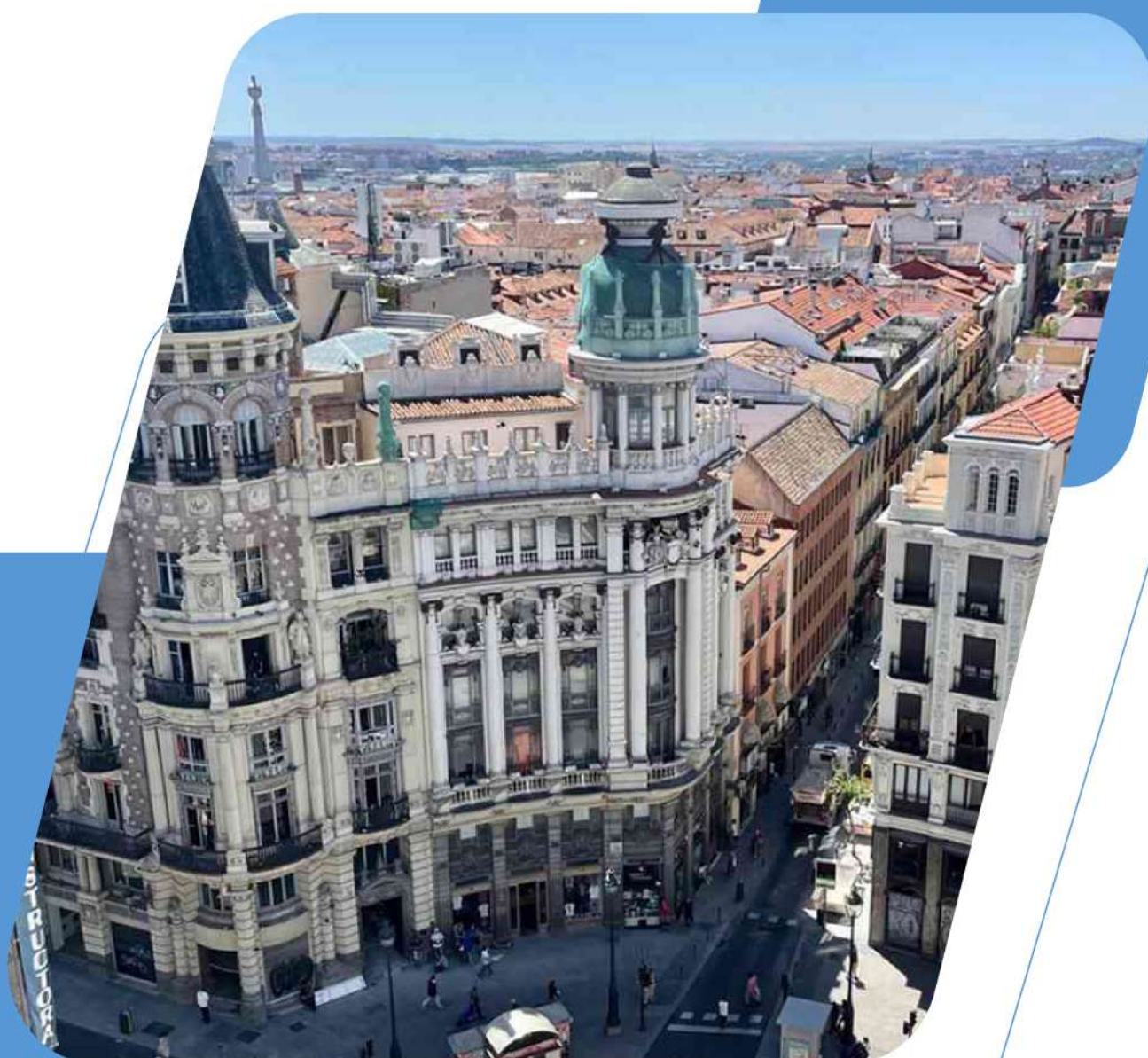




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Biological sciences

THE EFFECT OF SOME POLYPHENOLIC COMPOUNDS ON THE ACTIVITY OF ATP-SENSITIVE POTASSIUM CHANNELS OF LIVER MITOCHONDRIA IN ALLOXAN DIABETES

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Abstract

In this work, the effect of polyphenols YAN-2 (ratio 6:1) and YAN-2 (ratio 4:1) on the activity of the ATP-dependent potassium channel (mitoK+ATP channel) in rat liver mitochondria under alloxan diabetes conditions was studied. Alloxan monohydrate was used to create a diabetes model in rats. Mitochondria were isolated from rat liver by differential centrifugation. Polyphenols YAN-2 (6:1 ratio) and YAN-2 (4:1 ratio) were found to increase the activity of mitoK+ATP channels in the liver of rats with alloxan diabetes.

Keywords: Liver, mitochondria, ATP-dependent potassium channel, alloxan diabetes, polyphenolic compounds

Introduction. The mitochondrial ATP-dependent potassium channel (mitoK+ATP channel) is one of the ion transport systems that plays an important role in the functional activity of mitochondria. The role, pharmacology and regulation of this channel in cellular function are currently being widely studied. It has been established that activation of mitoK+ATP channels implements a protective mechanism of cell adaptation under conditions of hypoxia and oxidative stress [Novikov V.E., 2013]. To date, one of the most studied mitochondrial ion channels that regulate the metabolic and functional activity of the cell is the mitoK+ATP channel. Currently, the biophysical properties of the mitochondrial potassium channel and its physiological significance are well studied. The effect of polyphenolic compounds on the activity of the mitoK+ATP channel of liver mitochondria is studied in various pathological processes. However, the effect of polyphenols YaN-2 (6:1 ratio) and YaN-2 (4:1 ratio) on the activity of mito-K+ATP channels in the liver of rats under alloxan-induced diabetes has not been studied. In this context, the aim of this study was to investigate the effect of some polyphenols YaN-2 (6:1 ratio) and YaN-2 (4:1 ratio) on the activity of mitoK+ATP channels in the liver of rats under alloxan-induced diabetes.

Materials and methods. White outbred male rats weighing 180-200 g were used for experiment. The laboratory animals were fed under the conditions of a standard vivarium diet. Alloxan monohydrate was used to induce diabetes in the experimental animals. The rats selected for the experiment were divided into groups: Group I - control (n=5), Group II - experimental (alloxan diabetes, n=5), Group III - experimental (alloxan diabetes + YAN-2 in a ratio of 6:1), n=6, Group IV - experimental (alloxan diabetes + YAN-2 in a ratio of 4:1), n=6, and Group V (alloxan diabetes + quercetin). To create diabetes mellitus in animals of experimental groups II, III, IV and V, after a day of fasting, a solution of alloxan was injected subcutaneously into the abdominal cavity at a dose of 150 mg/kg (5% in 0.2 ml of distilled water) [Agzamov Kh., 1983]. In rats that had been induced with alloxan diabetes, blood was taken every three days and the glucose level was determined. Twelve days after the injection of alloxan into rats, when the blood glucose level exceeded 11 mmol/l, animals of group II were administered 0.2 ml of 0.9% NaCl solution once a day, and animals of experimental groups III and IV were administered the studied substance once a day for 10 days. The studies were conducted after the blood glucose level dropped below 11 mmol/l. Rat liver mitochondria were isolated using the differential centrifugation method of W.C. Schneider [Schneider et al., 1951]. The permeability of mitoK+ATP channels (0.3–0.4 mg/ml protein) was determined in 3 ml cells by the change in optical density at a wavelength of 540 nm using a

spectrophotometer (V-5000 spectrophotometer).

IM as follows: 125 mM KCl, 10 mM HEPES, 5 mM succinate, 1 mM MgCl₂, 2.5 mM K₂HPO₄, 2.5 mM KH₂PO₄, 0.005 mM rotenone and 0.001 mM oligomycin, pH 7.4 [Vadzyuk O.B., 2008].

Results. The experiments were conducted *in vivo*. The experiments studied the effect of polyphenols YAN-2 (ratio 6:1) and YAN-2 (ratio 4:1) on the permeability of liver mitoK⁺ATP channels under conditions of alloxan diabetes in comparison with the flavonoid quercetin. The permeability of the liver mitoK⁺ATP channel was studied in the presence of ATP in the incubation medium. According to the results obtained, it was found that the permeability of the liver mitoK⁺ATP channel increased without the presence of ATP in the incubation medium. However, it was found that the permeability of liver mitoK⁺ATP channels in rats of group II with alloxan-induced diabetes was reduced compared to the control group (group I). Rats of group III with alloxan diabetes received pharmacotherapy with the polyphenol YAN-2 in a ratio of 6:1 and rats of group IV received pharmacotherapy with polyphenol YAN-2 in a ratio of 4:1. It was found that the permeability of liver mitoK⁺ATP channels was increased in rats with alloxan diabetes of groups III and IV, which received pharmacotherapy with polyphenolic compounds, compared with the control (I) group. It was found that the permeability of liver mitoK⁺ATP channels increased in group V rats with alloxan diabetes treated with the flavonoid quercetin compared to polyphenolic compounds. From the obtained results, it can be concluded that the inhibition of liver mitoK⁺ATP channel permeability under the influence of alloxan is characterized by a sharp decrease in the flow of potassium ions through the membrane. A decrease in the potassium ion cycle can lead to a decrease in the mitochondrial membrane potential and a change in the matrix volume. The isolated polyphenolic compounds YAN-2 in a ratio of 6:1 and YAN-2 in a ratio of 4:1 are able to restore the flow of K⁺ ions in the liver mitochondrial membrane.

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Economic sciences

THE IMPACT OF MULTIMEDIA AND DIGITAL TELEVISION: A DEVELOPMENT ENGINE FOR RURAL AREAS IN ALBANIA

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Abstract

In Albania, the development of multimedia technology and digital television is creating new opportunities for the transformation of rural areas, where the challenges of isolation, lack of infrastructure, and educational inequalities continue to affect development prospects. This study explores how digital technology can serve as a catalyst for the empowerment of young people in rural communities, enabling them to create their content, promote local culture, and build new economic models through simple multimedia tools. The analysis draws on data from higher education, student surveys, and labour market studies, and highlights the growing interest of young people in fields such as animation, audiovisual production, and digital journalism. However, the lack of practical infrastructure, specialised laboratories, and collaboration with industry remains a significant obstacle. The study suggests that the development of innovation centers in rural areas, the integration of technology into university programs, and the creation of bridges between education and the labor market are essential steps for social inclusion and the sustainable development of the territory. Multimedia, in this context, is not only a communication tool but a strategy for territorial equality and community activation.

Keywords: multimedia, rural areas, Albania, digital technology, youth, sustainable development, education, innovation.

