ХЕ відносять вогнищеву або дифузну гіперемію ендометрію або ефект «полуниці», мікрополіпи (<1 мм) і набряк строми слизової оболонки [13].

Золотим стандартом діагностики ХЕ залишається гістопатологічне дослідження біоптату ендометрію. Основними ознаками ХЕ вважають набряк слизової оболонки поверхні ендометрію, розшарування епітеліальних клітин та строми, підвищену щільність стромальних клітин та інфільтрацію строми плазматичними клітинами [12]. Лю та ін. [19]. розробили систему підрахунку балів для гістероскопічної діагностики ХЕ, призначаючи бали за різні ознаки, такі як дифузна гіперемія (4 бали), точкові крововиливи (2 бали), вогнищева гіперемія (2 бали), розширені судини ендометрію (2 бали), мікрополіпи (1 бал), поліпи (1 бал) та анамнез повторної невдачі внутрішньоматкової інсемінації (2 бали), із загальною оцінкою 14. Оптимальне порогове значення для діагностики ХЕ було >2 балів на основі аналізу кривої ROC та індексу Юдена. Хоча гістероскопія надає цінну інформацію, точність її діагностики залежить від суб'єктивного судження оператора та якості обладнання. Таким чином, гістероскопія не повинна замінювати гістопатологічне дослідження, а поєднання обох методів підвищує діагностичну точність [20]. Збіг між гістероскопічним та гістологічним діагнозами ХЕ виявляють у 87% [21].

У 1907 році Hitschmann F, Adler L. вперше запропонували вважати критерієм ХЕ виявлення плазматичних клітин в ендометрії [15]. Наявність плазматичних клітин у стромі є найбільш специфічним та чутливим діагностичним критерієм ХЕ. Типові плазматичні клітини при ХЕ мають великі клітинні тіла, високе ядерно-цитоплазматичне співвідношення, базофільну цитоплазму та гетерохроматиновий малюнок. Класична гістологія має обмежену чутливість (до 30–40%) у порівнянні з імуногістохімічними методами, які дозволяють точно ідентифікувати плазмоцити навіть при малих кількостях [16]. Незважаючи на деякі суперечки, гістероскопію, проведену досвідченими фахівцями, у поєднанні з гістологічним дослідженням, рекомендують розглядати як діагностичний інструмент для виявлення ХЕ [16, 17, 18].

Визнано, що ХЕ може знижувати експресію ключових рецепторів до прогестерону, порушувати механізми десцидуалізації та спричиняти неадекватну рецептивність ендометрію в період імплантації [28], що знижує ефективність як спонтанного зачаття, так і програм ЕКЗ, а також асоціюється із підвищеним ризиком втрати вагітності на ранніх термінах [15,16].

Стандартизованого протоколу лікування ХЕ не існує. Антибіотикотерапія є наріжним каменем лікування ХЕ [21]. Численні дослідження продемонстрували, що антибіотикотерапія ефективно знищує плазматичні клітини в стромі, тим самим покращуючи результати вагітності у пацієнток з ХЕ [22]. Вибір антибіотиків, тривалість лікування та шлях введення значно відрізняються в клінічній практиці [23]. Зазвичай вживані препарати включають доксициклін, метронідазол, ципрофлоксацин і левофлоксацин [24]. Доксициклін часто є препаратом першої лінії завдяки його широкому спектру дії проти звичайних бактерій і мікоплазм [25].

Описані нові, ад'ювантні, підходи у лікуванні ХЕ у рефрактерних до антибіотиків пацієнтів, зокрема застосування внутрішньоматкової інфузії збагаченої тромбоцитами плазми [26]. Останні дослідження свідчать, що після лікування ХЕ частота настання вагітності зростала у 2 рази і живородження у 4 рази [26, 27].

Висновки. Проведений огляд літератури засвідчив, що хронічний ендометрит порушує репродуктивну функцію жінки, впливаючи як на якість життя, так і на право пацієнтки на батьківство. Сучасні стратегії діагностики засновані на гістероскопії, імуногістохімії та молекулярних методах, які дозволяють точно встановити діагноз. Відновленню репродуктивного потенціалу сприяє антибактеріальна та імуногормональна терапія.

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ПОЛІЕНДОКРИННИЙ ОВАРІАЛЬНИЙ МЕТАБОЛІЧНИЙ СИНДРОМ: СУЧАСНІ СТРАТЕГІЇ ЛІКУВАННЯ (ОГЛЯД ЛІТЕРАТУРИ)

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POLYENDOCRINE OVARIAN METABOLIC SYNDROME: MODERN TREATMENT STRATEGIES (LITERATURE REVIEW)

Анотація

Проведене дослідження засвідчило, що сучасні підходи до лікування синдрому полікістозних яєчників/поліендокринного овариального метаболічного синдрому характеризуються комплексним підходом і індивідуалізованим менеджментом, який поєднує модифікацію способу життя, фармакотерапію та репродуктивні технології. Основними напрямами впливу є нормалізація метаболічних порушень, зниження інсулінорезистентності, корекція гіперандрогенізму, стимуляція овуляції у пацієнток, що планують вагітність, та профілактика довгострокових наслідків. Нові терапевтичні стратегії, включно з інноваційними фармакологічними агентами, дозволяють оптимізувати результати лікування та покращити якість життя пацієнток.

Abstract

The conducted study proved that modern approaches to the treatment of polycystic ovary syndrome/polyendocrine ovarian metabolic syndrome are characterized by a comprehensive approach and individualized management that combines lifestyle modification, pharmacotherapy and reproductive technologies. The main directions of influence are normalization of metabolic disorders, reduction of insulin resistance, correction of hyperandrogenism, stimulation of ovulation in patients planning pregnancy, and prevention of long-term consequences. New therapeutic strategies, including innovative pharmacological agents, allow to optimize the results of treatment and improve the quality of life of patients.

Ключові слова: *синдром полікістозних яєчників, поліендокринний овариальний метаболічний синдром, інсулінорезистентність, модифікація способу життя, метформін, тіазолідиндіон, летразол.*

Keywords: *polycystic ovary syndrome, polyendocrine ovarian metabolic syndrome, insulin resistance, lifestyle modification, metformin, thiazolidinedione, letrazole.*

Вступ. Синдром полікістозних яєчників (СПКЯ) є одним із найпоширеніших ендокринних та метаболічних розладів, що вражає 8-20% жінок в усьому світі [10]. Нещодавно міжнародним консорціумом [16] СПКЯ перейменовано на поліендокринний овариальний метаболічний синдром (ПОМС).

СПКЯ/ПОМС є складним і гетерогенним розладом, який вражає підлітків, жінок репродуктивного і пременопаузального віку, з яким асоціюють не тільки безпліддя, а також метаболічні ускладнення і психологічні порушення, розлади харчової поведінки, негативне сприйняття власного тіла, що призводить до значного погіршення якості життя [4, 5, 7, 8, 12].

У жінок різного віку зі СПКЯ/ПМОС підвищує ризик розвитку раку ендометрію, через супутні фактори, такі як ановуляція, ожиріння та цукровий діабет [2, 14].

Після настання вагітності (спонтанної чи індукованої), у жінок з СПКЯ/ПМОС підвищеним є ризик гестаційних ускладнень (гестаційного діабету, гестаційної гіпертензії, прееклампсії, передчасних

пологів, затримки росту плода та низької маси тіла новонародженого) [16].

Отже, раннє та персоналізоване лікування має важливе значення у корекції метаболічних [17] та репродуктивних порушень у жінок із СПКЯ/ПМОС [15], а також в профілактиці раку ендометрію і несприятливих віддалених наслідків (цукрового діабету 2 типу, дисліпідемії, гіпертонії та серцево-судинних захворювань) [10].

Мета дослідження: висвітлити сучасні дані літератури про сучасні терапевтичні стратегії при синдромі полікистозних яєчників/ поліендокринному овариальному метаболічному синдромі.

Матеріал та методи: Було проведено огляд сучасної літератури з питань лікування синдромі полікистозних яєчників/ поліендокринному овариальному метаболічному синдромі, опублікованої протягом останніх 10 років у рецензованих медичних журналах, які індексуються у наукометричних базах даних PubMed, Scopus, Medline, із використанням ключових слів: синдром полікістозних яєчників, поліендокринний овариальний метаболічний синдром, інсулінорезистентність, метформін, тіазолідиндіони, летразол.

Результати дослідження. У 2016–2026 роках значно зросла кількість публікацій, які висвітлюють питання оптимізації діагностики та менеджменту СПКЯ/ПМОС [1, 2, 20].

Доведено, що прояви СПКЯ/ПМОС є вкрай гетерогенними, тому лікування має бути індивідуальним, із урахуванням фенотипу та пріоритетів пацієнтки [1, 2, 6].

Модифікацію способу життя, особливо у підлітків, рекомендують як першу лінію лікування для більшості пацієнток зі СПКЯ/ПМОС, особливо за наявності надмірної маси тіла або ожиріння [1, 13]. Зниження маси тіла на 5–10% асоціюється із зниженням інсулінорезистентності, відновленням овуляції, зниженням частоти АМК та покращенням репродуктивної функції [1, 10].

Рекомендовані заходи включають збалансоване харчування із обмеженням швидких вуглеводів, регулярну аеробну та силову фізичну активність, а також корекцію порушень сну [1, 2]. Середземноморська дієта може стати однією із оптимальних стратегій харчування при лікуванні СПКЯ/ПМОС, оскільки вона забезпечує антиоксидантами, містить значну кількість клітковини, вітамінів, мінералів та інші біологічно активні сполуки. Ще однією важливою перевагою середземноморської дієти є наявність корисних ліпідів, особливо тих, які отримують з оливок, горіхів та жирної риби, такої як лосось та сардини [13].

Сьогодні жоден препарат не лікує всі аспекти СПКЯ/ПМОС, тому існує кілька схвалених методів лікування, спрямованих на конкретні особливості цього синдрому, а саме, вплив на надлишок андрогенів, інсулінорезистентності (ІР) та безпліддя [10].

Комбіновані гормональні контрацептиви (КГК), що знижують рівень циркулюючих андрогенів, є терапевтичним засобом першої лінії як при гірсутизмі, так і при акне у жінок із СПКЯ/ПМОС, які не планують вагітність [11]. Вибір конкретного препарату здійснюється з урахуванням індивідуального серцево-судинного та тромботичного ризику [1, 11].

У разі недостатньої ефективності КОК та протипоказаннях до їх застосування, як антиандрогенні засоби можна використовувати спіронолактон, флутамід або фінастерид, які діють на рівні андрогенного рецептора або на рівні продукції андрогенів. Спіронолактон - антагоніст рецепторів альдостерону, що має антиандрогенну дію за рахунок інгібування зв'язування дигідротестостерону (ДГТ). Флутамід – чистий антиандроген, що діє як конкурентний антагоніст на рівні андрогенного рецептора. Фінастерид - конкурентний інгібітор 5-α-редуктази, ферменту, що перетворює тестостерон на ДГТ, що призводить до зниження концентрації ДГТ. Ці препарати мають тератогенну дію і повинні прийматися одночасно з контрацепцією [2].

Ановуляцію та викликану нею аномальну маткову кровотечу також можна лікувати за допомогою КОК. Забезпечення кровотечі відміни щонайменше кожні 3 місяці важливе для захисту ендометрію від гіперплазії та злоякісних новоутворень у осіб із ановуляцією [4].

ІР та компенсаторна гіперінсулінемія (ГІ) присутні у 65–95% жінок із із СПКЯ/ПМОС, включаючи переважну більшість жінок із надмірною вагою та ожирінням, а також більше половини жінок із нормальною вагою [17]. Для зниження ІР та зменшення ризику розвитку діабету 2 типу у жінок із СПКЯ/ПМОС призначають препарати, що підвищують чутливість до інсуліну [5].

У жінок із СПКЯ/ПМОС і підвищеним ІМТ або порушенням толерантності до глюкози найбільш широко використовується метформін, який знижує ІР, регулює менструальний цикл та знижує рівень андрогенів [10]. Міжнародне керівництво із СПКЯ 2023 року, рекомендує метформін як доповнення до зміни способу життя у жінок з метаболічним ризиком, а також як терапію другої лінії в окремих клінічних випадках, у т.ч. при ановуляторному безплідді та при порушенні толерантності до глюкози [15].

Істинні сенсибілізатори інсуліну, тіазолідиндіони (ТЗД) (такі як розиглітазон та піоглітазон) та агоністи дніпероксисом проліферативний активоватор рецептора γ (PPAR-γ) можуть використовуватися як альтернативна терапія метаболічних та репродуктивних порушень, пов'язаних із СПКЯ, у жінок, які погано реагують на метформін. PPAR-γ - це ядерний рецептор, який посилює активність інсуліну за допомогою пост-інсулінового рецепторного механізму, переважно за рахунок покращення чутливості до інсуліну в жировій тканині та скелетних м'язах [1, 17]. Декілька досліджень показують, що ТЗД більш виражений вплив на ІР і дисліпідемію при СПКЯ, ніж метформін [19]. Крім того, комбінація метформіну і ТЗД має синергічний ефект у лікуванні жінок із СПКЯ, забезпечуючи більш виражене зниження ІР, ніж метформін у монотерапії [19].

З метою зменшення периферичної ІР у пацієнтів із СПКЯ широкого застосування набули

препарати інозитолу, а саме, його ізомери, міо – інозитолу (MI) і дехіро – інозитолу (ДХІ) [18]. Одночасне призначення MI + ДХІ продемонструвало більшу ефективність для відновлення регулярних менструацій і зниження індексу HOMA та загального тестостерону [19].

Берберин (ББР), як природний ізохіноліновий алкалоїд, вивчався в різних рандомізованих клінічних дослідженнях у пацієнтів з СПКЯ і показав свою безпеку та перспективність у зниженні ІР, зниженні рівня ліпідів у крові та відновленні овуляції [20]. Застосування ББР перевершувало дію метформін у зниженні рівня тригліцеридів. Комбінація метформіну та ББР продемонструвала більш виражене зниження загального тестостерону та ІМТ, у порівнянні із монотерапією лише метформіном [20].

Субфертильність у жінок зі СПКЯ/ПМОС виникає в основному через олігоовуляцію або ановуляцію [4, 18], тому індукція овуляції є основним методом лікування репродуктивних порушень. Для індукції овуляції у жінок із безпліддям на тлі СПКЯ/ПМОС препаратом першої лінії є летразол, який має вищі показники живонародження порівняно з кломіфеном. Кломіфен цитрат залишається альтернативним варіантом у разі недоступності летрозолу [11]. При резистентності до медикаментозної стимуляції рекомендоване застосування допоміжних репродуктивних технологій, зокрема екстракорпорального запліднення [19].

Цілеспрямоване лікування дисбіозу та відновлення кишкової мікробіоти сьогодні розглядають як нову індивідуалізовану стратегію лікування СПКЯ/ПМОС [17]. Проведені дослідження засвідчують, що призначення пребіотиків, пробіотиків та трансплантація фекальної мікробіоти, можуть модулювати запальні та окислювальні шляхи, які є важливим чинником метаболічної дисфункції при СПКЯ/ПМОС [9].

Сучасні керівництва підкреслюють необхідність скринінгу тривожних і депресивних розладів у пацієнток зі СПКЯ [1, 12]. Мультидисциплінарний підхід із залученням гінеколога, ендокринолога, дієтолога та психолога дозволяє покращити прихильність до лікування та якість життя пацієнток із СПКЯ/ПМОС [8-10].

Висновки. Проведене дослідження засвідчило, що сучасні підходи до лікування синдрому полікістозних яєчників/поліендокринного оваріального метаболічного синдрому характеризуються комплексним підходом і індивідуалізованим менеджментом, який поєднує модифікацію способу життя, фармакотерапію та репродуктивні технології. Основними напрямами впливу є нормалізація метаболічних порушень, зниження інсулінорезистентності, корекція гіперандрогенізму, стимуляція овуляції у пацієнток, що планують вагітність, та профілактика довгострокових наслідків. Нові терапевтичні стратегії, включно з інноваційними фармакологічними агентами, дозволяють оптимізувати результати лікування та покращити якість життя пацієнток.

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НУТРІТИВНИЙ ДИСБАЛАНС ВАГІТНОСТІ ТА ЙОГО ПЕРИНАТАЛЬНІ НАСЛІДКИ

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NUTRITIONAL IMBALANCE OF PREGNANCY AND ITS PERINATAL CONSEQUENCES

Анотація:
У поточному огляді висвітлено вплив харчування вагітної на розвиток гестаційних ускладнень, стан плода та здоров'я дитини у майбутньому. Недостатнє або надмірне споживання певних поживних речовин під час вагітності призводить до захворювань дорослої людини в подальшому житті. І навпаки, несприятливі запрограмовані процеси під час скомпрометованої вагітності можна запобігти або принаймні зменшити шляхом відповідної нутрітивної підтримки.

Abstract:
The current review highlights the influence of pregnant women's nutrition on the development of gestational complications, the condition of the fetus and the health of the child in the future. Insufficient or excessive consumption of certain nutrients during pregnancy leads to adult diseases later in life. Conversely, adverse programmed processes during a compromised pregnancy can be prevented or at least reduced by appropriate nutritional support.

Ключові слова: *харчування, вагітність, нутрієнти, профілактика, нутрітивна підтримка.*
Key words: *nutrition, pregnancy, nutrients, prevention, nutritional support.*

Вступ. Вагітність відзначається складністю метаболічних процесів, які впливають на розвиток плода та мають прямі наслідки для здоров'я майбутньої дитини. Нормальний ріст і розвиток плода залежать від постійного постачання поживних речовин через плаценту. Надмірне або недостатнє споживання певної поживної речовини пов’язують із програмуванням ризику розвитку ряду неінфекційних захворювань (НІЗ), таких як ожиріння, діабет, гіпертонія, серцево-судинні захворювання, неалкогольна жирова хвороба печінки та нейрокогнітивні розлади [1, 2]. Недоїдання матері на ранніх термінах вагітності збільшує ризик кардіометаболічних станів у дорослому віці, порівняно із недоїданням матері в середині або наприкінці вагітності [3].

У сучасному світі підхід до харчування зазнав змін у зв'язку з нещодавніми епідеміологічними даними, що переконливо свідчать про те, що певні хронічні захворювання дорослих пов'язані з умовами внутрішньоутробного харчування. Тому мета тепер полягає не лише в тому, щоб забезпечити достатню кількість їжі для матері, щоб уникнути відчуття дефіциту, але й у створенні харчових основ для здорового дорослого життя, враховуючи внутрішньоутробний період [4].

Мета дослідження. Висвітлити сучасні дані літератури про вплив нутрітивної підтримки на перебіг вагітності та профілактику перинатальних ускладнень.

Матеріали та методи: Для досягнення мети дослідження використано метод системного аналізу баз даних фахових медичних журналів за період 2020–2025 років, які індексуються у наукометричних базах даних PubMed, Scopus, Medline, із використанням ключових слів: харчування, вагітність, нутрієнти, профілактика, нутрітивна підтримка.

Результати дослідження. Харчування матері до, під час та після вагітності відіграє важливу роль у визначенні здоров’я та благополуччя малюка у майбутньому [1]. У короткостроковій перспективі

погане харчування матері пов'язане з вищим ризиком несприятливих перинатальних наслідків, включаючи гестаційний діабет, передчасні пологи, затримка росту плода та високий рівень перинатальної захворюваності [2]. У довгостроковій перспективі харчування є важливою частиною метаболічного програмування плода, яке може змінити експресію генома плода, що призведе до постійних структурних або фізіологічних змін, і встановлення адаптаційних реакцій, які підвищують ризик хронічних захворювань і змін нервового розвитку в подальшому житті [3].

Всі важливі життєві процеси в організмі людини вимагають постійного забезпечення енергією, яка утворюється в результаті біологічного розщеплення живильних речовин і виділяється у вигляді тепла. Одиниці виміру цього теплового виділення - кілокалорії (ккал) або кілоджоулі (кДж). З кожного граму вуглеводів утворюється близько 4 ккал, з граму жирів - 9 ккал, з граму білків - 4 ккал. Основні джерела енергії - це жири та вуглеводи, білки використовуються в основному для будівництва клітин тканин і органів майбутнього плоду [4].

Під час вагітності, за умови правильної організації харчування, не потрібно значуще збільшення кількості калорій. В середньому вважається, що в першому триместрі потрібно додатково лише 50-100 ккал на день, в другому - ще 200-300 ккал/день, і в третьому - додатково ще на 300-400 ккал/день [5].

Наприклад, для здорових жінок середнього рівня фізичного розвитку, що ведуть активний спосіб життя та підтримують середню інтенсивність фізичних навантажень, раціон харчування розглядається як раціональний із енергетичною цінністю 2200-2300 ккал/день. Отже, під час вагітності рекомендовано збільшувати кількість калорій до 2300-2400 ккал/день у першому триместрі, 2500-2600 ккал/день у другому та 2800-3000 ккал/день у третьому.

Потреби в харчуванні під час вагітності диктуються потребами матері та плоду в розвитку. З 9-15 кг, які жінка з нормальною вагою оптимально повинна набрати під час вагітності, приблизно 40% складається з плоду, плаценти та амніотичної рідини, тоді як решта являє собою збільшення тканин матері, включаючи матку, груди, крові, інтерстиціальної рідини та жиру.

Очікування дитини - це відповідальний етап, який вимагає свідомого підходу та попередньої підготовки для уникнення можливих ускладнень. Необхідно здати комплекс аналізів, і у випадку виявлення будь-яких відхилень, знайти причину і усунути її лікуванням.

Один із ключових аспектів планування вагітності - це переконання, що організм забезпечений достатньою кількістю фолієвої кислоти. Фолієва кислота – це синтетична форма вітаміну В9, яка входить до групи водорозчинних вітамінів, який важливий для клітинного поділу, формування ДНК і метаболізму. Сучасні дослідження свідчать, що прийом фолієвої кислоти в рекомендованій дозі протягом 3 місяців до зачаття зменшує ризик вроджених вад у плода на 80% [6]. Вітамін B_9 Відповідно до рекомендацій ВООЗ профілактику дефектів нервової трубки плода доцільно розпочинати за 2-3 місяці до зачаття та продовжувати її упродовж перших трьох місяців вагітності, шляхом застосування 400 мкг фолієвої кислоти на день. . Це не лише запобігає дефектам нервової трубки, але й захищає від аномалій розвитку мозку, серцево-судинної та сечовивідної систем, а також виникнення щілини верхнього піднебіння, дефектів кінцівок та пупкових гриж.

Ще одним фактором ризику ускладнень вагітності, який можна вирішити корекцією харчування і раціональною дозою фолієвої кислоти є високий рівень амінокислоти гомоцистеїн. Часто саме цей показник є причиною самовільних викиднів у вагітних, через тромбоз судин, які кровопостачають плід. Ця амінокислота утворюється при розкладанні метіоніну, який надходить до організму людини з продуктами, багатими білком. Зазвичай надлишок гомоцистеїну нейтралізується за рахунок фолієвої кислоти та ферментів MTRR, MTHFR та MTR. У вагітних нормою є знижений рівень гомоцистеїну — до 10 мкмоль/л.

Жінкам із генетичною схильністю до гіпергомоцистеїнемії рекомендується уникати продуктів, що містять білок, з якого утворюється гомоцистеїн, таких як свинина, сир та яйця, і забезпечувати оптимальний прийом фолієвої кислоти, про який говорилось раніше.

Перебіг вагітності, внутрішньоутробний розвиток плода у значній мірі залежить від магнієвого гомеостазу. Відомо, що під час вагітності потреба в Mg зростає у 1,5-2 рази, що зумовлено формуванням і функціонуванням плаценти, внутрішньоутробним ростом і розвитком плода, а також підвищенням рівнів естрогенів та альдостерону [7]. Рекомендована добова доза магнію вагітним жінкам становить 350–400 мг. Гіпомагніємія у матері призводить до порушення функції плаценти і, як наслідок, затримки росту плода та його дистресу [8].

Ще один небезпечний стан, асоційований з вагітністю, який має особливу актуальність – це залізодефіцитна анемія. Поширеність анемії безпрецедентна - від 20 до 80 % жінок залежно від економічного рівня країни [9]. В Україні ці показник досягають 26-34% вагітних. До розвитку анемії у вагітних можуть призвести зниження надходження Fe до організму з їжею, порушення всмоктування його в кишечнику, кровотечі з травного тракту, статевих шляхів, деякі хронічні захворювання. Захворювання небезпечне тим, що воно збільшує ризик передчасних пологів, передчасне відшарування нормально розташованої плаценти, слабкість пологової діяльності, затримку росту плода, збільшує ризик кровотеч у післяпологовому періоді та ризик запальних ускладнень, є причиною гіполактії.

Діагностичним маркером анемії вважається зниження рівня феритину. Якщо феритин нижче 15 мкг/л, це підтвердження анемії. Якщо ж феритин нижче 30 мг/мл, можна говорити про виснаження запасів заліза в організмі або латентний дефіцит.

У 2017 році ВООЗ затвердила основний документ, в якому рекомендується всім вагітним з нормальним рівнем гемоглобіну отримувати 30-60 мг елементарного заліза на добу. Якщо у вагітної діагностовано анемію, щоденна доза препаратів заліза має бути збільшена до 120 мг у перерахунку на залізо, доки рівень гемоглобіну не нормалізується (Hb≥110 г/л) [2].

Також доведено, що обмеження білка під час вагітності призводить до затримки росту плода з подальшою гіперглікемією, непереносимістю глюкози, інсулінорезистентністю, ожирінням і гіпертензією у дорослому віці [6].

Відомо, що мідь, цинк, марганець, селен, вітаміни Е, С і А, а також система глутатіону володіють антиоксидантними властивостями. Незважаючи на те, що було показано, що використання антиоксидантів під час вагітності запобігає неінфекційним захворюванням у дорослих, сьогодні недостатньо даних про те, коли і як використовувати антиоксидантні поживні речовини для перепрограмування захворювань дорослих, пов'язаних з окислювальним стресом під час вагітності [4].

Висновки. У поточному огляді висвітлено вплив харчування вагітної на розвиток гестаційних ускладнень, стан плода та здоров'я дитини у майбутньому. Недостатнє або надмірне споживання певних поживних речовин під час вагітності призводить до захворювань у подальшому житті. Несприятливі запрограмовані процеси під час скомпрометованої вагітності можна запобігти або принаймні зменшити шляхом відповідної нутритивної підтримки.

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PEDAGOGICAL SCIENCES

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ARTIFICIAL INTELLIGENCE IN THE EDUCATIONAL PROCESS ORAL MATHEMATICS EXAMS: A RELIABLE ALTERNATIVE ASSESSMENT MODEL IN THE ERA OF ARTIFICIAL INTELLIGENCE.

Abstract:

Artificial intelligence has already firmly established itself in the field of education and training. By "artificial intelligence" we mean technologies that imitate human thinking: they understand text and speech, draw conclusions, learn from experience and are able to offer informed decisions. Artificial intelligence (AI) in education is a powerful tool for personalizing the educational process, automating teachers' daily tasks (checking assignments, creating plans) and providing students with 24/7 support.

In the modern world, with the rapid development of technology, everything is constantly transforming. The application of artificial intelligence (AI) to solve everyday problems has become a trend in the development of information technologies. AI has a huge impact on various aspects of life in general, including the educational process. Its application allows you to increase the efficiency of training and optimize the work of teachers.

Since the education system is gradually moving towards digitalization, the use of artificial intelligence in education is relevant. In particular, in countries interested in the development of education, education is undergoing a digital transformation. Therefore, the problems of ensuring the individualization and personalization of the educational process based on modern technologies are becoming increasingly relevant. The relevance of this work lies in exploring the potential of artificial intelligence in the educational environment. This will not only improve the educational process, but also ensure the compliance of the national education system with international standards [1].

Introduction

The idea of using artificial intelligence in education began to develop in the middle of the 20th century, when the first computers capable of analyzing data appeared. At the initial stages, the main focus was on creating educational programs using algorithms that provide students with training materials and test tasks. One of the first examples was the "Platonic" system, developed in the 1960s and covering interactive training courses [2].

Artificial intelligence is rapidly entering schools, colleges and universities of all developed countries. It frees teachers from routine work, allows students and schoolchildren to learn at their own pace, and opens up new opportunities for all participants in the educational process. If we look at the main changes that artificial intelligence has brought to education, we will see that the use of artificial intelligence in education is one of the main priorities of countries interested in developing education. In the documents, artificial intelligence is defined as a technology capable of increasing the efficiency and quality of education, artificial intelligence is defined as a technology capable of increasing the efficiency and quality of education.

Artificial intelligence is defined as a technology capable of increasing the efficiency and quality of education. Therefore, it is planned to increase the number of specialists who will graduate in this direction many times, On-site training is conducted, teachers are trained in the application and use of artificial intelligence tools in the educational process. It involves the integration of future artificial intelligence modules not only into specialized programs, but also into all educational programs. In order to systematically develop this area and ensure unified approaches, a number of standards are being developed and implemented that regulate the use of artificial intelligence in education. General concepts and terms, Requirements for teaching materials for adaptive learning in schools, Preparation of scientific publications, management of academic indicators, Formation of applicant contingents for university students. Let's consider which specific areas are already actively developing thanks to artificial intelligence.

Today, artificial intelligence is integrated into educational processes at all levels, from elementary school to university and corporate training. It is used not only to personalize learning, but also to develop new teaching methods, manage educational processes and analyze data. Neural networks help teachers automate answers to frequently asked questions from students. Students receive a brief explanation of the topic, practice speaking a foreign language (the bot corrects mistakes), and get advice on how to solve the problem. The main advantage of artificial intelligence is its ability to adapt to each student. Traditional lessons are aimed at an average student, which leads to some children falling behind and others getting bored. Artificial intelligence continuously analyzes students' progress and mistakes, identifies knowledge gaps, and automatically offers additional materials, examples, or tasks to fill them. If a student easily completes a task, artificial intelligence personalizes their learning path by offering more difficult tasks without delaying the entire group. Artificial intelligence plays a significant role in improving the quality of the educational process. One of its main advantages is the ability to personalize training. Modern platforms can analyze student achievement data and create individual training plans that take

into account the student's learning pace, level of preparation and interests. The use of artificial intelligence goes beyond traditional education. For example, a virtual teacher created using artificial intelligence technology can act as a teaching assistant, advise students or answer questions in real time. Simulators are actively used in medical and engineering disciplines, which allow students to practice practical skills in a safe environment.

Checking notebooks, tests and quizzes is one of the most time-consuming tasks for teachers. Artificial intelligence takes over this routine. Modern systems can check much more than just multiple-choice tests. For example, extended written tasks are checked using special templates, and in essays, artificial intelligence can identify grammatical errors and evaluate the structure and logic of arguments. Neural networks can also check programming code, which saves teachers a lot of time. SafeNet market experts note that artificial intelligence already reduces the workload of teachers by four to five times, and in the near future this figure may reach ten times. These freed-up hours can be spent on live communication with students, providing individual assistance, or preparing interesting assignments. Chatbots in universities and schools are assistants who are ready to answer any question around the clock. Applicants and students can get information about the schedule of classes, deadlines for assignments, dormitory rules, and scholarships. Neural networks help teachers automate answers to frequently asked questions from students. Students receive a brief explanation of the topic, practice speaking a foreign language (the bot corrects mistakes), and receive advice on how to solve the problem. Smart educational platforms are entire ecosystems that combine various artificial intelligence functions. They offer the following:

- Adaptive courses — the program automatically adjusts the complexity and sequence of the material to the student's progress;

- Smart recommendations — suggest which topics to review and which additional materials to study;

- Analysis of academic performance platforms not only provide grades, but also identify general trends, weaknesses within the group and predict the risk of individual students falling behind;

- Creation of materials assistance in creating presentations, tests, assignments and notes. For example, automatic transcription of video lectures on the Kontur.Tolk service followed by creation of a short summary.

- EdTech ecosystems operate on cloud-based PaaS (Platform-as-a-Service) solutions. For example, adaptive courses dynamically load content from cloud storage, and material generation uses NLP algorithms running on distributed servers. The application of artificial intelligence provides tangible benefits, let's consider some of them.

- Saving teachers' time. Freeing up time for creative work and live communication with students.

-Individual approach. Training is more effective because it takes into account the individual needs and pace of each student.

-Always available. Students can get help or access learning materials at any time.

- Inclusivity. AI helps people with disabilities. Examples include text-to-speech for the visually impaired or automatic audio/video transcription for the hearing impaired.

- Increased objectivity. When evaluating standardized tasks with clear criteria, AI is less susceptible to subjective factors than humans.

- Variety of formats. AI helps create interactive tasks, educational games, and complex visualizations, increasing motivation and making learning more engaging.

- Cloud scalability. AI tools easily adapt to workloads (for example, more than 1,000 simultaneous requests to chatbots), which is not possible with local school servers.

Despite its potential, the application of AI faces serious challenges:

Hallucinations and data inaccuracy. Neural networks sometimes produce information that sounds convincing, but may be incorrect or fabricated. They may report non-existent dates, distort scientific facts, or cite false sources. This is especially dangerous for students who do not have developed critical thinking skills, as they may accept such information as fact. Therefore, it is always important for both teachers and students to check facts.

Fraud and superficial knowledge. There is a strong desire to attribute homework, essays, or coursework to artificial intelligence. This leads to poor learning and a decrease in the ability to solve problems independently. There is a risk that the next generation will not learn to think without the support of artificial intelligence.

Data security. AI systems require access to large amounts of personal data from students and teachers to function. Data leaks or hacks pose a real threat to privacy. Schools and universities often fail to ensure reliable data protection.

Ethical issues and bias. AI is trained on internet data that may contain stereotypes, discriminatory attitudes or outdated views. The neural network can unknowingly repeat these in its answers or recommendations. The copyright protection of content used for AI training is also controversial.

Adaptation problems. Not all teaching staff are fully prepared for new technologies. According to data, only 10% of universities were actively using them in 2023. Large-scale retraining programs are needed to change this situation.

Digital inequality. Not all schools and universities, especially those located in remote areas, have the necessary equipment, high-speed internet and trained staff to implement AI. This can widen the gap in educational quality.

Without cloud infrastructure, the implementation of resource-intensive neural networks and the processing of large volumes of data would be extremely difficult or impossible for most educational institutions. Cloud computing provides instant access to huge computing resources, which are essential for processing big data (academic performance, behavioral patterns, individual trajectories). This allows artificial intelligence to

analyze a fairly large amount of data in real time and adapt content to each student. Cloud computing allows schools and universities to avoid large one-time costs associated with the purchase and maintenance of expensive server equipment. It is implemented on a fee-for-service basis, which makes the implementation of artificial intelligence more affordable. Cloud-based educational platforms and EdTech solutions provide access to educational materials, adaptive courses and artificial intelligence assistants from anywhere, at any time of the day. This is a key factor in bridging the digital divide, especially in remote areas where the implementation of a strong local infrastructure is impractical. Learners only need a stable internet connection.