Introduction

The historical development of broadcasting and multimedia services in Albania has gone through a long and complex process, which has reflected the impact of political, economic and social changes in the country. The beginnings of journalism in Albania can be dated back to the mid-19th century, with the publication of the newspaper "Ishkodra" in 1868, which marked an important step in the transmission of information and the formation of public opinion (Agolli, 2018). This historical context is essential for understanding the evolution of media and multimedia services later.

After World War II, Albania went through a communist regime, which banned any form of free expression, including the media. During this period, the transmission of information was controlled by the state and focused on propaganda for the regime, making any attempt at diversification and innovation in media services difficult (Boçi, 2023). After the fall of the regime in 1991, Albania began a period of rapid and profound transformation, where private media began to flourish and the transmission of information diversified considerably. The development of television and radio has been of particular importance in this period. One of the first private channels, TV Klan, was created in 1997 and quickly became one of the most watched in the country, offering programs that included news, entertainment, and culture. Therefore, it is known that TV Klan played an important role in helping media pluralism in Albania, but any reference to this should belong to specialized studies on local media. In addition to television, the development of the Internet has also been critical in changing the broadcasting landscape in Albania. The growth of Internet use since the late 1990s and early 2000s has led to a rise in online services, such as news portals and social media platforms, which today offer new opportunities for information dissemination and interaction with the public. These channels have become very important for addressing social and political issues, thus allowing a more open and fair dialogue for the public (Lutfiu, 2024). Challenges continue to exist in the media field, both in terms of transparency and freedom of information, due to political and economic influences. However, recent trends show that Albania is on a path towards consolidating media freedom and diversifying multimedia services, focusing on

innovation and international standards. The historical development of broadcasting and multimedia services in Albania describes a long path that has gone from strict controls under the communist regime to a freer and more dynamic environment, with ongoing challenges but also new opportunities for further growth and development.

The role of multimedia technology in empowering rural communities is significant. As technology evolves, it presents opportunities for enhancing education and fostering economic stability in rural areas. Integrating multimedia in education creates engaging learning environments, particularly in regions with scarce educational resources. For instance, (Alam, 2023) notes that advancements in communication technologies have expanded the market for multimedia content delivery, which can be utilized for educational purposes in rural settings (Alam, 2023). Furthermore, multimedia resources support interactive learning experiences and increase student motivation and participation, as observed by (Brutman et al., 2024) in their research on foreign language learning (Brutman et al., 2024).

In the educational context, multimedia technology breaks down barriers to traditional learning methods. (Francia, 2022) discusses the development of multimedia worktexts aimed at enhancing oral communication skills among high school students, demonstrating the effectiveness of these tools in creating contextually relevant educational materials for diverse learners (Francia, 2022). Moreover, the application of multimedia resources in English language learning is supported by Rispatiningsih (2022), who asserts that multimedia aids various instructional methodologies, positively impacting student engagement and academic performance (Rispatiningsih, 2022). This is particularly important in rural settings where students may not have consistent access to traditional educational frameworks or qualified educators.

Multimedia technology also contributes to the socio-economic empowerment of rural communities beyond educational benefits. (Kong & Loubere, 2021) explore the impact of fintech innovations in rural China, illustrating how digital technologies, when integrated with multimedia communication, can improve access to financial services for previously underserved populations (Kong & Loubere, 2021). This access is vital for rural development, as it promotes economic activities and encourages entrepreneurship by providing readily available information and resources.

(Hosseini et al., 2017) elaborate on the application of telecommunications technologies in medical emergencies within rural areas, highlighting how multimedia communication can enhance healthcare delivery in regions with limited medical facilities (Hosseini et al., 2017). This demonstrates a broader application of multimedia technology that transcends education and positively impacts community welfare by addressing urgent health needs.

To effectively leverage these technologies for rural empowerment, it is crucial to acknowledge the challenges associated with their adoption. (Wu & Peng, 2024) emphasize that rural communities often experience lower access to technology compared to urban areas due to infrastructure deficits and differing consumer preferences (Wu & Peng, 2024). Therefore, it is essential to develop strategies that ensure multimedia initiatives are accompanied by improvements in infrastructure and training to optimize usage and benefits.

Multimedia and digital television are not just entertainment or information tools, but for rural areas they represent a real opportunity for economic development, social inclusion, and sustainable community building. Through technologies such as online broadcasting, local content production, distance education and digital marketing platforms, rural communities have the opportunity to:

- Promote local culture, crafts and tourism.*
- Build new businesses in the field of digital content (podcasts, YouTube channels, local documentaries).*
- Access quality education and real-time information.*
- Strengthen the connection of young people with their homeland through digital storytelling and interactive platforms*

Methodology

This study is based on a mixed methods approach, combining qualitative and quantitative instruments to analyze the impact of digital media and television on the development of Albanian rural areas. In the first phase, we studied how multimedia and television affect the development of rural areas, where we looked at it from the perspective of economic, social, and cultural development. We used semi-structured interviews with the media in local areas, residents of these areas, and local organizations, where through these questionnaires we aimed to collect different opinions on the contribution that the media have in informing and educating to have a local identity. These questionnaires were also used to assess the degree of use of digital media and perceptions of their impact on daily life. To deepen the

analysis, concrete cases of Albanian rural areas where the use of the media has brought visible results, highlighting successful practices and challenges encountered on the ground.

Result

Young people in rural areas are increasingly engaged with technology and digital media, but often face limitations in infrastructure, education, and employment opportunities.

Innovation is the central initiator of economic growth, development, and the creation of better jobs. It is the key that enables companies to compete in the global or local market successfully and the process that searches for solutions for social and economic challenges, from climate change to the battle against deadly diseases (Minga, A et al, 2023). The development of a territory and the role of business in innovation are closely intertwined. A thriving business sector can help drive economic growth and development in a region, while a supportive environment can foster innovation and entrepreneurship. (Jana, K et al, 2023).

The need for new technologies among rural youth has become increasingly significant as digital integration into various aspects of life accelerates. Several factors, including economic development, educational equity, and social connectivity, drive this urgency. In rural areas, where traditional economic opportunities may be limited, emerging technologies such as telework can present pathways for economic development and job creation (Gallardo & Whitacre, 2018). Telework can effectively bridge the gap between rural communities and urban economies, enabling residents to engage with wider markets and industries that were previously inaccessible.

Additionally, the agricultural sector, which is critical for rural livelihoods, can benefit from youth engagement and the adoption of technology. Ogunmodede et al. emphasize the potential of agribusiness as a vital area for youth participation, noting that empowering young individuals through targeted programs can facilitate this involvement, ultimately contributing to local economic resilience (Ogunmodede et al., 2020). Furthermore, the provision of educational programs that introduce technology in farming practices can encourage innovation and improve productivity.

Moreover, a collaboration between local libraries and youth coding clubs illustrates how partnerships can enhance digital skills among rural youth. This initiative addresses barriers such as affordability of technology and internet access, which are common challenges in rural areas (Kelly et al., 2022). By fostering coding skills and digital literacy, these programs not only prepare youth for the job market but also promote a culture of innovation within their communities.

Bridging the digital divide remains a pressing issue, particularly as highlighted in studies examining the socio-economic implications for rural populations. Vong et al. explored the intersection of knowledge management practices and digital skills acquisition, demonstrating how informed engagement can empower rural youth to utilize technology effectively (Vong et al., 2017). Their research underscores the advantages of equipping rural youth with relevant skills, enabling them to engage actively in digital spaces.

Importantly, addressing the barriers faced by rural youth concerning technology adoption is essential for fostering their participation in local economic activities. Venkatesan et al. affirm that while rural youth express interest in agricultural activities, their enthusiasm is often dampened by limited access to necessary resources and technology (Venkatesan et al., 2018). This highlights the importance of creating supportive environments that facilitate technology acceptance and utilization among youth.

Surveys and analyses conducted in Albania show a high interest among young people for careers in fields such as:

- 3D animation
- Video post-production and editing
- Audio-visual production
- Digital journalism and online marketing

This increase in demand should be accompanied by investments in educational centers, practical laboratories, and support for small start-ups in areas outside urban centers.

The development of education in the field of multimedia can serve as a starting point for the rural creative economy. Multimedia serves as a crucial bridge between education and local economies, enhancing educational methodologies while simultaneously fostering economic development in various regions. The integration of multimedia technologies within educational frameworks has been shown to significantly improve learning outcomes, facilitating more engaging and effective teaching methods. For example, Hamad and Chtourou highlighted that multimedia-enhanced learning, particularly through interactive educational tools, positively influences student engagement and cognitive skills in physical education contexts (Hamad & Chtourou, 2023). Similarly, Tayirova emphasizes the potential of

multimedia technologies to cultivate students' creativity and enhance educational practices, enabling a more dynamic learning environment (Tayirova, 2023). Furthermore, consistency in findings supports the efficacy of multimedia in education, as noted by Abdurrahman et al., who confirmed that multimedia components—such as audio and video—enhance teaching and learning processes across various subjects (Abdulrahman et al., 2020).

Beyond the educational sector, the implications of multimedia extend deeply into local economies. Chen and Liu assert that modern multimedia systems have transformed economic structures, particularly in countries like China, facilitating innovations in business management and reshaping consumer behaviors (Chen & Liu, 2021). The infusion of multimedia into education allows institutions to produce a skilled workforce adept at navigating today's digital landscape—thereby enhancing local economic development by increasing employability and encouraging entrepreneurship (Boccella & Salerno, 2016). A systematic literature review by Basri et al. discusses how educational tourism, particularly through language schools and multimedia resources, can stimulate local economies by generating employment and promoting cultural exchange (Basri et al., 2023).

Moreover, the relationship between educational institutions and economic growth is reinforced through the integration of multimedia technologies. Research has shown that higher education institutions drive local economic development by fostering new community dynamics and culture among students and faculty, which culminates in innovation and increased economic participation (Setyadi et al., 2021). Local economies are more likely to thrive when educational entities utilize multimedia tools effectively, as these tools not only enhance individual learner outcomes but also contribute to broader economic vitality and community resilience (Saraswaty et al., 2024).

Rural areas in Albania face a number of challenges that significantly hinder the process of sustainable development, including the lack of digital infrastructure, the emigration of young people to urban centers or abroad, and restrictions on access to specialized education. However, in this context, multimedia technology can play a key role as a modern and effective tool for improving the social and economic conditions of rural communities. One of the main challenges is the lack of technological infrastructure in many villages and remote areas, where access to stable and high-speed internet is still limited. This directly affects the inability to provide distance education, develop local digital content initiatives, or use modern tools for online marketing and promotion.