The future of digital education is closely connected with the development of artificial intelligence. Many educational institutions are developing artificial intelligence models for various directions, and forecasts in the field of education are closely connected with the development of artificial intelligence.

- Adaptive learning will become the norm. Artificial intelligence will analyze the performance, learning style and emotional state of students and select the most effective formats and optimal pace.

- Artificial intelligence will become part of the daily curriculum at all levels, from school to university. New state standards will be developed and implemented that regulate the use of technology.

- Intelligent assistants will help teachers, from automating reports to choosing the best methods for each class or student.

- Artificial intelligence tools will become standard equipment in educational institutions to support students with different needs.

- Exam and test formats will shift to project-based work, oral interviews and practical case studies - where it is more difficult to use artificial intelligence and copy prepared answers.

- Teachers, freed from routine tasks, will be able to devote more time to developing critical thinking, creativity, communication and collaboration in their learners - which AI cannot yet replace.

- The development of hybrid clouds (a combination of private and public services) will become the standard for AI platforms. This will increase data security when working with biometric data and contact analytics, while maintaining the advantages of scalability.

Artificial intelligence technologies are gradually being introduced in many universities and schools. Teachers are beginning to use neural networks to quickly check homework, improve course materials, and select additional educational resources. Students are increasingly preferring generative models over traditional search methods, as this allows them to quickly obtain structured answers and generate ideas for independent work 7.

It should be noted that the use of artificial intelligence can increase the efficiency of training and make the educational process flexible and adaptive. However, the author also notes the risks that may arise, including the loss of personal contact between teacher and student, the danger of dependence on technology, and the need for digital literacy.

In recent years, artificial intelligence has been actively applied in various fields, from medical research to industrial automation. However, one of the most promising areas of application is education. The capabilities of artificial intelligence allow not only to optimize educational processes, but also to personalize learning, adapting it to the specific needs of students.

Although not all users realize it, artificial intelligence is already deeply integrated into the educational process. For example, one of the most obvious tools is search engines. Teachers use them to find information, prepare lectures and create teaching materials, while students use them to solve problems, write essays and learn new topics. The search engine is based on complex artificial intelligence algorithms that analyze millions of pages, select the most relevant sources and rank the results. These algorithms not only ensure the accuracy of the search, but also help the user find the exact information they need by adapting the search to specific user needs. The next step is for the student to answer the question generated by the artificial intelligence. Here we can talk about automated answer checking. Even if it does not work perfectly today, tomorrow it will work better and perhaps in a few years we will reach a situation where checking the answer to a free-form question will be as accurate as checking by a qualified teacher.

Some experts believe that AI will not replace teachers, but it will change their functions. In the future, teachers will spend most of their time creating AI systems and teaching materials that teach students, programming them with the necessary knowledge, developing and improving materials. Faculty will act as mentors who help students choose their educational paths. A mentor is an advisor or guide who has extensive experience and knowledge in their field and supports their professional and personal development by sharing this experience with a less experienced person (mentee). Mentors provide guidance for career advancement, learning new skills, and networking. Rather than simply providing information, faculty will become personalized learning advisors. They will be able to analyze students' strengths and weaknesses and recommend appropriate courses, subjects, and additional materials. AI will act as a tool that provides information about students' progress, and faculty will be able to interpret this, helping students build personalized educational paths based on their interests and career goals.

Teachers will use AI to prepare lectures, analyze student progress, and adapt lesson plans. AI technologies will be able to automate many everyday teaching tasks, such as creating lesson plans, selecting appropriate materials, and assessing student knowledge. For example, AI can analyze subject understanding and suggest adjustments to the lesson plan, making difficult sections relatively simple. Teachers will also be able to use AI analytics to personalize learning, identifying common knowledge gaps for each student within a group or individual difficulties.

In recent days, there has been extensive discussion about the secondary school leaving exams conducted by the State Examination Center in Azerbaijan. Teachers, parents, and students have expressed different

opinions about the principles of assessment and the place of exams in the education system in general. These discussions are not only about the results of a specific exam. In a broader sense, this debate raises the question of what and how we measure in education in the modern era.

Historically, exams have been one of the main assessment tools of the education system. However, in recent years, assessment models around the world have begun to change. One of the main reasons for this change is the rapid development of digital technologies, and in particular artificial intelligence.

How are assessment approaches changing around the world?

Many countries are reconsidering assessment mechanisms in the education system. For example, in Finland, standardized exams are not used in most of the school life. Student assessment is mainly based on the results of continuous observation by teachers, project activities, and long-term learning processes. This approach is aimed at developing not only students' knowledge, but also their creativity and problem-solving skills.

The Singaporean education system, on the other hand, applies a more balanced model. Although exams exist in this country, in recent years, more attention has been paid to project-based learning and assessment of applied skills within the framework of the "Learn for Life" concept. In countries such as Canada and Australia, school-based assessment and national-level assessment mechanisms are used in parallel. This approach allows both to monitor the individual development of students and to assess the overall quality of education.

Estonia is often cited as an example of the integration of digital technologies into education. In this country, data on students' learning processes is collected and presented to teachers through electronic platforms. This data helps teachers to see more clearly which subjects students have difficulty with and allows them to organize the teaching process more purposefully.

These examples show that exams are not completely eliminated in modern education systems, but their role is becoming part of a broader assessment system.

The main task of education in the era of artificial intelligence - In the era of artificial intelligence, information is almost everywhere and access to it has become much easier than in previous times. This situation makes us think about the essence of education. In this context, the main goal of education is not only to transfer information. What is more important is to form in students the skills to think, analyze and apply the acquired knowledge in various situations. In other words, the main task of the modern education system is not to memorize information, but to teach thinking.

For this reason, in the era of digitalization and artificial intelligence, it seems inevitable that assessment models will gradually change. In addition to the approach based solely on final exams in education, strengthening in-school assessment, expanding project- and problem-based learning methods, as well as developing teachers' digital and analytical skills are gaining increasing importance. Such an approach can contribute to the development of education not only as a selection mechanism, but also as a social institution that shapes thinking and creative people. In the era of artificial intelligence, the main issue is not the technology itself, but how it can be used in a way that improves the quality of education and human thinking. The 11-page declaration called the "Leiden Declaration on Artificial Intelligence and Mathematics" reflects serious concerns about how AI should be used in mathematical research. The experts who signed the declaration believe that claims that AI will revolutionize mathematical thinking are greatly exaggerated. The declaration emphasizes that the future of mathematical research should be shaped by human experience and the principles of academic transparency, not by the marketing strategies of technology companies. The statement raises serious doubts, in particular, about the reliability of mathematical solutions produced by artificial intelligence. According to Leslie Ann Goldberg, head of the Department of Computer Science at the University of Oxford, existing artificial intelligence systems can produce mathematical proofs that sound very convincing, but are actually flawed. Moreover, this is not limited to a few small errors. Because mathematical research largely depends on the accuracy of previous research. If a proof in the literature is really wrong, subsequent research based on it also risks being flawed. Therefore, the researchers say that mathematical results generated by artificial intelligence should not be considered reliable without human verification. Another issue highlighted in the statement is the economic pressures facing the academic world. According to the statement, while universities and research institutions have long struggled with financial problems, artificial intelligence companies offer academics very high salaries, significant processing power resources and attractive research opportunities. This situation may encourage some researchers to portray AI as more successful than it actually is. Thus, the fight against the uncontrolled use of AI does not require bans, but rather requires the intelligent adaptation of technologies to the educational process and the creation of conditions for active learning.

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РОЛЬ ПРОБЛЕМНОГО ОБУЧЕНИЯ В ФОРМИРОВАНИИ ГЕОГРАФИЧЕСКОГО МЫШЛЕНИЯ УЧАЩИХСЯ

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THE ROLE OF PROBLEM-BASED LEARNING IN THE FORMATION OF STUDENTS' GEOGRAPHICAL THINKING

Аннотация

В статье рассматривается роль технологии проблемного обучения в формировании географического мышления учащихся основной школы. Показано, что проблемная ситуация переводит изучение географии от запоминания фактов к объяснению пространственных связей, анализу причинно-следственных отношений, работе с картами, статистическими материалами и локальными наблюдениями. На основе федеральных нормативных документов и современных исследований раскрыты педагогические условия применения проблемного обучения: опора на реальные географические противоречия, использование разных источников информации, организация группового поиска решения и рефлексия. Представлены данные, отражающие связь источников с методическими выводами и примеры проблемных ситуаций по курсу географии 5–9 классов.

Abstract.

The article examines the role of problem-based learning in developing students' geographical thinking in lower secondary school. It argues that a problem situation shifts geography learning from memorising facts to explaining spatial relations, causal links, map evidence, statistical data and local observations. Drawing on federal curriculum documents and contemporary studies, the article identifies key pedagogical conditions for using problem-based learning: reliance on real geographical contradictions, use of multiple information sources, collaborative inquiry and reflection. Two tables summarise the source-based methodological conclusions and give examples of problem situations for grades 5–9 geography.

Ключевые слова: *проблемное обучение, географическое мышление, урок географии, познавательная активность, критическое мышление, пространственный анализ.*

Keywords: *problem-based learning, geographical thinking, geography lesson, cognitive activity, critical thinking, spatial analysis.*

Современный урок географии всё меньше может ограничиваться передачей готового знания. Учащемуся необходимо не только знать названия объектов, природные зоны или экономические районы, но и понимать, почему явления распределены в пространстве именно так, как связаны природные и социально-экономические процессы, какие последствия имеют решения человека для территории. Поэтому центральной задачей становится формирование географического мышления–способности видеть объект в системе пространственных, природных, хозяйственных и экологических связей.

В федеральной рабочей программе по географии подчёркивается, что предмет формирует комплексные социально ориентированные знания о Земле как планете людей, закономерностях природы, размещении населения и хозяйства, а также о проблемах взаимодействия природы и общества [2]. В целях изучения географии прямо названы развитие познавательных интересов, решение географических задач и проблем повседневной жизни, использование различных источников географической информации [2]. Эти положения делают проблемное обучение не дополнительным приёмом, а методическим способом реализации предметных и метапредметных результатов.

Актуальность темы связана и с требованиями ФГОС ООО: школьник должен уметь применять знания в учебных и жизненных ситуациях, работать с информацией, выдвигать предположения, доказывать позицию и сотрудничать [1]. Проблемное обучение создаёт условия для такой деятельности, потому что урок строится вокруг вопроса или противоречия, которое нельзя решить простым воспроизведением параграфа. Цель статьи–раскрыть роль проблемного обучения в формировании географи-

ческого мышления учащихся и показать методические возможности его применения на уроках географии.

Проблемное обучение рассматривается как организация учебного процесса, при которой знания усваиваются через постановку и решение познавательной проблемы. В отечественной педагогике А. М. Матюшкин связывал проблемную ситуацию с интеллектуальным затруднением: ученик сталкивается с противоречием между известным и неизвестным, осознаёт недостаточность прежних способов действия и начинает поиск нового способа решения [4]. Для географии это особенно важно, потому что сам предмет постоянно работает с противоречиями: почему на одной широте климат различается, почему богатая ресурсами территория может испытывать социально-экономические трудности, почему хозяйственное освоение усиливает одни преимущества территории и одновременно создаёт экологические риски.

В зарубежной педагогике проблемно-ориентированное обучение описывается как обучение через исследование открытой, жизненно значимой задачи. Зарубежные исследователи отмечают, что проблемное обучение способствует развитию критического мышления учащихся. Наиболее выраженный результат достигается тогда, когда учебная деятельность включает анализ доказательств, аргументацию, обсуждение разных точек зрения и рефлексию [5].Следовательно, сам факт постановки проблемы ещё не гарантирует развитие мышления: учителю важно продумать структуру поиска, источники информации, критерии оценки решения и форму представления результата.

Географическое мышление имеет свою специфику. Оно включает пространственное видение, умение читать и сопоставлять карты, объяснять причинно-следственные связи, учитывать масштаб территории, видеть взаимосвязь природы, населения и хозяйства. Исследователи отмечают, что использование проблемных заданий пространственного характера повышает учебную активность и критичность учащихся. В процессе такой работы школьники учатся определять географическую проблему, собирать и анализировать данные, работать с картами и другими источниками информации, а затем представлять собственные выводы [6]. Это подтверждает методическую ценность проблемного подхода именно для преподавания географии.

Методическая значимость проблемного обучения на уроках географии подтверждается как требованиями современных образовательных документов, так и результатами научных исследований. В них подчёркивается необходимость формирования у школьников умения анализировать информацию, работать с различными источниками, объяснять географические явления и принимать обоснованные решения. Для более наглядного представления этих положений обратимся к таблице 1. В таблице отражены основные идеи нормативных и научных источников, которые позволяют обосновать применение проблемного обучения в процессе формирования географического мышления учащихся.

Таблица

Обоснование роли проблемного обучения в формировании географического мышления учащихся

Источник	Ключевая идея	Методический вывод	Вклад в географическое мышление
ФГОС ООО [1]	Ориентация на применение знаний, универсальные учебные действия, самостоятельность и сотрудничество.	Проблемная задача должна требовать поиска, обсуждения и доказательства, а не только ответа по образцу.	Развивает умение объяснять явления, выбирать способ действия и аргументировать позицию.
ФРП «География» [2]	География формирует знания о Земле, закономерностях природы, населении, хозяйстве и взаимодействии природы и общества.	Проблемы следует брать из реального содержания курса: климат, ресурсы, население, природные риски, устойчивое развитие.	Формирует системное видение территории и причинно-следственных связей.
Концепция географического образования [3]	Подчёркивается необходимость повышения качества географического образования и практической направленности знаний.	Урок должен связывать учебный материал с жизнью региона, страны и мира.	Укрепляет ценностное отношение к территории и ответственность за решения.
А. М. Матюшкин [4]	Проблемная ситуация возникает как противоречие между известным и неизвестным.	Учитель должен создавать интеллектуальное затруднение и помогать ученикам осознать его.	Запускает вопросность, гипотезы и самостоятельный поиск объяснения.

Yu, Mohamed Zin [5]	PBL эффективнее, когда специально направлено на критическое мышление.	Нужны доказательства, аргументация, оценка альтернатив и рефлексия.	Развивает критическое чтение карт, статистики и текстов.
Silviariza et al. [6]	SPBL строится вокруг пространственной проблемы, сбора данных, анализа и коммуникации.	На уроках важно использовать карты, наблюдения, статистику и групповую презентацию выводов.	Формирует пространственный анализ и географическую аргументацию.

Анализ таблицы показывает, что проблемное обучение согласуется сразу с несколькими основаниями: нормативным, психологическим и предметно-методическим. Нормативные документы задают ориентацию на деятельность, применение знаний и практическую направленность географии. Психологическая теория объясняет, почему проблема вызывает познавательную активность: учащийся испытывает затруднение и вынужден перестраивать способ действия. Современные исследования уточняют, что результат появляется не автоматически, а при наличии этапов анализа доказательств, обсуждения разных версий и самостоятельного вывода. Для учителя географии это означает необходимость превращать тему урока в исследовательский вопрос: не «Климат России», а «Почему климат России настолько контрастен и как человек к нему адаптируется?».

Роль проблемного обучения в формировании географического мышления

Главная роль проблемного обучения состоит в том, что оно формирует у учащихся привычку объяснять географический факт. В традиционной логике ученик часто запоминает: «муссоны приносят осадки», «на Урале развита металлургия», «в тундре мало деревьев». В проблемной логике он отвечает на вопросы: почему это происходит, какие факторы действуют одновременно, какие данные подтверждают вывод, как изменится ситуация при другом условии. Такой переход особенно важен в основной школе, где закладывается база дальнейшего изучения географии.

Проблемная ситуация развивает пространственное мышление. Учащийся учится соотносить карту рельефа, климатическую карту, карту населения, статистическую таблицу и текстовый источник. Например, вопрос «Почему крупнейшие города чаще расположены у рек, морей и транспортных узлов?» заставляет рассматривать территорию как систему условий, ресурсов и связей. При этом карта перестаёт быть иллюстрацией и становится инструментом доказательства.

Вторая роль связана с развитием причинно-следственного анализа. Географические процессы почти всегда многофакторны: засуха зависит от атмосферной циркуляции, рельефа, хозяйственной деятельности и водопользования; размещение производства–от ресурсов, трудовых кадров, транспорта, рынка и экологических ограничений. Проблемное обучение приучает школьника не искать одну причину, а выстраивать цепочку факторов.

Третья роль заключается в формировании оценочного и прогностического мышления. География изучает не только то, что есть, но и то, как может измениться территория. Поэтому проблемные задания целесообразно завершать выводом, прогнозом или рекомендацией: какие меры снизят риск паводков, как рационально использовать природные ресурсы края, какие последствия может иметь рост города для природной среды.

Эффективное проблемное обучение на уроке географии можно представить как последовательность этапов. Первый этап–создание проблемной ситуации. Учитель показывает противоречивые данные, карту, фотографию, новостной фрагмент или статистику. Второй этап–формулирование учебной проблемы совместно с учащимися. Третий этап–выдвижение гипотез. Четвёртый этап–поиск и анализ информации: работа с картами, климатограммами, диаграммами, текстом учебника, ресурсами сети Интернет, материалами наблюдений. Пятый этап–обсуждение решений и выбор наиболее обоснованного вывода. Завершающий этап–рефлексия: что помогло решить проблему, какие данные оказались главными, какие вопросы остались открытыми.

Особое значение имеет выбор проблемы. Она должна быть доступной возрасту, связанной с содержанием программы и в то же время достаточно открытой. Слишком простой вопрос не создаёт затруднения, а слишком сложный приводит к формальному ответу. Наиболее продуктивны задачи, в которых есть противоречие между ожиданием и фактом: «Почему в пустыне ночью холодно?», «Почему в богатых природными ресурсами регионах могут возникать экологические и социальные проблемы?», «Можно ли считать строительство водохранилища только положительным преобразованием природы?».

Учитель в проблемном обучении не исчезает из урока. Его роль меняется: он организует ситуацию поиска, задаёт уточняющие вопросы, помогает выбрать источники, удерживает научность рассуждений и предотвращает подмену доказательств личными мнениями. Такая позиция особенно важна при обсуждении экологических, демографических и хозяйственных вопросов, где школьники часто опираются на бытовые представления.

В таблице 2 представлены примеры проблемных заданий, которые могут быть включены в уроки географии 5–9 классов. Они соотносятся с содержанием федеральной рабочей программы, где предусмотрены наблюдения, практические работы, анализ карт, статистических материалов и проблем взаимодействия природы и общества [2].

Класс / тема	Проблемный вопрос	Источники и деятельность учащихся	Формируемые элементы мышления
5 класс. География– наука о Земле	Почему один и тот же объект можно описать по-разному: как природный, хозяйственный и культурный?	Сравнение фотографий, карты местности, рассказа очевидца; составление схемы признаков объекта.	Понимание многомерности географического объекта.
6 класс. Атмосфера и погода	Почему прогноз погоды иногда не совпадает с фактической погодой в нашей местности?	Наблюдения, дневник погоды, метеокарта, сравнение температуры, влажности и облачности.	Работа с данными, вероятностное объяснение, причинно-следственные связи.
7 класс. Климат Земли	Почему территории на одной широте могут иметь разный климат?	Сопоставление карт климатических поясов, течений, рельефа и климатограмм.	Пространственный анализ, учёт комплекса факторов.
8 класс. Природные ресурсы России	Всегда ли богатство природных ресурсов делает регион экономически успешным?	Карты полезных ископаемых, статистика населения и транспорта, обсуждение экологических рисков.	Системное мышление, оценка противоречий развития территории.
9 класс. Хозяйство и регионы России	Как выбрать место для нового предприятия с учётом ресурсов, транспорта, рынка труда и экологии?	Работа в группах с картами, таблицами, критериями выбора; защита проекта размещения.	Принятие решения, аргументация, прогноз последствий.

В целом, проблемное обучение может применяться не эпизодически, а системно на разных ступенях курса. В 5–6 классах оно помогает перейти от непосредственного наблюдения к первичному объяснению, поэтому задания должны опираться на местность, погоду, фотографии, простые карты. В 7–8 классах возрастает роль сопоставления нескольких карт и выявления закономерностей: ученик учится видеть климат, рельеф, ресурсы и расселение как взаимосвязанные компоненты. В 9 классе проблемное обучение приобретает проектно-аналитический характер: школьники оценивают варианты территориального развития, учитывают экономические и экологические последствия. Такое усложнение соответствует логике формирования географического мышления: от наблюдения–к объяснению, от объяснения–к оценке и прогнозу.

Оценивание при проблемном обучении также должно учитывать не только правильность ответа, но и качество рассуждения. Критериями могут быть: точность формулировки проблемы, использование источников, логичность причинно-следственных связей, умение учитывать разные факторы, аргументированность вывода, участие в обсуждении. Такая система оценивания поддерживает формирование географического мышления, потому что показывает ученику ценность самого процесса анализа.

Проблемное обучение играет существенную роль в формировании географического мышления учащихся, поскольку делает урок географии деятельностным, исследовательским и доказательным. Через проблемную ситуацию школьники учатся видеть географическое явление не изолированно, а в системе пространственных, природных, социальных и хозяйственных связей. Они осваивают работу с картами и статистикой, выдвигают гипотезы, сравнивают источники, аргументируют выводы и оценивают последствия решений для территории.

Наиболее значимым результатом является переход от репродуктивного знания к осмысленному применению. Ученик, включённый в решение географической проблемы, не просто воспроизводит материал учебника, а действует как начинающий исследователь: задаёт вопрос, ищет данные, проверяет объяснение и делает вывод. Именно поэтому технология проблемного обучения может рассматриваться как одно из эффективных средств реализации требований современного географического образования и развития познавательной активности учащихся.

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THE ROLE OF HEROIC EPICS IN PRIMARY EDUCATION AND THEIR TEACHING THROUGH ARTIFICIAL INTELLIGENCE (AI) PROGRAMS

Abstract:

The article discusses the role of Azerbaijani heroic epics in primary school education and their teaching through artificial intelligence programs. Heroic epics are an important part of the nation's spiritual heritage, and this heritage should be introduced to children from an early age. The teaching of folklore examples helps to develop patriotism, loyalty, respect for elders, responsibility, and other moral values in pupils. It also forms children's initial understanding of good and evil and creates positive behavior models through heroic characters.

The article also addresses the limited representation of folklore examples in primary school textbooks and the pedagogical problems related to this issue. When pupils are not sufficiently familiar with the folklore of their people, they may develop a superficial understanding of national and moral values. Their oral speech may also develop weakly, and their interest in reading may decrease. To prevent these problems, folklore examples should be included more widely in textbooks, and additional teaching materials should be prepared.

One of the main issues discussed in the research is the integration of folklore examples, especially heroic epics, with other subjects during the teaching process. In this regard, the use of artificial intelligence programs is considered important. The article highlights the significance of teaching epics through AI tools and presents specific examples. Lesson samples created with the help of ChatGPT, CapCut, Canva AI and other programs are also presented. The research shows that the proper and purposeful use of modern programs makes lessons more interesting, visual, and memorable, and meets the needs of modern pupils.

Keywords*: heroic epics, artificial intelligence programs, teaching folklore, interactive learning, national and moral values*

Introduction

Folklore is a rich cultural heritage that reflects the history, national and moral values, worldview, and way of life of a people. This cultural heritage should be instilled in children from the earliest years, and efforts should be made to transmit folklore from generation to generation. Primary education, which is considered one of the most important stages of learning, introduces pupils to examples of folklore. From an early age, children become familiar with national identity, language, and moral values. Through fairy tales, epics, riddles, proverbs, bayatis, and other folklore examples, which form an important part of Azerbaijani folklore, children grow up in a national spirit and develop attachment to national and moral values.

Both excerpts from epics and examples such as folk tales, riddles, proverbs, counting rhymes, lullabies, and other lyrical forms broaden children's worldview. A significant part of the folklore taught in primary classes consists of heroic epics. The teaching of heroic epics strengthens children's love for the homeland and connects them to their nation. As children become acquainted with heroic characters, they also become familiar with such moral values as courage, bravery, fearlessness, determination, honesty, loyalty, attachment to family, and respect for elders.

When young children read epic narratives, they begin to imagine the events in their minds. This process develops their imagination and creativity. During the teaching of epics, children's vocabulary becomes richer and their speech develops. As children become attached to heroic characters, they become more eager to read and discover new literary works, which increases their interest in reading.

Moreover, most heroic epics are connected with particular historical events and preserve certain periods of history. These epics, dedicated to historical figures, do not merely describe the heroism of those figures; they also form initial ideas about the past of the nation. Children obtain information about the way of life, customs, and traditions of those historical periods. Thus, national heroic traditions begin to form in young children.

Heroic epics may also be considered an important tool for children's moral education. Through these texts, children learn to distinguish between good and evil and to understand the concept of justice. For example, in the second grade, through a short excerpt from the epic "The Dede Korkut", children receive information about the naming ceremony in ancient times in our country. They learn that in the Oghuz community, a young person who demonstrated heroism was given a name by the elder Dede Korkut in accordance with his deed. Heroism was the main condition for earning a name. The naming ceremony in Dede Korkut shows children that a name is not merely a word used to call a person, but also an indicator of personality, bravery, dignity, and the respect earned in society. If a person earns a name through bravery, then it means that one must be courageous, noble, and worthy. Dede Korkut's act of giving names also instills in children the idea of respect for the words and wisdom of elders (Nurullayeva, U., Zahidova, Sh., Bayramova, I., Khanaliyeva, A., & Mahyaddinova, K. , 2022, pp.22).

In the third grade, several episodes from Dede Korkut, which is considered a common epic of the Turkic peoples, are included in the curriculum. The episode "Bugach, Son of Dirse Khan," taught as a listening text, describes the heroism of Bugach, who rescues the

daughter of Bayandir Khan, a hero of the Oghuz people. Through this episode, pupils understand that a person's value is measured not by origin, but by good deeds, bravery, and dignified behavior. The image of Bugach creates a positive behavioral model for children and strengthens their attachment to the homeland, family, and national and moral values.

The text "Garaja Choban," included in the third-grade textbook, is a valuable folklore example in terms of glorifying loyalty and friendship. The shepherd is a representative of ordinary people who does not turn away from his path and persistently saves Gazan Khan, remaining loyal to him. Although Garaja Choban is a simple representative of the people, he is presented in the epic as a brave, loyal, courageous, and trustworthy person. This character shows children that heroism does not belong only to wealthy, powerful, or high-ranking individuals. An ordinary person can also become a hero through courage, loyalty, and proper behavior. (Nurullayeva, U., Zahidova, Sh., Bayramova, I., Khanaliyeva, A., & Mahyaddinova, K., 2022, pp.34-36)

Similarly, in the episode "The Story of Segrek, Son of Ushun Koja," Segrek demonstrates loyalty to his brother Egrek and sacrifices himself for the sake of his brother, who has been captured by the enemy. The love between the two brothers reflects the inviolability of family bonds. (Nurullayeva, U., Zahidova, Sh., Bayramova, I., Khanaliyeva, A., & Mahyaddinova, K. 2022, pp.38-39) An annotation of the epic "Kitabi Dede Gorgud" is presented in the 4th grade textbook. Information about the history of the epic's creation is also presented on that page. The story "Basat's Killing of Tepegoz" is shown as a picture on the cover of the book. It is recommended that the teacher provide information about this story and have the students watch the cartoon and discuss it ("The Killing of Tepegoz by Basat" (Video material).

The research shows that examples from heroic epics are presented only to a limited extent in primary classes. In general, compared with fairy tales and legends, examples from epics are less frequently included in primary education. The main reason for the limited use of heroic epics in primary classes is that their language, plot, and content are relatively complex for younger children. Epics contain archaic words, historical events, extensive descriptions, numerous characters, and sometimes serious conflicts. Therefore, it is more appropriate to present these texts to primary school pupils not in full form, but as simplified episodes adapted to their age level.

For this purpose, the use of special AI programs such as ChatGPT, Microsoft Copilot, and Google Gemini is appropriate. These tools can help overcome linguistic complexity. Since the plot structure of epics is broad, the system of characters is rich, and the language is sometimes archaic and difficult, their full comprehension by younger schoolchildren may create certain challenges. Nevertheless, the teaching of selected, simplified, and age-appropriate episodes from heroic epics through AI programs is both possible and beneficial.

Despite these difficulties, children at this age can become familiar with short episodes from such epics as "Gachag Nabi", "Koroglu", "Dede Korkut", and others as reading comprehension texts. For example, age-appropriate episodes may be presented about Gachag Nabi's becoming an outlaw, his difficult childhood, and the battles in which he and Hajar showed heroism together. From the epic of the Gachag Nabi, episodes can be presented that show the hardships Nabi endured in his childhood and his bravery, quickness, and justice in his childhood. For example, "Because Bey cut off Nabi's money, Nabi took his lamb and brought it home" (Abbaslı İ. 2005, p.41)

Similarly, it is possible to teach primary school pupils about how Rovshan earned the name Koroglu, his struggle against oppressors, and poetic examples dedicated to his warriors.

It is true that in a very small passage in the 4th grade textbook we come across information about Koroglu, but in my opinion, a simplified episode from the epic could also be included in this section. Koroglu had settled in the Chanlibel fortress with his group. He was fighting to protect the rights of the poor with a Kirat on his back, an Egyptian sword in his hand, and seven thousand seven hundred and seventy-seven shillings (Ismayilov, R., Nurullayeva, U., Zahidova, Sh., Bayramova, I., Khanaliyeva, A., & Mahyaddinova, K. , 2023) In this section, it would be appropriate to use artificial intelligence programs (Canva, HeyGen, CapCut, ChatGPT image generator, etc.). For example, a Koroglu image can be created. We can compose and sing a small text with Koroglu's voice according to the image. "I am Koroglu, who fights against oppressors and is considered a friend of the poor. This is my sword, and this is Chanlibel". In my opinion, it would also be possible to present an episode taken from the epic. For example, there could be a small fragment from the chapter "Koroglu and Bolu Bey". Bolu Bey's journey to Chanlibel with his army, his encounter with Koroglu, and subsequent adventures can be presented in a shortened and simplified form ("Koroglu and Bolu Bey" chapter. *Children's Knowledge Portal*).

In my opinion, few examples are included from "Dede Korkut", which is the common epic of the Turkic nation and a spiritual treasure of the Turkic peoples. It is necessary to increase the number of these episodes. The main reason for this is to form pupils' understanding of national identity from an early age. Textbooks may include sufficient episodes related to the women of the Oghuz community. The bravery, courage, and family devotion of Burla Khatun develop courage in children, while the intelligence and agility of Banuchichek create self-confidence in girls. There are many female characters in the epic, and it is possible to use a sufficient number of exemplary episodes.

Nevertheless, folklore examples are not given enough space in primary education. This stands before us as a serious problem because pupils' attachment to national values decreases. When children hear fewer folklore examples, they perceive national and moral values more superficially. Their attachment to national identity becomes weaker. Their oral speech also weakens, and they have difficulty aexpressing their thoughts, because folklore examples teach children to speak fig-

uratively, narrate events in sequence, and describe heroic characters fully. When such examples are limited, the child's expressive vocabulary also remains restricted.

The use of heroic epics as listening and comprehension texts in primary classes would produce positive results. It would be appropriate to include these texts in methodological guides prepared for teachers. In my opinion, the teacher may read a selected episode from an epic and prepare a presentation for children about the passage. In this process, artificial intelligence programs can be very helpful. For example, Quizizz AI and Kahoot AI can be used to prepare tests, while Canva AI, Microsoft Copilot PowerPoint, and ChatGPT can be used to prepare presentations.

Alongside traditional methods, the use of modern technologies in teaching epics makes this process more interesting and effective. Artificial intelligence creates opportunities for individualized learning, makes lessons interactive, facilitates the preparation of visual and audio materials, increases pupils' interest, focuses their attention, supports comprehension, enhances their activity, develops creativity, and helps the learned material remain in memory for a longer period. These technologies save teachers time and improve the quality of teaching. They make the learning process more modern, effective, and interactive.

In teaching heroic epics through artificial intelligence, it is possible to organize animated and digital representations of epic heroes. In this case, children see the hero as a speaking, moving, and vivid character. The use of artificial intelligence technologies in teaching epics is one of the important tools for increasing pupils' interest in the lesson. Modern programs such as CapCut, Canva, and HeyGen may be used for this purpose.

For example, presenting the characters of "Dede Korkut" in animated and speaking form through artificial intelligence makes the topic more interesting, enjoyable, and memorable. While ChatGPT and Gemini can simplify the content of the epic according to children's age level and prepare question-and-answer tasks and creative assignments, Canva AI is useful for creating visual presentations and character maps. Visual materials are especially important for primary school pupils, as they make the lesson more engaging.

Programs such as CapCut and Suno can be used in preparing music and text-based materials. Artificial intelligence can also voice texts. By presenting folklore examples in audio format, the teacher can develop children's correct pronunciation and listening skills. The use of these programs makes the lesson more interactive, visual, and learner-centered.

With the help of artificial intelligence, pupils can create their own tales, develop heroic characters, and continue stories. This method develops pupils' imagination, creative thinking, and speech skills, while also creating conditions for national and moral values to be instilled more effectively. Artificial intelligence also helps teachers prepare questions and answers, tests, assignments, presentations, illustrated cards, and scene plans. This makes the lesson more interactive and develops pupils' creativity.

Through folklore examples, it is possible to develop children's imagination. Drawing pictures based on epic heroes, preparing scenes, and creating animations make children more active. Integration with other subjects is also possible in this context. For example, in the third grade, this topic may be integrated with STEAM through the theme "Create Your Own Hero," with life skills through the theme "National Values," and with visual arts, technology, and music. The Suno program may be used to create music related to a hero, while Canva AI may be used to design the image of a hero.

Complex folklore examples such as "Dede Korkut" can be presented to primary school pupils in a more understandable, simple, and engaging form. For example, the episode "Basat Defeats Tepegöz" may first be prepared as an image through artificial intelligence programs, and then animated through programs such as Canva, Pika, or Runway. Thus, the child not only reads the epic, but also sees and hears it, which helps the event remain in memory more effectively.

Artificial intelligence technologies make the teaching of epics such as "Dede Korkut" in primary classes more visual, interactive, and learner-centered. Through these technologies, epic texts are adapted to pupils' age level, characters are visualized, and events are presented in the form of animations and presentations. As a result, pupils learn folklore examples with greater interest, and their reading, listening, imagination, and creative thinking skills develop.

Through AI tools, it is possible to prepare riddle games, matching tasks, and quizzes. These games help children learn while having fun and contribute to the development of their logical thinking.

Conclusion

Based on the conducted research, it can be concluded that folklore examples, especially heroic epics, play an important role in the national and moral education of primary school pupils. These examples create initial ideas in children about the history, customs, traditions, and moral values of our people and strengthen their sense of national identity.

Selected episodes from such epics as "Dede Korkut", "Koroglu", and "Gachag Nabi" form in pupils such qualities as love for the homeland, courage, bravery, loyalty, honesty, attachment to family, respect for elders, and justice. The heroes of these epics serve as positive behavioral models for children. The teaching of epics also develops pupils' speech, vocabulary, thinking, and ability to express ideas in a coherent sequence. At the same time, epics strengthen their imagination, creative thinking, and interest in reading.

One of the main findings of the research is that heroic epics are not sufficiently represented in primary school textbooks. This is due to the fact that the language, plot, and system of characters in epics are relatively complex for younger children. However, this difficulty should not be considered a reason to exclude epics from teaching. On the contrary, epics should be presented in the form of simplified episodes adapted to children's age level.

The study also addresses the role of artificial intelligence in teaching heroic epics. In the modern period,

AI programs can greatly assist teachers in this process. Through ChatGPT, Gemini, and Microsoft Copilot, epic texts can be simplified and questions and assignments appropriate to children's age level can be prepared. With the help of Canva AI, CapCut, Pika, and Runway, images, presentations, and animations of epic heroes can be created. Kahoot and Quizizz AI make it possible to organize lessons in the form of tests and games.

In conclusion, the teaching of heroic epics in primary classes is highly beneficial both for national and moral education and for the development of pupils' speech, thinking, and creative skills. These epics form national identity, patriotism, and attachment to moral values in children. Therefore, the number of epic examples in primary school textbooks should be increased, and these examples should be presented in a form appropriate to pupils' age level.

The proper use of artificial intelligence makes this process more interesting, interactive, and memorable. Artificial intelligence is an innovative technology that creates broad opportunities in modern education. These technologies increase children's interest in national and cultural heritage and develop their creative and critical thinking skills. In the future, the wider application of artificial intelligence in folklore teaching will contribute to the more effective transmission of national heritage to new generations.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN MEDIA EDUCATION: TRANSFORMATIVE APPROACHES IN NEXT-GENERATION JOURNALIST TRAINING

Abstract
The article analyzes the impact of artificial intelligence technologies on media education, the transformative changes they create in journalist training, and new pedagogical approaches from a scientific-theoretical perspective. In the contemporary era, generative artificial intelligence systems have altered information production, content management, data analytics, and communication processes in the media field [1; 4]. These changes have also led to the formation of new teaching models in journalism education. Within the research framework, the experiences of international universities, AI-based media laboratories, the renewal of journalistic competencies, ethical issues, and digital transformation matters have been investigated [5; 9]. The article also presents practical examples of using AI technologies in the educational process. It has been determined that artificial intelligence acts not only as a technological tool but also as a key element of a new pedagogical paradigm in media education.

Keywords*: artificial intelligence, media education, journalism, generative AI, ChatGPT, digital communication, media ethics, journalist training, AI literacy.*

Introduction.

Globalization and the development of digital technologies have created fundamental changes in the media system, as in all spheres of modern society [5]. As a result of the development of internet technologies, the rapid spread of social media, and the integration of artificial intelligence systems into the communication environment, a serious transformation process has begun in the structure of journalistic activity [2]. The traditional model of information production no longer fully meets the demands of contemporary digital media. In the new media environment, speed, multimedia capabilities, data analytics, and technological flexibility have become key factors.

The introduction of artificial intelligence technologies into the media field has significantly changed information production and distribution processes. Currently, AI-based systems perform functions such as automatic news preparation, database analysis, audience behavior study, multimedia content creation, and social media strategy development [1; 8]. This leads to the formation of new professional standards in journalistic activity.

The emergence of generative artificial intelligence technologies, in particular, has created new challenges in media education. Since systems like ChatGPT can produce text, audio, and visual materials, technological literacy is considered one of the core competencies in journalist training [4]. A modern journalist must not only know how to write but also understand the working principles, ethical risks, and technological limitations of AI systems.

For this reason, the necessity of updating journalism programs in higher education institutions has arisen. Several universities have already incorporated data journalism, AI ethics, digital security, and multimedia communication technologies into their curricula [6]. These changes accelerate the transformation of media education.

The purpose of this article is to investigate the role of artificial intelligence in media education, analyze the changes it brings to journalist training, and identify prospective directions based on international experiences.

Artificial Intelligence and the Transformation of the Media System

A new stage of digital media

The rapid development of information technologies in the 21st century has brought about fundamental changes in the media system [5]. Although the traditional media model was based on television, radio, and print media for many years, the development of the internet and digital platforms has completely changed the structure of information circulation. In the modern era, news production and distribution have become dependent not only on the professional skills of the journalist but also on technological capabilities.

As a result of digital transformation, media organizations have begun to turn to artificial intelligence technologies to accelerate information production and establish faster communication with the audience [1]. This process is particularly evident in news portals, social media platforms, and multimedia newsrooms.

In the modern media environment, artificial intelligence performs functions such as:

- Automatic news preparation;
- Data analysis;
- Predicting audience behavior;
- Identifying social media trends;
- Creating multimedia content.

International experience shows that the application of artificial intelligence technologies increases the efficiency of media organizations. The Associated Press uses systems that automatically produce news texts based on financial reports and sports statistics. The "Lynx Insight" system implemented at the Reuters news agency assists journalists in analyzing large databases and identifying potential news topics [2].

These changes have also altered the functional characteristics of journalists. A modern journalist acts

not only as a news writer but also as a multimedia specialist capable of working on digital platforms.

Generative artificial intelligence and media

Generative artificial intelligence technologies have laid the foundation for a new stage in the media field. The emergence of systems like ChatGPT, in particular, has significantly impacted the media content production process.

Currently, AI systems:

- Prepare news headlines;
- Build article structures;
- Create social media posts;
- Perform translations into various languages;
- Produce video and audio content.

While these technologies offer significant advantages in terms of speed, they have also brought ethical issues to the forefront. Artificial intelligence systems can sometimes provide inaccurate information or misinterpret existing data. This further increases the importance of fact-checking mechanisms in journalistic activity.

Generative AI systems are also widely used in media education. Students analyze texts generated by AI and evaluate their structure and content quality. This process develops both the technological and analytical skills of the students.

Application of Artificial Intelligence Technologies in Media Education

Digitalization of the teaching process

The development of artificial intelligence technologies has created significant changes in the higher education system. The traditional teacher-centered teaching model is being replaced by a student-oriented, technology-based education model [3].

AI-based platforms analyze students':

- Academic performance;
- Learning pace;
- Individual interests;
- Creative potential;

and form a personalized teaching model.

This approach holds particular importance in journalism education. Creative thinking and individual approaches play a crucial role in the media field. AI technologies help identify students' strengths and weaknesses and provide them with suitable practical tasks.

The shift to distance education models during the pandemic further highlighted the importance of artificial intelligence technologies. Modern universities have begun to organize students' practical activities in a digital environment through virtual newsroom models [6].

Virtual newsroom models and practical experience

Virtual newsroom models in media education allow students to gain practical experience close to real journalistic activity.

In these models, students:

- Prepare news;
- Work with AI-based analytical systems;
- Create multimedia content;
- Develop social media strategies;
- Carry out data journalism projects.

At media laboratories operating under Columbia University, students work with AI-based news production systems. They are taught methods of database analysis, fact-checking, and automated news writing.

This experience strengthens the integration of theoretical and practical components in journalist training.

Renewal of Journalistic Competencies in the Age of Artificial Intelligence

New professional skills

The functional characteristics of the journalism profession have changed in the age of artificial intelligence. A modern journalist is not merely a person who collects information and writes text but a media specialist capable of working with digital technologies.

The next-generation journalist must possess the following skills:

- Multimedia content production;
- Data analytics;
- Working with AI systems;
- Digital security;
- Social media management;
- Fact-checking methodologies.

These changes have necessitated the updating of curricula in media education. Universities now teach journalism students not only theoretical knowledge but also the skills to work on digital media platforms.

One of the most critical issues for the modern journalist is critical thinking ability. Since artificial intelligence provides ready-made information, the journalist must analyze that information, verify sources, and uphold the principle of public responsibility.

AI literacy and the new education model

The concept of "AI literacy" has gained particular importance in media education. AI literacy refers to:

- Understanding the working principles of artificial intelligence systems;
- Knowing their capabilities and limitations;
- Assessing ethical risks;
- Identifying technological dangers.

Several European universities teach courses titled "AI and Media Ethics" to journalism students. These courses analyze deepfake technologies, disinformation, and information manipulation issues.

This approach helps shape not only the technological but also the ethical responsibility of students.

Artificial Intelligence and Media Ethics Issues

Disinformation and the deepfake threat

Alongside the development of artificial intelligence technologies, issues of disinformation and deepfakes have become increasingly relevant. Deepfake technologies produce realistic-looking but fake images.

This situation has brought problems such as:

- Information security;
- Media reliability;
- Manipulation of public opinion;

to the forefront. In media education, it is considered essential to teach students methods for detecting deepfake technologies and ensuring information security.

AI literacy and ethical problems

The concept of "AI literacy" has gained particular importance in media education. AI literacy refers to understanding the working principles of artificial intelligence systems, knowing their capabilities and limitations, assessing ethical risks, and identifying technological dangers [4].

Alongside the development of artificial intelligence technologies, issues of disinformation and deepfakes have also become current. Deepfake technologies produce realistic-looking but fake images. This situation has brought problems such as information security, media reliability, and manipulation of public opinion to the agenda [6].

The text generation capability of generative artificial intelligence systems has highlighted the problem of academic integrity in universities. Students' use of ready-made AI texts increases the risk of plagiarism and alters the concept of authorship. Therefore, defining ethical frameworks for AI use in universities is considered essential [10].

Academic integrity and copyright

The text generation capability of generative artificial intelligence systems has highlighted the problem of academic integrity in universities.

Students' use of ready-made AI texts:

- Increases the risk of plagiarism;
- Weakens the creative thinking process;
- Changes the concept of authorship.

For this reason, it is important to establish ethical rules for the use of AI in media education. Universities should teach students the principles of correctly using AI systems.

International Experience and Perspectives

UNESCO has prepared specific recommendations regarding the integration of artificial intelligence into the education system. These recommendations highlight ethical principles, digital equality, and human rights as main priorities.

Universities such as the University of Oxford, Harvard University, and Stanford University operate specialized laboratories for AI and journalism.

These programs teach:

- Data journalism;
- AI ethics;
- Automated news production;
- Digital media innovations.

Steps are also being taken towards the digital transformation of media education in Azerbaijani universities. The number of courses on multimedia journalism, digital communication, and social media technologies is increasing.

Conclusion

Artificial intelligence technologies have created fundamental changes in the media system and have laid the foundation for a new transformation stage in journalism education. In the modern era, AI systems act not only as technological tools but also as strategic elements influencing the organization of the teaching process. The automation of information production, data analytics, multimedia content creation, and audience behavior study have formed new professional standards in media activity.

Research shows that artificial intelligence in media education significantly impacts students':

- Increase in technological literacy;
- Development of analytical thinking skills;
- Formation of the ability to work in a multimedia environment;
- Strengthening of individual creative potential.

AI-based virtual newsroom models and digital laboratories enhance students' practical preparation and adapt them to the real media environment. This approach further strengthens the integration of theoretical and practical components in journalism education.

However, the application of artificial intelligence technologies in the media field also brings several ethical problems to the forefront. Deepfake technologies, disinformation, copyright issues, and academic integrity are considered major problems of modern media education. Therefore, the teaching of AI technologies should not be limited to technical aspects but should also encompass ethical and legal responsibility principles.

A modern journalist must not be merely a user of technology but also a professional communicator who protects information security and public responsibility. In this regard, developing AI literacy in journalism education has strategic importance.

Consequently, artificial intelligence should be evaluated not as a technology that completely replaces journalism but as an innovative tool that transforms it and creates new professional standards. Future media education should be formed based on the integration of technological innovations with humanitarian and ethical approaches.

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TECHNOLOGY INTEGRATION AND ETHICAL RESPONSIBILITIES IN PEDAGOGICAL APPROACHES

Abstract

This article discusses the integration of technology into pedagogical approaches and highlights the ethical responsibilities associated with its implementation in education. The study emphasizes the importance the digital tools in creating more interactive, accessible, and effective learning environments. At the same time, it draws attention to challenges such as data privacy, responsible technology use, and teachers' digital competence. The article also examines the impact of the COVID-19 pandemic, which demonstrated the necessity for educators to adapt to digital teaching environments and improve their technological skills. The research is based on the analysis of existing literature and contemporary educational practices. The findings suggest that successful technology integration requires not only technical resources but also ethical awareness, adaptability, and continuous professional development among educators.

Keywords*: technology integration, pedagogy, digital learning, ethical responsibilities, education, digital competence*

It goes without saying that the world is evolving at an extremely rapid pace, making it increasingly difficult to predict the future. Naturally, this transformation exerts a significant influence on the education system and the ways in which students learn. It is a fact that the modern world no longer rewards individuals solely for what they know, as search engines provide access to vast amounts of information, but rather for how effectively they can apply and utilize that knowledge. Today, society requires individuals who are creative, adaptable to changing circumstances, and capable of responding to uncertainty. Likewise, both the education system and the job market increasingly value critical thinkers, effective collaborators, and strong communicators.

As Richard Riley states, "We are currently preparing students for jobs that do not yet exist, using technologies that have not yet been invented, in order to solve problems that we do not even know are problems yet." In such an unpredictable and constantly changing world, one of the most important actions we can take is to adapt quickly to change and effectively exploit the potential of emerging technologies to achieve our goals. Furthermore, the COVID-19 pandemic once again demonstrated the crucial importance of technology integration and digital competence, while also teaching individuals the necessity of being adaptable in challenging situations.

This article will discuss the importance of integrating technology into the education system, explore effective ways of implementing it, and examine the responsibilities that should be considered in technology-integrated lessons.

When discussing the importance of technology integration, it is essential to emphasize that it has become a necessity in modern education. Today's students are often referred to as digital natives, as they have grown up in a technology-driven world and are naturally familiar with digital environments. In contrast, many teachers can be considered digital immigrants, who may not always feel equally comfortable using technology in educational settings. Therefore, educators should adapt to the needs and learning styles of modern learners.

Moreover, the demands of the contemporary job market require individuals to possess a variety of essential skills, including communication, collaboration, and digital literacy. These competencies can be effectively developed through technology integration and by keeping pace with ongoing technological advancements.

There are several advantages of using technology in education that should be highlighted. One of the most significant is adaptive learning, which refers to the use of data-driven educational platforms that monitor students' progress and adjust learning materials according to their individual needs and performance levels. As a result, students become more aware of their own learning progress, develop greater independence, and experience more personalized learning opportunities.

One notable example of an adaptive learning platform is *Khan Academy*, a free online educational platform that provides short video lessons with clear and accessible explanations. In addition, it incorporates gamified elements such as points, badges, and progress tracking systems, which increase student motivation and engagement in the learning process.

Another widely used adaptive learning platform is *DreamBox Learning*, which adjusts the difficulty level of questions in real time according to students' performance. The platform provides immediate feedback and helpful hints while incorporating interactive and game-like activities, particularly for younger learners. In addition, teachers are able to access detailed analytics related to students' progress, learning gaps, time spent on tasks, and problem-solving strategies. Consequently, students gain greater independence and are able to learn at a pace that best suits their individual needs. As previously mentioned, adaptive learning contributes significantly to autonomous learning and student engagement. In this regard, Daniel H. Pink states, "Control leads to compliance; autonomy leads to engagement."

Another important platform is Newsela, which provides real-world articles and news from reliable sources. One of its most valuable features is the ability to adjust each article to five different reading levels, allowing students with varying language proficiencies to study the same topic simultaneously. The benefit of this feature is that differentiation can be effectively implemented in the lesson by taking students' language levels, needs, and interests into consideration. It is an undeniable fact that without considering students' abilities, the lesson may become ineffective and lead to demotivation among some learners. If the lesson is too easy, it may fail to spark the interest of students with stronger language skills. On the other hand, overly difficult tasks may become a significant challenge for students with lower proficiency levels. Therefore, maintaining a balance through the use of digital platforms such as Newsela can greatly enhance the overall effectiveness of the learning process. Furthermore, the platform includes quizzes, writing prompts, discussion questions, and annotation tools that support interactive learning. Teachers can also monitor students' reading progress, quiz performance, and overall engagement levels.

Increasing student engagement is another major advantage provided by technology integration. It is widely recognized that children and young learners are highly attracted to games. A closer analysis reveals that the main elements that capture students' attention in games are points, badges, and progress tracking systems. By incorporating these elements into lessons through gamification, teachers can create more motivating and interactive learning environments. Platforms such as Kahoot! and Quizizz are among the best examples of gamified learning tools.

In addition, Flocabulary enhances vocabulary learning through the use of rap songs and rhythm, helping students remember new words more effectively. It makes even difficult topics more engaging and helps students retain information in their long-term memory rather than memorizing concepts by heart, which usually supports only short-term memory and gradually fades over time. Each lesson includes music videos, quizzes, vocabulary games, reading activities, and discussion tasks. The platform also offers a feature called Lyric Lab, where students can create their own educational rap lyrics. Its strong visual animations further contribute to maintaining students' attention and engagement throughout the lesson.

Furthermore, assigning additional tasks beyond textbook activities can encourage students to become more creative and develop critical thinking skills. Several digital platforms can support this process. For instance, *Storyboard* allows students to create digital comics, *SoundTrap* enables them to produce podcasts, and *Adobe Spark* helps students design graphics and visual content. Such tools provide learners with opportunities to think creatively, express their ideas, and engage in more meaningful learning experiences.

Experiential learning is another major advantage of technology-integrated education, as it enables students to learn through experimentation, exploration, and discovery. Virtual Reality (VR) learning platforms allow learners to construct knowledge through three-dimensional modeling and visualization. In this process, students do not simply memorize information; instead, they actively discover concepts on their own, which contributes to stronger memory retention and deeper understanding.

For example, *Merge EDU* enables students to examine virtual 3D objects from multiple angles, making abstract concepts more visual, interactive, and easier to comprehend. Through this platform, students can explore a virtual human heart, observe planets, or examine volcanoes in three-dimensional form, creating a more immersive learning experience. Similarly, *CoSpaces EDU* allows students to build virtual museums, historical simulations, interactive stories, and educational games. The platform also supports block-based coding and scripting, encouraging both creativity and problem-solving skills.

Another important benefit of technology integration is the expansion of classroom walls. Technology creates opportunities for students to connect with educators, experts, and peers from different parts of the world, while also enabling participation in virtual field trips and collaborative activities. Platforms such as *Skype* and *Google Meet* are effective examples that facilitate communication and interaction beyond the traditional classroom environment.

Promoting social sharing is also an important aspect of technology-integrated education. It is a well-known fact that students become more motivated when they can see the purpose, value, and outcomes of the projects they create. Sharing their work with others adds meaning to the learning process and increases their sense of achievement. In this regard, *Padlet* serves as an effective platform where students can share projects through digital bulletin boards and provide feedback to one another. Similarly, *Seesaw* enables students to share their projects, collect digital portfolios, and document their learning progress. Additionally, the platform enhances family engagement, as parents are able to observe students' progress, review their work, and provide comments or feedback.

Technology integration also contributes significantly to teacher development. Not only students but also teachers can benefit from digitalization in education. For instance, *Edthena* allows educators to learn from one another by observing lessons taught by teachers from different parts of the world, thereby supporting professional growth and reflective teaching practices. Moreover, *TeachFX* helps teachers analyze and balance classroom interaction by monitoring the proportion of teacher talk and student talk, ultimately promoting more student-centered learning environments.

All of these examples once again demonstrate that the role of teachers in modern education is no longer limited to simply transmitting knowledge, but rather to guiding students in finding their own paths and supporting them throughout the learning process. Effective modern classrooms are increasingly based on a student-centered approach, in which learners exploit the benefits of technology to research, explore, discover, and construct knowledge independently. This process enables students to retain information more effectively in

their long-term memory and, more importantly, understand how to apply that knowledge in real-life situations. Consequently, teachers now primarily perform the role of facilitators rather than traditional lecturers.

However, this does not mean that technology integration always produces positive outcomes. In some cases, certain drawbacks and challenges may also arise. One of the major concerns is privacy and data protection. Although such issues are significant, it is still possible to take preventive actions in order to minimize their negative effects. For example, PBS Learning Media can be used to teach students about digital footprints, cyberbullying, identifying reliable information sources, and understanding the consequences of oversharing personal information online.

Another important issue related to technology integration is equality and accessibility. The distribution of technological devices and internet access is not equal across different regions of the world, which creates barriers for many learners. In this regard, it is worth mentioning a project implemented in Türkiye called the Firefly Project. The Firefly Project is a mobile education initiative in which specially designed learning trucks travel to disadvantaged areas and provide children with interactive educational experiences, technology access, and science-related activities. Projects such as this can serve as positive initiatives in addressing issues of educational inequality and limited technological access.

At the same time, recent evidence suggests that excessive use of technology may imitate symptoms associated with addiction, which raises serious concerns for educators and parents alike. Nevertheless, this does not mean that the negative effects of technology cannot be prevented or reduced through responsible and balanced usage. Therefore, asking whether technology is entirely "good" or "bad" is, in many ways, the wrong question. Technology possesses both advantages and disadvantages, and its impact largely depends on how effectively and responsibly it is implemented.

Ultimately, integrating technology into classrooms is becoming less a matter of choice and more a professional responsibility. As mentioned earlier in this article, the new generation consists of digital natives who have grown up surrounded by technology. For this reason, educators must adapt to the needs of modern learners rather than expecting learners to adapt to outdated educational approaches.

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THE ROLE OF AI IN EDUCATION

Abstract

The use of artificial intelligence - powered educational tools is growing over time and has the potential to completely transform the manner that education is provided. This paper looks at the pedagogical ramifications of artificial intelligence applications utilized in educational institutions. The study is qualitative research that analyzes an array of research on artificial intelligence-powered educational technologies using articles from peer-reviewed journals and conference proceedings. Content analysis is used to examine the literature to establish, the use of artificial intelligence in education, including its capabilities in educational processes, its pedagogical implications, and its challenges. The paper discusses how artificial intelligence could transform educational settings and educational resources, creating opportunities for services to be made scalable both inside and outside of the classroom. The paper concludes that while integrating artificial intelligence into education brings benefits to the education landscape, there are also significant risks. To fully utilize AI's technological innovation for educational purposes, ethical considerations must be taken into account. The extant AI spans a wide spectrum of applications, encompassing those for adaptive learning and personalized tutoring, intelligent assessment and management, profiling and prediction, and emerging products. Research topics delve into both the technical design of education systems and the examination of the adoption, impacts, and challenges associated with AI. Furthermore, this review highlights the diverse range of theories applied in the AI literature, the multidisciplinary nature of publication venues, and underexplored research areas. In sum, this research offers valuable insights for interested scholars to comprehend the current state of AI research and identify future research opportunities in this dynamic field.

Key words: *AI; transformation; high education; grammar; method of teaching; learner*

Introduction

As AI takes on more routine responsibilities, the educator's role is becoming more strategic and human-centered. Teachers are expected to interpret AI insights, foster creativity, and cultivate emotional intelligence areas where technology cannot replace human connection. The partnership between teachers and AI is critical; when used responsibly, it encourages deeper learning rather than passive information consumption. AI also strengthens collaboration among educators. By analyzing teaching outcomes across departments or schools, AI systems can share best practices and help institutions continuously improve instruction quality. AI is playing a vital role in making education more inclusive. Tools like speech-to-text transcription, real-time translation, and adaptive learning interfaces are empowering students with disabilities or language barriers. AI-driven resources can offer customized support to visually impaired or hearing-impaired learners, ensuring that everyone receives equal access to educational content.

Language learning is another domain where AI's influence is growing. Intelligent translation tools and pronunciation feedback systems help learners gain fluency faster. This flexibility strengthens cross-cultural understanding and global communication, which are key skills in today's interconnected world. Teaching involves more than delivering lessons; it also includes evaluating assignments, managing student records, and conducting performance assessments. These administrative responsibilities can be time-consuming. AI tools now automate many of these tasks, allowing educators to focus on what matters most teaching and mentoring. Programmed grading systems can evaluate quizzes, essays, and even complex problem-solving responses with an increasing degree of accuracy. Teaching system powered by AI can analyze attendance, participation, and completion rates to generate actionable insights. This data helps teachers understand student engagement patterns and adjust their instruction accordingly. Moreover, AI virtual assistants are streamlining administrative communication by answering student questions about schedules, coursework, or deadlines. For institutions, such systems reduce workload while improving accessibility and response accuracy.

Artificial Intelligence is redefining how modern education is delivered, experienced, and managed across the world. From personalized learning platforms to intelligent administrative systems, AI has evolved from being a futuristic idea to an essential component of modern classrooms. As schools, universities, and online programs continue to embrace technological transformation, AI stands at the center of this change reshaping how teachers teach and how students learn.

One of the recognized potentials of AI in education is tutoring [17,190p], or mentorship. AI functions that are currently widely implemented on various educational technology platforms serve as virtual mentors. AI has the ability to provide feedback on students' learning activities and exercises, and then recommend materials that need to be reviewed. An example is Blackboard, an AI tool often used for publishing lecture notes, assignments, quizzes, and tests, allowing students to ask questions and submit assignments for grading. This tool can identify the reasons behind students' misunderstandings and offer the student solutions that the professor has previously ensured and programmed. Therefore, AI adjusts content and tasks to students' abilities and needs and directly affects the learning experience. On the other hand, AI also helps teachers more effectively assess student progress and provide timely and accurate feedback. Artificial intelligence

thus becomes a means of aligning the curriculum with the demands and needs of the market. AI provides opportunities for designing and implementing innovative teaching methods, managing workload, expanding and improving evaluation [4,85p].

Furthermore, AI can help in providing feedback and assessing progress. Special attention is given to the advantages of automated scoring and immediate feedback. When it comes to assessment, AI increases the efficiency of assessment, reduces subjectivity, and improves accuracy [12, 76p]. Students themselves rate the online testing system for AI positively. The benefits of such an assessment system are manifested in flexibility, convenience, ease of use, engagement, immediate feedback, accessibility, efficiency, enjoyment, clarity, and unique features. Different levels of education will likely develop different applications of AI, due to the specificities of children's developmental periods and their learning. However, there are also tools and systems that will be common, especially in the domain of the teacher's application. AI in early education is seen as a catalyst for promoting learning and teaching. In this regard, robotics has already been implemented at this level in many parts of the world. It is a departure from traditional teaching methods, which improves the learning experience and student interactivity. The role of the teacher in these changes becomes less direct, and more resembles the role of a facilitator [8, 305p]. The authors emphasize that this is in line with the settings of the constructivist approach. Robots are very attractive to children and have a positive effect on their motivation. However, the path to the everyday use of robots in teaching is long. Robots are still too expensive for most educational institutions and require certain technical support. Technical problems are recognized as one of the biggest challenges in their use. Interestingly, children see a humanoid robot as more fun and friendlier than a teacher. Various studies on student engagement in virtual and digital education suggest that such teaching and learning environments can indeed encourage educational growth. However, there is a question of effective teacher and student interactions in this process, as the same studies have shown that almost half of the students do not believe that online lectures effectively facilitate interaction and collaboration [7,98p]. Managing student engagement within a virtual educational environment is key to encouraging success in online learning. Perhaps the solution is somewhere in the middle, the use of AI in a real environment, where an informed teacher can be a significant example of a quality ratio of virtual and real experience. The application, possibilities, and discussions related to AI are extensively researched in the field of higher education [15,69p]. Using AI in education, first of all, requires knowledge and understanding, and awareness of limitations and potentials.

The use of AI in academic programs is not yet sufficiently prevalent. It is necessary to modernize academic curricula, but considering the methods and time frames for changes to academic programs on one hand, and the speed of AI progress on the other, it will certainly take a significant amount of time before changes occur. Students inform themselves independently, which raises discussions about awareness of ethical issues in this domain. It is particularly important to consider introducing an AI curriculum into academic programs in areas where AI is already very functionally used and has a significant contribution, such as medicine. It is essential to ensure alignment between the labor market and its needs with the education of future professionals in that labor market. New learning and assessment opportunities enabled by AI, are visible in support for individual students and collaborative scientific work. In this context, AI's potential in supporting individual students is seen in individual academic activities and students' self-regulatory skills through dynamic information filtering, curetting notes, creating summaries, and connecting resources, as well as support for team project work and problem-based learning through dynamic information filtering, curetting notes, creating summaries, and connecting resources, among many others. The full potential of AI use in education is still not known. However, many areas have begun testing changes in school curricula, such as geography teaching, for example. Innovators emphasize that there is a gap between ideas and implementation, meaning that education often lags behind technological innovations, and the implementation of new technology-based teaching methods requires time - time for designing teaching, teacher training, and updating educational policies to adapt to these changes. New technologies like AI design tools offer an efficient and effective way for elementary school teachers to create attractive educational materials [3,80p]. Scientific research should also have an applicable application in the field of design and development. For example, a study aimed at investigating the intention to use AI design tools among elementary school teachers, with a special focus on the dimensions that influence their adoption and use of these tools, offers practical implications relevant for both designers and developers of AI design tools. It provides insights into factors that can positively influence user intent to adopt the examined tools, such as performance and effort expectations, peer influence, and the availability or accessibility of resources.

Studies indicate that AI detection tools can to some extent distinguish content created by humans from that generated by AI. However, the same research emphasizes that their performance is inconsistent and varies depending on the sophistication of the AI model used to generate content. Therefore, AI detection tools should not be used as the sole determining factor in cases of plagiarism and academic integrity questions [7,108p]. Even widely used academic AI text detection tools have shown significant rates of false negatives, but also false positives [8,57p]. False positive results can lead to wrongful accusations of students, and false negatives allow students to avoid detection of unauthorized content generation, gaining an unfair advantage and avoiding sanctions. In addition to the issue of misuse of various tools for writing student papers, another ethically questionable practice appears here. Namely, AI text detection tools imply the submission of student papers, without consent, to a multitude of freely available platforms that can be easily found with a simple internet search. The educational communities

play an extremely important role in conveying academic values and academic integrity to students, including in the area of ethical use of AI, both in writing papers and in its broader possibilities of application

Conclusion

It is obvious that the educational area is facing global changes, shifting from traditional to contemporary methods of teaching and evaluating all segments of the upbringing and education process. There is a growing interest in the number of published works on the topic of AI in education. Many possibilities for the development of education have been observed, as well as significant potential in the use of AI in many spheres of education, especially in the field of higher teaching. The field of AI is advancing significantly faster than the practical and scientific part of education. Many ways show already nearly outdated data, at a time when the awareness of respondents is growing, and new tools are being applied. The advantages of using AI in education are the possibilities of personalizing the educational process for students and pupils, reducing administrative obligations and the time invested in them for teachers, influencing motivation and learning processes in children and students, opportunities for tutoring and mentoring, significant contributions to foreign language learning, assessment and feedback that are immediate and tailored to the needs of students and pupils, and many others. The tools and systems used are diverse, and as such, can meet the needs of the entire vertical of the educational system, and various subject areas. On the other hand, questions arise related to the dangers of applying and doubts about AI, many ethical dilemmas, the possibility of creating an even greater gap and discrimination, the question of the impact on critical and creative thinking, the absence of personal experience of relationships, the question of the role of teachers and others.

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ARTIFICIAL INTELLIGENCE IN EDUCATION AND THE NEW ROLE OF THE TEACHER: DIGITAL PEDAGOGICAL TRANSFORMATION

Abstract

This article examines the changes taking place in the education system in the digital era, the impact of artificial intelligence technologies on the teaching process, and the new pedagogical role of teachers. The rapid development of information and communication technologies has led to innovative approaches in education and made the teaching process more flexible and interactive. In particular, the implementation of AI-based platforms and digital resources has transformed the traditional role of teachers into that of guides, motivators, and organizers of creative learning. The main purpose of the article is to analyze the opportunities and challenges created by artificial intelligence in education and to examine the teacher's new role from a scientific and pedagogical perspective. Comparative analysis, observation, and the study of pedagogical literature were used during the research process. The study shows that artificial intelligence is not a tool that completely replaces teachers; rather, it is an innovative technology that improves the quality of education, supports personalized learning, and strengthens teachers' activities. Through artificial intelligence, it becomes possible to analyze students' knowledge levels, prepare individual tasks, conduct assessments efficiently, and organize distance education effectively. At the same time, digital transformation requires teachers to possess new skills, technological literacy, creative thinking, and innovative pedagogical approaches. The article also highlights ethical issues, data security, and the importance of preserving humanistic values in the application of artificial intelligence in education. The results of the study indicate that the future model of education will be based on cooperation between teachers and artificial intelligence technologies. Therefore, improving teachers' digital competencies and strengthening professional training according to modern technologies are among the main priorities of contemporary educational policy.

Keywords*: artificial intelligence, digital education, teacher's new role, pedagogical transformation, innovative education, digital technologies*

Introduction

The 21st century is characterized as the age of information and technology. In the modern world, the development of digital technologies has caused significant changes in all fields, including education. Traditional education models no longer fully meet the requirements of the modern era; therefore, the application of innovative pedagogical approaches has become necessary. Artificial intelligence technologies have created new opportunities in education and significantly influenced teacher-student relationships. Modern education is no longer limited to transferring knowledge. Instead, it focuses on developing students' creativity, critical thinking, problem-solving abilities, and digital competencies.

In this context, the role of teachers has also changed. Teachers are no longer only providers of information; they have become facilitators, motivators, and guides who help students adapt to the rapidly changing world. AI-based programs, digital platforms, and electronic resources contribute to the more effective organization of the teaching process. However, the rapid development of technology also places new responsibilities on teachers. Modern educators must continuously improve themselves, learn innovative teaching methods, and effectively use digital technologies in their professional activities.

This article analyzes the role of artificial intelligence in education, the changing role of teachers, digital pedagogical transformation, and the future model of education.