Furthermore, educational institutions in these areas are not equipped with practical laboratories, while teaching in applied technologies is limited and often relies only on theory. Another obstacle is the lack of cooperation between universities and the creative industry, which makes it difficult for students in rural areas to benefit from professional internships or specialized mentoring in the fields of audiovisual technology. This creates a gap between theoretical preparation and the practical skills required by the market. In some cases, local communities themselves are skeptical about using technology as a development opportunity, due to a lack of awareness or clashes with traditional cultural norms. According to Marku et al, 2024, Students expressed limitations in social opportunities, scarcity of recreational activities, inadequate infrastructure, and limited access to public services as important factors contributing to migration trends

However, despite these challenges, there is great potential to turn multimedia technology into a sustainable development tool. The creation of community technology centers in rural areas, structured as open laboratories for training, content production and collaboration between young people and local actors, can help revitalize cultural and economic life. The inclusion of courses focused on multimedia and digital journalism in regional schools and universities can create a new generation capable of building careers in these fields, without being forced to leave their communities. Multimedia also offers the opportunity to promote local tourism and cultural heritage through the production of videos, documentaries, websites and digital stories that make the area more recognizable and accessible to the general public. At the same time, it helps local producers to engage in wider markets through online platforms. This economic dimension is reinforced by the opportunity offered by technology to develop forms of remote work, such as graphic design, video editing, content editing or digital marketing, which can be practiced from any place, including the most isolated areas. Finally, the development of small start-ups dealing with digital content in rural areas, if supported by public funds or partnerships with the private sector, can generate new jobs, increase the inclusion of women and help prevent the abandonment of the territory. These initiatives, combined with integrated development policies, can transform multimedia technology from a privileged urban tool, into a real strategy for territorial equality and social inclusion in Albania

Conclusions

The analysis of the role of multimedia technology and digital television in the development of rural areas in Albania highlights that these technologies represent an untapped potential for promoting sustainable territorial development, social inclusion of young people and economic revitalization of local communities. Despite the lack of technological infrastructure in some areas, the interest of young people in pursuing careers in the fields of multimedia and digitalization is high, signaling the need for modernization of curricula, expansion of practical opportunities and the establishment of special laboratories in universities and schools in non-urban areas. It is concluded that multimedia can serve as an effective bridge between education, culture and the local economy, enabling the promotion of cultural heritage, the development of rural tourism and the connection of local producers with wider markets through digital platforms. To achieve this, it is necessary to build collaborative structures between universities, the technology industry and local authorities. These interactions can create innovative ecosystems, where young people have the opportunity to develop ideas, learn through practice and build small creative enterprises without leaving their communities. Multimedia technology should be treated as a strategic element in national rural development policies, being seen not only as a tool for information, but as a powerful catalyst for positive change, contributing to territorial equality, reducing inequalities and improving the quality of life in the countryside.

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PROJECT IMPLEMENTATION AND MANAGEMENT STRATEGIES IN INDUSTRIAL ENTERPRISES OF AZERBAIJAN

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Abstract

Effective management and implementation of projects in industrial enterprises play a crucial role in fostering economic development and establishing a sustainable industrial structure. This article analyzes the key factors influencing project management in Azerbaijani industrial enterprises, explores the challenges encountered in practice, and evaluates strategic approaches for improving these processes. Contemporary project management methods are examined in the context of project planning, resource allocation, risk management, and execution control. The study draws upon both international best practices and examples from the local industrial landscape.

Keywords: project management, industrial enterprise, strategic planning, project implementation, Azerbaijani industry, management challenges.

In recent decades, state programs and investment incentives implemented in the industrial sector of the Republic of Azerbaijan have played a significant role in the country's economic development. Notably, the role of the construction sector and the construction materials industry is indisputable [6; 7]. The establishment of export-oriented manufacturing enterprises, the development of industrial parks in various regions, and the modernization of technologies have further increased the significance of project-based management. Under these circumstances, the proper planning, coordination, and execution of projects within industrial enterprises have come into sharper focus. Project management involves not only technical and financial dimensions but also functions as a strategic tool that shapes the overall development trajectory of an enterprise. In the contemporary context, successful implementation of industrial projects requires a systematic approach across all stages of the project life cycle. This life cycle comprises several interconnected phases: conceptual development, detailed planning, execution, monitoring and control, and closure. Each phase is interdependent and exerts a direct impact on the overall success of the project.

The industrial structure of Azerbaijan is highly diversified, comprising sectors such as petrochemicals, construction materials, light industry, mechanical engineering, and food production [5, p. 17]. The scale and complexity of projects implemented in these sectors vary considerably. Consequently, instead of applying a unified and rigid project management model, it is more appropriate to adopt customized approaches tailored to the specific operational domain of each enterprise. For example, projects in the oil and gas industry are primarily focused on technological safety and environmental risks, whereas in the light industry sector, speed-to-market and product competitiveness are of greater importance. At present, in many enterprises, project planning is limited to the early stages, and financial and risk analyses are often conducted superficially. As a result, this leads to project discontinuation or failure to achieve intended outcomes in subsequent phases. Poor planning further causes issues in workforce coordination and prevents optimal allocation of technical resources. Moreover, in some enterprises, project managers are appointed from among individuals who lack formal education or practical experience in management, which significantly reduces the effectiveness of decision-making processes.

At the same time, project financing and budgetary control remain underdeveloped areas in Azerbaijan. Financial resources allocated to projects are often spent inefficiently due to the absence of a well-established system for budget planning and expenditure monitoring. Consequently, cost overruns and project cancellations are frequently observed. In project management, in addition to financial stability, precise time scheduling is also a critical component. Many industrial projects in Azerbaijan are completed significantly behind schedule, leading to increased costs and loss of market share. Furthermore, there are considerable gaps in the risk management dimension of projects. Prior to project

initiation, technical, legal, political, and market risks are either generalized or entirely overlooked. However, such risks can have a direct impact on the financial and social outcomes of the project. Effective risk management requires not a reactive, but a proactive approach-aimed at identifying and mitigating potential threats before the project begins.

Control and monitoring mechanisms are also among the key factors for the successful execution of a project. Unfortunately, in many industrial enterprises, such mechanisms are either non-existent or merely symbolic. In the absence of clearly defined indicators-Key Performance Indicators (KPIs)-project progress is often assessed solely based on general reports, which fails to reflect the actual state of implementation. Executing projects without proper oversight and analytical evaluation may result in significant deviation from strategic goals. All these challenges highlight the necessity for a systematic approach to project management in Azerbaijan's industrial sector. Globally recognized project management methodologies-such as PRINCE2, PMBOK, Agile, and Lean-provide structured frameworks for managing projects in a phased and results-oriented manner [4, p. 113]. Adapting these systems to the local context can offer substantial benefits from legal, economic, and human resource perspectives.

Table 1

Key problems in project management in industrial enterprises of Azerbaijan and their prevalence rates			
№	Problem category	Prevalence rate (%)	Brief description
1	Weakness in the planning phase	65%	Lack of clear objectives, inaccurate time and resource planning
2	Professional deficiency of project managers	52%	Absence of certified managers
3	Budget overruns and lack of financial control	48%	Project budgets being unrealistic and lack of expenditure monitoring
4	Failure to assess risks in advance	41%	Failure to consider technical, legal, and market risks at the project initiation stage
5	Delays during the implementation phase	58%	Issues with subcontractors, logistics, and labor shortages
6	Poor organization of monitoring and control	46%	Absence of KPIs, irregular evaluation of project progress

Source: compiled by the author based on analytical generalization of data from "AzStat" and local industrial reports

The data presented in Table 1 clearly demonstrate the project management phases in which weaknesses are most prevalent in Azerbaijan. As shown, poor project planning is one of the primary causes of overall project failure. The vague definition of project objectives and inadequate resource planning negatively affect all subsequent phases of the project. Such weak planning leads to technical, financial, and organizational issues during the implementation stage. At the same time, the lack of professionalism among project managers hinders the effective steering of projects. In many industrial enterprises in Azerbaijan, individuals who have not received specialized training in project management are appointed as project leaders. This results in delays in critical decision-making, poor internal communication, and a lack of control throughout the project's lifecycle. In contrast, in developed countries, possessing certified project management competencies is considered a fundamental requirement for project managers.

Failure to execute projects within the allocated budget is also among the most widespread problems [1, p. 101]. Due to improper budgeting, the absence of contingency reserves, and the failure to forecast additional costs during the implementation phase, many industrial projects either face financial shortages or are completed with compromised quality. The lack of financial control is especially prevalent in projects commissioned by the government. Therefore, the involvement of financial experts and independent auditors during the budgeting stage should be considered essential.

One of the most critical phases in project management is risk management. As illustrated in Table 1, the failure to assess risks in advance is among the key factors contributing to project failure. If technical, legal, and market risks are not identified and addressed in a timely manner, unexpected obstacles may arise during the implementation phase. For example, in a construction project, if legal risks related to land ownership are not identified beforehand, the project may be suspended due to legal disputes during execution. The same applies to technical risks: the use of uncertified materials or those that do not meet technical specifications can lead to the termination of the project. Weaknesses in monitoring and control systems also hinder the effective tracking of project processes. Without measurable indicators (Key Performance Indicators - KPIs) established for each project phase, it becomes difficult to make informed decisions about the project's actual status. In many Azerbaijani enterprises, project progress is tracked only through monthly reports, which leads to the late identification of delays or budget overruns. Modern project management systems offer specific tools and methodologies to

mitigate such problems [2, p. 190]. The Agile model enables project management through small iterations and facilitates the flexible optimization of processes based on continuous feedback. PMBOK (Project Management Body of Knowledge) provides a comprehensive conceptual framework for the systematic management of all project phases. Implementing these frameworks in Azerbaijani industrial enterprises would not only enhance the competencies of project managers but also improve overall management quality. Moreover, the integration of digital technologies into project management is a vital factor for increasing efficiency [3, p. 198]. Project management software such as MS Project, Primavera, Trello, and Jira allows for real-time tracking and optimization of schedules, resource usage, and project progress. These tools provide real-time analytics on resource utilization rates, timelines, and risk levels. Although many enterprises in Azerbaijan remain cautious about adopting such technologies, digitalization is becoming an essential component of modern project management.

In conclusion, it should be noted that due to the structural and operational diversity of industrial enterprises in Azerbaijan, project management approaches must be customized. Management strategies applied in sectors such as oil and gas, agricultural processing, construction, and light industry should be designed in accordance with the specific risks and needs of each industry. To achieve this, sector-specific project management standards and methodological documents must be developed. At the same time, human capital development plays a leading role in improving project execution. Project managers should possess not only technical knowledge but also soft skills such as communication, leadership, stress tolerance, and decision-making. These competencies enhance flexibility and adaptability during project implementation. For this purpose, it is recommended to expand project management curricula at universities and vocational training centers and to promote internationally certified training programs.

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ASSESSMENT OF THE EXISTING SYSTEM OF PROFESSIONAL EDUCATION OF THE REPUBLIC OF TAJIKISTAN

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ОЦЕНКА СУЩЕСТВУЮЩЕЙ СИСТЕМЫ ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ РЕСПУБЛИКИ ТАДЖИКИСТАН

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Abstract

The market of educational services for the construction industry currently does not have time to effectively respond to the needs of the market of specialists and workers for the industry. The article analyzes the situation of personnel training in Tajikistan and provides proposals for improving the training of personnel for construction in higher education institutions.

Аннотация

Рынок образовательных услуг для строительной отрасли в настоящее время не успевает эффективно реагировать на потребности рынка специалистов и рабочих кадров для отрасли. В статье проанализирована ситуация подготовки кадров в Таджикистане и даны предложения для совершенствования подготовки кадров для строительства в высших учебных заведениях.

Keywords: personnel training, construction, higher education institutions.

Ключевые слова: подготовка кадров, строительство, высшие учебные заведения

Существующая система профессионального образования в Таджикистане показывает как достижения, так и ряд проблем, требующих внимания и дальнейших реформ.

Обеспечение различных отраслей экономики страны высококвалифицированными специалистами и рабочими кадрами, отвечающими требованиям рынка труда, возложено на учреждения среднего и высшего профессионального образования, и именно эти ступени образования могут внести существенный вклад в развитие национальной экономики.[1]

Система профессионального образования в Таджикистане находится в стадии развития и требует комплексного подхода к реформированию с акцентом на повышение качества, практической ориентированности и доступности образования. Для этого необходимы дополнительные инвестиции, совершенствование нормативно-правовой базы, активное сотрудничество с работодателями и международными партнерами.

Подготовку кадров для экономики Таджикистана осуществляют следующие учреждения образования:

Таблица. 1

Учреждения среднего и высшего профессионального образования в Таджикистане

№ п/п		Годы					2023 к 2019, в %
		2019	2020	2021	2022	2023	
1	2	3	4	5	6	7	8
1	Число учреждений СПО в РТ, единиц, всего	74	78	79	84	84	113,5
2	в них учащихся, тыс.человек	90,4	97,7	95,5	87,2	89,6	99,11
3.	Число учреждений ВПО, единиц	40	41	41	46	46	115
4.	в них студентов, тысяч человек	229,6	245,9	239,5	218,1	214,4	93,4

Примечание: .Статистический ежегодник Республики Таджикистан, 2024. Агентство по статистике при Президенте Республики Таджикистан.

По данным таблицы наблюдается положительная динамика расширения сети учреждений

средне профессионального образования и высших учебных заведений за период 2019-2023 годов, что свидетельствует о росте спроса на высшее образование и государственной политике по увеличению доступности профессионального образования.

Несмотря на рост числа учреждений СПО, количество учащихся не увеличилось пропорционально. После пика в 2020 году наблюдается снижение, вероятно связанное с демографическими изменениями, миграцией, экономическими факторами или влиянием пандемии COVID-19. В 2023 году количество учащихся стабилизировалось на уровне 2019 года. Такая же ситуация наблюдается в ВУЗах, снижение студентов при росте числа учреждений может указывать на рассредоточенность ресурсов и необходимость оптимизации сети вузов.

Каждый год учреждения СПО и ВПО выпускают специалистов разных профессий, многих из которых рынок труда не может обеспечить рабочими местами.

Таблица 2

Численность выпускников учебных заведений

тысяч человек

№ п/п	Годы	Число выпускников учреждений высшего профессионального образования		Число выпускников учреждений среднего профессионального образования		Число выпускников начального профессионального образования		Число выпускников общеобразовательных школ (11 класс)	
		Всего	в т.ч. девушки	Всего	в т.ч. девушки	Всего	в т.ч. девушки	Всего	в т.ч. девушки
1	2	3	4	5	6	7	8	9	10
1.	2019	43,2	16,4	20,8	13,5	11,7	3,3	114,7	53,1
2.	2020	42,4	15,8	23,6	15,9	11,4	3,0	116,3	54,1
3.	2021	53,6	21,3	25,1	16,9	11,2	2,8	112,9	52,3
4.	2022	44,8	18,8	23,7	17,3	8,3	2,3	113,6	52,8
5.	2023	41,0	17,9	21,6	16,5	7,3	2,2	103,3	48,3
	2023 г. к 2019 г.	94,91	109,15	103,85	122,22	62,39	66,67	90,06	90,96

Примечание: Статистический сборник Рынок труда Республики Таджикистан 2024, с.

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Анализируя данные таблицы по численности выпускников различных уровней образования с 2019 по 2023 г./, можно выделить несколько важных тенденций. Общий объем выпускников всех уровней немного колеблется, с максимальным показателем в 2021 году — 112,9 тысяч человек, и снижается к 2023 году — до 103,3 тысяч, что составляет примерно 90,96% от уровня 2019 года.

Количество выпускников снизилось в 2023 году, что может быть связано с миграционными факторами или структурными изменениями в системе образования. Процентное соотношение выпускников к 2019 году показывает снижение, особенно заметное у начального профессионального образования (около 62%). Несмотря на стабильность в средне- и высше-профессиональной подготовке, наблюдается снижение количества выпускников начального уровня и общее сокращение числа выпускников, что требует внимания к развитию системы профессионального образования и привлечению молодежи к профессиональному обучению.

Ситуация на рынке труда в Таджикистане и подготовка кадров для экономики характеризуются рядом особенностей и вызовов, обусловленных социально-экономическими условиями страны.

Несмотря на постепенное развитие экономики, значительная часть населения занята в сельском хозяйстве и неформальном секторе. Молодежь часто сталкивается с трудностями при трудоустройстве по специальности. Это говорит о высоком уровне безработицы и занятости в неформальном секторе.

Миграция рабочей силы: Большое число трудоспособных граждан, особенно молодых мужчин, уезжают на заработки за рубеж (в основном в Россию), что влияет на структуру рынка труда и дефицит квалифицированных кадров внутри страны.

Многие выпускники образовательных учреждений не находят работу по специальности из-за отсутствия практических навыков и несоответствия образовательных программ потребностям экономики.

В Таджикистане создаются возможности для повышения квалификации и переобучения работников с учетом меняющихся потребностей экономики.

Таблица 3

*Профессиональная подготовка кадров, повышение
квалификации и стажировка по отраслям экономики*

человек

№ п/п		Годы					2023 к 2019, в %
		2019	2020	2021	2022	2023	
1	2	3	4	5	6	7	8
	Число работников, прошедших подготовку и переподготовку, повысивших квалификацию и прошедших стажировку, всего	21888	46507	53220	49750	35113	160,42
	в том числе в отраслях						
1.	промышленность	3955	1621	2789	1726	2215	56,01
2.	сельское хозяйство	-	174	184	171	266	
3.	транспорт и связь	728	1707	1298	337	235	32,28
4.	строительство	56	89	17	17	2	3,57
5.	торговля	69	167	189	241	161	233,33
6.	жилищно-бытовое хозяйство и бытовое обслуживание населения	-	-	-	-	-	-
7.	наука и научное обслуживание	-	-	-	-	-	-
8.	здравоохранение	2347	6859	12307	8911	3959	168,68
9.	образование	10699	29492	30364	31431	22806	213,16
10.	культура и искусство	-	-	-	-	-	-
11.	органы управления	679	1585	1428	776	539	79,38
12.	другие отрасли	3355	4813	4644	6140	4930	146,94

Примечание: Статистический сборник Рынок труда Республики Таджикистан 2024, с.

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Анализируя данные по подготовке и повышению квалификации работников за 2019-2023 годы, видно, что общее число участников резко увеличилось — с 21 888 в 2019 году до 35 113 в 2023 году, что составляет примерно 160,42% по сравнению с 2019 годом. Это свидетельствует о повышенном внимании к развитию кадров и профессиональной подготовке.

В отраслевом разрезе видно, что не все отрасли серьезно относятся к своим кадрам. В строительстве количество работников, прошедших подготовку и переподготовку, за указанный период остается очень низким — всего 56 человек в 2019 году и максимум 17 человек в 2021 и 2022 годах. В 2023 году показатель снизился до 2 человека, что составляет 3,57% от 2019 г. Очевидно, что в строительной отрасли подготовка и переподготовка кадров идет значительно медленнее и менее активно по сравнению с другими секторами. В отличие от этого, например, в здравоохранении — 2347 человек в 2019 и 3959 — в 2023 году прошли стажировку и повысили квалификацию, а в образовании — с 10 699 до 22 806 человек, что говорит о стратегической значимости данной сферы и отражает высокий спрос и значительные усилия по развитию кадровых резервов.

В отраслях транспорта и связи, промышленности и сельском хозяйстве тоже наблюдается значительный спад этого процесса, хотя и не столь драматичный, как у строительства.

Таким образом, несмотря на общий рост общего числа работников, прошедших повышение квалификации, отрасли, связанные с строительством и транспортом, остаются с низкими показателями по сравнению со сферами здравоохранения и образования. Эта ситуация говорит о меньшем акценте на профессиональном развитии в строительной отрасли, что может приводить к дефициту квалифицированных специалистов и замедлению развития сектора. В то же время, сферы образования и здравоохранения демонстрируют активное участие, что отражает стратегический приоритет их развития и необходимость квалифицированных кадров.

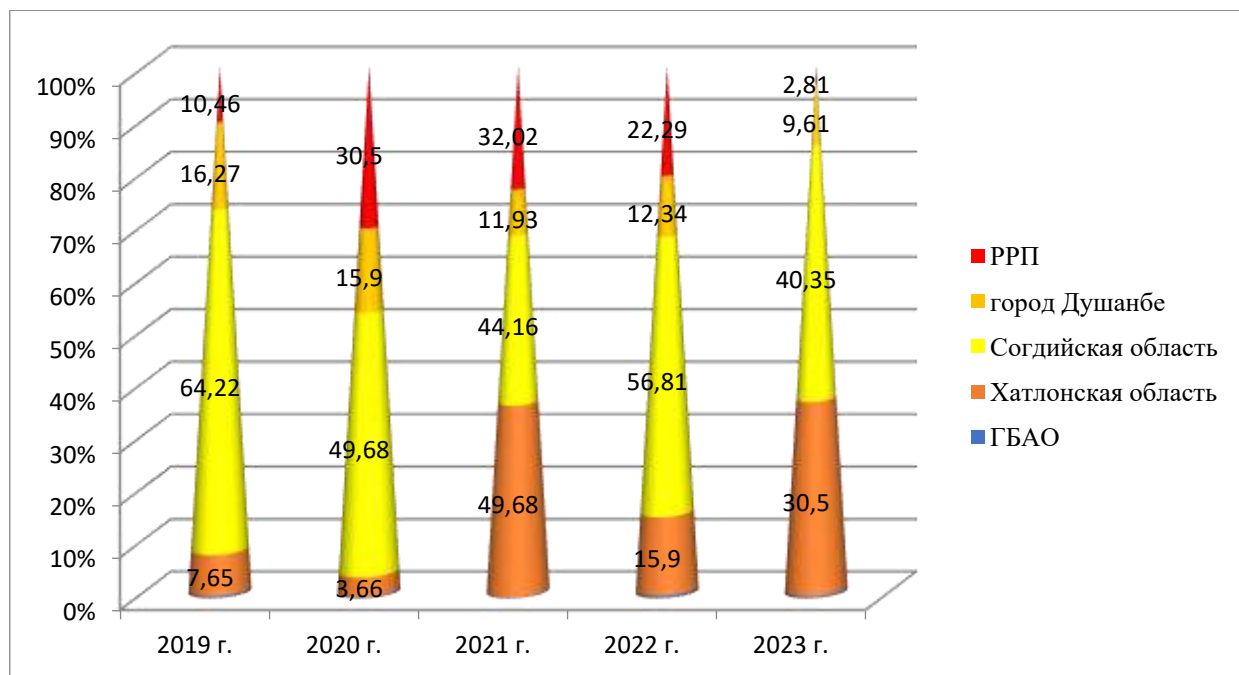


Рисунок 1. – Удельный вес кадров повысивших квалификацию по регионам за 2019-2023 гг.