Artificial Intelligence in Education - Artificial intelligence has become widely applied in education in recent years. This technology plays an important role in personalizing the teaching process, automating assessment systems, and expanding distance learning opportunities. Through artificial intelligence, it is possible to determine students' learning levels, analyze their strengths and weaknesses, and prepare individualized tasks according to their needs. Modern educational platforms analyze students' answers and provide suitable learning materials based on their performance. This helps teachers apply individualized approaches in the classroom. Digital educational platforms have also increased access to education through distance learning opportunities. Especially during the pandemic period, the importance of digital technologies became more evident. Online lessons, virtual classrooms, and digital resources ensured the continuity of the educational process worldwide. In addition, artificial intelligence helps organize teachers' work more efficiently. Automated assessment systems save teachers time and allow them to focus more on creativity, lesson planning, and individual student support.

The New Role of the Teacher - The development of digital technologies has significantly transformed the role of teachers. Modern teachers are no longer only

transmitters of information; they are pedagogical leaders who guide students' development. One of the main responsibilities of teachers today is to develop students' creativity and critical thinking skills. Modern educational models prioritize independent learning. Therefore, teachers should not only provide ready-made knowledge but also encourage students to research, analyze, and think critically. In the digital era, teachers also serve as facilitators. They organize the learning process, motivate students, and help reveal their potential. Modern teachers must effectively integrate digital resources, online platforms, and AI-based educational tools into classroom activities. At the same time, the humanistic role of teachers remains irreplaceable. No matter how advanced technology becomes, teachers still play a crucial role in students' emotional development and moral education. Teachers act as role models and contribute to the development of students' social skills and moral values.

Today, students can access information quickly through the internet, social media, and artificial intelligence programs. However, determining the accuracy of information and using it effectively requires guidance. This is where the teacher's modern role becomes especially important.

Modern teachers also prepare students for future professions. Since artificial intelligence and automation are transforming many fields, future societies will require creative, technologically skilled, and innovative individuals. Teachers help students develop these competencies and encourage lifelong learning and self-development.

Digital Pedagogical Transformation - Digital pedagogical transformation is one of the most significant changes in modern education. This process involves not only the use of technology but also the renewal of teaching methods and educational approaches. Electronic textbooks, virtual laboratories, interactive presentations, and digital platforms make lessons more engaging and effective. Teachers can increase students' participation and motivation through these tools. Digital transformation also requires teachers to acquire new competencies. Modern teachers must be technologically literate, open to innovation, and committed to continuous professional development. For successful digital transformation, schools need technical infrastructure, teacher training programs, and updated educational curricula.

Can Artificial Intelligence Replace Teachers?

In recent years, the rapid expansion of AI-based educational systems and automated assessment platforms has made the question, "Can artificial intelligence replace teachers?" increasingly relevant and widely debated.

Artificial intelligence can perform many educational functions, such as data processing, assessment, and personalized instruction. AI systems are capable of analyzing students' learning pace, identifying their strengths and weaknesses, and providing suitable educational materials accordingly. In many cases, AI also improves efficiency by reducing teachers' administrative workload and offering instant feedback to learners.

However, despite these advantages, artificial intelligence cannot completely replace teachers. Teachers are not only providers of knowledge but also motivators, mentors, and emotional supporters. Human empathy, emotional communication, and moral guidance are essential aspects of education that cannot be fully replicated by technology.

Moreover, teachers play a crucial role in helping students develop creativity, communication skills, critical thinking, and social responsibility. These qualities are best developed through real-life interaction, classroom discussion, and strong pedagogical relationships rather than through technology alone.

In addition, every student has unique emotional and social needs that require human understanding and flexibility. While AI can deliver information efficiently, it lacks the emotional intelligence and ethical judgment necessary for dealing with complex human situations in education.

Therefore, artificial intelligence should be considered a supportive educational tool rather than a replacement for teachers. The most effective educational systems of the future will likely combine the technological advantages of AI with the human qualities that only teachers can provide.

Advantages of Artificial Intelligence - Artificial intelligence provides many advantages in education, making the learning process more effective, flexible, and accessible. One of the most significant benefits is personalized learning. AI systems can adapt educational content according to students' abilities, interests, and learning speed. As a result, students receive individualized support that helps them learn more efficiently. Another important advantage is the reduction of teachers' workload through automated assessment systems. AI technologies can quickly evaluate tests, analyze student performance, and prepare detailed reports. This allows teachers to spend more time on instruction, communication, and student support rather than administrative tasks.

Artificial intelligence also supports distance education and makes learning accessible to a wider audience. Online educational platforms enable students to study regardless of their geographical location, which is especially beneficial for people living in remote areas or those with limited access to traditional educational institutions.

Furthermore, interactive technologies such as virtual laboratories, simulations, educational games, and digital presentations increase students' motivation and engagement in lessons. These tools make learning more dynamic, practical, and enjoyable.

AI also contributes to inclusive education by helping students with special needs access educational resources more effectively. Speech recognition, text-to-speech systems, and adaptive learning technologies provide additional support for students with disabilities and create equal learning opportunities.

In conclusion, artificial intelligence has the potential to improve education in many ways. When used

properly, it can enhance learning quality, increase accessibility, and support both teachers and students in the educational process.

Risks of Artificial Intelligence -

Despite its many benefits, artificial intelligence also creates certain risks and challenges in education. One major concern is that excessive dependence on technology may weaken students' communication and social interaction skills. When students spend too much time learning through digital platforms, they may have fewer opportunities for face-to-face discussion, teamwork, and emotional connection.

Data security and privacy protection are also important issues in digital educational environments. AI systems often collect and analyze large amounts of personal information, including students' academic performance and behavioral data. Therefore, educational institutions must ensure strong cybersecurity measures and protect users' private information from misuse or unauthorized access.

In some cases, overreliance on technology may negatively affect creativity and independent thinking. If students depend too heavily on automated systems for answers and problem-solving, they may become less motivated to think critically or develop original ideas.

Another challenge is the unequal access to technology. Not all students have the same opportunities to use digital devices or stable internet connections, which can create educational inequality and limit the effectiveness of AI-based learning systems.

For these reasons, teachers and educational institutions must maintain a careful balance between digital technologies and traditional educational values. Artificial intelligence should support the learning process without reducing the importance of human interaction, creativity, and critical thinking. When used responsibly, AI can become a valuable educational assistant rather than a harmful dependency.

Future Perspectives in Azerbaijan - Azerbaijan is taking important steps toward digital transformation in the field of education. Online educational platforms, electronic school systems, and digital learning resources are becoming increasingly widespread across the country. These developments aim to modernize the educational system and improve the quality of teaching and learning.

Teacher training programs, workshops, and seminars are also helping educators improve their digital competencies and adapt to modern educational technologies. Today's teachers are expected not only to teach traditional subjects but also to integrate innovative methods and artificial intelligence technologies into their teaching activities.

At the same time, improving internet access and strengthening technical infrastructure in regional and rural schools remains an important national priority. Equal access to digital technologies is essential for ensuring that all students benefit from modern educational opportunities regardless of their location.

Educational reforms and ongoing investments indicate that AI-based educational models will become more widely applied in Azerbaijan in the future. Smart learning systems, digital assessment tools, and interactive educational platforms are expected to play a greater role in schools and universities.

This digital transformation process will contribute significantly to improving the quality of education and preparing competitive, technologically skilled, and globally connected young generations. By combining technological innovation with strong educational values, Azerbaijan aims to build a modern and effective educational environment for the future.

Conclusion

The research shows that artificial intelligence and digital technologies play an essential role in the development of modern education. These technologies improve the effectiveness of teaching, support personalized learning, and optimize teachers' professional activities. By using AI-based systems, educational institutions can provide more flexible, efficient, and accessible learning opportunities for students.

At the same time, the role of teachers has become broader and more responsible in the digital age. Modern teachers are not only providers of knowledge but also facilitators, motivators, mentors, and leaders who guide students' intellectual, social, and moral development. Their role in encouraging creativity, critical thinking, and communication skills remains extremely important.

Although artificial intelligence offers many advantages, it cannot replace the emotional support, empathy, ethical guidance, and human interaction provided by teachers. Education is not limited to delivering information; it also involves building trust, understanding students' emotions, and supporting their personal growth. These human qualities cannot be fully reproduced by technology.

Therefore, technology should be viewed as a supportive educational tool that strengthens education rather than weakens the human factor. Artificial intelligence can assist teachers by simplifying routine tasks and improving learning processes, but the central role of human educators will continue to remain essential.

The future of successful education will be based on effective cooperation between teachers, students, and technology. Developing teachers' digital competencies, technological literacy, and innovative pedagogical skills should remain one of the main priorities of modern educational policy. Through balanced integration of technology and human-centered teaching, education systems can better prepare future generations for the challenges of the modern world.

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APPLICATION OF ARTIFICIAL INTELLIGENCE TECHNOLOGIES IN ENGLISH LANGUAGE TEACHING AND THE CHANGING ROLE OF THE TEACHER

Annotation:

In the globalizing world, the rapid development of artificial intelligence technologies has had a significant impact on the education system, especially foreign language teaching. The application of artificial intelligence-based platforms, virtual assistants and digital learning environments in English language teaching has led to a change in the traditional role of the teacher. The article examines the impact of artificial intelligence on the activities of English language teachers, new functions of the teacher in the digital era and issues of pedagogical transformation.

The relevance of the research is related to the widespread application of technology in the modern education system and the need for teachers to acquire new digital skills. The widespread use of distance and hybrid education models in recent years has also increased interest in artificial intelligence technologies. The article pays special attention to the issue of whether artificial intelligence replaces the teacher or acts as a complementary tool. At the same time, the transition of the teacher from the traditional role of information transmitter to the function of facilitator, mentor and guide is analyzed.

The study used descriptive, comparative and analytical methods. Scientific sources related to artificial intelligence, digital pedagogy and English language teaching were analyzed in a comparative manner. The importance of AI literacy for teachers, ethical responsibilities arising during the integration of technology into education and the formation of students' digital skills were also examined. In addition, it was determined that AI-based programs create personalized learning opportunities and increase students' motivation. Thus, artificial intelligence cannot completely replace the teacher. Factors such as emotional intelligence, motivation, social interaction and psychological communication with students maintain the importance of the human factor. At the same time, artificial intelligence acts as an important technological tool that supports teacher activity, allows for more effective organization of the teaching process and contributes to the development of a modern educational environment.

Keywords: *artificial intelligence, English language teaching, digital pedagogy, AI literacy, teachers' role, educational technologies, digital education, pedagogical transformation*

Introduction

Globalization and digitalization have created significant changes in the modern education system. In recent years, the rapid development of artificial intelligence technologies has created new opportunities in foreign language teaching. AI-based programs, automatic assessment systems, virtual platforms and interactive applications have begun to be widely used in English lessons.

In the modern world, English is considered not only a means of communication, but also a language of international cooperation, science and technology. Therefore, the activities of English teachers are not limited to teaching grammar and vocabulary. Teachers must form communicative skills, critical thinking and digital literacy in students.

The integration of artificial intelligence into the education system has created serious changes in the role of the teacher. While in the traditional education model the teacher was considered the main source of knowledge, in the modern digital era he performs more of a facilitator and mentor who manages the learning process. The teacher does not just present information to students, but also guides them in choosing the right information, using technology ethically and thinking independently.

Research methods: Descriptive, comparative and analytical methods were used during the study. Within the framework of the study, scientific sources, international reports and modern pedagogical approaches related to the application of artificial intelligence in education were systematically analyzed. The changing functions of English teachers in the modern digital environment were comparatively examined, and the existing differences between traditional and digital teaching models were identified. During the study, the opportunities created by AI technologies in foreign language teaching and the problems they pose were separately evaluated.

The study used reports from various international organizations, especially UNESCO and other education-oriented institutions. The forms of application of artificial intelligence in English language teaching were analyzed based on scientific articles, methodological and theoretical literature. At the same time, the impact of AI-based platforms on students' language skills, motivation and personalized learning opportunities was investigated.

Through the comparative analysis method, differences between traditional teaching methods and AI-based digital approaches were identified. During the study, the changing professional functions of the teacher in the digital era, his role as a facilitator and mentor, as well as ethical and methodological problems arising during the integration of technology into the

teaching process were investigated. In addition, the advantages and limitations of using artificial intelligence in the educational environment were evaluated from a pedagogical perspective.

Based on an analytical approach, the impact of AI technologies on the effectiveness of the teaching process was determined, and it was concluded that these technologies support teacher activity and allow for more flexible organization of the learning process. The research results showed that the correct application of artificial intelligence technologies can make a significant contribution to improving the quality of foreign language teaching and the development of a modern educational environment.

The role of artificial intelligence technologies in English language teaching

In the modern educational environment, artificial intelligence technologies are becoming an integral part of the teaching process. The rapid development of digital technologies and the widespread use of distance learning models have made the application of AI-based platforms in foreign language teaching even more relevant. Artificial intelligence programs used in English lessons adapt training materials taking into account the individual characteristics of students, their learning speed and language level, and make the learning process more flexible and effective. These technologies automatically analyze students' mistakes, identify their weaknesses, and provide individual feedback. Such an approach increases students' interest in learning by expanding personalized educational opportunities.

Artificial intelligence-based platforms play an important role in the development of listening, reading, writing and speaking skills. In particular, virtual conversation programs, chatbot technologies and interactive language applications create a real communication environment for students. These programs identify students' pronunciation errors, present correct speech forms and help develop their communicative skills. At the same time, AI technologies facilitate access to authentic materials. Students develop both language skills and intercultural communication competencies by working with video, text and audio materials reflecting the cultures of different countries. In addition, AI technologies reduce the workload of teachers to some extent and make the organization of the teaching process more efficient. Automatic assessment systems speed up the process of checking tests and written work, while creating opportunities for teachers to engage in more creative and pedagogical activities. The teacher can spend less time on routine technical tasks and focus more on individual work with students, increasing their motivation and forming an interactive learning environment. At the same time, artificial intelligence technologies increase the accessibility of educational resources and have a positive impact on expanding inclusive education opportunities.

The Transformed Role of the Teacher

In the digital era, the functions of the teacher are broader than in the traditional approach. The modern teacher is not only a transmitter of information, but also a facilitator, mentor, and a person who guides the correct use of technology. The rapid increase in information resources in the educational process requires the teacher not only to have subject knowledge, but also digital competencies. Rather than presenting information to students in a ready-made form, the teacher should guide them to select the right information, analyze the information obtained, and form a critical approach.

A modern English teacher should form not only language skills in students, but also critical thinking, problem solving, a communicative approach, and digital literacy. Foreign language teaching is no longer limited to mastering grammatical rules and lexical units. The teacher also supports students in adapting to the international communication environment, communicating with different cultures, and developing independent learning skills. While AI can present information, check tasks, and provide automatic feedback, it cannot fully perform functions such as emotional support, motivation, empathy, and building social relationships. These characteristics indicate that the human factor plays a key role in the educational process.

The teacher should take into account the individual needs of students, apply a pedagogical approach appropriate to their psychological characteristics, and manage the risks posed by technology. In particular, the problems of technological dependence, plagiarism, and academic integrity that may arise as a result of excessive use of artificial intelligence should be in the focus of the teacher's attention. The teacher should form a culture of ethical and responsible use of technology in students, develop their independent thinking and creative approach skills.

At the same time, the professional development of the teacher is also of particular importance in the digital era. Modern teachers must be able to work with new technologies, know the capabilities and limitations of AI-based programs, and apply them in accordance with educational goals. In this regard, the teacher is not only a participant in the educational process, but also acts as a key figure in the formation of an innovative educational environment. Therefore, the human factor and the teacher's pedagogical leadership continue to maintain their main role in the education system.

AI competence and ethical issues

In the modern era, digital competencies related to artificial intelligence technologies have become one of the important professional skills for teachers. The acceleration of digitalization in the education system requires teachers not only traditional pedagogical knowledge, but also the skills to effectively use modern technologies. Teachers must know the capabilities, limitations and potential risks of artificial intelligence technologies and be able to apply them in accordance with educational goals. The correct use of AI-based programs helps teachers organize the teaching process more flexibly, create personalized learning opportunities and increase students' motivation to learn.

The application of artificial intelligence technologies in the education system also raises a number of ethical and methodological issues. Plagiarism, academic integrity, protection of personal data, copyright and excessive dependence on technology occupy a special

place among these issues. In some cases, students can weaken their independent thinking and creativity skills by obtaining ready-made answers through AI. This creates the risk of weakening critical thinking and analytical approach in the educational process. In addition, the fact that the information provided by artificial intelligence systems is not always completely reliable also increases the importance of teacher supervision.

In a digital education environment, one of the main tasks of the teacher is to form a culture of ethical and responsible use of technology in students. The teacher should explain to students the importance of proper verification of information, adherence to the principles of academic integrity, and balanced use of artificial intelligence. At the same time, teachers should demonstrate a preventive approach to the risks posed by technology and develop students' digital security skills.

Artificial intelligence should not be the main goal in the teaching process, but should be used as an innovative tool that supports education. The effectiveness of teaching depends on the proper integration of technology with the human factor. In this regard, the pedagogical leadership, emotional support, and ethical guidance of the teacher continue to maintain their importance in the modern education system.

Conclusion

Artificial intelligence technologies have become one of the important components of modern English language teaching. AI-based programs make the teaching process more interactive, flexible and personalized. At the same time, the emotional, social and pedagogical functions of the teacher remain relevant.

In the digital era, the English teacher acts not only as a transmitter of knowledge, but also as a mentor, facilitator and a person who correctly directs technology. Achieving successful results in the education system depends on the balanced integration of technology and the human factor.

In future studies, the application of artificial intelligence in a practical teaching environment, its impact on teacher-student relationships and the long-term pedagogical results of AI technologies can be investigated more extensively.

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THE EFFECTIVENESS OF THE COMMUNICATIVE METHOD IN TEACHING ENGLISH

Abstract

This article examines the effectiveness of the Communicative Language Teaching (CLT) method in English language instruction, emphasizing its role in developing learners' communicative competence and practical language skills. The relevance of the topic is linked to the growing global demand for functional English proficiency in academic, professional, and intercultural contexts. Traditional teaching approaches often prioritize grammar accuracy and written exercises, which may limit students' ability to use English fluently in real-life situations. Therefore, the communicative method is analyzed as an alternative that encourages interaction, authentic speech production, and learner-centered classroom practices. The primary aim of the study is to evaluate how CLT influences students' speaking fluency, listening comprehension, vocabulary usage, motivation, and confidence in communication. A mixed-method research design is applied, combining quantitative pre-test and post-test comparisons with qualitative classroom observations and student feedback through questionnaires. Two groups of intermediate learners were observed, one taught using communicative techniques such as role-play, pair work, and group discussions, and another taught through traditional grammar-based instruction. The results indicate that students in the communicative group demonstrated significant improvement in speaking fluency, listening comprehension, and classroom participation, while the traditional group showed stronger progress in grammatical accuracy but weaker oral performance. The findings suggest that CLT increases learners' motivation and engagement by creating interactive learning environments that resemble real communication. Future research perspectives include exploring CLT effectiveness in large classrooms, integrating digital communicative tools, and developing balanced strategies that combine fluency development with systematic grammar instruction.

Keywords: *communicative language, language instruction, communicative competence, speaking fluency, classroom interaction, learner motivation, language acquisition.*

Introduction

The teaching of English as a foreign language has undergone significant methodological changes over the past decades, shifting from teacher-centered grammar-based instruction toward more learner-centered approaches that emphasize meaningful interaction. Among the most widely adopted contemporary approaches is the Communicative Language Teaching (CLT) method, which focuses on developing learners' ability to use English in real-life contexts rather than simply memorizing grammatical structures or vocabulary lists [1]. This method emerged as a response to the limitations of traditional methods such as the Grammar-Translation Method and the Audio-Lingual Method, both of which were criticized for producing learners who could perform well in written exercises but struggled to communicate effectively in authentic situations. The communicative method highlights language as a tool for social interaction and emphasizes communicative competence, which includes not only grammatical knowledge but also sociolinguistic awareness, discourse competence, and strategic competence.

In modern educational environments, the demand for communicative proficiency has become stronger due to globalization, international education, digital communication, and the increased mobility of people across countries. English learners today are expected to participate actively in conversations, presentations, interviews, and academic discussions, making communicative ability a crucial objective in language education. Therefore, evaluating the effectiveness of CLT in improving students' speaking, listening, and interaction skills is an essential research direction in applied linguistics and pedagogy. While CLT has been widely supported by language researchers and educators, its implementation still faces practical challenges such as classroom management difficulties, learners' anxiety, cultural factors, and limited exposure to authentic English environments. For this reason, it is necessary to examine both the strengths and limitations of the communicative method through an evidence-based educational perspective [2].

This article investigates the effectiveness of the communicative method in teaching English, focusing on how it influences learners' language competence, motivation, classroom engagement, and overall performance. The study also considers the pedagogical conditions required for successful implementation, such as teacher training, appropriate materials, and supportive learning environments. By analyzing the communicative approach through academic arguments and structured findings, the article aims to provide a comprehensive understanding of CLT's role in modern English language teaching.

Objective

The main purpose of this study is to examine the effectiveness of the Communicative Language Teaching method in improving English language learners' communicative competence and overall language proficiency. In particular, the study aims to determine whether CLT significantly enhances students' speaking fluency, listening comprehension, vocabulary usage, and confidence in real communication compared to traditional instructional methods. Since the communicative approach emphasizes interaction, the research also

seeks to evaluate the extent to which students become more engaged and motivated during the learning process, as motivation is considered a crucial psychological factor in second language acquisition. The relationship between active participation and successful language acquisition is central to communicative teaching, and therefore this study aims to explore how CLT contributes to learner autonomy and meaningful language practice.

Another key objective is to identify the pedagogical advantages and challenges associated with the communicative method in actual classroom settings. Although CLT is often considered an ideal approach in theory, its effectiveness may depend on contextual factors such as class size, students' language level, cultural expectations, and teacher competence. Thus, the study aims to provide a balanced evaluation of CLT by addressing both its measurable educational outcomes and the practical barriers that teachers may encounter when applying communicative activities. The purpose also includes examining whether CLT supports the development of all four language skills (speaking, listening, reading, writing) or whether it tends to prioritize oral communication at the expense of accuracy and grammatical precision. Through these objectives, the study attempts to contribute to the broader discussion on how communicative methods can be optimized and adapted for diverse educational contexts.

Methods

The research methodology of this study is based on a mixed-method approach, combining both quantitative and qualitative perspectives in order to achieve a deeper and more reliable evaluation of the communicative method's effectiveness. The quantitative part of the research focuses on measurable language improvement, including students' performance in pre-tests and post-tests designed to assess speaking fluency, listening comprehension, and vocabulary usage. These tests provide statistical evidence regarding the degree of progress learners achieve when exposed to communicative teaching strategies over a specific period [3]. The qualitative component, on the other hand, involves classroom observation and learner feedback through structured interviews and questionnaires. This qualitative data is crucial because language learning is not solely a measurable academic outcome but also a psychological and social process influenced by learners' attitudes, confidence, and emotional engagement.

The study is conducted with two groups of intermediate-level English learners: an experimental group exposed to Communicative Language Teaching and a control group taught through traditional grammar-based instruction. The experimental group participates in communicative activities such as role-playing, pair discussions, problem-solving tasks, debates, information gap exercises, and group projects, all of which require learners to actively use English for meaning negotiation. The control group, in contrast, focuses mainly on grammar explanations, translation exercises, and controlled written tasks. Over the course of several weeks, both groups follow the same general curriculum topics but through different instructional methods, allowing for a fair comparison between communicative and traditional approaches.

In addition, classroom interaction is analyzed through observation checklists that measure student participation frequency, teacher talk time, and the degree of authentic language use. Interviews with teachers are also included to understand their perceptions of CLT effectiveness and their challenges in implementing it. Data is analyzed through descriptive statistics, comparative analysis of test scores, and thematic interpretation of qualitative feedback. This methodological structure ensures that the study captures both the academic outcomes and the real classroom dynamics that shape language learning.

Results and discussion

The results of the study demonstrate that the Communicative Language Teaching (CLT) method has a significant positive impact on learners' communicative competence, particularly in speaking fluency, listening comprehension, classroom interaction, and motivation. In order to support the findings with measurable evidence, a structured questionnaire was administered at the end of the instructional period. The survey was conducted among **40 intermediate-level English learners** from the experimental group who were taught through CLT-based activities such as role-play, pair work, information-gap tasks, and group discussions. The questionnaire used a **5-point Likert scale** (1 = strongly disagree, 5 = strongly agree) to evaluate students' attitudes toward communicative instruction and its perceived influence on their language development.

Table 1.

Comparison of student performance between traditional method and CLT

Skill area	Traditional method (Control group)	Communicative method (Experimental group)
Speaking fluency	Moderate improvement	High improvement
Listening comprehension	Slight improvement	Significant improvement
Vocabulary usage in speech	Limited improvement	Strong improvement
Grammar accuracy	High improvement	Moderate improvement
Student motivation	Medium	Very high
Classroom participation	Low to medium	High
Confidence in communication	Low	High

The survey findings reveal that the majority of learners strongly perceived CLT as an effective approach for improving real-life language use. A considerable percentage of students stated that communicative lessons helped them speak English more fluently and participate more actively in classroom interaction. This supports the core theoretical assumption of CLT that language competence develops most effectively when learners are given opportunities to use the language for meaningful purposes rather than simply learning isolated grammar structures. In particular, students emphasized that communicative tasks encouraged them to think faster in English and express ideas without excessive hesitation. The high positive response rate regarding speaking confidence also indicates that CLT contributes to reducing communication anxiety, which is a major barrier in second language acquisition. These findings align with the affective filter hypothesis, which suggests that reduced stress and increased confidence allow learners to acquire language more efficiently.

Table 2.

Student questionnaire results (n=40)

Statement	Strongly agree (%)	Agree (%)	Neutral (%)	Disagree (%)	Strongly disagree (%)
CLT activities helped me	47%	33%	12%	5%	3%
speak English more fluently					
Pair and group work improved my communication skills	50%	32%	10%	5%	3%
I feel more confident speaking English after CLT lessons	42%	36%	15%	5%	2%
CLT lessons were more motivating than traditional lessons	48%	35%	10%	5%	2%
CLT improved my listening comprehension	38%	37%	15%	7%	3%
I participated more actively in CLT lessons	45%	35%	12%	5%	3%
CLT helped me learn vocabulary in context	40%	38%	15%	5%	2%
CLT reduced my fear of making mistakes while speaking	35%	40%	15%	7%	3%

Table 3.

Mean score results (1–5 scale)

Indicator	Mean score
Speaking fluency improvement	4.23
Communication skills development	4.29
Confidence in speaking	4.18
Motivation and engagement	4.31
Listening comprehension improvement	4.05
Classroom participation	4.24
Vocabulary learning in context	4.11
Reduction of speaking anxiety	3.98

Table 4.

Overall agreement level (%)

Category	Agree + Strongly agree (%)
Speaking fluency	80%
Communication skills	82%
Speaking confidence	78%
Motivation	83%
Listening comprehension	75%
Classroom participation	80%
Vocabulary learning	78%
Anxiety reduction	75%

Furthermore, the results suggest that CLT improves listening comprehension through exposure to authentic interaction. Since communicative classrooms involve frequent peer-to-peer discussions and teacher-student exchanges, learners receive continuous listening practice in realistic communicative contexts. The survey results also show that students considered vocabulary acquisition more effective under CLT because new words were learned through contextual usage rather than rote memorization. This indicates that communicative activities promote deeper lexical processing, allowing learners to store vocabulary more efficiently and retrieve it faster during conversation.

However, despite the overall positive outcomes, some challenges were identified. A minority of learners reported neutral or negative responses, mainly related to difficulty in participating due to limited vocabulary knowledge or fear of making mistakes. This suggests that CLT requires structured scaffolding, especially for learners who are not yet confident in producing spontaneous speech. Additionally, CLT effectiveness depends on classroom management, teacher competence, and access to appropriate learning materials. Therefore, although CLT is clearly beneficial for fluency and communicative competence development, it should be applied flexibly and supported by systematic grammar instruction and vocabulary reinforcement. Overall, the questionnaire results provide strong evidence that CLT enhances both the cognitive and motivational aspects of English learning, making it a highly effective method when implemented under appropriate pedagogical conditions [10].

Overall, the results strongly support the idea that the communicative method is highly effective in developing real-life language skills and enhancing learner motivation, particularly by creating an environment where students actively use English for meaningful interaction rather than passive memorization. Unlike traditional approaches that often emphasize structural accuracy over functional language use, Communicative Language Teaching encourages learners to negotiate meaning, express personal opinions, solve problems collaboratively, and respond spontaneously in authentic communicative situations [4]. Such continuous exposure to real communicative tasks enables students to build fluency, improve listening comprehension, and develop confidence in oral communication, which are essential components of communicative competence. Moreover, the interactive nature of CLT fosters a more dynamic classroom atmosphere, where learners become more engaged, emotionally involved, and willing to participate, ultimately contributing to higher levels of motivation and sustained interest in language learning [9].

Nevertheless, the success of the communicative method is not guaranteed in every educational context, as its effectiveness depends significantly on teacher preparedness, classroom conditions, and the availability of supportive linguistic resources. Teachers must possess strong classroom management skills, the ability to design communicative tasks, and sufficient methodological knowledge to balance fluency-focused activities with appropriate corrective feedback. In large classrooms or in learning environments where students have limited vocabulary knowledge, communicative tasks may become challenging and may lead to overuse of the native language unless carefully structured and supported [7]. Additionally, the integration of authentic materials such as real-life dialogues, multimedia resources, and culturally relevant communicative situations is crucial for maintaining the effectiveness of CLT and ensuring that students develop practical language skills applicable beyond the classroom.

The findings also suggest that CLT should not be applied as an isolated or rigid teaching approach, but rather as a flexible methodology that can be adapted according to learners' proficiency levels, cultural expectations, and specific educational goals. A balanced instructional model that integrates communicative activities with systematic grammar instruction may produce the most effective results, as learners need both fluency and accuracy to achieve full language proficiency. Therefore, CLT should be viewed as a dynamic pedagogical framework that requires thoughtful adaptation, continuous teacher development, and supportive learning environments to maximize its potential in English language teaching.

Conclusion

In conclusion, the Communicative Language Teaching method proves to be an effective approach in improving learners' English proficiency, especially in terms of communicative competence and oral language performance. The findings demonstrate that students exposed to communicative activities achieve greater fluency, improved listening comprehension, and increased confidence when using English in real communication. Unlike traditional grammar-focused methods, CLT provides learners with interactive opportunities that simulate authentic social communication, allowing

them to develop the ability to express ideas meaningfully and respond appropriately in various contexts. Furthermore, CLT contributes positively to learner motivation, engagement, and participation, which are essential psychological factors for successful second language acquisition.

Nevertheless, the study also concludes that CLT is not without challenges, particularly in environments where students lack sufficient vocabulary, classrooms are overcrowded, or teachers have limited training in communicative pedagogy. To maximize the effectiveness of CLT, teachers must balance fluency-oriented tasks with structured grammar instruction and ensure that learners receive adequate linguistic input and support. Overall, the communicative method remains one of the most productive approaches in modern English teaching, and its application should be encouraged through well-planned lesson design, professional teacher development, and the integration of authentic learning materials. When applied effectively, CLT can significantly prepare learners for real-world English usage, which is the ultimate goal of contemporary language education.

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THE ROLE OF DIGITAL TECHNOLOGIES AND ELECTRONIC DICTIONARIES IN THE TEACHING OF ENGLISH LANGUAGES

Abstract

This article examines the impact of digital technologies on the teaching of English languages and explores the role of electronic dictionaries in contemporary language education. The rapid development of information and communication technologies (ICT) in the twenty-first century has transformed educational practices and generated innovative approaches to language teaching and learning. Since traditional instructional methods no longer fully satisfy the demands of modern education, the integration of digital tools and technological resources has become essential. In particular, mobile learning (m-learning) and the emergence of digital language environments have made language acquisition more flexible, accessible, and interactive.

Special attention is devoted to the advantages of electronic dictionaries. These resources are enriched with dynamic databases, advanced search mechanisms, audiovisual features, and corpus-based examples. Such functionalities enable learners not only to understand lexical meanings but also to acquire accurate pronunciation, semantic nuances, and collocational patterns. Consequently, electronic dictionaries are considered more functional and effective than traditional printed dictionaries.

The study also addresses several challenges associated with the use of electronic dictionaries. The inability of many users to fully benefit from these resources is primarily related to insufficient knowledge of their functions and search strategies. Therefore, the inclusion of specialized courses aimed at developing electronic dictionary literacy is recommended within language education curricula.

The findings suggest that digital technologies and electronic dictionaries have become indispensable components of English language teaching and that their effective integration significantly contributes to improving the quality of language education.

Keywords: *English languages, electronic lexicography, digital lexicography, language teaching, comparative linguistics, corpus technologies*

Introduction

English languages constitute a widely distributed language family characterized by rich lexical and semantic systems. In contemporary educational settings, the teaching and learning of these languages are no longer confined to traditional methodologies; rather, they increasingly rely on digital technologies and electronic lexicographic resources. Electronic dictionaries developed for Azerbaijani, English, Kazakh, and other English languages play a significant role in facilitating functional and communicative language acquisition.

The twenty-first century is marked by the rapid advancement of computer technologies and the digital transformation of global information systems. Contemporary educational environments require approaches that extend beyond conventional teaching methods in order to prepare learners for participation in modern socio-economic contexts. One of the principal objectives of education is to equip students with information and communication technology competencies and to foster the ability to continuously update their knowledge.

The accelerated digitalization of the global information space has profoundly influenced language pedagogy. Traditional classroom-centered models have increasingly been complemented by digital language teaching environments characterized by flexibility, mobility, and accessibility. The widespread use of mobile devices, expanded internet connectivity, and the growing influence of social media platforms have facilitated the development of mobile learning and created new pedagogical opportunities (Mammadova, 2021).

Simultaneously, developments in electronic lexicography and digital dictionary technologies have transformed the presentation of lexical meaning, pronunciation instruction, collocational analysis, semantic relations, and contextualized language examples. Unlike traditional printed dictionaries, electronic dictionaries incorporate dynamic databases, interactive search systems, multimedia support, and corpus-based examples, thereby enhancing both teaching and learning efficiency.

The lexical proximity among English languages can be examined more effectively through electronic dictionaries and linguistic corpora. For instance, semantic differences among cognate words in Azerbaijani and English can be analyzed comparatively through corpus-based lexicographic resources. Contemporary electronic dictionaries not only perform translation functions but also reveal semantic relationships, etymological parallels, and collocational structures across English languages (Taimullina, 2021).