Строительная отрасль нуждается в разносторонне подготовленных специалистах — от рабочих профессий до инженеров, проектировщиков, управленцев. Ключевую роль в обеспечении отрасли профессиональными кадрами играют образовательные учреждения: вузы, колледжи, техникумы, профессиональные училища и центры повышения квалификации[2]. Эффективное взаимодействие всех звеньев системы образования — необходимое условие устойчивого развития строительного сектора.

Вузы осуществляют подготовку инженерно-технических кадров — архитекторов, инженеров-строителей, проектировщиков, технологов, руководителей проектов. Их вклад заключается в формировании теоретической базы. Они закладывают фундаментальные знания в области математики, физики, строительной механики, проектирования и управления. В рамках научных лабораторий и кафедр ведутся разработки новых строительных материалов, технологий, подходов к проектированию и энергоэффективности. Современные вузы внедряют в образовательный процесс технологии BIM, автоматизированное проектирование, устойчивое строительство, роботизацию и 3D-печать. Многие вузы развивают партнерства с зарубежными организациями и проводят стажировки, что способствует распространению передовых практик.

Колледжи и техникумы играют важную роль в подготовке специалистов среднего звена: техников, мастеров строительных и монтажных работ, операторов строительных машин и т.д. Их особенности это **прикладной характер обучения**. Образование максимально приближено к практике, с большим объемом учебной практики на реальных объектах. Эти учреждения быстрее адаптируются к изменениям в отрасли и требованиям работодателей. Всё чаще колледжи внедряют системы, при которых студенты учатся и одновременно работают на строительных предприятиях.

Рабочие профессии — основа строительного производства. Образовательные учреждения, занимающиеся подготовкой рабочих, обеспечивают рынок труда рабочих по востребованным специальностям: каменщик, бетонщик, арматурщик, электрик, сварщик, отделочник и др. Возможность получить профессию за короткие сроки позволяет быстро закрывать кадровый дефицит.

Переход к современным технологиям требует от работников постоянного обновления знаний. Повышение квалификации позволяет адаптироваться к новым строительным стандартам, нормативам, цифровым технологиям. Профессиональная переподготовка особенно актуальна для специалистов, меняющих профиль деятельности или возвращающихся в отрасль. Онлайн-обучение и дистанционные курсы делают процесс гибким и доступным.

Для максимальной эффективности образовательный процесс должен быть интегрирован с реальной строительной практикой. Это возможно через:

- Производственную практику и стажировки на предприятиях;

- Совместную разработку учебных программ с участием работодателей;
- Материальную поддержку учебных заведений со стороны бизнеса (оборудование, инструменты, финансирование);
- Государственные программы профориентации и развития СПО.

В Таджикистане предпринимаются шаги по модернизации системы образования, включая внедрение новых образовательных стандартов, развитие профессионально-технического образования и повышение качества подготовки специалистов.

Тем не менее, несмотря на положительные тенденции, система подготовки кадров сталкивается с вызовами, такими как ограниченные финансовые ресурсы, недостаточная материально-техническая база, а также необходимость дальнейшего совершенствования нормативно-правовой базы и образовательных программ.

Для повышения эффективности подготовки кадров в строительной отрасли необходим комплексный подход:

1. **Модернизация образовательных программ.** Введение новых технологий (BIM-моделирование, автоматизация процессов, устойчивое строительство) в учебные курсы позволит студентам быть востребованными после окончания обучения.

2. **Развитие системы дуального образования.** Совмещение теоретического обучения с практикой на строительных площадках обеспечивает формирование прикладных навыков у будущих специалистов.

3. **Государственная поддержка и стимулирование.** Важно развивать программы профориентации, популяризации строительных профессий, а также поддерживать студентов стипендиями, льготами и гарантиями трудоустройства.

4. **Цифровизация образования.** Внедрение онлайн-платформ, симуляторов и цифровых лабораторий делает обучение доступным и эффективным, особенно в условиях быстро меняющихся технологий.

5. **Профессиональная переподготовка и повышение квалификации.** Строительные технологии развиваются стремительно, и для уже работающих специалистов необходимо регулярно проходить обучение и сертификацию.

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Geographical sciences

NATURAL DISASTERS THAT OCCURRED IN NAKHCIVAN AUTONOMOUS REPUBLIC AND THEIR PREVENTION MEASURES

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NAXÇIVAN MUXTAR RESPUBLİKASINDA BAŞ VERMİŞ TƏBİİ FƏLAKƏTLƏR VƏ ONLARIN QARŞISININ ALINMASI TƏDBİRLƏRİ

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Abstract

The article provides information on the relevance of the topic, research object, purpose, material methodology, and emergency situations of population displacement during an earthquake in the autonomous republic. The main content of the work reflects the theoretical and practical issues about the earthquake and the causes of its occurrence on the earth, the degree of destruction caused by its scores.

As a result, several suggestions and recommendations were made for the prevention of emergency situations of population displacement from the settlements of the autonomous republic and the implementation of organizational, engineering-technical, information technology and systematic measures for its solution.

Xülasə

Məqalədə mövzunun aktuallığı, tədqiqat obyektı, məqsədi, material metodikası və muxtar respublikada yaşayış məntəqələrindən zəlzələ zamanı əhalinin köçürülməsi xarakterli fəvqəladə hallar haqqında məlumat verilir. İşin əsas məzmununda zəlzələ və onun yer kürəsində əmələ gəlmə səbəbləri, ballarına görə törətdiyi dağıntıların dərəcələri haqqında nəzəri və praktik məsələlər öz əksini tapmışdır.

Nəticədə muxtar respublikanın yaşayış məntəqələrindən zəlzələ zamanı əhalinin köçürülməsi xarakterli fəvqəladə halların qarşısının alınması və onun həlli üçün təşkilati, mühəndis-texniki, informasiya texnoloji və sistemli tədbirlərin həyata keçirilməsi məqsədilə bir neçə təklif və tövsiyələr verilmişdir.

Keywords: earthquake, volcano, relief, geological structure, rock, natural processes, magma, seismology, anticline, syncline

Açar sözlər: zəlzələ, vulkan, relyef, geoloji quruluş, süxur, təbii proseslər, maqma, seysmologiya, antiklinal, sinklinal

Aktuallıq. Həyat şəraitinə mənfi təsir edən təbii fəlakətlərdən biri olan “zəlzələ” yəni “yeraltı təkanlar”, yer qabığında gözlənilməz anda baş verən hadisədir. Bu təkanların miqyası yer altındakı seysmik hərəkətlərin böyüklüyünə, yer səthindəki dağıntılarla ölçülür.

Bu məqsədlə ölkəmiz, o cümlədən Naxçıvan Muxtar Respublikası Alp-Himalay seysmik qurşağında

yerləşdiyinə görə bu bölgədə daimi olaraq zəlzələ və vulkan hadisələri gözlənilir. Məhz, buna görə də muxtar respublikada "Naxçıvan muxtar respublikasında baş vermiş təbii fəlakətlər və onların qarşısının alınması tədbirləri" mövzusunun secilməsi aktualdır.

Tədqiqatın məqsədi və vəzifələri. Tədqiqatın əsas məqsədi muxtar respublikanın yaşayış məntəqələrindən zəlzələ zamanı əhəlinin köçürülməsi məsələlərini təşkil etmək üçün təklif və tövsiyyə verməkdən ibarətdir.

Mövzunun yerinə yetirilməsi üçün aşağıda göstərilən bir neçə məsələ qoyulmuş və uğurla həll olunmuşdur.

Tədqiqat obyektı. Tədqiqat obyektı kimi Naxçıvan Muxtar Respublikasının əraziləri götürülmüşdür.

Material və metodika. Mövzuya aid ədəbiyyat, xəritə, şəkil, stasionar materialları toplanılmış və işin metodikası hazırlanmışdır. Mövzu işlənərkən tarixin ayrı-ayrı inkişaf mərhələlərində xarici ölkələrdə, o cümlədən Azərbaycan və Naxçıvan MR-də təbii fəlakətlərdən biri olan torpaq sürüşməsi, sel hadisələri, qar uçqunları, "zəlzələ" yəni "yeraltı təkanlar" üzrə tədqiqat aparan alimlərin monoqrafiya, metodik vəsait, xəritə materialları və müasir tələlərə cavab verən iş təcrübələrindən istifadə olunmuşdur [3, 4, 5, 6, 7, 8, 10].

Təhlil və müzakirə. Naxçıvan muxtar respublikanın ərazisi dağlıq relyefə malik olmaqla bərabər Yer kürəsində seysmik zonanın Alp-Himalay qırışıqlığı olan ərazilərdə yerləşir. Bu baxımdan ərazidə hər an seysmik hadisələrin baş verməsi gözlənilir.

Naxçıvan MR-in relyefi başlıca olaraq düzənlik və dağlıq hissədən ibarətdir. Ərzinin dəniz səviyyəsinə ən yaxın nöqtəsi Kotam kəndi yaxınlığında Araz çayının yatağı (600 m), ən hündür nöqtəsi isə Qapıcıq dağıdır (3904 m). Dəniz səviyyəsindən orta hündürlüyü 1400 m-ə bərabərdir. Ərazinin 1/3 hissəsini düzənlik hissə təşkil edir ki, onun da orta hündürlüyü 800 m-dir. 2/3 hissəsi 1000-2000 m hündürlükdə, 20 faizi isə 2000 m-dən hündürdə yerləşir. Ərazidə hündürlüyü 3500 m-dən artıq olan bir neçə zirvə var. Tədqiqatlar nəticəsində məlum olubdur ki, ərazinin 1720 km²-i 1000 m-ə qədər hündürlükdə, 2623 km²-i 1000-2000 m, 820 km²-i 2000-3000 m və 80 km²-i isə 3000 m-dən hündürdə yerləşir [2].