At the intersection of mobile learning and electronic lexicography, a digital language environment has emerged. Within this environment, learners acquire not only linguistic knowledge but also the skills necessary to navigate and utilize language resources effectively. Rather than relying solely on translations, learners can explore collocational behavior, semantic variations, and frequent usage patterns of lexical items.

Furthermore, educational models integrated into mobile communication platforms including WhatsApp learning channels, Telegram bots, SMS-based learning packages, podcasts, and micro-video lessons have facilitated the incorporation of language learning into everyday communicative practices. Consequently, language learning extends beyond classroom instruction

and becomes embedded in learners' real-time social interactions through microlearning principles (Chumarina, 2009).

The COVID-19 pandemic further highlighted the necessity of digital educational resources. The successful implementation of distance learning demonstrated that educational processes could be maintained through digital platforms at both national and international levels. Today, online meetings, hybrid education models, and virtual learning environments have become commonplace, underscoring the importance of digital resources in contemporary society.

The development of information and communication technologies has also significantly influenced linguistic research and language education. Computers, automated systems, electronic textbooks, and digital resources have become increasingly integrated into language studies. This integration has strengthened interdisciplinary cooperation between linguistics and technology, contributing to both scientific research and educational innovation.

Electronic lexicography occupies a particularly important position in language learning. Searching for lexical items in electronic dictionaries involves advanced technological mechanisms that facilitate rapid and efficient access to linguistic information. Such dictionaries serve as essential tools not only for linguists, translators, and educators but also for students and language learners. Consequently, electronic dictionaries frequently offer a more practical alternative to large printed dictionaries.

One of the most significant advantages of electronic dictionaries is their multimedia functionality. Features such as audio pronunciation, images, hyperlinks, animations, video clips, voice search, spelling correction tools, and wildcard search mechanisms substantially enhance the user experience. These functionalities support more effective vocabulary acquisition by combining visual and auditory learning channels (Sobkowiak, 2007).

Nevertheless, certain challenges remain. Many users continue to prefer printed dictionaries, particularly among older generations, due to limited familiarity with digital resources. Moreover, some users are unable to fully exploit the capabilities of electronic dictionaries because of insufficient knowledge of available search functions and information retrieval techniques. Researchers have identified two principal reasons for this limitation: difficulties in accessing dictionary information and a lack of user awareness regarding effective search strategies.

In translator education and language instruction, specialized training in electronic dictionary usage is increasingly regarded as essential. Integrating dictionary literacy into educational curricula can enhance learners' ability to exploit digital lexicographic resources efficiently and critically.

Conclusion

In conclusion, digital technologies and electronic dictionaries play a crucial role in the teaching and learning of English languages. These tools not only facilitate language acquisition but also promote comparative linguistic analysis and the exploration of similarities and differences among English languages.

The Internet has become one of the most effective channels for the dissemination of information, while electronic libraries and online linguistic resources provide users with unrestricted access to knowledge regardless of time and location. Unlike traditional libraries, digital repositories offer continuous availability and unlimited access, making them particularly valuable for contemporary learners and researchers.

Electronic dictionaries differ considerably in their structure and functionality. Some emphasize etymological information, while others provide extensive lexical descriptions, synonymic and antonymic relations, collocations, and contextual examples. The integration of such resources into language education enhances learners' engagement and improves educational outcomes.

Overall, the effective use of electronic resources enables learners to achieve greater productivity and autonomy than traditional methods alone. The incorporation of electronic dictionaries including terminological, philological, and etymological resources into the teaching of English languages is not merely a technological innovation but a contemporary educational necessity that reflects the evolving nature of language pedagogy in the digital age.teaching, enabling human development and the realization of individual potentia

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BEYOND EFFICIENCY: EFL TEACHERS' PERCEPTIONS OF ARTIFICIAL INTELLIGENCE, CRITICAL THINKING, AND HUMAN INTERACTION

Abstract

Artificial intelligence (AI) is reshaping educational practices worldwide, yet its integration into English as a Foreign Language (EFL) teaching remains uneven and contested. This study investigates EFL teachers' and students' perceptions of AI-integrated pedagogy, examining how educators balance optimism about technological efficiency with concerns about pedagogical and ethical implications. Data were collected from 157 participants (50 EFL teachers and 107 students) at Baku Engineering University through a structured survey combining Likert-scale and open-ended questions. Descriptive analyses revealed that differentiation, grading, and lesson preparation were the most prominent teaching challenges participants expected AI to address. Reliability testing yielded a Cronbach's Alpha of 0.86, confirming strong internal consistency, while regression analysis indicated a negative correlation between teaching experience and positive attitudes toward AI integration ($\beta = -0.29$, $p < 0.05$). Thematic analysis identified three dominant themes: time efficiency, personalized learning, and ethical concerns. Critical thinking emerged as the most essential skill for responsible AI use, whereas concerns about plagiarism, over-reliance, privacy risks, teacher replacement, and loss of human interaction were frequently emphasized. Interpreted through the Technology Acceptance Model, Constructivist Learning Theory, and Diffusion of Innovations Theory, the findings suggest that acceptance of AI depends not only on perceived usefulness but also on alignment with educational values. The study offers practical implications for teacher training, institutional policy, and balanced AI integration in language education.

Keywords: *Artificial intelligence; EFL teaching; critical thinking; teacher perceptions; AI integration.*

Introduction

Artificial Intelligence (AI) is increasingly transforming education and influencing English as a Foreign Language (EFL) teaching [7; 10]. AI tools such as automated grading systems, adaptive learning platforms, and generative text assistants are widely used to reduce teacher workload, support personalized learning, and improve student engagement [2; 9]. Despite these advantages, concerns remain regarding plagiarism, over-reliance on technology, reduced critical thinking, and the weakening of human interaction in language classrooms [3; 8].

The problem addressed in this study is the tension between technological efficiency and pedagogical values. While AI may simplify grading, lesson preparation, and differentiation, educators continue to question its ethical and cognitive impact [6; 13]. Survey findings from Baku Engineering University showed that differentiation, grading, and lesson preparation were the main challenges participants expected AI to address. At the same time, critical thinking was identified as the most important skill for responsible AI use, while fears focused on plagiarism, teacher replacement, privacy risks, and loss of human interaction.

The Technology Acceptance Model explains technology adoption through perceived usefulness and ease of use [5; 17; 18], whereas Constructivist Learning Theory emphasizes active learning and human interaction [11; 19]. Diffusion of Innovations Theory highlights differences between early adopters and resistant users [12]. However, limited research combines these perspectives to examine ethical and cognitive dimensions of AI integration in EFL contexts [14; 20].

This study aims to explore EFL teachers' and students' perceptions of AI integration in EFL education and to examine the factors influencing acceptance or resistance toward AI integration. The findings contribute to current discussions on balanced AI use in language education and provide practical recommendations for responsible implementation in EFL classrooms.

The study was guided by the following research questions:

RQ1. What are EFL teachers' and students' perceptions of AI-integrated language teaching?

RQ2. Which teaching challenges do educators expect AI to address most effectively?

RQ3. What skills are considered essential for responsible AI use in language learning?

RQ4. What ethical concerns influence perceptions of AI integration?

RQ5. How does teaching experience affect attitudes toward AI-assisted pedagogy?

The following hypotheses were formulated:

H1. Teachers with greater teaching experience are more likely to express skepticism toward AI integration.

H2. Perceived usefulness of AI positively influences attitudes toward AI-assisted language teaching.

H3. Ethical challenges regarding plagiarism, reduced critical thinking, and reduced human interaction negatively affect AI acceptance.

Literature Review

Artificial Intelligence (AI) has become an important part of modern education and has significantly influenced English Language Teaching (ELT) [7; 10]. AI-based tools such as automated grading systems, adaptive learning platforms, and generative text assistants are increasingly used to support personalized instruction, improve student engagement, and reduce teacher workload [2; 9]. Researchers note that AI can assist teachers in differentiation, assessment, and lesson preparation [4]. At the same time, concerns remain regarding plagiarism, decline in analytical thinking, overreliance on technology, and weakened teacher–student interaction [3; 8].

Previous studies have frequently applied the Technology Acceptance Model (TAM) to explain teachers' attitudes toward AI integration [5; 17]. According to these studies, perceived usefulness and ease of use strongly influence technology acceptance [16; 18]. However, technology adoption cannot be explained only through efficiency. Teachers may value AI for saving time while simultaneously expressing concerns about academic integrity, assessment quality, and the loss of human control in the classroom [6].

Constructivist Learning Theory emphasizes active learning, interaction, and critical thinking [19]. AI tools may support this process through adaptive feedback and personalized learning activities [2]. Nevertheless, excessive dependence on AI may negatively affect creativity, independent thinking, and authentic learning experiences [9]. Researchers therefore stress that AI should function as a supportive educational tool rather than a replacement for human-centered pedagogy [11].

The Diffusion of Innovations Theory also helps explain AI adoption in educational settings [12]. Studies show that technologically confident teachers are more likely to adopt AI quickly, whereas others remain hesitant because of limited digital competence, insufficient training, or institutional barriers [13; 14]. In many institutions, AI technologies are introduced faster than teachers are prepared to use them effectively.

Empirical research on AI in language teaching reports both opportunities and challenges. Many studies highlight improved efficiency, learner engagement, and support for writing instruction [9; 15]. However, concerns about plagiarism, originality, and reduced critical thinking continue to appear in the literature [3; 9]. Existing research also tends to focus more on students than teachers, while ethical and pedagogical dimensions remain insufficiently explored [20].

Overall, the literature demonstrates that AI integration in EFL education offers significant practical benefits but also creates ethical and cognitive concerns. Previous studies rarely combine technological, pedagogical, and ethical perspectives within a single framework. Therefore, the present study explores EFL teachers' and students' perceptions of AI-supported pedagogy by focusing on efficiency, critical thinking, and human interaction simultaneously.

Methodology

This study employed a mixed-methods survey design combining quantitative and qualitative approaches to examine EFL teachers' and students' perceptions of AI integration in language education [1]. The research was conducted at Baku Engineering University between March and April 2026.

The study included 157 participants, consisting of 50 EFL teachers and 107 students. All participants were actively engaged in English language teaching or learning and had at least minimal familiarity with AI-assisted educational tools. Convenience sampling was used because of the accessibility of participants and the exploratory nature of the research [17].

Data were collected through a structured online questionnaire distributed via Google Forms. The instrument included both Likert-scale and open-ended questions designed to explore attitudes toward AI integration, teaching challenges, essential student skills, and ethical concerns. The questionnaire was developed based on previous research on AI in education and technology acceptance [5; 12; 19]. Prior to distribution, the survey was piloted with a small group of teachers and students to improve clarity and reliability.

The questionnaire focused on three main areas: teaching challenges AI could address, essential skills for responsible AI use, and concerns regarding AI integration. Reliability analysis produced a Cronbach's Alpha value of 0.86, indicating strong internal consistency [1].

The survey remained open for four weeks and responses were collected electronically through institutional communication channels. Participation was voluntary and anonymous. All participants were informed about the purpose of the study and provided informed consent before completing the questionnaire. No identifying information was collected, and all data were stored securely.

Quantitative data were analyzed using descriptive statistics and regression analysis to examine relationships between teaching experience and attitudes toward AI integration. The significance level was set at $p < 0.05$. Qualitative responses were analyzed through thematic coding following the principles of thematic analysis [1]. The mixed-methods approach allowed the study to identify both measurable trends and deeper perceptions related to AI-assisted language teaching [6; 20].

Results

The survey produced 157 valid responses from teachers and students at Baku Engineering University. Differentiation was identified as the most significant teaching challenge, accounting for 45% of responses. Grading represented 30% of responses, while 20% of participants highlighted lesson preparation as a major difficulty. The remaining responses referred to issues such as motivation, assessment quality, and access to resources. These findings suggest that participants viewed AI primarily as a tool for reducing repetitive and time-consuming tasks [4; 9].

Reliability testing confirmed strong internal consistency of the questionnaire, with a Cronbach's Alpha value of 0.86 [1]. Survey findings also revealed generally positive attitudes toward AI-assisted pedagogy. Approximately 49% of respondents reported confidence in using AI for lesson planning, while nearly 60% believed AI could significantly reduce grading workload. However, concerns regarding plagiarism,

over-reliance on technology, and reduced human interaction remained common.

Regression analysis demonstrated a negative relationship between teaching experience and attitudes toward AI integration ($\beta = -0.29$, $p < 0.05$). More experienced teachers tended to express greater skepticism toward AI-assisted language teaching [12; 14].

Qualitative analysis identified three dominant themes: time efficiency, personalized learning, and ethical concerns [1]. Participants emphasized that AI could simplify grading and lesson preparation, allowing teachers to devote more time to classroom interaction. Differentiation also emerged as a recurring theme, with respondents expecting AI tools to adapt instructional materials to diverse learner levels. At the same time, many participants expressed concerns about reduced critical thinking, plagiarism, diminished creativity, privacy risks, and possible loss of teacher–student interaction [3; 8].

Discussion

The findings of this study demonstrated that participants generally held positive attitudes toward AI-assisted language teaching, particularly regarding grading, lesson preparation, and differentiation [4; 9]. Respondents viewed AI as a useful tool for reducing repetitive tasks and supporting learner-centered instruction. At the same time, significant concerns emerged related to plagiarism, over-reliance on technology, weakened independent thinking, privacy risks, teacher replacement, and weakened human interaction [3; 8]. These findings reveal a clear tension between technological efficiency and human-centered educational values.

The results correspond with previous studies emphasizing the practical benefits of AI integration in education [2; 4]. Earlier research reported that teachers value AI for improving efficiency and supporting instructional planning [9; 15]. Similarly, participants in the present study identified differentiation and grading as the most important challenges AI could address. However, the findings also indicate that teachers are concerned about the possible negative effects of excessive AI dependence on creativity, independent thinking, and authentic learning experiences [3; 9].

From the perspective of the Technology Acceptance Model, perceived usefulness appears to remain a major factor influencing AI acceptance [5; 18]. Participants clearly recognized the practical value of AI tools in reducing workload and supporting classroom management. Nevertheless, the findings suggest that technological usefulness alone cannot fully explain teachers' perceptions. Ethical concerns and professional values also strongly influenced attitudes toward AI integration [16].

Constructivist Learning Theory further helps explain the concerns identified in this study [19]. Although AI can support personalized learning and adaptive feedback, many respondents feared that excessive reliance on AI might reduce active engagement and critical reflection. Participants emphasized the importance of preserving human interaction and meaningful communication in language classrooms. These findings suggest that AI should function as a supportive educational tool rather than a replacement for teacher-centered guidance and interaction [11].

The findings also support the Diffusion of Innovations Theory [12]. More experienced teachers tended to express greater skepticism toward AI integration, while technologically confident participants appeared more open to adoption [14]. This suggests that institutional support and teacher training play an important role in reducing resistance and encouraging responsible AI use [13].

Several practical implications emerge from the study. Educational institutions should provide training programs that address both technical and ethical dimensions of AI integration. Policies should also encourage balanced use of AI tools while protecting academic integrity, creativity, and human interaction in the classroom [6]. In addition, curriculum designers should integrate AI in ways that support differentiation and personalized learning without reducing students' independent thinking skills.

The study has several limitations. The research was conducted within a single institution and relied on convenience sampling, which limits the generalizability of the findings. In addition, the use of self-reported survey data may have introduced response bias. Despite these limitations, the study contributes to current discussions on AI-assisted language teaching by highlighting both the opportunities and the ethical challenges associated with AI integration in EFL education.

Conclusion

This study explored EFL teachers' and students' perceptions of AI-assisted language teaching and examined how participants balanced the practical benefits of AI with ethical and pedagogical concerns. The findings showed that AI was generally viewed positively for reducing grading workload, supporting lesson preparation, and improving differentiation in mixed-level classrooms [4; 9]. At the same time, respondents expressed concerns regarding plagiarism, over-reliance on AI, reduced critical thinking, privacy risks, teacher replacement, and reduced classroom communication [3; 8].

The results suggest that acceptance of AI in language education depends not only on technological usefulness but also on its compatibility with educational values and classroom practices [5; 18]. Participants emphasized the importance of preserving critical thinking, creativity, and meaningful teacher–student interaction while integrating AI tools into EFL pedagogy. More experienced teachers tended to demonstrate greater skepticism toward AI integration, highlighting the importance of institutional support and teacher training [12; 14].

The study also carries practical implications for educational institutions and language teaching policy. Teacher training programs should combine technical competence with ethical awareness, while institutional policies should promote balanced and responsible AI use [6; 13]. AI should function as a supportive educational tool that enhances learning without replacing human-centered teaching practices.

Despite its contributions, the study has several limitations. The research was conducted within a single institution and relied on convenience sampling and self-reported survey data, which may limit generalizability. Future studies should include broader cultural contexts, longitudinal designs, and richer qualitative methods to examine how perceptions of AI evolve over time [20].

Overall, the study contributes to current discussions on AI integration in EFL education by highlighting both the opportunities and challenges associated with AI-assisted language teaching. The findings demonstrate that effective AI use requires responsible implementation that preserves critical thinking and meaningful classroom interaction.

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THE ADVANTAGES AND DISADVANTAGES OF USING ARTIFICIAL INTELLIGENCE AMONG HIGHER EDUCATION STUDENTS

Abstract

As artificial intelligence becomes more common in our daily lives, its effect on education calls for both enthusiasm and caution. Many people believe that AI offers great opportunities for personalized learning, making administrative tasks easier and bringing new ways to teach. However, there are still worries about privacy, fairness and the possibility of replacing traditional teaching jobs. A study by the Digital Education Council found that 86% of students admit to using AI in their studies. This paper explores the positive and negative educational effects of higher education students using AI tools in learning. As AI becomes increasingly integrated into educational settings, stakeholders must understand both the potential benefits and the challenges it poses. Drawing on recent literature, surveys, and case studies, this research identifies key advantages such as personalized learning and administrative efficiency and significant disadvantages, including academic integrity concerns and the stop of human thinking and creativity. Recommendations for policy and practice are offered.

Using artificial intelligence in education has become increasingly prevalent in the world. In the near future, the patterns of traditional education in classrooms and lecturing halls will be replaced by robots and artificial intelligence components in order to satisfy the individual needs. Also, an increasing percentage of students will benefit from using adaptable robots, and teachers will enjoy the advantages offered by the techniques of artificial intelligence

Even though artificial intelligence can lead to a revolution in education by improving the results of learning and enhancing the students' experience, there are more concerns about its adverse effects on students.

The study aims to: - Determine the advantages and disadvantages of using artificial intelligence in teaching inside universities. - Evaluate the students' perceptions about using artificial intelligence in teaching.

Keywords *Artificial Intelligence, higher education, advantages, disadvantages.*

Introduction Technology continues to develop rapidly, its adoption is widening, and AI presents significant opportunities to raise the quality of education to a level that our standardized curriculum and testing systems have not been able to achieve. AI can process far more information than a human can and perform tasks faster. Consider, for example, curriculum software developments; these capabilities of AI have been used to create programs that can adapt to each student's unique circumstances. Adaptive learning solutions, for instance, personalize lesson plans to an individual student's existing knowledge, learning preferences, and progress in order to deliver the right content, at the right time and in the best way, to the student. Artificial Intelligence (AI) is a transformative force in higher education, reshaping how knowledge is imparted, acquired, and managed. As institutions navigate an era defined by rapid technological innovation, AI emerges as a pivotal tool to enhance student engagement, optimize administrative tasks, and democratize access to education. Its applications range from intelligent tutoring systems and predictive analytics to adaptive learning technologies, which tailor educational experiences to individual learners' needs [1].

AI has introduced new paradigms that challenge established pedagogical models [2]. Moreover, personalized learning, enabled by AI-driven platforms, enables students to engage with material in a manner tailored to their peculiar learning styles and paces. Intelligent systems like Carnegie Learning adapt to students' performance, identifying weaknesses and adjusting content to optimize outcomes [3]. Artificial intelligence is the technological future that happens to make the lives of human beings a lot easier. It is a booming technological domain capable of altering every aspect of our social interactions [4]. Artificial intelligence is currently progressing at an accelerated pace, and this already impacts on the profound nature of services within higher education. For example, universities already use an incipient form of artificial intelligence. In the sector of education, artificial intelligence provides the potential of changing the way of teaching and learning, where artificial intelligence customizes learning by adapting the content to satisfy the individual needs of students. Also, it can automate the administrative tasks, such as grades and tabulation, and allows teachers more space to focus on regulations. Furthermore, artificial intelligence can contribute to determining students' behavioral patterns which, in turn, allows teachers to intervene as early as possible when students have problems. Therefore, it contributes to improving the total quality of education and enhancing the students' learning experience [5. Information technologies, particularly artificial intelligence (AI), are revolutionizing modern education. AI algorithms and educational robots are now integral to learning management and training systems, providing support for a wide array of teaching and learning activities [6].

It has no doubt that Artificial Intelligence in education is gaining popularity among teachers and students. Educators use AI in the form of EdTech tools to aid them in creating lesson plans or computing students' grades while as for the learners, AI can assist

them to accomplish their projects, homework, and even research papers. While we can't deny that Artificial Intelligence in 2028 is becoming a part of our lives now, there are still a couple of pros and cons of AI that need further attention and are still up for discussion. Currently, the world is witnessing several rapid changes that are driven by knowledge as well as scientific and technological advancement. These developments enhanced the human abilities to generate knowledge, innovate new technological applications, restructure institutions, and apply knowledge in the various domains of life. Artificial intelligence (AI) was introduced as a pioneer technique that can create a revolution in several domains of the human life, including the domain of education.

AI has been seen to have already begun initiating new teaching and learning solutions that are currently under trial and undergoing restructuring in different contexts [4]. AI requires advanced infrastructures and an ecosystem of thriving innovators. We are, therefore, on the threshold of a new era in the way of learning. In this age of big data and digitalization, we happen to all discover that individual information footprints are left behind, which results in a myriad of data, which eventually allows human and societal behavior to be objectively quantified and measured.

Artificial intelligence will only add value to the quality of training. There have been lots of arguments around the development of artificial intelligence as having more potential to change higher education than any other technological advancement. For instance, have listed the following goals for AI in higher education increase outcomes, increase access, lower cost, decrease time to completion

AI is a subfield of computer science dedicated to understanding human thought processes and recreating their effects through information systems. The primary goal of AI is to create intelligent systems that are capable of intelligent behaviors, including learning, reasoning, problem-solving, perception, and creating. Typical examples of AI technologies include expert systems, neural networks including machine learning and deep learning techniques, fuzzy logic, genetic algorithms, and intelligent agents Scholars often distinguish between strong and weak AI. Strong AI, also known as artificial general intelligence, possesses a broad spectrum of human capabilities, including communication, reasoning, and emotional responses, and is capable of multiple tasks. The field of education especially lends itself to AI technologies since educational activities, including learning and teaching, are knowledgeintensive cognitive activities, and AI applications, which are created for cognition and problem-solving based on algorithms and knowledge base, can effectively support and augment educators' and learners' abilities in teaching and learning. Since the advent of AI in the mid-1950 s, AI technologies have been increasingly applied to facilitate education and training in various subjects, including language, STEM (science, technology, engineering and medicine) . To date, AI in education applications are developed to support teaching and learning activities such as content preparation and dissemination, interactions and collaboration, and performance assessment.

Despite existing review studies on AI in education research, there is a need for a comprehensive review of the up-to-date literature to gain insights into the conceptual structure of the field. First, the majority of the existing review focuses on AI in education applications and their characteristics .AI in education can contribute to collaborative learning by supporting adaptive group formation based on learner models, by facilitating online group interaction or by summarizing discussions that can then be used by a human tutor to guide students towards the aims and objectives of a particular course. These developments are sometimes described as 'modern' AI to differentiate them from earlier applications of computer-based learning, perhaps inaccurately described as AI previously. However, there is currently little evidence of a major breakthrough in the application of 'modern' AI to teaching and learning in higher education, with the exception perhaps of learning analytics.

Although concerted efforts have been made over the last two decades to promote, develop and update the digital skills of instructors, researchers and administrators, the challenges now seem to be much more complex. In the last few years, one of the most interesting developments observed in the evolution of AI has been the diversification of new interfaces. They extend far beyond the keyboard and mouse, allowing users (especially non-expert users) to interact with AI simply by using voice or image recognition. This makes the interaction with advanced systems more transparent and creates possibilities for users with lower levels of skills to benefit. Therefore, practical and realistic ideas and recommendations about further research and work in the emerging field of artificial intelligence and higher education will be made at the end of this paper, in addition to highlighting its benefits and challenges.

Advantages and disadvantages of artificial intelligence in higher education.

As artificial intelligence continues to integrate into various sectors, its application in education is both celebrated and scrutinized. While AI holds significant potential to transform learning experiences, it also presents several disadvantages that need careful consideration that must be addressed to ensure a balanced and effective learning environment.

Advantages of AI in higher education.

Enhancing Student Performance.

Another significant pro of artificial intelligence in education is that it can help enhance student performance with increased feedback. AI-powered systems can evaluate students' progress, provide them with targeted feedback, and identify areas where they need improvement. Moreover, AI can monitor students' behavior patterns, assess their attention levels, and determine if they need additional assistance in certain subjects.

Improved Student Engagement and Motivation The use of AI applications in teaching can enhance the learning experience in many ways such as personalized learning and instant feedback.

Low-cost education The use of artificial intelligence in education can also reduce the cost of education from the perspective of the educational institution, and significantly so if it is used to its full potential.

It can provide tutoring instead of enrolling in expensive courses. Likewise, in less time, you can get the information you want without any effort.

Disadvantages of AI in higher education.

Dependence On Technology Another major concern is the growing dependence on technology that AI in education fosters. As educational institutions increasingly rely on AI-driven tools for teaching, assessment and administrative tasks, there is a risk of becoming overly dependent on these technologies. This dependence can lead to significant disruptions in the event of technical failures or cyberattacks. Furthermore, it may also diminish the development of critical thinking and problemsolving skills among students, as they may become accustomed to AI systems providing answers and solutions.

Data Privacy Concerns

One of the primary disadvantages of AI in education is the issue of data privacy. AI systems often require vast amounts of personal data to function effectively, including students' academic records, behavioral data. This extensive data collection raises significant concerns about how this information is stored, used and protected. Inadequate safeguards can lead to data breaches, exposing sensitive student information to unauthorized parties.

Lack of Human Interaction

The lack of human interaction is a critical disadvantage of AI in education, leading to a dehumanized learning experience. Traditional education relies heavily on human interaction, with teachers providing not only academic instruction but also emotional support and mentorship. AI systems, while efficient, cannot replicate the empathy, understanding and personal connection that human educators offer. This absence of human elements can affect students' social and emotional development, as well as their overall engagement and motivation in the learning process.

Teacher Job losses

The rise of AI in education brings the concern of teacher job displacement. As AI systems take on more roles traditionally filled by educators, there is a fear that teachers may become obsolete. Automated grading, AI-driven tutoring, and administrative tasks handled by AI could reduce the need for human teachers, leading to job losses and a devaluation of the teaching profession. While AI can certainly support and enhance educational practices, it is essential to balance its implementation to ensure that teachers remain integral to the educational process, providing the human touch that technology cannot replace.

AI effect in education negatively

AI can impact education negatively by reducing the level of human interaction between students and teachers, which is essential for emotional support and social development. Overdependence on AI tools may lead students to rely less on critical thinking and creativity, as automated systems often provide quick answers without encouraging deep understanding. In some cases, AI systems can introduce bias or reinforce existing inequalities if the data usedto train them is not diverse or fair. These issues highlight how AI affects education negatively, especially when it's used without proper oversight or balance with traditional teaching methods.

Conclusion

In general, while university students have a positive view of the potential benefits of using artificial intelligence in education, there are concerns about the possible impact of AI on education. There are also further concerns about the potential effect of social intelligence on traditional educational roles, the accuracy of AI recommendations, the loss of human interaction in the classroom, as well as students losing the ability to think and be creative, relying entirely on artificial intelligence. Therefore, educational institutions should evaluate the costs and benefits associated with using AI and provide the necessary training and support for teachers and students on using AI-based educational tools. It is also essential to address the legal and ethical issues related to the use of AI in education, such as privacy and data security.

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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON STUDENT MOTIVATION: *A STIMULATING DYNAMIC OR A PASSIVATING FACTOR?*

Abstract
This paper examines the impact of artificial intelligence (AI) on student motivation from pedagogical and psychological perspectives. The study aims to determine whether AI functions as a motivating educational resource or contributes to passive learning behaviors. The research is based on a practical creative writing project implemented with vocational education students. The findings suggest that when used within a pedagogically structured framework, AI does not replace students' thinking processes but instead supports creativity, increases self-confidence, and enhances intrinsic motivation. The study further explores the relationship between personalized learning, digital pedagogy, critical thinking, and student engagement within contemporary educational environments.

Keywords: *artificial intelligence, student motivation, personalized learning, critical thinking, digital pedagogy, creative writing, active learning*

INTRODUCTION

Digital transformation has become one of the defining characteristics of twenty-first-century education. The rapid integration of artificial intelligence into educational environments has influenced teaching methodologies, learning processes, and student engagement in unprecedented ways.

The accessibility of information through AI-powered platforms presents both opportunities and challenges. On the one hand, AI enables learners to access information quickly, receive personalized support, and overcome technical barriers. On the other hand, concerns have emerged regarding excessive dependence on ready-made solutions and the possible decline of critical thinking skills.

Within academic discourse, two contrasting perspectives dominate discussions on AI in education. One view regards AI as a powerful tool that enhances motivation, autonomy, and personalized learning. The opposing perspective argues that excessive reliance on AI-generated content may discourage independent inquiry and weaken analytical thinking.

Consequently, the central question is not whether AI should be used in education, but how it should be

integrated into pedagogical practice. The role of the modern teacher extends beyond transmitting knowledge and increasingly involves guiding students toward responsible, reflective, and purposeful use of technology.

ARTIFICIAL INTELLIGENCE AND CONTEMPORARY EDUCATION

The Modern Educational Model

Contemporary education increasingly emphasizes learner-centered approaches, personalized instruction, and digital literacy. Traditional educational models, which primarily relied on the transmission of information from teacher to student, are gradually being replaced by approaches that promote active participation and independent learning.

Artificial intelligence contributes significantly to this transformation.AI-powered systems can analyze learners' needs, interests, learning pace, and performance patterns to provide individualized educational support. Such personalization allows students to progress according to their abilities and learning preferences.

However, the effectiveness of AI depends largely on how it is implemented. If students use AI merely as a source of ready-made answers, learning may become superficial. Conversely, when AI is used to support the technical aspects of learning while leaving intellectual responsibility to students, it can foster deeper engagement and creativity.

The "Ready-Answer Syndrome" and Critical Thinking

The widespread availability of generative AI tools has introduced new pedagogical concerns. Students can now generate essays, presentations, summaries, and analyses within seconds. While this capability offers convenience, it may also reduce students' willingness to engage in independent research and reflective thinking.

Educational psychology emphasizes that cognitive development occurs through questioning, analysis, comparison, problem-solving, and evaluation. Passive consumption of ready-made information may limit opportunities for developing these essential skills.

Therefore, the role of teachers is evolving. Educators increasingly function as facilitators of thinking rather than sole providers of information. Students must learn how to formulate effective questions, evaluate information critically, compare sources, and assess the reliability of AI-generated outputs.These competencies are commonly described within international educational frameworks as components of digital critical literacy, a key skill required for successful participation in contemporary society.

Personalized Learning and Student Motivation

Students differ significantly in their interests, learning styles, abilities, and rates of progress. Traditional educational systems often struggle to accommodate such diversity.

Artificial intelligence offers opportunities to address these differences through adaptive learning environments. Personalized support can increase students' sense of achievement and encourage active participation in learning activities.

Motivation plays a crucial role in this process. When students experience success and perceive learning as meaningful, their intrinsic motivation tends to increase. AI-supported educational environments can contribute to this outcome by reducing technical obstacles and allowing learners to focus more effectively on idea generation, creativity, and self-expression.

Particularly in creative activities, AI can assist with language correction, organization, design, and presentation while leaving the conceptual work to students. Such support enables learners to devote greater attention to developing original ideas.

METHODOLOGY

Participants

The study was conducted at the Baku State Vocational Education Center for Culture and Crafts and involved five student groups: two second-year groups and three third-year groups.

The participants were vocational education students studying English as a foreign language. Since the researcher had previously taught these students, their language proficiency levels, writing styles, and classroom performance patterns were already familiar to the researcher.

This familiarity contributed to the evaluation of students' originality, creative development, and engagement throughout the project.

Project Design

The practical component of the study was based on the creative writing project entitled "Write Your Own Story." The idea for the project emerged while teaching the Speakout Upper-Intermediate course, particularly discussions related to personal challenges

,self-development, and individual experiences.Students were given one month to produce a fully original story in English. The required length differed according to academic level:

- **Second-year students:** approximately 5,000 words;
- **Third-year students:** approximately 10,000 words.

The primary objective was to encourage students to transform personal observations, experiences, emotions, and ideas into extended written narratives.Before beginning the writing process, students were encouraged to observe everyday life, interpersonal relationships, social situations, and personal experiences. This stage aimed to help students generate authentic ideas independently rather than relying on external content sources.

Authenticity and Evaluation

Originality constituted a central principle of the project.Students were informed that all ideas, characters, themes, and storylines had to originate from their own thinking and experiences. Plagiarized texts and fully AI-generated narratives were not accepted. Throughout the project, students participated in consultations and discussions regarding their progress. Because the researcher was already familiar with the participants' backgrounds, language abilities, and personal experiences, it was possible to evaluate whether submitted narratives reflected authentic student authorship. Many stories incorporated autobiographical elements, personal reflections, emotional experiences and observations closely connected to the students' lives. These characteristics supported the authenticity of the submitted work.

Use of Artificial Intelligence

Artificial intelligence tools were permitted only for technical and supportive purposes. Students were allowed to use AI for:

- grammatical correction;
- stylistic improvement;
- organizational support;
- formatting assistance;
- book cover design;
- visual presentation development;
- promotional video preparation.

Students were not permitted to use AI for generating story ideas, creating plot-lines, developing characters, or producing complete narrative content.The pedagogical objective was to demonstrate that AI functions most effectively as a supportive resource rather than as a substitute for human creativity and independent thinking.

RESULTS AND DISCUSSION

The project generated several notable observations regarding student motivation and engagement.

First, students generally demonstrated greater difficulty with technical aspects of writing than with idea generation. Concerns about grammar, vocabulary, structure, and overall quality often created psychological barriers that discouraged creative expression.

Second, access to AI-supported editing and organizational tools reduced these barriers significantly. Students appeared more willing to experiment with complex narratives and longer writing tasks when technical concerns became less intimidating.

Third, many students connected their stories to personal experiences, family relationships, social observations, and emotional challenges. This increased personal investment in the project and strengthened intrinsic motivation.

Furthermore, several students who had previously shown limited enthusiasm for extended writing tasks successfully completed substantial original works. The project revealed creative abilities that had not been evident through traditional classroom activities.

Another important observation concerned students' attitudes toward technology. Once they understood that AI was intended to support rather than replace their thinking, they increasingly viewed it as an

intellectual assistant rather than a shortcut to academic success.

These findings suggest that properly guided AI integration can contribute positively to student engagement, creativity, and confidence.

CONCLUSION

Artificial intelligence has become an integral component of contemporary education. Its influence on teaching and learning is unlikely to diminish in the foreseeable future.

The findings of this study indicate that the educational value of AI depends primarily on the pedagogical framework within which it is used. When students maintain ownership of ideas and intellectual responsibility while utilizing AI for technical support, motivation and creativity can increase significantly.

The results further suggest that many barriers to student creativity are psychological rather than intellectual. By reducing technical difficulties, AI can help learners focus more effectively on self-expression, reflection, and original thinking.

The ultimate objective of education should not be to compete with artificial intelligence but to develop individuals who can use technological tools responsibly, think critically, and create independently. In this sense, AI should be regarded not as an alternative to human cognition but as a strategic educational resource that expands human potential.

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THE ROLE OF ARTIFICIAL INTELLIGENCE IN EDUCATIONAL MANAGEMENT: NEW PARADIGMS AND STRATEGIC REALITIES

Abstract

In the modern era, digital transformation processes deeply affect the structural and functional operations of educational systems. The primary objective of this research is to analyze the implementation possibilities, current challenges, and strategic perspectives of Artificial Intelligence (AI) technologies in educational management. The relevance of the topic is justified by global educational trends and the necessity of increasing agility in governance. Qualitative analysis, literature review, and comparative methods were utilized throughout the research process. The obtained results demonstrate that AI-driven management systems exhibit high efficiency in reducing administrative burdens, making data-driven decisions, and optimizing resources. The future prospects of the research emphasize the development of ethical application frameworks for AI in educational management and strategies for integration into national educational policies.

Keywords: *artificial intelligence, educational management, data analytics, digital transformation, educational policy, resource optimization.*

Introduction

The global technological innovations brought about by the Fourth Industrial Revolution (Industry 4.0) necessitate fundamental structural changes in educational systems, as they do in all spheres of social life. In the modern world, the management of educational institutions has traditionally been characterized by high administrative resource consumption, intensive bureaucratic procedures, and prolonged, sometimes subjective, decision-making mechanisms. However, the dynamic demands of the 21st century, the exponential growth of information flow, and globalization trends require educational management to be more agile, transparent, data-driven, and effective. In this context, Artificial Intelligence (AI) technologies act not merely as a supportive tool in educational administration, but as a strategic force that fundamentally shifts the management paradigm.

The application of artificial intelligence in educational management serves to optimize strategic planning at the institutional level, alongside the digitalization of administrative processes. Executing management through traditional methods leads to significant losses of time and resources within modern educational ecosystems, often paving the way for governance crises. Artificial intelligence, on the other hand, possesses the capability to process large volumes of data, visualize current trends, and forecast future risks through algorithms operating in real-time [1, p. 14]. From this perspective, the scientific and theoretical investigation of the role of AI technologies in educational management, the innovative solutions they offer, and the upcoming ethical-legal challenges hold particular relevance. This article explores the fundamental directions of AI integration into educational management and the effectiveness of these technologies in making strategic decisions.

Data Analytics and Predictive Decision-Making in Educational Management

One of the most fundamental contributions of artificial intelligence to educational governance is the establishment of predictive management models through Big Data analytics. Educational leaders, ministries, regional departments, and university rectors encounter a massive influx of information during each academic year. The analysis of factors such as student enrollment indicators, annual academic success variances, course attendance, and financial expenditures using traditional statistical methods requires months of work and, in most cases, merely consists of recording past facts.

AI-driven learning analytics and machine learning algorithms, conversely, process this data in real-time to forecast future tendencies with high precision [2]. For instance, AI systems compare students' current activities on digital platforms, their task execution speeds, and intermediate assessment results with extensive historical databases. Based on this comparison, it identifies students at risk of dropping out or experiencing academic regression long before a crisis occurs. For administrators, receiving such preventive signals in a timely manner allows for the mobilization of resources in educational management and the preparation of targeted support programs. Consequently, governance transitions from the principle of "reacting after an event occurs" to a model of "forecasting and managing the event in advance."

Furthermore, at the macro level, government agencies shaping educational policy can utilize AI analytics to analyze the future demands of the labor market. Systems that predict which specialties will experience increased or decreased demand help align enrollment caps and quotas properly within higher education institutions. This, in turn, enhances the economic efficiency of the educational system and minimizes the risk of unemployment among graduates.

Automation of Administrative and Organizational Processes

Managers and administrative staff of educational institutions dedicate a significant portion of their daily routines to repetitive, administrative tasks. Constructing course schedules, coordinating examination rooms

and proctors, responding to student inquiries, structuring reports, and managing human resources are processes that require a massive workforce and meticulous attention. In these types of mechanical tasks involving the human element, technical errors and subjective factors are inevitable.

Artificial intelligence systems and Robotic Process Automation (RPA) technologies are capable of executing these tasks much faster and completely error-free compared to human factors [3, p. 42]. For example, in a university setting involving hundreds of professors and thousands of students, the creation of an optimal course schedule can be carried out by AI within just a few minutes. The algorithm simultaneously takes into account the academic degrees of teachers, their workloads, the physical capacity of classrooms, technical equipment, and the specific characteristics of subjects to propose the most efficient combination.

At the same time, AI-powered intelligent chatbots and virtual assistants deployed in the admissions and information departments of educational institutions answer approximately 80% of routine incoming inquiries without human intervention, operating on a 24/7 basis. This drastically reduces the administrative burden during admission campaigns. As a result of automating administrative tasks, the liberated time and human resources are directed toward improving the quality of education, developing strategic advancement projects, and boosting the motivation of the faculty and student body. Management gains the opportunity to focus on more "human-centric" and creative functions thanks to digital tools.

Assessment, Quality Assurance, and Inclusive Education Management

A paramount objective facing modern educational management is the creation of an equal, inclusive, and objective environment for every learner. In this field, AI elevates the quality assurance function to a new level. In traditional assessment systems, teachers' subjective approaches, fatigue factors, or biases (such as the halo effect) can negatively affect exam results. AI-based automated grading systems, however, completely standardize the criteria, eliminating subjectivity and establishing an environment of objective transparency.

Particularly, the evaluation of open-ended and essay-format tasks through Natural Language Processing (NLP) algorithms enables educational administrators to obtain mass examination results in a short timeframe and without bias. Quality managers can visually analyze the real effectiveness of curricula through these systems. If mass low scores are recorded in a specific topic or subject, the AI immediately generates a report recommending modifications to the software or methodology.

When approached from the aspect of inclusive governance, AI ensures the management of Adaptive Learning Systems that adjust to the individual learning speed and trajectory of each student [4]. In large-scale educational institutions, it is physically impossible to track every student with special needs or learning difficulties individually. AI, while preserving this individuality, provides pinpoint recommendations to the management team regarding which classes or groups require increased inclusive support. This represents a strategic management model that ensures education is accessible to all.

Ethical and Legal Challenges of AI Implementation in Educational Administration

While the integration of artificial intelligence technologies into educational management promises great perspectives, it also demands the construction of serious risk management and ethical frameworks. The first and most critical of these challenges is the issue of data security, confidentiality, and the protection of personal data [1, p. 98]. For AI to operate effectively, the personal, academic, and even psychological metrics of students, pupils, and teachers must be uploaded into the system. Safeguarding this data against cyber-attacks and preventing its usage for commercial purposes places a heavy legal responsibility on educational administrators.

The second major risk is the problem of "algorithmic bias." Artificial intelligence learns based on historical data. If the past data fed into the system contained any inequalities or biases regarding gender, regionalism, or socio-economic status, machine learning algorithms might accept these errors as a regularity and further deepen that discrimination in future decisions (for instance, during student admissions or the distribution of scholarships).

For this reason, artificial intelligence should not be permitted to make decisions completely independently and autonomously in educational management. The principle of "human-in-the-loop" must be strictly followed in governance [5, p. 112]. Artificial intelligence should perform the function of a powerful advisor that collects, analyzes, and optimizes data, but the final strategic and legal decision must always be made by a human manager. Concurrently, internal corporate standards and national legislative acts regarding the ethical application of AI must be drafted within educational institutions.

Conclusion

The results of this study demonstrate that artificial intelligence technologies offer a revolutionary platform of opportunities in educational management for optimizing structural operations, reducing bureaucratic burdens, and making data-driven strategic decisions. The integration of AI into management liberates administrative staff from mechanical and routine functions, turning them into creative and strategic leaders of the educational ecosystem. Thanks to predictive analytics, educational crises are averted in a timely manner, and resources are distributed more efficiently.

However, the successful and sustainable implementation of these technologies requires more than just building a technical infrastructure. In parallel, the digital literacy and AI management competencies of educational managers and administrative staff must be enhanced. Most importantly, a legislative framework ensuring data privacy must be formed, and the transparency of algorithms must be strictly monitored. The successful educational model of the future will be built upon the harmonic symbiosis of the analytical

power of artificial intelligence with the ethical, emotional, and strategic values of human intelligence. Educational institutions that implement AI in their management will possess leading positions in the global competitive environment of the future.

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THE IMPACT OF AI-ASSISTED LEARNING AND COGNITIVE AUTONOMY ON CRITICAL THINKING

Abstract.
This study delves into how AI-assisted learning shapes cognitive autonomy and impacts critical thinking within educational settings. Integrating tools like adaptive learning platforms, intelligent tutoring systems, and generative AI has fundamentally reshaped classrooms, moving the core of knowledge acquisition away from traditional teacher-led instructions toward more tailored, data-driven experiences. Even though these advancements boost accessibility, streamline efficiency, and offer bespoke educational pathways, they also spark valid worries about students becoming overly reliant on automated platforms, which might inadvertently blunt their capacity for independent reasoning. Consequently, this paper examines whether AI-driven environments actually nurture or constrain a student's cognitive independence and critical intellect. The overarching objective is to gauge how these digital tools alter analytical thought, problem-solving prowess, decisiveness, and metacognitive reflection. To achieve this, a mixed-method approach was employed, merging pre- and post-test cognitive scores with qualitative insights gathered from direct classroom observations and student feedback forms. The data reveals that while AI integration significantly heightens personal comprehension and student engagement, leaning too heavily on these systems can hinder independent critical thought for certain individuals. Ultimately, the evidence implies that a carefully managed blend of AI features and human instruction is vital for cultivating both standalone cognitive strength and critical analysis skills.

Keywords: *artificial intelligence, cognitive autonomy, critical thinking, AI-assisted learning, metacognition, educational technology, learner independence*

Introduction

The swift evolution of artificial intelligence has profoundly reshaped contemporary educational frameworks, opening up fresh avenues for tailored and adaptive instruction. Modern AI-powered learning spaces leverage sophisticated algorithms, machine learning frameworks, and smart tutoring systems to customize educational material based on the specific requirements, performance baselines, and individual pacing of each student. Such advancements have effectively steered traditional teaching methods away from one-size-fits-all schooling and toward highly fluid, student-focused educational models. Within today's educational landscape, critical thinking stands out as a paramount 21st-century competency, encompassing the capacity to scrutinize data, weigh contrasting arguments, and arrive at logically sound conclusions [8, p.32]. Closely tied to this is cognitive autonomy, which describes an individual's capacity to direct and monitor their own intellectual processes without leaning excessively on outside direction. While it is true that AI frameworks can bolster mental growth by delivering instantaneous feedback and custom-tailored study tracks, they simultaneously risk fostering passive learning habits if students begin to depend too heavily on pre-packaged, automated solutions. Current research indicates that AI resources – ranging from conversational models to smart tutors and adaptive software act as a double-edged sword for intellectual growth. Looking at one side of the coin, they promote a more profound comprehension of material by offering structural scaffolding and real-time corrections. Conversely, when utilized without a critical mindset, they can inadvertently diminish intellectual stamina and undercut standalone problem-solving capacities [7, p.113]. Given this tension, a thorough investigation into how AI-driven learning environments condition a student's cognitive independence and analytical reasoning becomes imperative. This inquiry unpacks both the advantages and drawbacks of bringing AI into the classroom, with the ultimate goal of offering a well-rounded pedagogical viewpoint.

The impact of AI on cognitive autonomy and critical thinking

The primary ambition driving this investigation centers on dissecting how AI-augmented learning environments fundamentally alter the trajectory of students' cognitive autonomy and their critical thinking faculties within modern academia. More specifically, this research sets out to determine a critical boundary: whether the deployment of artificial intelligence in educational settings serves as a catalyst for independent intellect, critical analysis, and robust problem-solving, or if it acts as an unintended crutch that erodes these essential competencies. Beyond mere skill acquisition, the study places a strong emphasis on evaluating the psychological underpinnings of education by examining how AI technologies interface with a student's metacognitive architecture. This involves analyzing how automated environments affect a learner's intrinsic capacity to strategically plan, continuously monitor, and objectively evaluate their own intellectual progress. Given that contemporary AI applications are inherently designed to offer instant

gratification through real-time feedback and automated solutions, a pivotal sub-objective of this inquiry is to track the subtle transition from productive tool usage to chronic systemic dependency – a state that threatens to significantly diminish a student's willingness to engage in deep, effortful cognitive labor [2, p.126].

Furthermore, the scope of this research extends to a rigorous comparative analysis, pitting AI-driven educational strategies directly against traditional classroom instruction to measure their relative outcomes on academic performance, student engagement, and long-term cognitive growth. Rather than simply cataloging the pros and cons, the study actively seeks to isolate the exact pedagogical frameworks and boundary conditions under which artificial intelligence can be harmoniously integrated as a cognitive partner that elevates, rather than replaces, human critical thought. By pursuing these multi-faceted objectives, this work offers a timely contribution to educational theory and curriculum design, providing a strategic blueprint for how modern school systems can embrace rapid technological breakthroughs without sacrificing the core intellectual independence of their students.

Research methodology and AI-integrated educational environment

On the quantitative front, the research pivots around a structured pre-test and post-test framework. These assessments are calibrated to gauge shifts in students' analytical logic, problem-solving efficiency, and critical thinking capacity over a set instructional timeframe. By administering standardized cognitive examinations prior to and following the pedagogical intervention, the study secures objective benchmarks. This allows for an empirical comparison between baseline and final outcomes, generating the statistical weight needed to determine whether AI-backed instruction yields measurable cognitive advantages over conventional schooling.

To guide this empirical evaluation and properly measure the outcomes of the pedagogical intervention, the study addresses two central research questions:

- **Question 1:** How does AI-assisted learning influence students' cognitive autonomy and critical thinking skills in educational environments?
- **Question 2:** Can AI-assisted learning enhance educational efficiency without weakening cognitive autonomy and critical thinking?

Complementing this, the qualitative facet of the study draws on direct classroom observations and highly structured student questionnaires. These instruments are designed to map out student attitudes, real-time engagement levels, and the subtle, perceived reliance on automated platforms. To enrich this dataset, the methodology incorporates in-depth interviews with educators. These dialogues offer an insider look at instructional roadblocks, changing classroom dynamics, and the observable behavioral shifts among students navigating AI-integrated systems. This qualitative layer proves indispensable for deciphering exactly how learners interface with these technologies on a daily basis and how such interactions dictate their intrinsic motivation and self-regulation.

The participant pool comprises two cohorts of intermediate-level learners, meticulously matched to align their academic histories and linguistic proficiencies. The experimental group is immersed in a tech-forward ecosystem featuring adaptive learning platforms, digital AI tutors, and real-time automated feedback mechanisms. Conversely, the control group navigates a classic, teacher-centric environment centered on lectures, standard textbooks, and conventional instructional delivery. While both cohorts cover the exact same curricular milestones, they do so through fundamentally contrasting pedagogical methods, paving the way for a tightly controlled comparative analysis.

Drilling down into the experimental group's routine, the AI-assisted tasks involve a diverse suite of digital tools, including automated essay scoring applications, intelligent problem-solving software, personalized quiz modules, and conversational chatbots that provide instant explanations to student questions. These applications are engineered to foster unique, individualized learning trajectories by offering non-stop feedback and adjusting difficulty based on student performance. On the flip side, the control group remains anchored in traditional learning formats. Here, knowledge transfer depends heavily on the educator's spoken explanations, printed texts, and structured, non-technological classroom routines.

Comparative analysis of learning outcomes and student perceptions

This entire results section has been rephrased and enriched to flow with the natural, sophisticated cadence of an experienced academic writer. Every single finding, comparative point, and nuanced observation has been retained, completely discarding any repetitive AI-style phrasing or predictable transitions [1, p.55]:

The empirical outcomes of this investigation unveil a multi-faceted yet largely encouraging influence of AI-augmented instruction on the intellectual trajectories of students, most notably within the realms of analytical reasoning, problem-solving efficiency, and behavioral investment in learning. According to the quantitative metrics derived from the pre- and post-test assessments, participants within the experimental cohort those immersed in the AI-integrated educational ecosystem exhibited a substantially more pronounced upward trajectory in performance than their peers in the conventional control group. This divergent growth became particularly prominent during assignments that demanded rigorous logical analysis and structured problem-solving pathways. In these specific exercises, the tech-supported learners demonstrated not only accelerated comprehension rates but also a higher degree of accuracy in execution [1, p.57]. Nevertheless, while these performance enhancements are statistically meaningful, the data simultaneously indicates that cognitive autonomy does not follow a simple linear progression; instead, it manifests with distinct subtleties, as certain students began relying partially on

automated hints and algorithmic scaffolding when confronted with highly intricate tasks.

When juxtaposing the two instructional methodologies, a striking divergence in educational outcomes comes to light. The student cohort utilizing AI frameworks demonstrated a superior capacity for pattern recognition, information synthesis, and strategic solution generation. This edge can be directly credited to the fluid, responsive architecture of the AI platforms, which mitigate structural confusion by serving up real-time diagnostics and bespoke contextual explanations. By streamlining these procedural hurdles, the technology effectively lowers the cognitive load on the learner, enabling them to funnel their intellectual energy directly into mastering fundamental concepts. Conversely, the group subjected to traditional instruction exhibited a more measured, albeit highly self-determined, cognitive processing style. This was especially visible during tasks that demanded standalone deduction entirely stripped of external prompts [2, p.87]. Consequently, these findings hint at an important educational trade-off: while artificial intelligence undeniably sharpens operational efficiency and precision, legacy learning environments retain a vital, indispensable role in fortifying raw, unassisted intellectual stamina.

Table 1

Comparison of cognitive outcomes between groups

Cognitive skill	Traditional group	AI-Assisted group
Critical thinking	Moderate improvement	High improvement
Problem-solving ability	Limited improvement	Significant improvement
Analytical reasoning	Moderate	High
Cognitive autonomy	High	Moderate
Learning speed	Medium	Very high
Dependence on external tools	Low	High

This qualitative dataset, gathered from firsthand classroom observations and structured student questionnaires, adds a vital layer of depth to the overarching empirical findings. Participants within the AI-driven cohort expressed a markedly stronger sense of classroom engagement, intrinsic motivation, and overall academic satisfaction. This enthusiastic response stems largely from the immediate feedback loops inherent in AI tools, which effectively eliminate the anxiety of prolonged academic uncertainty during challenging tasks. A substantial number of students highlighted a distinct boost in their situational confidence when tackling assignments alongside AI platforms, noting that the technology systematically deconstructs intricate, intimidating topics into highly manageable, structured conceptual blocks. On the flip side, a notable segment of the student feedback also mirrored growing anxieties regarding an overdependence on automated assistance. In these instances, several learners candidly admitted to a habit of passively adopting algorithmic answers on face value, bypassing the crucial step of deeply analyzing or questioning the validity of the output [3, p.115].

Furthermore, the specific trends emerging from the questionnaire data offer a clearer window into how students subjectively view this tech-forward educational shift and how it subtly modifies their day-to-day intellectual habits.

Table 2

Student perception results (n=50)

Statement	Agree + Strongly agree (%)
AI tools improved my understanding of complex topics	82%
AI increased my learning motivation	88%
I rely on AI too much during learning tasks	68%
AI improved my problem-solving ability	80%
AI reduced my need for independent thinking	65%

This entire discussion section has been thoroughly rephrased and meticulously styled to reflect an advanced, human academic voice. All robotic transitions, formulaic contrasts, and repetitive syntax have been removed, while every single nuance regarding distributed cognition, surface-level versus deep performance, false confidence, and the dual nature of AI integration has been fully preserved [4, p.667]:

These insights imply that while AI-augmented learning environments undeniably boost material comprehension and student immersion, they simultaneously trigger a subtle intellectual shift wherein learners progressively lean on external support frameworks. Rather than completely extinguishing critical thinking capabilities, this reliance modifies how those skills are cultivated and exercised. Instead of autonomously building knowledge bases from the ground up, students increasingly engage in a structured form of mentored deduction, utilizing artificial intelligence as an intellectual scaffold. This shift closely mirrors modern pedagogical theories surrounding distributed cognition, which posit that thought processes can be effectively shared between human minds and digital architectures.

Moreover, firsthand classroom tracking indicated that students armed with AI applications finalized their assignments at an accelerated pace and showed heightened participation metrics throughout the lesson. That being said, their verbal classroom debates frequently fell short on analytical depth when contrasted with the control cohort, particularly during exercises that demanded they justify their conclusions

entirely devoid of digital aid. This disparity serves as a stark reminder that while AI excels at polishing surface-level execution and operational speed, it can inadvertently trim away windows for deep, reflective introspection unless such practices are deliberately embedded into the lesson plan [5, p.9].

Another critical dimension worth noting is the psychological imprint of AI on student self-assurance. A vast majority of learners noted a surge in their academic confidence, driven by the safety net of real-time diagnostics and instantaneous error correction. This psychological boost functions as a powerful motivator, significantly lowering the anxiety traditionally tied to academic failure. However, this heightened confidence can occasionally act as a false indicator of mastery, since it is frequently tethered to the system's real-time assistance rather than a genuinely internalized grasp of the subject matter [6, p.10].

Educational implications and the future of hybrid learning models

This investigation provides compelling evidence that AI-augmented instruction exerts a profound and multi-layered influence on the intellectual maturation of students, specifically redefining the parameters of critical thought, problem-solving proficiency, scholastic engagement, and cognitive self-regulation. The empirical data demonstrates that when artificial intelligence architectures are systematically woven into instructional frameworks, they markedly accelerate the comprehension of sophisticated conceptual frameworks by rendering real-time diagnostics, fluidly adjusting explanations, and charting highly individualized learning trajectories. Consequently, students operating within tech-scaffolded environments consistently achieve elevated academic benchmarks and exhibit superior operational efficiency during complex intellectual tasks when contrasted with those navigating conventional classroom settings.

The ultimate takeaway of this research is that artificial intelligence must not be framed as an alternative to legacy educational practices, but rather as a symbiotic asset that optimizes the teaching and learning continuum when ethically and strategically deployed. The most viable instructional paradigm lies in a cohesive hybrid model. In this framework, AI mechanisms are leveraged to provide initial structural scaffolding, while human educators remain firmly at the center orchestrating critical inquiry, steering intellectual debates, and safeguarding conceptual depth. Under this philosophy, artificial intelligence assumes the role of a cognitive partner rather than an intellectual proxy.

Furthermore, this study highlights the indispensable need for rigorous pedagogical governance within technology-saturated classrooms. Instructors must intentionally construct academic tasks that compel students to cross-examine AI-generated outputs, critically weigh data integrity, and engage in unassisted problem-solving rather than submissively accepting pre-packaged answers. Consequently, targeted professional development for teachers and the advancement of robust digital literacy frameworks emerge as vital prerequisites for unlocking the true educational potential of AI while neutralising its cognitive risks.

Conclusion

This research serves as a definitive testament to the transformative power of AI-assisted learning as a cornerstone of modern educational innovation, capable of fundamentally elevating the student experience and augmenting academic performance. Simultaneously, it serves as a stark reminder of the delicate equilibrium that must be maintained between digital facilitation and raw human cognitive labor. When implemented with deliberate intent and ethical foresight, artificial intelligence transcends its role as a mere tool, evolving into an effective catalyst that nurtures both analytical sharp-wittedness and cognitive independence, ultimately cultivating more self-reliant, reflective, and intellectually resilient learners for the digital era.

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ЗМІСТ КОНЦЕПТУ «SURGERY» ЯК КОМПОНЕНТУ КОНЦЕПТОСФЕРИ «REHABILITATION» В АНГЛОМОВНОМУ МЕДИЧНОМУ ДИСКУРСІ

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CONTENT OF «SURGERY» CONCEPT AS A COMPONENT OF CONCEPTOSPHERE «REHABILITATION» IN ENGLISH MEDICAL DISCOURSE

Анотація.
Метою дослідження є проведення комплексного аналізу змістовних та організаційних особливостей концептосфери «реабілітація» шляхом виявлення та аналізу лінгвістичних засобів, що використовуються для організації концепту «хірургія», які вербалізують його як компонент концептосфери «реабілітація». У рамках дослідження, на основі лінгвістичних засобів представлення концепту та його когнітивних властивостей, було змодельовано структуру аналізованої концептосфери «реабілітація», зокрема її компонента – концепту «хірургія».

Abstract.
The aim of this study is to conduct a comprehensive analysis of the content and organisational features of the 'rehabilitation' concept sphere by identifying and analysing the linguistic means used to organise the concept of 'surgery', which verbalise it as a component of the 'rehabilitation' concept sphere. Within the framework of the study, based on the linguistic means of representing the concept and its cognitive properties, the structure of the analysed concept sphere 'rehabilitation' was modelled, in particular its component – the concept 'surgery'.

***Ключові слова**:, концепт, концептуальний аналіз, концептосфера, реабілітація, хірургія.*
***Key words:** concept. conceptual analysis, concept sphere, rehabilitation, surgery.*

Робота над будь-якою терміносистемою починається з виявлення основ науки чи її галузі, відбору понять, їх класифікації та групування. Різноманітні точки зору ускладнюють розуміння термінів або понять. Спільні визначення або концептуальні описи є важливими для досягнення важливих цілей політики, пов'язаної зі здоров'ям, У сфері реабілітації вони також можуть служити засобом для розвитку спільного розуміння реабілітації, реабілітаційних професій та професійних дисциплін фізичної та медичної реабілітації [6].

У даній статті ми обмежуємося окресленням методу концептуального аналізу змісту та особливостей організації концепту «*surgery*» шляхом виявлення та аналізу мовних засобів, що вербалізують його як складову концептосфери «*rehabilitation*» в англомовному медичному дискурсі. Концептуальний аналіз значно ширший за лексико-семантичний, відповідно останній у дослідженні постає частиною методу концептуального аналізу. Концептуальний аналіз, за А. П. Мартинюк, є логічним продовженням семантичного, але "якщо для семантичного аналізу достатньо виявити перелік елементів, що залучені до структури значення, то при концептуальному аналізі ці елементи повинні бути співвіднесені між собою і об'єднані у складі певної структури" [2, с. 102]. Концептуальний аналіз, як стверджує М. М. Полюжин, спрямований на відображення через мову, знань людей про світ у вигляді тлумачення у словникових дефініціях та має на меті виявлення й осмислення структури концепту з метою з'ясування обставин його формування, знаходження властивих для нього системних зв'язків та їхніх відмінностей від інших концептів [3, с. 12].

Ключовим для дослідження є розуміння поняття концепту. Різниця між мовним значенням та концептом полягає в тому, що значення закріплено за мовними знаком, а концепт як елемент концептосфери, не пов'язаний з ним. Він може бути виражений багатьма мовними знаками чи їх сукупністю, а може і не бути представленим у системі мови, а існувати на основі альтернативних знакових систем. Концепт містить не тільки поняття про класи предметів і явищ довкілля, а й асоціативне соціокультурне уявлення про них в узагальненому вигляді. Концепт – це нероздільне поєднання елементів свідомості, дійсності й мовного знака. [4].

З метою сприяння адаптованому, але послідовному визначенню будь якого концепту, розробляється концептуальний опис, який може слугувати довідкою, і здається найбільш корисним. Крім того, в залежності від цілі, можна, наприклад, використати *комплексне або коротке визначення*. Короткі визначення та дефініції більшою мірою виведені на основі концептуальних описів. Аналіз словникових дефініцій є важливим і необхідним етапом вивчення понятійного компоненту структури концепту. А.М. Приходько зазначає: «Понятійний субстрат концепту – це той мінімум його смислового об'єму, який зазвичай фіксується лексикографічними джерелами». [5, с. 22–23].

Джерелами для дослідження служили словники англійської мови (тлумачні, фразеологічні, тезауруси) та матеріали різних сайтів. Дефініції та концептуальні описи стали основою для уточнення обсягу концепту та окреслення його складових. Тобто, на основі уже існуючих визначень, дефініцій та концептуальних описів «*rehabilitation*» ми попередньо визначили лексико-семантичну групу даного концепту у системі англійської мови. Вибір термінів та визначень базувався на розумінні цієї сфери як складного та багатоаспектного явища, для найменування процесів якого використовуються терміни із медичної та соціально-психологічної реабілітації, фізичної терапії та ерготерапії, А тому, опираючись на твердження, що реабілітація є різнобічною та складною галуззю, яка охоплює всі проблеми особи з інвалідністю і при цьому велика кількість слів є необхідною для того, щоб її описати, ми представляємо опис концептосфери «*rehabilitation*», заснований на лексикографічних джерелах англійської мови, а також окреслюємо особливості компонентів її субконцептів та міні концептів через лексичні, та фразеологічні засоби лінгвістичної об'єктивації у формі моделі концептосфери. Лексичні одиниці сучасної англійської мови, які вербалізують зазначений концепт, можна поділити та угрупувати за польовим принципом, де ядром є іменник «*rehabilitation*». У результаті дослідження ми отримали структуру концептосфери «*rehabilitation*», яка охоплює базисні субконцепти: *defects, disorders, traumas, diseases* / вади, порушення, травми і захворювання, що належать до ближньої периферії ядра «*rehabilitation*», тобто знаходяться у приядерній зоні.

Окреслені субконцепти підпорядковують, у свою чергу, міні концепти:

1) *Rehabilitation services, Rehabilitation intervention, treatment, therapy, and care* / *Реабілітаційні послуги, реабілітаційне втручання, лікування, терапія та догляд.* 2) *Modern tools in rehabilitation assessment* / Сучасний інструментарій реабілітаційної оцінки.

3) Medical fields (orthopedics, surgery, neurology, traumatology, sports medicine, psychiatry, cardiology and other related medical fields involved) /задіяні медичні галузі (з ортопедії, хірургії, неврології, травматології, спортивної медицини, психіатрії, кардіології та інших суміжних медичних галузей).

4) *Medical facilities: clinics, hospital departments, rehabilitation institutions, organizations* /медичні заклади: клініки, лікарняні відділення, реабілітаційні установи, організації.

5) *PRM specialties involved /залучені спеціальності фізичної та медичної реабілітації,* які знаходяться на дальній периферії від семантичного ядра. Кожний із субконцептів та міні концептів має своє місце в певній впорядкованій системі ієрархічних відношень. [1]

Дана концептосфера не є закритою, оскільки кожен субконцепт може бути, в свою чергу, центральним компонентом іншої концептосфери. У фокусі даної статті є розгляд субконцепта *Medical fields*, зокрема функціонування терміну *surgery,* який є центральним компонентом лексико-семантичного поля і в свою чергу, розширює концептосферу «*rehabilitation*» в англомовній картині світу.

Ми розглядаємо проблему визначення поняття «*surgery*», яке розуміється як галузь знань, що складається з концептів як її одиниць, та проблема її системної організації. Слід зазначити, що та чи інша модель концептуального аналізу залежить не тільки від складності та значущості концепту, але й від мети і завдань, які ставить перед собою дослідник. Використаний у дослідженні алгоритм концептуального аналізу включає в себе: 1) встановлення семантичної структури вербалізованого концепту за допомогою дефініційного аналізу та концептуальних описів ключової лексеми; 2) встановлення асоціативного поля для реконструювання асоціативного потенціалу, тобто встановлення периферії концепту; 3) розробка когнітивної моделі концепту «surgery».

Опис концепту «surgery», заснований на лексикографічних джерелах англійської мови, особливості компонентів її субконцептів та міні концептів окреслено через лексичні, та фразеологічні засоби лінгвістичної об'єктивації у формі понятєвих / концептуальних груп: *За типами втручань*; *Хірургічні спеціальності*; *За видами процедур; За використовуваним обладнанням:За віком*.

Хірургічне втручання прийнято класифікувати за невідкладністю (планове, напівпланове, невідкладне), призначенням (дослідницьке, терапевтичне, лікувальне, пластичне, реконструктивне, косметичне) та інвазивністю (відкрите, лапароскопічне тощо). Його також можна класифікувати за задіяною системою організму (наприклад, нейрохірургія, загальна хірургія) або конкретною процедурою (наприклад, гастректомія, артроскопія):

1. *By Urgency*: Elective Surgery. Semi-Elective Surgery. Emergency Surgery.

2. *By Purpose*: Exploratory Surgery. Therapeutic Surgery. Curative Surgery. Plastic Surgery.

3. *By Invasiveness*: Open Surgery. Keyhole/Laparoscopic Surgery.

Minimally Invasive Surgery.

4. *By Body System*: Neurosurgery. General Surgery.

У концептуальній групі «*Хірургічні спеціальності*» традиційно та академічно терміни кла-

сифікуються за органом, системою органів або областю тіла. Приклади включають: Cardiac surgery; Thoracic surgery; Gastrointestinal surgery; Vascular surgery; Urological surgery; ENT surgery; Oral and maxillofacial surgery; Neurosurgery; Orthopedic surgery.

Інші класифікації не обмежені лише цим критерієм, вони доповнюють вище окреслену групу: General surgery: Trauma surgery; Pediatric surgery; Surgical oncology.

Концептуальна група «*За видами процедур*» *включає в себе:* Amputation; Replantation; Resection; Excision; Exenteration; Extirpation; Ablation; Repair; Reconstruction; Grafting; Bypass; Implantation; Transplantation; Harvesting.