Relyefin ikinci əsas hissəsi orta dağlıq sahə olub, çox az bir hissəsi dağarası çökəkliklərdən ibarətdir. Bu sahə okean səviyyəsindən 1000 m-dən 2500 metrə qədər ucalır. Alçaq dağlıq hissə düzənliklərlə orta dağlıq hissə arasında yerləşir və bu da Naxçıvan MR-in şimal-qərbində və cənub-şərqində çox dar, mərkəzdə isə geniş sahəni əhatə edir.

Kükü dağından cənubda nisbi hündürlüyü 1700 metrə çatan uçurumlara rast gəlinir. Silsiləyə daxil olan Təknə, Badamlı, Keçəl dağ silsilələri arasında dərinliyi 400 m-dən artıq olan dərələrə rast gəlinir.

Ş.Əzizbəyov, M.Abbasov və B.Antonov ərazidə geomorfoloji xüsusiyyətləri müəyyən etmək üçün tədqiqatlar aparmış və ərazini 2 zonaya bölmüşlər: akkumulyativ və denudasion zonalar [2, s. 42,].

Akkumulyativ relyef forması Arazboyu zonanı əhatə etməklə, allüvial, dellüvial və allüvial-prolüvial çöküntülərdən təşkil olunmuşdur. Bu zonada 2 relyef tipi ayrılır: 1. Neogen və IV dövr süxurlarından ibarət dağətəyi zona 2. Prolüvial və allüvial çöküntülərdən ibarət müasir düzənliklər.

Dağətəyi zona akkumulyasiya zonasına keçid təşkil edir və nisbətən qədim yaşıdır. Süxurları eosen, oliqasen, miosen yaşlı travertinli, gilli müasir torpaqlardan ibarətdir. Düzənliklərin şimal-şərq hissələri şiddətli parçalanmış, akkumulyasiya sahəsi olan maili düzənliklər isə IV dövrün yeni tektonik hərəkətləri nəticəsində qalxmışdır. Maili düzənliklərin formalaşmasında Araz çayı və onun qolları mühüm rol oynayır.

Muxtar respublikanın orta axarlarında akkumulyativ və erozion-akkumulyativ terraslardır. IV dövrdə orta dağlıq ərazilərdə daha çox çökməyə məruz qalmışdır. Bu, proseslər muxtar respublikada çayların orta axarlarında müşahidə olunması ilə izah olunur. Çay terraslarının yüksəkliyinin Araza doğru azalması və onun hazırkı çöküntülər altında batması Arazboyu düzənliyin hazırda enməyə məruz qaldığını göstərir. Qarabağlar, kəndlərinin ətrafında Ərəfsə kəndinin aşağısında, Əlincə çay boyuda, Kotam çayının Kotam kəndindən yuxarı hissəsində, Buzqov kəndinin yuxarisında, Cəhri çayının sağ sahilində travertin çöküntüləri və sementləşmiş qədim buzlaq izləri var.

Yeni tektonik hərəkətlər respublikanın qərb hissəsinə nisbətən şərqində daha sürətlə baş vermişdir. Nəticədə muxtar respublika ərazisinin şərq hissəsində, xüsusilə də orta dağlıqda çay şəbəkəsi öz yatağını bir neçə yerdə dəyişərək qurumuş və qədim dərələr relyefdə indiyə qədər saxlanılmışdır.

Muxtar respublika arid iqlim şəraitində daha çox parçalanmışdır. Bu ərazilərdə relyef yeni tektonik hərəkətlər nəticəsində müxtəlif dərəcədə deformasiyaya məruz qalmışdır. İqlim şəraiti və süxurların tərkibindən asılı olaraq ərazinin qərbi ilə şərqinin relyefinin parçalanma dərəcəsi eyni deyildir. Ərazinin şərq yarısında olan süxurlar ekzogen proseslərə daha çox məruz qalır. Ona görə də şərq hissənin orta

dağlıqda dellüvial çöküntülərə daha çox rast gəlinir. Şimal-şərq hissədə isə eroziyaya davamlı devon çöküntülərindən ibarət olan monoklinal relyefdə şərqdəki qədər çöküntü yoxdur. Şərq hissədə dellüvial çöküntülər gillicəli iri kəsəklərdən, qərbdə isə kiçik çınqıllardan ibarətdir.

Denudasion relyef forması əsasən orta dağlığı əhatə edir. Bu zonada iqlimin kontinentallığı azalır və yağıntının miqdarı isə çoxalır. Orta dağlıq qurşaqlarda erozion-denudasion və qismən də arid denudasion mənşəli vulkanogen və çökmə süxurlar yayılmışdır. Bu zonada çılpaq, şiddətli parçalanmış uçurumlu yamacların olması ətəklərdə zəngin allüvial çöküntülərin, səpinti konuslarının, çınqıllıqların yaranmasına səbəb olmuşdur. Belə çöküntülərə Qaraquş, Gəmiqay, Mehri və s. dağ zirvələrinin ətrafında daha çox rast gəlinir.

Qərb hissədə orta dağlığı təşkil edən süxurlar dislokasiyaya uğramış devon və karbon dövrü çöküntülərindən ibarətdir. Devon çöküntüləri olan sahələr zəif, karbon çöküntülərindən ibarət olan sahələr isə şiddətli parçalanıb. Buna hündürlüyü 1700-1800 m olan Təndirli, Xırmancıq, Mehridağ və s. dağlarda rast gəlinir. Bu ərazilər üçün dar dərələr və tənqilər xarakterikdir. Cağazir, Qabaqlıçay dərəsi və s. orta dağlıq hissə Naxçıvançay, Əlincəçay, Gilançay, Vənəndçay, Əylis çay, Ordubadçay və onların qolları ilə, xüsusən də Naxçıvançayla Vənənd çay arası şiddətli parçalanıb.

Məlumdur ki, muxtar respublikanın insanların həyat şəraitinə mənfi təsir edən təbii fəlakətlərdən biri olan torpaq sürüşməsi, sel hadisələri, qar uçqunları, dağlardan fiziki aşınma və tektonik hərəkətlər nəticəsində iri həcmli daşların yamac boyu hərəti də geniş miqyasada müşahidə olunur.

İlk növbədə muxtar respublikanın ərazilərində çayların aşağı hissələrində apardığımız tədqiqatlar nəticəsində sellərin yaratdığı relyef formaları ilə tanış olaq (Şəkil 1,2,3,4).



Şəkil 1



Şəkil 2



Şəkil 3



Şəkil 4

Növbəti fotolarda isə muxtar respublikanın orta dağlıq hissələrində daş uçqunlarının yaratdığı relyef formaları ilə tanış olaq (Şəkil 5,6,7,8).



Şəkil 5



Şəkil 6



Şəkil 7



Şəkil 8

Aşağıda isə zəlzələ və vulkanların yaşayış məskənlərində əhaliyə ziyan verdiyi vəsadlar haqqında məlumat verilir [1, 9]. Zəlzələ-yeraltı zərbələr və yerin üst qatının titrəməsidir. Bu həm tektonik proseslərlə müşayiət olunan təbii olaraq, həm də partlayış, su bəndlərinin doldurulması, dağlarda yeraltı sürüşmələrlə müşayiət olunan süni olaraq baş verir. Vulkanların püskürməsi zamanı da kiçik yeraltı təkanlar baş verə bilər.

Yerin ani bir vaxt ərzində tektonik proseslərlə əlaqədar olaraq tərpənməsinə zəlzələ deyilir. Zəlzələlərlə əlaqədar bütün proseslər seysmik hadisələr adlanır. Zəlzələni "seysmoqraf" adlı cihazla ölçürlər (Şəkil 9-10).



Şəkil 9-10. Zəlzələni ölçən cihaz

Zəlzələlər dağıdıcı təsirinə görə 12 ballıq Rixter cədvəli ilə qiymətləndirilir. Baş verən dağıntılara görə zəlzələlər Merkalli cədvəli ilə qiymətləndirilir. Zəlzələlər yer qabığının fəal vulkanizm zonalarında daha çox təkrarlanır. Hər il dünyada 100 minlərlə zəlzələ baş verir ki, onların da 15–20-si daha fəlakətli olur. Onlar əsasən okeanlarda baş verir.

Yerin daxilində zəlzələ törədən hərəkətlərin baş verdiyi yərə zəlzələ ocağı və ya hiposentr deyilir.

Zəlzələ ocağının üzərində olan yer səthinə (və ya proyeksiyasına) zəlzələ mərkəzi və ya episentr deyilir. Yeraltı təkanlar zəlzələdən ən qısa məsafə qət etdiyi üçün ən güclü dağıntı episentrdə baş verir. Episentrdən aralandıqca dağıntı və insan tələfatı azalır. Zəlzələ ocağı dərinədə yerləşdikcə zəlzələ daha geniş ərazini əhatə edir. Zəlzələ ocağı dayazda yerləşdikdə isə zəlzələnin yer səthində yayıldığı sahə kiçik olsa da, daha çox dağıntı törədir (Şəkil 11, 12, 13, 14).



Şəkil 11, 12, 13, 14. Zəlzələ ocağı və uzaqlaşdıqca dağılma dərəcələri

Zəlzələlər çox güclü vulkan partlayışı nəticəsində də baş verir. Zəlzələ və vulkanlar əsasən geosinklinal (dağlıq) ərazilərdə-litosfer təbəqələrinin sərhəddində geniş yayılıb. Azərbaycan palçıq vulkanlarının ən çox yayıldığı ərazilərdəndir (xüsusilə Abşeron və Qobustanda). Vulkan və zəlzələlərin yayıldığı bəzi ərazilərdə yeraltı sular adətən yüksək temperatura malik olur. Bu sular da çoxlu duz və qaz olduğu üçün onlar mineral sular adlanır. Suların isti olmasına səbəb Yer səthinə yaxın olan qaynar maqmanın təsiridir. İsti sular yerin daxilindəki çatlarla səthə çıxır, bulaq şəklində çay və dənizlərə tökülür. Bəzən yeraltı sular yüksək təzyiq altında səthə çıxaraq fəvvarə vururlar. Fəvvarə şəklində Yer səthinə çıxan isti bulaqlara qeyzərlər deyilir. Qeyzərlər adətən müəyyən fasilələrlə fəvvarə vururlar. Hər bir qeyzərdə su buxarının səthə çıxdığı dairəvi çökəkliyə qrifon deyilir. Qeyzər sularının tərkibində həll olmuş halda müxtəlif mineral birləşmələr, xüsusi ilə kükürtlü maddələr olur. Qeyzər qrifonlarının kənarında toplanan bu minerallar qeyzerit adlandırılan süxurlar yaradırlar. Qeyzərlər ən çox İslandiya, Kamçatka, Yeni Zelandiya və Sakit okean adalarında yayılıb. Yeraltı isti sülardan evlərin, istixanaların qızdırılmasında, mineral sülardan isə müalicə məqsədi ilə istifadə edilir.