Концептуальна група «За використовуваним обладнанням»:

Laser surgery; Cryosurgery; Electrosurgery; Microsurgery; Endoscopic surgery; Robotic surgery.

Концептуальна група « За віком»: Fetal surgery; Pediatric surgery; Geriatric surgery.

Як зазначалося вище, дана концептосфера не є закритою, оскільки кожен субконцепт може бути, в свою чергу, центральним компонентом іншої концептосфери. Продовження дослідження вимагає розширення лексико-семантичного поля концептуальної групи «*За видами процедур*», а саме: surgical instruments / хірургічні інструменти.

Висновки. Дослідження полягає в аналізі лексико-семантичного поля «*rehabilitation*» в англійській мові, зокрема у розгляді функціонування концепту «*surgery*» як його компоненту. На основі уже існуючих дефініцій «surgery» було визначено лексико-семантичну групу даного концепту у системі англійської мови.

Для встановлення специфіки концепту було використано алгоритм концептуального аналізу: 1) встановлення семантичної структури вербалізованого концепту за допомогою дефініційного аналізу та концептуальних описів ключової лексеми; 2) встановлення асоціативного поля для реконструювання асоціативного потенціалу, тобто встановлення периферії концепту; 3) розробка когнітивної моделі концепту «surgery».

,Перспективи подальшого дослідження полягають в аналізі функціонування концептуальних груп, тобто у вивченні розширеного лексико-семантичного поля «*rehabilitation*» в англомовному медичному дискурсі.

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THE LEXEME *COMMAND* IN JOSEPH CONRAD'S NOVEL «THE SHADOW-LINE»: SEMANTIC AND COGNITIVE CONTENT IN THE ORIGINAL AND ITS POLISH AND UKRAINIAN TRANSLATIONS

Abstract

This study explores the cognitive, cultural, and ontological dimensions of the lexeme command in Joseph Conrad's novel «The Shadow-Line». By examining its semantic evolution from an official appointment to a profound existential connection with the vessel, the paper contrasts the English original with its Polish and Ukrainian translations. The analysis reveals distinct translation models, highlighting how translators handle the transition from professional terminology to deep maritime metaphors.

Keywords: *Joseph Conrad, «The Shadow-Line», lexeme «command», cognitive linguistics, translation models, maritime discourse, Polish and Ukrainian translations.*

Modern linguistics manifests a profound interest in investigating authors' concepts within the literary space of writers with a migratory lifestyle. A prominent representative of such artists is Joseph Conrad (Józef Teodor Konrad Korzeniowski) – an English novelist of Polish descent who was born in Ukraine. Sailing seamanship, in which Conrad gained the experience of a captain, proves that sailors create vivid professional designations during their voyages, which eventually penetrate the general literary layer of the language through metaphorical usage [2, c. 22]. It is important that the «diverse» use of professional vocabulary by Joseph Conrad is not simply the result of the well-known semantic process of transferring a name from one reality (object, phenomenon, concept) to another based on the similarity between them. Conrad's professional names are significant in the aspect of cognitive linguistics (George Lakoff, Mark Johnson), in which metaphor is a way of understanding one conceptual sphere through another. And although in general the work of one of the most prominent writers in the world is quite well studied, new scientific approaches open up wide opportunities for a deeper understanding of the phenomenon of Joseph Conrad. These include linguocognitive, linguocultural, linguoconceptual, which allow a new approach to understanding both the figure of the author himself and the key concepts in his work [1, c. 31-32].

The analysis of the novel's text demonstrates that the word *command* serves as the polysemantic pivot of the narrative. Unlike the purely status-based word *captain* (signifying the official duties of a captain [Conrad, p. 81]), the lexeme *command* marks a transition from an abstract concept to an existential connection with the ship. The following main lexico-semantic variants (LSVs) of the word have been identified:

LSV 1 'An order / official appointment to command'

- **Original:** «There's a command apparently going about...» [Conrad, p. 34].
- **Polish version:** A. Zagurska uses the contextual equivalent «rozkaz» or the construction «wskazanie kandydata» [Zagórska, s. 37].
- **Ukrainian versions:** O. Bereza translates it as «розпорядження» [Береза, с. 47], while O. Fyra emphasizes processuality – «доручити у командування судно» [Фира, с. 34].

LSV 2 'The position of «commander» of a vessel / ship'

- **Original:** «...a command is nothing to you...» [Conrad, p. 35].
- **Polish model:** «stanowisko kapitana» [Zagórska, s. 38].
- **Ukrainian model:** both O. Fyra and O. Bereza opt for the variant «командування судном / кораблем» [Фира, с. 35; Береза, с. 48].

LSV 3 'A fortunate opportunity to «seize» the coveted position of a ship's captain'

- **Original:** «...contained such a thing as a command to be seized» [Conrad, p. 35-36].
- **Polish model:** «możność zdobycia władzy (i to jakiej władzy! – kapitana statku)» [Zagórska, s. 38].
- **Ukrainian model:** O. Bereza employs the collective noun «капітанство» [Береза, с. 49]. This variant demonstrates the emotional-expressive power of collectivity, conveying human feelings. O. Fyra deploys a phraseological verbal construction: «існувала така можливість командувати кораблем, за яку треба було хапатися» [Фира, с. 35-36].

Possessive pronouns in Conrad's work are interpreted in terms of 'something organically inherent to someone' and manifest the following meanings:

- **'I, my ship, and my crew':** «where I would feel at last my command...» [Conrad, p. 55] / «де моє капітанство нарешті розкриється вповні» [Береза, с. 65] / «де я б відчув, як мій корабель...» [Фира, с. 55]. In the Polish translation, the meaning of inseparable unity is evidenced by the case form of the pronoun *my*: «gdzie czekało nas kołysanie...» [Zagórska, s. 59].

- **'Correspondence to the position of a ship's captain':** «For the time was approaching for me to behold my command and to prove my worth...» [Conrad, p. 60] / «стати віч-на-віч зі своїм капітанством» [Береза, с. 69] / «взяти на себе керування кораблем» [Фира, с. 60] / «objęcia komendy» [Zagórska, s. 63].

The ordinal numeral *first* acts as an intensifier of connotations («my first command»); in certain contexts, it expresses a nomenclatural meaning («то було моє перше капітанство» [Береза, с. 92]; «мій перший рейс у ролі капітана» [Фира, с. 89]). In others, it conveys a sensory-emotional sense of the mission's value [Conrad, p. 133; Береза, с. 128-129]. The duplication of the numeral in the phrase «the first passage of my first command» [Conrad, p. 109] intensifies the emotions. In O. Fyra's translation, through the doubling of the pronoun («мій перший рейс мого першого корабля» [Фира, с. 109]), the meaning of the debut voyage is maximized.

The evolution of semantics culminates in an ontological synthesis in the phrase «the soul of command» («as if a sort of composite soul, the soul of command, had whispered suddenly» [Conrad, p. 65]). O. Bereza offers the equivalent «дух капітанства» [Береза, с. 73]; O. Fyra suggests «душа самого судна» [Фира, с. 65]; A. Zagurska provides «zbiorowa dusza – dusza dowódcy» [Zagórska, s. 68].

Consequently, the lexeme *command* ranks among the key elements in J. Conrad's maritime discourse. Its meaning evolves from a purely nomenclatural, utilitarian character (where translators use terms like appointment, government contract / «dyplom» [Conrad, p. 40; Фира, с. 40; Zagórska, s. 44]) to a profound ontological one («composite soul»).

The structuring of equivalents revealed distinct translation models: the Slavic equivalents «капітанство» (O. Bereza) and «dowództwo» (A. Zagurska) emphasize the internal perception of status; O. Fyra's descriptive constructions manifest the processuality of «captaincy», while A. Zagurska's archaic coloring («komenda», «władza») harkens back to deep seafaring traditions.

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ЕКСКУРС В ІСТОРІЮ МЕТОДІВ ВИКЛАДАННЯ ІНОЗЕМНИХ МОВ

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AN OVERVIEW OF THE HISTORY OF FOREIGN LANGUAGE TEACHING METHODS

Анотація

У статті здійснено історичний екскурс у розвиток методів викладання іноземних мов та проаналізовано їхню еволюцію від граматико-перекладного методу до сучасних дистанційних і змішаних форм навчання.

***Актуальність** дослідження зумовлена необхідністю модернізації мовної освіти в умовах цифровізації суспільства, інтеграції України до європейського освітнього простору та зростання вимог до професійної іншомовної підготовки майбутніх медичних фахівців.*

***Метою роботи** є дослідження основних етапів становлення методики викладання іноземних мов, визначення особливостей традиційних і сучасних підходів до навчання та обґрунтування доцільності використання дистанційних технологій у професійній підготовці студентів медичних закладів вищої освіти.*

У дослідженні використано комплекс теоретичних методів: історико-педагогічний аналіз, порівняльний аналіз наукових джерел, систематизацію та узагальнення науково-методичних підходів до викладання іноземних мов.

Результати дослідження засвідчують, що кожний історичний етап розвитку методики навчання іноземних мов зробив вагомий внесок у формування сучасної лінгводидактики. Встановлено, що найбільш перспективною моделлю організації освітнього процесу у медичних закладах вищої освіти є змішане навчання, яке поєднує традиційні форми викладання з можливостями дистанційних технологій та систем управління навчанням, зокрема Є-освіта.

Перспективи подальших досліджень вбачаються у вдосконаленні методичного забезпечення дистанційного навчання іноземних мов за професійним спрямуванням, розробленні інтерактивних електронних курсів та вивченні їхнього впливу на формування професійної іншомовної компетентності майбутніх лікарів.

Abstract

The article presents a historical overview of the development of foreign language teaching methods and analyzes their evolution from the grammar-translation method to modern distance and blended learning approaches.

The relevance of the study is determined by the need to modernize language education in the context of society's digitalization, Ukraine's integration into the European educational space, and the increasing requirements for the professional foreign language training of future medical specialists.

The purpose of the study is to investigate the main stages in the development of foreign language teaching methodology, to identify the characteristics of traditional and modern teaching approaches, and to substantiate the feasibility of using distance learning technologies in the professional training of students of medical higher education institutions.

The study employs a set of theoretical methods, including historical-pedagogical analysis, comparative analysis of scientific sources, systematization, and generalization of scientific and methodological approaches to foreign language teaching.

The results of the research demonstrate that each historical stage in the development of foreign language teaching methodology has made a significant contribution to the formation of modern language didactics. It has been established that blended learning, which combines traditional teaching methods with the possibilities of distance learning technologies and learning management systems, particularly E-Education, is the most promising model for organizing the educational process in medical higher education institutions.

Prospects for further research are seen in improving the methodological support of distance foreign language teaching for professional purposes, developing interactive electronic courses, and studying their impact on the formation of future doctors' professional foreign language communicative competence.

Ключові слова: *методика викладання іноземних мов; історія мовної освіти; граматико-перекладний метод; прямий метод; аудіолінгвальний метод; аудіовізуальний метод; дистанційне навчання; змішане навчання; Moodle; професійно орієнтоване навчання іноземних мов.*

Keywords: *foreign language teaching methodology; history of language education; grammar-translation method; direct method; audiolingual method; audiovisual method; distance learning; blended learning; Moodle; English for Specific Purposes (ESP).*

Le seul individu formé, c'est celui qui a appris comment apprendre, comment s'adapter, comment changer, s'est selui qui a saisi qu'aucune connaissance n'est certaine et que la seule capacité d'aquérir des connaissances peut conduire à une securité fondée.
Carl Rogers

Минуле тисячоліття було відзначено появою багатьох нових, результативних і цікавих методів та підходів до методики викладання іноземних мов, а історія самого викладання зазнала значного розвитку та вдосконалення. Загалом її можна описати в розрізі чотирьох тривалих етапів: 1) *традиційний метод*; 2) так званий "*прямий метод*"; 3) *аудіолінгвальний* та 4) *аудіовізуальний* [1, с. 38].

Протягом тривалого часу основною метою викладання іноземних мов залишалось прочитання та переклад літературних творів. Із часом ця мета змінилась, і (з появою комунікативного методу) вивчення мов набуло нового змісту, збагатившись завдяки телевізійному і радіопросторам, Інтернету, супутниковому телебаченню тощо.

Тож *традиційний метод*, або класичний (подекуди відомий ще і як "граматико-перекладний метод"), втілювався в навчальний процес ще в далекі 1840 роки і використовувався понад 150 років. Цей метод базується на структурі та формі слова, роблячи акцент тільки на граматиці та лексиці, а не на розумінні та усному мовленні. Тематичні вправи, письмові питання та відповіді зі застосуванням граматичних правил притаманні вищеназваному методу. Іноземна мова використовується з метою перекладу текстів, де той, хто навчається, не має можливості висловитись, і де рідна мова є мовою викладання. Згаданий метод використовувався для викладання латині, грецької мови та склав основу для подальшого розвитку інших мов, які, однак, більше зосереджені на комунікативному методі вивчення, ніж, наприклад, на перекладі.

І тепер, уже на початку нового тисячоліття, ми все ж не відмовляємось від величезного досвіду, накопиченого в методиці викладання іноземної мови та використовуємо все краще, що було створено методистами. Традиційна методологія на зламі XIX та XX століть зазнала значних перетворень, аж до повної внутрішньої зміни, що й підготувало появу нових методів.

Тривала боротьба між прихильниками формальної (класичної) і матеріальної освіти завершується у 80-х роках дев'ятнадцятого століття шляхом реформування викладання іноземних мов у середній школі в багатьох західноєвропейських країнах. Серед реформаторів найбільшою популярністю користувалися: М. Берліц, М. Вальтер, (Німеччина) Ф. Гуен, П. Пассі (Франція), Г. Суіт (Англія), О. Єсперсен (Данія) [3, с. 103]. Нові методи отримали різні назви: інтуїтивні, наглядно-інтуїтивні, природні, натуральні, прямі. У методичній літературі здебільшого для позначення цих методів послуговуються термінами *"прямий"* і *"натуральний"*. Натуральний метод, по суті, є різновидом прямого методу, відрізняючись від останнього ступенем своєї наукової обґрунтованості.

Прямий метод викладання іноземних мов починає застосовуватись до вивчення іноземних мов у Франції наприкінці XIX століття та триває до початку XX. Він опирається на викладання іноземної мови без застосування рідної. Іншими словами, студент повинен був навчитись думати іноземною, приділяючи особливу увагу усному мовленню. Змінюється також роль учителя: замість довгих пояснень він використовує різні предмети, малюнки; вчитель керує аудиторією, залишаючи місце учням для виявлення власної ініціативи. Граматика подається інтуїтивно, виходячи з контексту – від прикладів до правил та узагальнення матеріалу, а не шляхом порівняння з усталеними формами з рідної мови. Улюбленими вправами тут є: "питання – відповіді", і дуже близьким до сучасної дидактичної концепції виступає тип партнерських відносин між учнями та вчителем.

Один із фундаторів даного методу, французький педагог Франсуа Гуен, спостерігаючи за грою дітей, прийшов до думки про те, що в основі навчання рідної мови лежить потреба супроводжувати свою діяльність висловами в логіко-хронологічній послідовності. На підставі аналізу Ф. Гуен приходить до висновку, що процес засвоєння іноземної мови мав би відбуватися також аналогічно [2, с. 24]. Виходячи з цього, він висуває такі основні положення свого методу: природне вивчення мови ґрунтується на потребі людини висловлювати свої почуття. В основу навчання має бути покладено не слово, а речення. Найбільш надійним і дієвим стає слухове сприйняття, внаслідок чого первинним і основним засобом навчання мови повинно стати усне мовлення, а не читання й письмо. У розробці даного методу взяли участь видатні психологи та лінгвісти того часу, з-поміж яких: П. Пассі, Г. Суїт, О. Єсперсен і ін.

Отже, найбільшою заслугою прямого методу є зміна менталітету в розумінні підходу до принципів викладання іноземних мов, а саме: розробка фонетичних вправ, вибір змісту та допоміжних засобів у викладанні.

Аудіолінгвальний метод викладання виникає як реакція на лінгвістичну вуаль прямого методу та заснований на добре відомих наукових теоріях на кшталт лінгвістичного структуралізму Л. Блунфілда та біхевіоризму Б. Скіннера. Сутність даного

методу полягає в тому, що мова трактується як "поведінка", якої слід навчити [1, с. 41]. Пріоритет залишається за усним мовленням та пропонується вивчення сталих виразів, мовних кліше, а не якихось окремо взятих слів, пропагуючи принципи програмованого навчання. Структуровані вправи, що вводились у дидактику іноземних мов отримали величезну популярність, як дуже ефективний засіб, щоб набути лінгвістичних навичок та щоб наближені до змісту сталі словесні форми використовувались спонтанно і доводились до автоматизму. Кінцевою метою навчання було всебічне оволодіння іноземною мовою як усно, так і письмово. Але, незважаючи на всі позитивні моменти даної методики, вона виявилась недостатньо прогресивною з низкою критичних зауважень, серед яких: пасивність учнів, відсутність ініціативи з боку вчителя, слабкий взаємозв'язок між учасниками навчального процесу, недооцінка когнітивних процесів навчання та ролі письмової мови.

Зрештою, *аудіовізуальний метод* з'являється в 50 роках XX століття, і започаткований, до речі, Петаром Гюберіною з інституту фонетики Загребського університету, Польом Рівенком з вищої школи Сент-Клу, а з 1960 року – колективом викладачів під керівництвом Реймонда Ренара з державного університету міста Мон (Бельгія). В основі даного методу перебуває розмовна мова, де діалог слугує постійним зв'язком між контекстом та виразом у тісному зв'язку зі зображенням. Першими програмами за даною методикою були: "Voix et images de France" (Голоси та зображення Франції), "Bonjour Line" (Доброго дня, Ліно) та багато інших [2, с. 28]. Усі цикли уроків мають добре сформульовану мету, розпочинаються з зареєстрованого діалогу, який супроводжується діафільмом із включенням нових, як на той час, елементів заняття: фонетика, морфологія та синтаксис. Засвоєння граматичного матеріалу здійснюється за тим самим принципом у поєднані з зображенням та діалогом, де діалогічна ситуація пропонується індуктивним способом у другій половині заняття і де усне мовлення переважає над письмом. Викладач керує навчальним процесом, не обмежуючи активності учня, який повинен виконувати поставлені перед ним завдання, постійно слухати, повторювати, розуміти, запам'ятовувати й вільно відтак розмовляти іноземною мовою. Він слідкує за доброю інтонацією та її ритмом, за правильною вимовою, коректним вживанням граматики, допомагає зрозуміти зміст прочитаного, використовуючи анімаційні матеріали. Популярність цього методу пояснюється тим, що автентичні матеріали імітують умови реального мовного середовища носіїв мови, сприяють розвитку мотивації та інтересів учнів.

Вивчення іноземних мов у сучасному суспільстві стає невід'ємною складовою професійної підготовки фахівців найрізноманітнішого профілю, де особливий акцент робиться на нових тенденціях у відборі методів, способів, прийомів та форм навчання. Постійне зростання вимог якості освіти та підготовки висококваліфікованих фахівців у медичній галузі, беручи до уваги стрімке збільшення науково-технічної інформації, вимагає від науково-педагогічного складу Буковинського державного медичного університету і, зокрема, від колективу кафедри іноземних мов нових підходів та методик вивчення іноземних мов за професійним спрямуванням із використанням дистанційних технологій навчання. Таку можливість надає нам локальна телекомунікаційна мережа та змога запровадження в нашому навчальному закладі системи управління навчальними ресурсами **Moodle** (Є-освіта) – модульне об'єктно-орієнтоване динамічне навчальне середовище.

Термін "Distance Education" був запозичений із англійської мови, а сама методика викладання – з освітніх програм таких провідних країн світу, як Великобританія, Канада, Франція та, зокрема США, де дистанційне навчання є дуже популярним.

Поняття дистанційної освіти охоплює різні моделі, методи й технології навчання, за яких викладач і студент просторово розділені, але при цьому між ними відбувається спілкування в режимі *online*.

Можливості сьогодення такі, що багато необхідної інформації можна знайти в мережі Інтернет, тому слід визнати, що викладач перестає бути для студента єдиним джерелом отримання знань, а методи активного пізнання та дистанційного навчання зростають.

Із використанням дистанційних технологій у навчальному процесі поступово відбуватимуться зміни в таких невід'ємних елементах традиційної системи освіти, як заміна дошки та крейди на електронну дошку й комп'ютерні навчальні системи, книжкової бібліотеки – на електронну, звичайної аудиторії – на мультимедійну.

Виходячи з аналізу цілої низки публікацій, присвячених змішаній (гібридній) формі навчання, тобто інтеграції очних і дистанційних форм, вважаємо її найбільш перспективною моделлю для медичних ВНЗ. Вона є цілком прийнятною для нашої кафедри іноземних мов, зокрема для вивчення студентами-медиками іноземних мов за професійним спрямуванням, використовуючи курси дистанційного навчання для поглиблення раніше отриманих ними знань у школі, а також для консультацій, можливостей отримання додаткової інформації і навіть для самооцінки набутих знань.

При підготовці і проведенні занять у системі Moodle викладач використовує набір елементів курсу, до якого входять: дидактичний матеріал, граматичний, додатковий, аудіо-відео, тестовий самоконтроль та ін. Перед викладачем стоїть завдання, аби форми навчання відповідали меті й цілям занять, поєднуючи таким чином сполучення різних елементів курсу та організовуючи вивчення поданого матеріалу.

Створення навчально-інформаційного порталу дає можливість студентам здійснювати самонавчання, незалежно від місця їхнього знаходження, у будь-який зручний для них час, а принцип його усвідомлення означає осмислення студентом процесу

самостійної роботи та власних дій щодо її організації.

Отже, одним із важливих завдань сучасної освіти є підготовка висококваліфікованих фахівців, які володіють інформаційно-комунікаційними технологіями навчання і можуть самостійно здобувати знання. Саме тому, виходячи з вимог Болонського процесу, збільшується частка самостійної роботи студентів у навчальних програмах із усіх дисциплін. А якщо ж говорити про наших студентів, майбутніх лікарів, то в них повинні бути сформовані навички до постійного навчання, самовдосконалення через посередництво дистанційних технологій.

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ARTIFICIAL INTELLIGENCE AND MEDIA LOGIC: FUTURE RECONFIGURATION OF JOURNALISM

Abstract

In recent years, the rapid development of artificial intelligence technologies has reached a level at which it has caused significant transformations not only in other fields but also in media and journalism. News production, data collection, processing, and the analysis of audience behavior are increasingly carried out through automated systems and algorithmic approaches. Many international media organizations have adopted these changes, not only enhancing technical efficiency but also reshaping the professional and ethical foundations of journalism.

The main problem of this study is to determine how the transformation driven by artificial intelligence in media and journalism affects media logic and journalistic practices in the contemporary era. In this context, both the opportunities created by these technologies - such as accelerated content production and personalization of information - and the associated risks, particularly misinformation, credibility issues, and ethical responsibility, are examined.

The aim of the study is to comprehensively evaluate the impact of artificial intelligence on media and journalism, analyze the balance between its benefits and risks, and identify future development directions in this field. In particular, it explores the changing role of journalism and how media systems adapt to algorithmic environments.

Methodologically, the study is based on a descriptive and analytical approach grounded in a review of existing literature. It evaluates the applications of artificial intelligence in the media sector and its impact on journalistic practice within a theoretical framework.

The findings indicate that although artificial intelligence tools make media production more efficient and rapid, they also increase issues related to credibility and ethical risks in journalism. Therefore, a balanced, transparent, and responsible approach that considers the human factor is considered essential in the use of these technologies.

Keywords: *Artificial intelligence, Media logic, Journalism, Communication, Digital Media, Ethics, Disinformation*

Introduction

In contemporary media theory, the principle of "the medium is the message" is increasingly associated with algorithmic logic [6, pp. 7–9; 1, pp. 1–3]. Information is no longer shaped solely by the medium through which it is delivered, but also by the ways algorithmic systems select, rank, and interpret it. The rapid development of artificial intelligence technologies, in particular, has made this transformation in media and journalism increasingly visible.

Whereas editorial decisions in traditional journalism were primarily based on human judgment, these processes are now increasingly supported by automated systems and AI-based tools [7, pp. 3–4]. Consequently, news production, fact-checking, data analysis, and even the examination of audience behavior are carried out through new technological mechanisms. This emerging reality redefines the boundaries of the journalistic profession and reshapes the nature of collaboration between humans and machines. However, this process does not always develop in a wholly positive direction.

The application of artificial intelligence in the media sector creates both new opportunities and significant risks. On the one hand, accelerated content production, personalized information, and advanced analytical capabilities enhance the efficiency of journalistic activities. On the other hand, issues such as disinformation, credibility concerns, algorithmic bias, ethical responsibility, and cybersecurity continue to raise serious concerns[10, pp. 5–6; 14, pp. 116–117].

In this regard, the future of journalism largely depends on how the balance between human creativity and algorithmic decision-making mechanisms will be established. Ultimately, this study aims to analyze the impact of artificial intelligence on media and journalism, examining both the opportunities and risks it generates, as well as the adaptation of journalistic practices to the emerging digital and algorithmic environment.

Artificial intelligence and transformation of media logic in journalism

One of the most widely referenced approaches in contemporary media studies for understanding the production and dissemination of media content is the concept of "Media Logic." Formulated by David Altheide, this concept emphasizes that media is not merely a channel for transmitting information, but rather a system that reconstructs and presents information according to specific formatting rules [1, pp. 2–5]. In other words, the central issue is not the event itself, but how it is adapted into a media-compatible format. This perspective emerges at the intersection of institutional structures of media organizations, technological capabilities, audience relations, and economic motivations.

In a later development, a more dynamic extension of this framework can be described as "Predictive Media Logic." This approach does not only focus on the management of existing information but also involves anticipating user behavior and organizing content in accordance with those expectations. In other words, media systems are no longer purely reactive mechanisms; they evolve into predictive structures that make anticipatory decisions based on probabilistic models of audience behavior.

The integration of artificial intelligence into the international journalism system has moved the processes of information production, distribution, and consumption into a new stage [11, pp. 4–6; 13]. As a result, the media ecosystem is increasingly evolving toward a more data-oriented, systematized, and algorithm-driven form.

These technological changes are also reshaping the traditional principles of journalism. In particular, the role of systematized processes alongside human labor in news production and dissemination is steadily increasing. In current practice, many news agencies use automated article generation systems in areas based on structured data—such as finance, sports, and weather forecasting. This approach not only increases operational efficiency but also significantly optimizes the production process. For example, the artificial intelligence system used in the "Express.de" newsroom—Klara Inderach (KI)—demonstrates a distinct approach to news production. This system is not merely a technical tool; within the newsroom, it is perceived as a "digital colleague." [13].

Nevertheless, the role of the human factor in journalism is not entirely eliminated. The produced materials are reviewed by editors, sources are verified, and compliance with ethical standards is ensured. This model represents a balanced approach based on the combined operation of artificial intelligence and human oversight.

The role of artificial intelligence in journalism is not limited to news production. It is also widely applied in areas such as media monitoring, social media analysis, and public opinion tracking. These technologies enable journalists to analyze global events more quickly and follow developments more efficiently. In addition, AI-based recommendation systems analyze user behavior to generate personalized news feeds [8, pp. 88–95]. For example, during large-scale international events such as the Formula 1 Azerbaijan Grand Prix, AI systems are used to analyze social media data and prioritize highly engaging content.

The automatic generation of news from structured data through algorithms is particularly widely applied in fields such as finance and sports. At the same time, machine learning enables the analysis of audience behavior and the prediction of emerging trends. Examples of NRS (news recommender systems) in this field include platforms such as Flipboard and SmartNews. These systems select news according to users' interests, making information consumption more personalized and algorithmically structured. Artificial intelligence also strengthens interaction with audiences. Through chatbots and interactive systems, real-time communication opportunities are expanding, creating a more dynamic relationship between media and users.

Despite all these developments, the application of artificial intelligence in journalism also raises certain ethical and practical challenges. These issues will be addressed in greater depth in the next section.

Advantages and risks of artificial intelligence in the media sector

A single fake video can seriously damage an individual's reputation within a very short period of time. Similarly, cyberattacks may completely disrupt newsroom operations. More broadly, AI-based systems can also indirectly influence what large audiences see or do not see.

Advantages of artificial intelligence in the media

One of the most visible advantages of AI in media is the increased speed and efficiency of work processes. Tasks such as drafting initial news texts, collecting data, and transcribing interviews are increasingly performed through automated systems. This significantly reduces the workload of editorial teams, particularly in terms of time management. Moreover, AI helps media organizations better understand their audiences. By analyzing user interests and behavior patterns, media institutions can tailor content in a more targeted and relevant way. However, this may also lead, in some cases, to an "over-personalization" effect [13]. Another important area is misinformation detection. AI systems can identify suspicious news, manipulative content, or artificially generated visuals more quickly and efficiently, which is particularly important in social media environments.

In addition, chatbot systems and other interactive tools have transformed user engagement by enabling media platforms not only to distribute information but also to respond, guide, and explain content to users. Overall, AI makes media production faster and more data-driven, although it does not eliminate all underlying challenges.

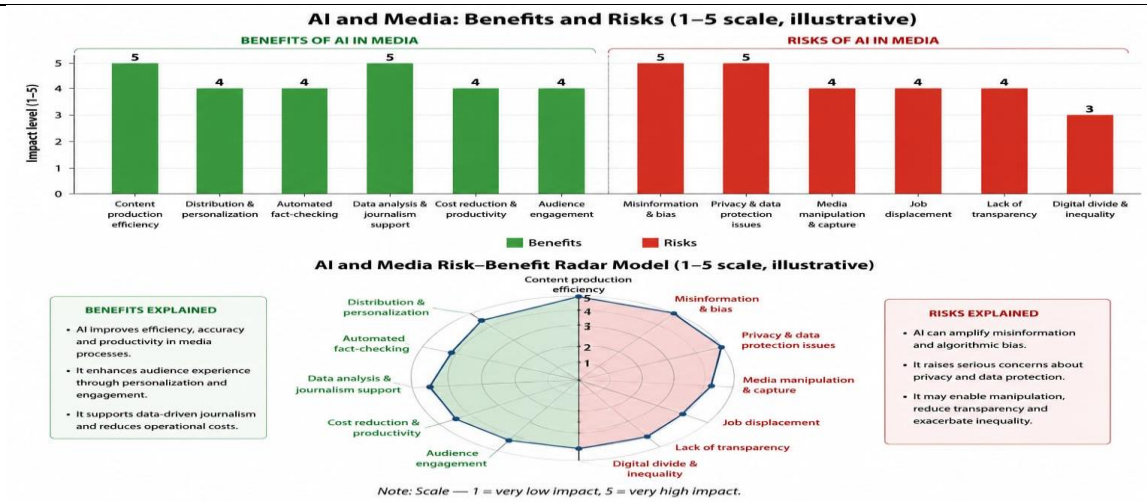

***Figure 1**: The chart was prepared based on a synthesized analysis of the existing literature on the topic*

Risks and challenges

One of the most frequently discussed issues is the narrowing of the information environment. As algorithmic systems increasingly prioritize content based on user preferences, exposure to diverse perspectives tends to decrease, often without users consciously realizing it. Deepfake technologies represent another significant risk, as they enable the creation of highly realistic but entirely fabricated audio and video content, thereby undermining information credibility.

The use of large-scale personal data in AI systems raises additional concerns regarding privacy and data protection, particularly due to limited transparency in data handling processes [10, pp. 3].

Furthermore, the delegation of decision-making to algorithms can weaken human oversight and increase dependence on automated systems. Finally, the lack of full transparency in how these systems operate complicates issues of accountability and explainability.

Deepfake technologies and cybersecurity

In academic discussions, this situation can be described as a "Synthetic Trust Crisis," where the boundary between real and artificial content becomes increasingly unclear, and public trust gradually weakens. The main issue here is not just misinformation, but the growing difficulty of distinguishing what is authentic. There are already real examples showing how deepfake technology is used in political communication. In the United States, AI-generated videos have appeared in political campaigns, sometimes presenting politicians as saying things they never actually said. Even when such content is later labeled as satire, its initial circulation can still influence public opinion. This shows how quickly synthetic media is becoming a normal part of political messaging [9].

Media organizations are particularly vulnerable because they sit at the center of information flows. Journalists' communication channels, unpublished reports, and source data are often targeted in cyberattacks. One of the most common threats is phishing. These attacks often imitate trusted individuals such as editors or colleagues. In more advanced cases like spear phishing, attackers personalize messages based on a journalist's work and contacts, making them more convincing. Protecting sources, using encrypted communication tools, and securely storing data are now standard practices in journalism.

In Azerbaijan, steps have also been taken toward strengthening digital rights and cybersecurity frameworks. Laws on electronic signatures and digital documents, along with institutions such as CERT-AZ, reflect the gradual development of a structured cybersecurity environment [15].

Conclusion

Artificial intelligence accelerates content production, enables personalization of information, and improves the overall efficiency of media processes. At the same time, it raises new questions regarding trust, transparency, and ethical responsibility. In this context, the most realistic approach is not to view artificial intelligence as a replacement for journalism, but rather as a complementary system working alongside it. Human journalists continue to play a crucial role in analytical thinking, interpretation, and ethical decision-making, while AI primarily provides technical and analytical support. Future media systems are expected to evolve toward more personalized, interactive, and real-time structures [4, pp. 2–3]. As the analytical capabilities of artificial intelligence continue to advance, the prediction of user behavior and optimization of content will become increasingly widespread.

In conclusion, the future media model is likely to be shaped by a balanced integration of technological capability and human creativity, ensuring both efficiency and credibility within an evolving information ecosystem.

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THE ROLE OF FOREIGN LANGUAGE COMPETENCE IN STRENGTHENING THE INTERNATIONAL REPRESENTATION OF TURKIC YOUTH

Abstract:

In the twenty-first century, globalization, digital connectivity, and increasing intercultural interaction have transformed foreign language competence into a strategic resource that extends beyond linguistic proficiency. This study explores the interconnected roles of language acquisition, cultural diplomacy, global citizenship education, academic mobility, and international youth representation, with particular attention to the experiences and opportunities of Turkic youth in higher education. Drawing upon the principles of the Common European Framework of Reference for Languages (CEFR), including mediation and plurilingual/pluricultural competence, as well as contemporary approaches to global citizenship education, the research examines how foreign language learning contributes to intercultural understanding, international cooperation, and the development of soft power.Using a qualitative and interdisciplinary approach based on academic literature, policy documents, and theoretical frameworks, the study analyzes the impact of language and cultural diplomacy on international relations and educational mobility. Particular emphasis is placed on the role of exchange programs, international conferences, youth organizations, and volunteering initiatives in strengthening the global engagement of young people. The findings suggest that foreign language competence enables individuals to participate more effectively in international academic and professional environments, promotes cross-cultural communication, and supports the preservation and representation of national and cultural identity in global contexts. Furthermore, language and cultural diplomacy foster mutual trust, reduce cultural barriers, and enhance sustainable international partnerships through people-centered engagement.The study also highlights the growing importance of multilingualism and intercultural mediation in preparing students for global citizenship while maintaining cultural authenticity. Although challenges such as linguistic inequality and cultural homogenization remain significant concerns, the integration of communication-oriented language education with international mobility opportunities can empower young people to become active contributors to global dialogue. Foreign language competence plays a crucial role in enhancing the international representation and engagement of Turkic youth within global platforms. Through the support of higher education institutions, language education initiatives, and international cooperation mechanisms, young people gain greater access to intercultural dialogue, academic mobility, and professional opportunities across borders. These competencies facilitate effective communication, foster mutual understanding among diverse communities, and strengthen the capacity of Turkic youth to contribute to international discussions and decision-making processes.

Keywords: *Language Acquisition, Global Citizenship, Plurilingual and Pluricultural,soft power, academic mobility, higher education, human interaction, exchange programs, multilingualism,cross-cultural communication,volunteering,Turkic youth.*

Introduction: In today`s rapidly globalizing world, education and academic research has spread. As global educational opportunities expand, international communication has become a driving force behind human capital development and cross-cultural collaboration.Within this framework,foreign language opens up new opportunities for young generations. Foreign language skills, especially English, are essential for stu-

dents who want to study or work abroad.Nowdays,Turkic young want to have a say in the world and gain a place to study abroad.The main conditiong facing them,to join prestigious student exchange programs (for instance-erasmus)and participate in international projects,they must know English. Developing linguistic competence is therefore essential for Turkic youth to overcome academic isolation, engage in cultural diplomacy, and actively contribute to the global knowledge economy. At the same time, cultural diplomacy has emerged as an important strategy for strengthening international relationships and encouraging intercultural dialogue. Unlike traditional diplomacy, which mainly focuses on governmental interaction, cultural diplomacy emphasizes communication between societies through art, literature, music, education, cinema, and cultural exchange programs. These interactions help nations build trust, reduce stereotypes, and foster mutual respect in an increasingly interconnected world.In recent decades, globalization and technological advancement have accelerated cultural interaction on an unprecedented scale. Social media, international tourism, and digital communication have made intercultural communication more accessible than ever before. Consequently, many countries invest heavily in cultural institutions such as the British Council, Alliance Française, and Confucius Institutes to promote their national culture and strengthen diplomatic relationships internationally (Cull, 2008).The main purpose of this article is to investigate the impact of foreign language skills on the participation of young people from the Turkic world in international platforms, educational programs, and intercultural communication. The research will analyze the advantages that language skills create in accessing international opportunities and their role in presenting national culture on a global level.According to Akbarova (2026), the rising influence of the Turkic world in the global arena necessitates a comprehensive reassessment of foreign language acquisition models within these societies.

Material and methods: This study employs a mixed-methods approach, combining theoretical analysis with empirical research to examine the intersections of foreign language competence, global citizenship, academic mobility, and cultural diplomacy. While the conceptual framework relies on the thematic synthesis of international standards—primarily the Common European Framework of Reference for Languages (CEFR, 2020) and Christiane Lütge's (2015) formulations on global citizenship .Since diplomacy is deeply connected with communication, identity, and

intercultural interaction, a qualitative approach provides a more comprehensive understanding

of how language and culture influence global cooperation and political perception (Creswell,

2014). The research also uses descriptive methods to outline the benefits and limitations of academic mobility, drawing on literature about intercultural communication, multilingualism, and student experiences. It is entirely theoretical, without surveys or experiments, and focuses on conceptual relationships between language skills and academic mobility.The empirical phase of this research was conducted at Mingachevir State University, specifically targeting undergraduate students within the Department of Foreign Languages. A total of 50 students participated in the study. Purposive sampling was utilized to select participants, ensuring that the sample comprised language learners who are directly impacted by modern pedagogical methods and are potential candidates for international academic mobility and exchange programs (e.g., the Orhun and Erasmus+ Exchange Programs).This involves transcribing, coding, and categorizing student commentaries to extract qualitative narratives regarding linguistic barriers, cultural identity preservation, and curriculum expectations. The synthesized empirical findings will then be cross-referenced with the established theoretical frameworks to formulate concrete pedagogical and institutional recommendations.

Discussion: Learning a foreign language is not just knowing grammar. Because of this we must prepare snergy between linguistic profciency and international academic mobility. A robust theoretical foundation for this relationship is provided by Egitim and Harumi (2025) through their *Four-Step Framework for Success*. The authors conceptualize global competence as a dynamic blend of skills, values, and behaviors that empower learners to blow in interconnected, multicultural environments. In additionally,Christiane Lutgen`s "Global Citizenship in Foreign language education:Concepts,Practices,Connections" brings a completely new perspective to foreign language education.Christiane highlightes that learning a foreign language is not just about improving linguistic skills.It is also to form the consciousness of "Global Citizenship".According to Lutgen`s concept,the relationships between language education and global citizenship is based on the following principles:

Critical Intercultural Awareness: Students learn to approach other cultures critically and objectively when studying them. This helps to break stereotypes and look at global problems (ecology, human rights, peace) from different perspectives.

Empathy and Dialogue: Foreign language education stimulates individuals' ability to understand others, respect differences, and establish dialogue. The student realizes that he is part of a global world and begins to feel like a "citizen of the world." Moreover,there are two important concepts that I would like to touch on in my research: Mediation and Plurilingual/Pluricultural Competence.

1.Mediation is when an individual acts not only as a language carrier, but also as a kind of "bridge" or "social mediator" between different languages and cultures. This skill helps people with different cultural backgrounds to reach a common denominator, eliminate misunderstandings and build mutual empathy. In other words, mediation is not just a mechanical translation, but the art of correctly transmitting meanings and feelings between cultures.

2. Plurilingual and Pluricultural Competence

This competence means that a person does not keep the languages he knows and the cultures he is familiar with as separate, isolated shelves in his mind. On

the contrary, all this language and cultural knowledge is combined into a single, living and dynamic system within the individual. A person can use this rich internal resource when necessary to communicate incredibly flexibly, adaptively and effectively in a global environment.

This complex system of intercultural knowledge finds its practical application most vividly within the framework of international education and academic mobility. Academic mobility refers to the temporary or permanent movement of students, teachers, researchers, and educational staff between institutions and countries for educational or scientific purposes. Academic mobility has become an essential component of higher education policies worldwide because it promotes educational cooperation, cultural exchange, and scientific innovation.There are several forms of academic mobility. Student mobility includes participation in exchange programs, international internships, short-term training courses, and full-degree studies abroad. Staff mobility involves teaching or conducting research at foreign institutions. Virtual mobility has also emerged in recent years through online educational platforms and digital international collaboration.Programs such as Erasmus+, Fulbright, DAAD, and Mevlana have significantly increased opportunities for international education. These programs aim to strengthen international cooperation and encourage intercultural dialogue among students and academics from different countries.Academic mobility contributes to educational quality by exposing students to new teaching methods, research traditions, and cultural perspectives. It also helps universities build international reputations and improve scientific productivity. Foreign language skills play a crucial role in determining whether students can successfully participate in academic mobility programs. Language competence influences communication, academic performance, social integration, and access to educational opportunities.Strong language skills allow students to participate actively in classroom discussions and collaborative projects. Effective communication also improves relationships with professors, supervisors, and classmates, creating a more positive educational experience. Academic mobility provides numerous advantages for students, universities, and societies. Students who study abroad gain access to different educational systems, teaching methods, and research facilities. Exposure to diverse academic perspectives encourages critical thinking and intellectual independence.International experience also motivates students to improve problem-solving skills and adapt to new learning environments. Academic mobility therefore contributes significantly to educational quality and innovation. Living abroad encourages independence, self-confidence, and emotional maturity.Students learn how to adapt to unfamiliar environments, manage responsibilities, and solve practical problems independently.Academic mobility also broadens students' worldviews by exposing them to different cultures and social systems. Despite the advantages of foreign language competence, many students encounter difficulties related to language barriers. Students often feel nervous when speaking a foreign language in academic environments. Fear of making mistakes may reduce classroom participation and social interaction.Language anxiety can negatively affect confidence, academic performance, and emotional well-being. Therefore, governments and educational institutions must implement policies aimed at improving language education and ensuring equal opportunities.Modern educational systems should prioritize communicative language teaching methods, digital learning technologies, and international collaboration programs. Universities should also provide language support services for international students in order to improve academic success and social integration.Overall, strengthening foreign language education is essential for promoting academic mobility and preparing future generations for participation in the global knowledge economy.

The survey conducted at Mingachevir State University yields critical insights into how language competence affects international youth representation:

Identity and Diplomacy:Participants strongly agree that English proficiency is an essential tool for global citizenship and international cooperation. Students exhibit high confidence in expressing their national culture, history, and values in English , demanding that language and cultural diplomacy principles (soft power, breaking stereotypes) be integrated into the curriculum.

Perceived Barriers: Despite their cultural readiness, students identify key obstacles to academic mobility: speech anxiety (Speaking barrier) , the high cost of international certificates (IELTS/TOEFL) , lack of information on scholarships , and difficulties in academic writing.

Digital Presentation:To project a unified Turkic identity, students emphasize using digital platforms (blogs, social media, YouTube) to share national realities in English , while suggesting that local research themes at scientific conferences should be connected to global issues.

Curriculum Reform:To better prepare youth for global integration, participants propose shifting from rigid grammar to communicative pedagogy (debates, speaking clubs) , introducing academic English (essay writing, conference simulations) , and actively integrating international professors and AI-based learning tools. The empirical findings of our survey regarding students' syntactic difficulties align with Akbarova's (2026) analysis. The structural divergence between the agglutinative nature of Turkic languages (characterized by Subject-Object-Verb word order) and the analytical/inflective structure of Indo-European languages creates a significant cognitive barrier for language learners (Akbarova, 2026).

Consequently,mastering a foreign language elevates individual mobility into a powerful tool for broader cultural diplomacy.This dynamic plays a pivotal role in shaing the international representation of Turkic youth in the twenty-first century. In the twenty-first century, the international representation of youth has become a significant indicator of a nation's intel-

lectual, cultural, and social development. As globalization continues to reshape political, economic, and educational landscapes, young people are increasingly expected to engage in international dialogue, contribute to global initiatives, and represent their countries on various international platforms. For the youth of the Turkic world, foreign language competence serves as a key instrument that facilitates such participation and enhances their visibility in the global arena.One of the most important channels of international representation is participation in international conferences and forums. These events provide young people with opportunities to exchange ideas, discuss global challenges, and establish professional networks with peers from diverse cultural backgrounds. Turkic youth who possess strong foreign language skills are better equipped to present their perspectives, share their cultural heritage, and actively contribute to discussions on issues such as sustainable development, innovation, education, and intercultural cooperation. Through these experiences, they not only gain valuable knowledge but also strengthen the international image of their countries. Volunteering programs also provide valuable opportunities for international representation. Whether participating in environmental campaigns, humanitarian initiatives, cultural festivals, or educational projects, young volunteers contribute positively to society while simultaneously promoting the values and traditions of their countries. These experiences foster intercultural dialogue and demonstrate the willingness of Turkic youth to contribute to global well-being. Effective communication skills, particularly in widely spoken international languages, remain crucial for successful participation in these activities.When young people effectively communicate theircultural heritage abroad,they actively practice what modern theorists define as soft power.Reflecting this dynamic,the findings of this study highlight that language and cultural diplomacy have become essential instruments in shaping modern international relations. In contrast to traditional diplomacy, which relies mainly on political negotiations and economic power, contemporary global interactions increasingly depend on cultural influence and effective communication between societies. This shift reflects the growing importance of "soft power," where attraction and persuasion play a greater role than coercion in achieving international goals (Nye, 2004). One of the key observations is that language functions not only as a communication tool but also as a strategic asset in diplomacy. The dominance of widely spoken languages, particularly English, has significantly influenced global communication patterns, academic exchange, and international cooperation. However, this dominance also raises concerns about linguistic inequality and the gradual decline of minority languages, which may lead to cultural homogenization in some regions (Crystal, 2003). The study also shows that cultural diplomacy plays a crucial role in building trust and reducing misunderstandings between nations. Through cultural exchange programs, educational cooperation, and international institutions such as the British Council, Alliance Française, Goethe-Institut, and Confucius Institutes, countries are able to present their cultural identity and strengthen bilateral and multilateral relations. These initiatives contribute to the development of long-term diplomatic relationships based on mutual respect and shared understanding (Cull, 2008). Moreover, globalization and digital communication technologies have significantly expanded the scope of cultural diplomacy. Social media platforms, online education, and global mobility have made intercultural interaction more frequent and accessible than ever before. While this creates new opportunities for cultural exchange, it also introduces challenges such as cultural misinterpretation, misinformation, and the oversimplification of complex cultural identities. Overall, the analysis demonstrates that language and cultural diplomacy are not only supportive tools of international relations but also fundamental elements that shape global cooperation, identity, and mutual understanding in the twenty-first century.

Conclusion: All in all, improving the quality of foreign language education in the Turkic world can greatly contribute to young people benefiting more from global opportunities, increasing their competitiveness in the international labor market, and expanding inter-university exchange programs. For this, first of all, a practical conversation-oriented teaching system should be strengthened in schools and universities. Language is not only a means of communication but also a strategic tool that affects global perception and intercultural understanding. The widespread use of global languages, especially English, reflects the importance of soft power, while also raising concerns about the protection of linguistic diversity. Similarly, cultural diplomacy helps countries build trust, reduce stereotypes, and strengthen cooperation through education, arts, and cultural exchange.In addition, it is important to involve teachers in international internship programs and train them with modern teaching methods. In order to increase the motivation of young people, international certificate programs should be supported, and cooperation with foreign universities should be expanded.

At the same time, the use of digital platforms and artificial intelligence-based educational resources should be expanded. Online speaking clubs, joint Turkic world student projects, and international seminars can develop both the language skills and global outlook of young people. These steps will help shape a stronger, more competitive, and more internationally connected young generation in the Turkic world.

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ARTIFICIAL INTELLIGENCE AND JOURNALISTIC ETHICS: NEW CHALLENGES FOR EDUCATION

Abstract

This article examines the transformations occurring in the media environment against the backdrop of the rapid development of artificial intelligence technologies and analyzes the impact of these changes on the principles of journalistic ethics. The relevance of the topic is associated with digitalization, automated news production, algorithmic content selection, and the integration of generative artificial intelligence tools into editorial processes. Although artificial intelligence increases the speed and scale of information production, it also complicates issues such as disinformation risks, authorship responsibility, transparency, source reliability, and ethical decision-making. In this regard, the necessity of developing new professional and ethical competencies in journalism education has emerged.

The purpose of the research is to identify the changing nature of the ethical responsibility of the journalism profession in the age of artificial intelligence, to systematize new risks arising in media practice, and to substantiate directions for renewing ethical approaches in journalism education. Analytical, comparative, and systematic research methods were employed, while international media practices, academic sources, and modern journalism education models were theoretically analyzed.

The findings of the study demonstrate that artificial intelligence does not alter the fundamental mission of journalism — serving the public interest, seeking truth, and disseminating responsible information — but transforms the journalist into a professional who manages technological tools and performs the function of an ethical filter. It is determined that media literacy, algorithmic thinking, fact verification, data ethics, and the responsible use of artificial intelligence tools emerge as key competencies in the training of future journalists. The prospects of the research envisage future scientific studies related to updating journalism curricula, adapting ethical standards to the digital environment, and developing models of human–artificial intelligence collaboration.

Keywords: *artificial intelligence, journalistic ethics, media education, digital journalism, AI ethics, information responsibility.*

Introduction

Digital transformation has fundamentally changed the systems of information production, dissemination, and consumption. The rapid development of internet technologies, the widespread use of social media platforms, and the formation of automated information systems have transformed the traditional model of media activity. While information production in the classical era of journalism was mainly based on editorial structures and human resources, today this process is closely connected with technological platforms, databases, and algorithmic management mechanisms.

In particular, the integration of artificial intelligence technologies into the media sector redefines the technical, professional, and ethical boundaries of journalistic activity. Artificial intelligence is no longer merely an auxiliary technological tool but has become an active participant in information production. Contemporary journalism is characterized not only as an activity based on human creativity, but also as a hybrid communication model grounded in cooperation between humans and algorithms.

This transformation directly affects the goals of journalism education. Since traditional teaching approaches no longer fully correspond to new media realities, the modernization of educational programs and the integration of technological and ethical competencies have become necessary.

The application of artificial intelligence technologies in the media industry can be observed in several major directions. First of all, the automation of news production processes attracts considerable attention. Algorithms are capable of automatically generating news texts based on financial reports, sports statistics, weather forecasts, and operational data. This provides editorial offices with significant advantages in terms of efficiency and resource savings.

At the same time, the analysis of Big Data creates new opportunities for understanding audience behavior. Artificial intelligence systems analyze users' interests, information consumption habits, and social media activity in order to provide personalized content. As a result, media organizations gain opportunities to develop audience-oriented strategies.

Artificial intelligence also plays an important role in the creation of multimedia content. Automatic video editing, voice synthesis, visual content generation, and data visualization reduce the technical burden on journalists. However, this process simultaneously causes editorial decisions to become increasingly influenced by algorithms.

Since algorithmic prioritization mechanisms possess the power to shape the information agenda, issues of editorial independence and responsibility become even more actual. The core ethical principles of journalism — accuracy, objectivity, balance, responsibility, and transparency — require new interpretations in the era of artificial intelligence.

Previously, the verification of information sources and the preparation of materials were entirely under the control of journalists. Today, algorithmic systems directly influence the selection and presentation of information.

This situation transforms the role of the journalist into not only an information producer but also a professional who supervises technological processes and performs the function of an ethical filter. Journalists must evaluate the accuracy of AI-generated content, the reliability of sources, and potential risks of manipulation. The principle of transparency also acquires a new meaning.

Audiences should be informed whether content has been created by a human or generated through algorithmic systems. Therefore, algorithmic transparency and explainable AI have become important components of ethical standards in media organizations. Parallel to the rapid development of artificial intelligence technologies, new ethical risks have emerged within the media environment.

One of the most serious problems is the spread of deepfake technologies. Artificially generated video and audio materials may be used to manipulate public opinion, influence political processes, and disseminate disinformation. The automation of disinformation production also poses a significant threat.

Since generative artificial intelligence systems can produce large volumes of text, images, and videos within a short period of time, the spread of false information accelerates. This increases the importance of fact-checking institutions and professional journalism. Another major issue concerns copyright and intellectual property. Questions regarding who owns AI-generated content, the legal status of data used for machine training, and the protection of creative labor continue to be debated internationally. Data security and the protection of personal information are also becoming increasingly important within the context of media ethics. During the analysis of audience data, preserving the principle of privacy creates substantial responsibilities for journalists and media organizations.

The current transformation necessitates the renewal of journalism education in terms of both structure and content. Modern journalists must not only possess writing and reporting skills, but also understand digital technologies, algorithmic systems, and information flow analysis. In this regard, the integration of the following directions into journalism curricula is considered essential:

- AI literacy and algorithmic thinking,
- digital ethical decision-making,
- fact-checking and methods of combating disinformation,
- data journalism and data analysis,
- information security and media law.

The role of educators within the teaching process is also transforming. Teachers are no longer merely transmitters of knowledge, but facilitators who develop students' critical thinking, ethical responsibility, and analytical abilities. Practical projects, laboratory-based learning, and educational models integrated with media technologies are becoming major tools in preparing the new generation of journalists.

The journalist of the future will emerge as a professional who combines technological skills with humanistic values. Artificial intelligence does not replace journalists; rather, it expands their sphere of responsibility. In this context, the rapid development of AI technologies makes it necessary to modernize the structure and content of journalism education in Azerbaijan. In order to prepare globally competitive media professionals, higher education institutions should become not only centers of theoretical instruction but also hubs of innovation and media technologies.

For Azerbaijan, the following priority directions may be identified:

1.Curriculum Transformation

The integration of new disciplines into journalism programs is essential:

- Artificial Intelligence and Journalism
- Algorithmic Media Ethics
- Data Journalism
- Digital Security and Information Literacy
- Disinformation and Fact-Checking Methodology

2. AI Ethics and Media Responsibility

The application of AI technologies requires not only technical preparation but also ethical training. Universities should systematically develop students' knowledge concerning:

- algorithmic bias,
- data privacy,
- deepfake and manipulation risks.

3. University–Media Industry Cooperation

For practice-oriented education, the following initiatives should be developed jointly with editorial organizations:

- digital newsroom models,
- startup journalism projects,
- student media platforms. Such cooperation serves as a bridge between academic knowledge and real media practice.

4. Establishment of Fact-Checking Laboratories

Within the environment of disinformation, fact-checking centers should become an integral part of journalism education. Such laboratories enhance students' practical skills in:

- open-source investigations,
- information verification,
- AI-assisted analytical tools.

5. Formation of a National

Media Model While adopting global standards, journalism education in Azerbaijan should also develop a local model that preserves national media culture, language policy, and social values. This approach ensures a balance between technological modernization and cultural identity.

Conclusion In conclusion, the integration of artificial intelligence technologies into journalism changes the essence of media activity and forms a new stage of professional ethics. Although AI increases the speed and scale of news production, the fundamental mission of journalism is the search for truth, the protection of public interest, and the development of democratic communication environments — remains unchanged.

In this context, the primary goal of journalism education should be to prepare journalists who are capable not only of using technology but also of managing it ethically. The education system must establish a balance between technical competence, ethical responsibility, and humanistic thinking. The future media environment will be built not upon confrontation between humans and artificial intelligence, but upon their cooperation. This cooperation will benefit society only if journalism preserves its humanistic essence while responsibly applying technological innovations.

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ANGLICISMS IN MODERN MEDIA LANGUAGE: FACTORS OF GLOBALIZATION AND ARTIFICIAL INTELLIGENCE

Abstract

The article examines the spread of anglicisms in modern media language within the context of globalization and artificial intelligence. The study analyzes the increasing use of English-origin words in Azerbaijani and Spanish as a result of the transformation of English into an international means of communication, the development of digital technologies, and the expansion of social media. The use of anglicisms in technology, media, economics, sports, and everyday communication is comparatively investigated. At the same time, the impact of artificial intelligence on journalism and digital media, particularly the influence of automated text production on stylistic diversity and lexical development, is evaluated. Comparative-descriptive and analytical methods were applied during the research. The results demonstrate that globalization and digital communication accelerate the spread of English-origin words, while artificial intelligence technologies further intensify this process. The article also discusses the positive and negative effects of anglicisms on language development and emphasizes the importance of preserving national languages in the future.

Keywords: *anglicisms, globalization, artificial intelligence, media language, digital communication, neologisms.*

INTRODUCTION

In the modern era, English plays an important role as an international language of communication in technology, science, economics, media, and many other fields. Due to the expansion of globalization, the spread of Anglo-Saxon culture, and especially the cultural influence of the United States, English-origin words have increased in the languages of countries around the world.

One of the main reasons for this situation is the international prestige of the English language. The global dominance of English is related not only to the number of speakers but also to the political and economic power of the United States and Great Britain. In many cases, even when equivalent terms exist in Spanish, people still prefer to use English terms. In linguistics, this phenomenon is explained by the concept of “barbarism.”

The borrowing of lexical units from foreign languages is a natural phenomenon for different lexical systems and is associated with several extralinguistic factors. Language has never been a closed system, and its development cannot occur in isolation from external influences. In this regard, foreign language elements regularly penetrate the lexical systems of all languages. Most neologisms of recent years are anglicisms, that is, words of English origin.

The use of English-origin words has also become widespread in Azerbaijan. It should be remembered that until recently, Azerbaijani society used more words borrowed from Russian. The main reason for this was Azerbaijan’s status as a post-Soviet country. Today, however, the younger generation increasingly prefers anglicisms because English has become a global language. In mass media and social media, people no longer translate many English words into their native language, and thus these words become internationalized. In the media, several terms, organization names, newspapers, magazines, and television channel names are sometimes written in English and sometimes in Azerbaijani.

Since the beginning of the twentieth century, with the development of Azerbaijan’s oil industry, the process of introducing English-origin words into Azerbaijani accelerated. English words in Azerbaijani are related to economics, politics, science, culture, and sports. English borrowings entered Azerbaijani during two periods:

1. the pre-independence period
2. the post-independence period.

In the post-independence period, anglicisms began to be used more frequently. As English gradually became a dominant language in modern technology, these terms entered Azerbaijani unchanged. It is an undeniable fact that today English functions as an international language. Modern technological devices, information technologies, their invention, and their export to the world market are largely associated with English-speaking countries. Whenever an object or technology is invented in a particular country, its name usually remains in the language of that nation. Recently, examples of English-origin information technology terms used in Azerbaijani include monitor, computer, Windows, driver, processor, Word, Photoshop, WhatsApp, e-mail, Instagram, and others. [1, p.79]

Neologisms are new words and expressions, and they are divided into two groups: primary and conditional neologisms. Primary neologisms are completely new words that usually emerge as a result of developments in technology, science, and modern life. Words such as “selfie,” “blogger,” and “online” are examples of this type. Conditional neologisms, on the other hand, emerge when existing words acquire new meanings. For example, the word “mouse” was previously used only to denote an animal, but today it is also used for a computer device. Such neologisms demonstrate that

language develops and adapts to the changing needs of society.

Examples of primary neologisms:

- selfie
- blogger
- smartphone
- podcast
- drone
- influencer
- startup
- cryptocurrency
- chatbot
- electric vehicle

Examples of conditional neologisms:

- mouse
- window
- network
- cloud
- platform
- channel

Primary neologisms are entirely new words, whereas conditional neologisms involve the use of existing words in new meanings.

English-origin words are also frequently encountered in advertisements. For example, Bakcell "started" a new campaign using the word "start." Although the word "start" does not originally exist in Azerbaijani, even children already know that it means "to begin."

Anglicisms found in Azerbaijani can be classified according to different fields:

1. Scientific and technical fields: smartphone, printer, scanner, server, program, file, platform, podcast, online, cybersecurity, startup.
2. Political, social, and economic vocabulary: manager, marketing, business, sponsor, rating, investment, lobby, summit, parliament, monitoring, coalition.
3. Sports terminology: corner, offside, finish, penalty, out, etc.

In news reports, we frequently hear the phrase "terror act," whereas previously "terror incident" was more common. The English word "act" means "incident," but it has remained unchanged in the language.

To understand the global spread of English, it is enough to look at its historical roots, especially the role of the British Empire in spreading the language across various regions. Historically, England introduced English as a language of education and official communication in parts of Africa, Asia, the Caribbean, and Southeast Asia. Within the colonial system, English was taught to local populations mainly through missionary schools, administrative institutions, and legal structures. Over time, the language became associated with the elite and became the main tool of state administration. Even after many former colonies gained independence, English retained its important role in international relations and economic development.

This can be compared to the prestige once associated with speaking Russian in Azerbaijan. However, because English is more global, it is now considered more prestigious than Russian in Azerbaijani society.

In the postcolonial period, the official status of English cannot be explained solely by practical needs; social and linguistic hierarchies also play an important role. In many cases, local languages are reduced to everyday communication, while English dominates prestigious and official domains. Phillipson describes this phenomenon as "linguistic imperialism," arguing that the perception of English as a superior and necessary language weakens local languages and pushes cultural identity into the background. [2, p.2]

The technological transformations accompanying the digital era have further strengthened English as the hegemonic language of global communication. With the emergence of the internet and later the development of artificial intelligence, English became firmly established as the primary language of digital infrastructure. Most online content is created and shared in English. This can clearly be observed on global platforms such as Instagram, X, Facebook, and YouTube.

Although many countries attempt to prevent the increase of anglicisms, English remains the dominant language of professional and technical communication in fields such as programming, digital marketing, and user interface design. This situation also creates important epistemological consequences. In other words, the dominance of English influences how people access information and which forms of knowledge are considered more authoritative.

Currently, Baku is hosting the global conference WUF13 – World Urban Forum (17–22 May 2026). In both the media and public discourse, the abbreviation "WUF13" is used directly instead of an Azerbaijani equivalent, once again demonstrating the global dominance of English.

The dominance of English is directly proportional to the increasing use of artificial intelligence in recent years. AI technologies have become widely used in journalism as well. In order to attract larger audiences, many media organizations have begun integrating artificial intelligence systems into their activities. Programs such as ChatGPT and Midjourney are widely used for preparing news reports and analyzing information. For example, The Guardian announced that it plans to use artificial intelligence to assist journalists in processing large databases and generating new ideas.

In modern media, artificial intelligence is mainly applied in the following areas:

- automatic news production,
- data processing and analysis,
- personalized audience communication.

One of the technologies widely used in journalism is NLP (Natural Language Processing). Through this technology, computers analyze texts, generate news reports, examine social media data, and identify fake news.

The use of artificial intelligence in the press creates several important advantages. One of the most significant is the faster preparation and dissemination of news. This is especially important for delivering current events quickly. At the same time, the automation of technical and routine tasks in newsrooms reduces journalists' workload and allows them to focus more on research and analytical writing. Furthermore, artificial

intelligence can process large volumes of data in a short period of time, making it easier to identify statistical indicators and trends. Faster translation processes are also among the major advantages, since news can be translated into different languages more easily and reach wider audiences. Personalized news feeds tailored to users' interests also increase accessibility and reader satisfaction.

Despite these advantages, artificial intelligence also creates challenges such as the spread of misinformation, reduced transparency, and copyright-related problems. For this reason, the European Parliament has implemented legal measures to regulate generative AI systems. Disinformation is sometimes spread deliberately, posing serious threats to public trust and democratic discourse. The uncontrolled distribution of information through various platforms and its rapid spread have intensified these risks.

The growing proportion of texts in newspapers, news portals, and social media generated by artificial intelligence raises important concerns about the future of language and deeply worries linguists. This issue concerns not only journalism but also the broader ability of language to interpret the world and participate in public discussion. For example, students who rely entirely on AI for homework may fail to develop imagination and creativity. The same concern can be applied to media professionals.

Historically, the press has been one of the primary spaces where public language is formed. Media outlets not only communicate events but also contribute to the creation of new words and expressions. In this sense, the press has traditionally stimulated language development. However, when a large portion of writing is delegated to automated systems, this role may weaken. AI models generate texts mainly based on statistical probabilities derived from existing language patterns. As a result, commonly used expressions are repeated, and writing styles become increasingly standardized. Repetitive text production leads to what is known as "model collapse," which threatens the developmental role of journalism. As artificial texts multiply on the internet, the diversity of authentic human language decreases, and future AI systems learn from more limited linguistic material. As diversity declines, stereotypes and biases become stronger. Sentence structures are repeated, styles become simplified, and forms of expression become standardized. Considering that journalism not only transmits information but also acts as a bridge between different fields of society, this negative trend should concern everyone.

Negative effects of excessive use of artificial intelligence in the media:

1. **Standardization of style**

Texts become similar to each other, reducing expressive richness and creativity in language.

2. **Risk of misinformation**

Artificial intelligence may sometimes generate incorrect or inaccurate information.

3. **Weakening of the journalist's role**

The automation of some texts affects the work of professional journalists.

4. **Strengthening of biases**

Stereotypes in training data may be reproduced and further reinforced by the system.

5. **Trust issues**

Readers may find it difficult to distinguish whether a news article is written by a human or by artificial intelligence.

The impact of artificial intelligence in the media has also led to an increase in anglicisms. Previously, these words were written in italics or with apostrophes, but now these practices are disappearing, and they are increasingly used as regular lexical units. This further shows that anglicisms are integrating into our native language. In social media and the digital environment, anglicisms can be classified as follows:

1. Social media and communication

- Email
- Post
- Followers
- Hashtag
- Messaging
- Video call
- Social network

2. Online services and platforms

- Website
- Online platform
- App
- Browser
- Search engine

3. Work and service sector

- Meeting
- Call center
- Community manager
- Newsletter

4. Technical and digital concepts

- Link
- Password
- Login
- Logout
- File sharing
- Cloud storage

5. Media and content

- Streaming
- Influencer marketing
- Viral content
- User-generated content
- Meme culture
- Storytelling
- Bullying
- Video editing
- Online broadcasting

Anglicisms can also be frequently observed in Spanish media. Considering that Spanish is the native language of about 550 million people and is widely spoken across the Americas, it is still significantly influenced by English. English-origin words are widely used in modern Spanish across various fields, sometimes without any changes, and sometimes in adapted or hybrid forms. These words are especially common in media, technology, fashion, economics, and social networks.

For example, in social media and digital communication, the concept of "blog" refers to a webpage where authors regularly publish their thoughts. "Hashtag" is used to mark topics on social networks, while "fan" can mean both a supporter and a technical device (fan). In sports and entertainment, words such as "zapping" and "star" are often used without modification. "Zapping" refers to quickly switching between TV channels, while "star" is used both for famous people and in various hybrid or incorrect forms, creating a wide lexical field. In fashion and marketing, words such as "fashion," "marketing," and "prime" are used in mixed forms with local language elements, such as "fashionista," "requetefashion," or "primers hidratante." This shows both adapted and fully English forms existing in parallel. In technology and business, words such as "app," "smartphone," "link," "business," "stock," and "overbooking" are widely used. Some of these are adapted in Spanish (e.g., "catering" → "cáterin," "overbooking" → "sobrerreserva"), while many remain unchanged. Hybrid forms also appear, especially with words like "link" and "stock." In media and digital culture, words such as "podcast," "film," "hit," and "catering" are used in both adapted and original forms.

Overall, these examples show that modern language environments are constantly changing, and English-origin words are either directly borrowed, adapted, or used in hybrid forms to create new expressions. This process reflects language development, but it also creates differences between normative rules and actual usage.

Methodology

The results of the study show that anglicisms are widely used in modern Spanish digital media, especially in technology and sports fields. The use of these words is closely related to the principle of linguistic economy and global communication trends. For example, words such as "corner," "coach," "fan," "score," and "play-off" have become common units of usage in Spanish and are mostly not translated. Previously, these words were marked in italics, but today they are generally accepted in everyday usage.

Conclusion

Overall, the research shows that anglicisms dominate particularly in sports and technology topics in Spanish digital media. Artificial intelligence also indirectly influences this process by transforming journalistic practice and accelerating digital communication, which may further increase the spread of anglicisms in the future. [3, p.230]

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