Müşahidələr göstərir ki, uçma birdən-birə baş verirsə, zəlzələ bir neçə dəqiqədən artıq davam etmir. Bəzən seysmik hərəkətlər bir neçə zəlzələ şəklində meydana çıxır. Bir zərbənin ardınca ikinci və sonrakılar hiss olunur: burada ayrı-ayrı zəlzələlər arasındakı fasilə bir neçə gün ola bilər. Həmin hadisənin səbəbi odur ki, əmələ gəlmiş baş zərbə həmin mağaranın başqa yerlərində və qonşu mağaralarda müvazinətin pozulması və əlavə uçğunların əmələ gəlməsinə səbəb olur. Bu kimi zəlzələlərə uçma və karst deyilir. Yer in özəyi və qabığı zəlzələnin yaranmasında çox böyük bir rol oynayır.

Yer daxilində zəlzələyə səbəb olmuş ilk hərəkətin baş verdiyi yerə hiposentr deyilir. Zəlzələnin proqnozu üsullarından biri Yer qabığında müxtəlif səslərə qulaq asmaqdan ibarətdir. Yer qabığında hər bir böyük pozğunluqdan qabaq xırda pozğunluqlar baş verir, bu pozğunluqlar zəlzələ yaratmır, lakin hazırlıq işi aparır. Bu ibtidai pozğunluqlar müxtəlif səslər yaradır, səslərə qulaq asmaq üsuluna əsasən həssas səs cihazları ilə bu səsləri eşitmək mümkün olur.

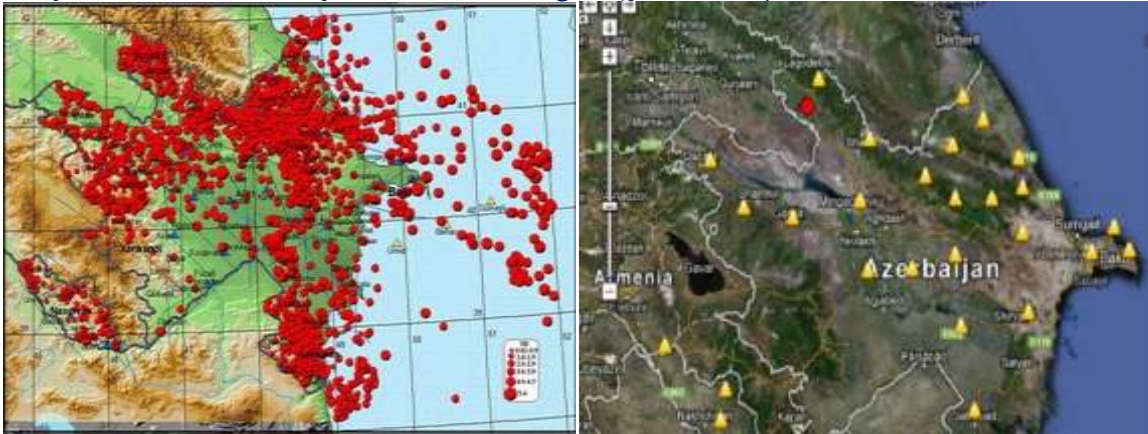
Zəlzələ proqnozunun ikinci üsulu, meylölçənlər vasitəsilə Yer səthinin meylini öyrənməkdən ibarətdir. Bu cihazlar Yer səthinin ən kiçik meylini böyük dəqiqliklə ölçür. Meylölçənlər Yer qabığının

hərəkətləri ilə və zəlzələyə hazırlıq işləri ilə əlaqədar olan meylləri qeyd etməkdən başqa, xarici səbəblər nəticəsində baş verən meylləri də göstərir. Təəssüf ki, meyllölçənin ümumi qeydlərindən, daxili səbəblərin yaratdığı meyli ayırmaq böyük çətinlik törədir.

Yer kürəsində baş verən zəlzələlər daha çox səth və normal zəlzələlərdir. Çox böyük dərinlikli zəlzələlər adətən Sakit Okean "Odlu qövsü"də baş verir. Zəlzələ ocağı nə qədər dərindirsə dalğaların təsir etdiyi ərazi də bir o qədər geniş olur. Zəlzələ ocağının Yer səthinə perpendikulyar proyeksiyası "episentr" adlanır.

Zəlzələnin baş verməsi üçün ilkin şərtlərdən biri də, yerin altında kövək süxurların olmasıdır. Yerin mərkəzinə tərəf irəlilədikcə temperatur artır. Nəticədə süxurlar nisbətən yumşaq olur və burada zəlzələnin yaranması üçün az imkan olur. Zəlzələ ona görə də yerin üst qatlarına yaxın zonlarda cəmləşir. Bəzi hallarda zəlzələ yerin 700 km dərinliyinə qədər işləyə bilirlər. Əgər iki lay toqquşarsa onda, sıxlığı yüksək olan yüngül layı aşağıya yerin dərinliyinə itələyir. Bu Vadati-Buniof-Zonaları adlı model ilə izah olunur.

Azərbaycan Respublikası ərazisi bütövlüklə 7 ballıq zəlzələ rayonu olmaqla yanaşı onun bir çox yerləri, o cümlədən, Abşeron yarımadası, Dağlıq Şirvan (xüsusilə Şamaxı), Şəki-Zaqatala zonası 8 ballıq zəlzələ rayonuna aid edilir. Şamaxı şəhərində daha çox dağıdıcı zəlzələlər olmuşdur. 1192-ci ildə baş verən zəlzələnin 7-8 bal gücündə olması və onun Şamaxını dağıtması haqqında tarixi məlumatlar vardır. Tezliklə bərpa olunub Azərbaycanın sənətkarlıq və ticarət mərkəzlərindən birinə çevrilən Şamaxı 1667-ci ildə olan zəlzələ zamanı yenidən dağıldı. 1902-ci il Şamaxı zəlzələsi-bu zəlzələ Azərbaycan tarixinin ən güclü, ən dəhşətli zəlzələsi hesab olunur. 1902-ci il yanvar ayının 31-də gündüz saat 12 radələrində, baş vermiş zəlzələ nəticəsində şəhər tamamilə dağıldı (Şəkil 15-16).



Şəkil 15-16. Azərbaycanda seysmik obyektlərin xəritəsi

Nəticə. Apardığımız tədqiqat işlərindən belə nəticəyə gəlmək olar ki, zəlzə baş verəndə əhalidən hədsiz dərəcədə xahiş olunur ki, imkan daxilində aşağıda qeyd olunanlara əməl etsinlər. Buda insanların bir qədər sağlam qalmaları üçün tövsiyyədir.

-İlk təkanı hiss etdikdə binanın təhlükəsiz tərk etmək üçün cəmi 10-15 saniyə vaxtınız olduğunu bilin

-Evdən çıxarkən ehtiyat çantası və mobil teflonunuzu götürün

-Qaz, su və elektrik enerjisini ümumi şəbəkədən söndürün

-Binanı tərk edib açıq və təhlükəsiz yerdə dayanın

-Əgər binanı 10-15 saniyə ərzində tərk etmək mümkün deyilsə, evdə qalın

-Liftdən istifadə etməyin

-Təşfişə düşüb yüksək mərtəbədən tullanmayın

-Evdə təyin etdiyimiz təhlükəsiz yerdə (yükdaşıyan divar və beton sütun) keçin

-Dəmir ayaqlı masa varsa, onun altına girin, diz üstə çökün və ya böyrü üstə uzanıb ayaqlarınızı bükün və əllərinizlə başın arxa hissəsini qucaqlayaraq qorunun

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Jurisprudence

ASSESSING DYNAMIC INTERPRETATION THROUGH THE LENS OF THE “CHAIN NOVEL” THEORY

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Abstract

In a state governed by the rule of law, legal norms are applied equally, impartially, and fairly. The interpretative activity is both necessary and inevitable when adapting legal norms to concrete disputes. Legal interpretation serves as a bridge between the statutes and the scenarios in which those statutes are applied to specific cases. According to widely accepted contemporary views, legal systems based on democracy and fundamental rights and freedoms are not static but are in a state of continuous development. Consequently, statutes, international treaties, and similar legal instruments possess a dynamic character and thus require interpretation in line with this nature. In conclusion, the interpretation of legal texts today must be conducted in accordance with the method of dynamic interpretation. Dynamic interpretation in law plays a critical role in ensuring the continued validity and effectiveness of legal systems in the face of social transformations.

Keywords: Teleological interpretation, dynamic interpretation, chain novel, hermeneutics, conceptual jurisprudence

Introduction

Interpretation in law is one of the fundamental subjects of general legal theory and methodology. The re-contextualization or concretization of legal texts in individual cases provides the means to resolve legal issues arising in everyday life. Indeed, a legal text functions like a framework that must be concretized according to the area it regulates [5]. When legal interpretation is mentioned, the German jurist F. C. von Savigny still comes to mind. According to Savigny, “the primary objective of interpretation is to understand how the legislator thought, to place oneself in the legislator’s position, adopt the legislator’s mindset, and artificially reproduce the legislator’s activity” [3]. What is at issue here, in Savigny’s own words, is “reviving before us the living ideas contained within the dead letters” of the law. Savigny is recognized as one of the pioneers of legal hermeneutics¹. Those who regard him as the first theorist of hermeneutic legal interpretation explain the relationship between Savigny and general hermeneutics through the intellectual influence between him and the significant hermeneutic thinker Schleiermacher [3]. Savigny is also considered one of the founders of the school of “conceptual jurisprudence” or “jurisprudence of concepts”². He summarized the methodological debates of legal science in his time and emphasized four elements of interpretation. These elements served as interpretative criteria in Roman law and medieval Italian law. Savigny identified these elements as the grammatical, logical, historical, and systematic components of interpretation (die vier Auslegungselemente) [3]. These classical methods of interpretation, originating from Savigny, continue to influence various branches of law to this day.

The principal shortcoming of classical methods of interpretation lies in their inadequacy in grasping the specific characteristics of the subject matter regulated by legal norms, as well as their lack of dynamism. Subsequently, in response to this insufficiency in capturing the evolving nature of legal domains, the teleological—or purposive—method of interpretation emerged [5]. Under this approach, the legislator, in enacting a legal norm, always acts with the intention of achieving a specific objective

¹ The issue of whether a legal text has a fixed and objective meaning for everyone has led to the emergence of a discipline known as hermeneutics (the science of interpretation). When the hermeneutic method is applied to law, the legal practitioner introduces their own original contribution in every legal application—something not directly provided by the legal text itself. Thus, this method does not require the practitioner to place themselves in the position of the norm-setter and attempt to understand their intention.

² The so-called “Conceptual Jurisprudence” (Begriffsjurisprudenz) fixed the meanings of legal institutions and concepts at a particular point in time and attempted to resolve legal issues based on these fixed definitions. This school is referred to as the “jurisprudence of concepts” due to the solution it proposed when the law could no longer respond to the evolving needs of society. According to this approach, when there is a gap in the law, the judge is expected to fill the gap using “concepts” derived from the provisions of the law. If no provision can be found through this method, the judge is not permitted to create law and must refer the matter to the legislature. In other words, according to this school of thought, if no applicable rule can be found for a case, the judge must resort to conceptual reasoning based on abstract legal concepts.

(ratio legis). In this method, the legislator's point of departure is the historical purpose ascribed to the law, and the legislator is presumed to have enacted the law in line with that purpose. However, since law is a living system that must adapt to the needs of every era, legal norms must be interpreted not in light of the legislator's original intent at the time of enactment, but according to the necessities of the present time [5]. For this reason, despite its many positive outcomes, the teleological method of interpretation has also been subject to criticism. The dynamic method of interpretation, which forms the basis of our discussion, can, in its simplest definition, be viewed as a response to the criticisms directed at the teleological method.

As an Objection to Teleological Interpretation: The Notion of Dynamic Interpretation

In legal doctrine, the dynamic method of interpretation is also referred to as the evolutive method of interpretation. The dynamic method has emerged as a collection of critiques directed at the teleological (purposive) method, which, over time, has proven insufficient in meeting certain needs. One of the primary criticisms of the purposive method is that it accepts the severance of the connection between the law and its original source following its entry into force, thereby rendering the law independent of its source. This, in turn, implies a disconnection between the legislature—being the law-making body—and the law itself. Such an approach may undermine and discredit the legislative branch of the state. Ultimately, through purposive interpretation, the judiciary may in effect create a norm of its own, leading to a practice that contravenes the principle of separation of powers [2]. Additionally, according to some views in the doctrine, the legislature may have intended for the law to always be understood in the form it had at the time it entered into force.

Another criticism directed at the purposive method of interpretation is that it leaves the interpretation to the particular characteristics of the specific case brought before the judge. This may lead to undesirable outcomes. It must be remembered that allowing the law to be shaped by the needs of each era in every individual case poses a risk to legal certainty and stability in legal practice [2]. Another doctrinal criticism of purposive interpretation is that the outcome reached through this method is often dependent on the subjective intention of the interpreter [2]. In dynamic interpretation, what the judge must do is reinterpret the law based on its purpose in order to adapt it to new circumstances emerging from advancing technology, and to deliver a judgment accordingly. Dynamic interpretation is the type of interpretation largely practiced by the jurists of the "jurisprudence of interests"³ and it aims to maintain a balance of interests. The fundamental goal and distinguishing feature of this school is to free judges from being rigidly bound to statutes. The legislator always seeks to balance interests in society but cannot foresee all possible disputes that may arise, nor can they provide solutions for every one of them. For this very reason, the judge must avoid excessive conceptualization, refrain from relying solely on logical interpretation, and seek to determine how and in what way social balance can be achieved in light of conflicting interests in order to provide satisfactory answers to the needs of social life. In conclusion, the judge is, like an architect, free to shape the legal norm as needed—provided they do not exceed the limits that have been prescribed [4].

Assessment in the Context of the "Chain Novel"

The dynamic method of interpretation is today widely used and broadly accepted in both national and international law—particularly in the field of human rights law. The evolving nature of the fundamental rights and freedoms enshrined in international treaties necessitates interpreting these rights and freedoms in light of contemporary events and conditions. Under the dynamic interpretation method, the judge is not required to examine the legislator's intent at the time the law was enacted or to reconstruct the social conditions of that period. According to this method, the judge creates the meanings of legal norms and thus becomes not only an implementer but also a developer of legal norms [4].

As previously noted, the legislator cannot define the meaning of laws in a single, immutable way, since such meanings are not fixed—they evolve over time. According to the dynamic interpretation method, the judge's primary goal and duty is to reflect this change through the law and to adapt the law's purpose to meet evolving conditions [4]. In this view, the legislator merely takes the first step by enacting the law; how the law is to be applied is ultimately determined by the judiciary. Indeed, each time a law is applied by a judge, it gains new meaning [4]. Thus, it may be said that dynamic interpretation embodies a transformative understanding of law. This is precisely why it is also referred to as "evolutive interpretation". In contrast to teleological interpretation, dynamic interpretation does not take the legislator's historically embedded purpose as its starting point. As a result, the judge becomes the

³ This school of thought stands in opposition to the "jurisprudence of concepts" (Begriffsjurisprudenz) movement led by Savigny.

element that assigns meaning to the law, and the law itself becomes increasingly detached from the legislator and its original historical context. All of this renders the dynamic method of interpretation a wholly independent category of interpretation [4].

Among contemporary works in legal doctrine on interpretation, Ronald Dworkin's systematized "Chain Novel" method stands out as particularly noteworthy. This method offers a powerful metaphor, especially in the context of dynamic interpretation [1]. Dworkin argues that law is not composed solely of rules but that political theories and principles also play a significant role in its formation [1]. In Dworkin's theory, the resolution of legal disputes is based on the principles of "fit" and "integrity", which he illustrates through the metaphor of a novel written in chapters by different authors [1]. The "Chain Novel" metaphor is built on the assumption that a group of writers each contribute a chapter to a larger novel, with the role of the first writer likened to that of the legislator. In this regard, the first author has a relatively freer hand. However, for a coherent and successful "novel" to emerge, subsequent writers must compose their chapters in a way that fits with and corresponds to the previous ones, thereby establishing a meaningful relationship with the earlier sections [1]. The interpretation of prior chapters is crucial for the production of a coherent literary work.

Drawing from Dworkin's approach, we are of the opinion that judges, when engaging in interpretative activity, should regard themselves as novelists, and accordingly render just decisions. This is because, as one scholar puts it: "...when we look at normative fiction, we see that the norm is not merely the normative text. Rather, the norm is a construct that gains meaning through the achievement of justice in each concrete case and exists within a continuum. In this sense, norms form a chain novel. Through the accumulation of judicial decisions, norms begin to branch and evolve—just like coral islands. Sometimes, these coral formations appear beautiful, vibrant, and appealing; other times, they may seem dark and even disturbing. Thus, the norm is a structure that must be understood within continuity" [1]. In conclusion, the advantages provided by the dynamic interpretation method can be summarized as follows:

- Agile adaptability to social changes: Dynamic interpretation enables the legal system to keep pace with societal developments.*
- Protection and enhancement of fundamental rights: Courts can adapt the interpretation of rights to new circumstances by balancing individual freedoms with the legitimate interests of society in light of evolving social contexts, thereby adding a new dimension to the rights and freedoms enshrined in legal texts.*
- Promotion of legal certainty: Dynamic interpretation also emphasizes stability and predictability within the legal system. Rather than disregarding established legal principles entirely, it seeks to apply them flexibly to meet current needs. Such an approach supports legal certainty by providing a framework for consistent decision-making [4].*

However, since dynamic interpretation requires judges to exercise discretion in interpreting laws, and this discretion allows for flexibility, it may also open the door to potential subjective biases. Therefore, mechanisms must be established to ensure that judicial interpretation of legal rules through the dynamic method does not become a tool for judicial overreach or the imposition of personal views on concrete disputes [4].

Conclusion

The legal system, by its very nature, must evolve in response to the shifting contours of societal values, norms, and technologies. Central to this adaptive function is the doctrine of dynamic interpretation, which grants legal actors the interpretive flexibility to construe statutes, precedents, and constitutional provisions in light of contemporary contexts. This approach acknowledges that legal norms are not static but may evolve to reflect developments in moral reasoning, scientific understanding, and social expectations. The "chain novel" metaphor aptly illustrates this continuity, portraying legal norms as interconnected elements of a coherent narrative requiring consistent, contextual interpretation.

Dynamic interpretation is thus a joint enterprise of the judiciary and the legislature. While courts ensure that legal texts remain responsive through context-driven adjudication, legislative bodies maintain the authority to revise the legal framework in response to structural change. The legitimacy of this method depends on maintaining a balance between judicial adaptability and democratic accountability. Properly applied, it ensures that the law remains a living instrument, capable of delivering justice in a principled yet context-sensitive manner. Consequently, dynamic interpretation, when properly applied, enables the legal system to remain responsive to societal transformation while preserving coherence, judicial integrity, and democratic legitimacy.

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SOME LEGAL ISSUES OF ARTIFICIAL INTELLIGENCE

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ALGUNOS PROBLEMAS LEGALES DE LA INTELIGENCIA ARTIFICIAL

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Abstract

This article addresses the key legal issues arising from the development and use of artificial intelligence. It analyzes the legal nature of AI, liability for its actions, protection of personal data and privacy, as well as algorithmic discrimination and fairness of decisions. Special emphasis is placed on the necessity of international harmonization of legal approaches to ensure effective and equitable regulation of AI on a global scale. The study aims to contribute to the development of a comprehensive legal understanding of the challenges posed by the digital era.

Abstracto

Este artículo aborda los principales problemas jurídicos derivados del desarrollo y uso de la inteligencia artificial. Se analizan la naturaleza legal de la IA, la responsabilidad por sus acciones, la protección de datos personales y la privacidad, así como la discriminación algorítmica y la equidad en la toma de decisiones. Se destaca especialmente la necesidad de armonización internacional de los enfoques legales para garantizar una regulación efectiva y justa de la IA a nivel global. El estudio pretende contribuir al desarrollo de una comprensión jurídica integral de los desafíos de la era digital.

Keywords: artificial intelligence, legal issues, liability, personal data protection, algorithmic discrimination, international law, AI ethics, regulation

Palabras clave: inteligencia artificial, problemas jurídicos, responsabilidad, protección de datos personales, discriminación algorítmica, derecho internacional, ética de la IA, regulación

La era contemporánea se ha caracterizado por el vertiginoso desarrollo de las tecnologías digitales, entre las cuales la inteligencia artificial (IA) ocupa un lugar destacado. Más allá de ser una mera innovación técnica, la IA representa un fenómeno que transforma los fundamentos de la realidad social, económica y jurídica, trascendiendo así el ámbito puramente ingenieril para convertirse en objeto de reflexión y regulación jurídica. El aprendizaje automático, las redes neuronales, los algoritmos generativos y otras formas de IA se integran cada vez más activamente en procesos de toma de decisiones, gestión, diagnóstico médico, práctica judicial, operaciones financieras, seguridad y otros ámbitos clave de la vida social. Este proceso va acompañado no solo de avances técnicos, sino también del surgimiento de todo un abanico de cuestiones jurídicas nuevas, muchas de las cuales aún carecen de solución.

El concepto y la naturaleza jurídica de la inteligencia artificial

El problema de la definición y calificación jurídica de la inteligencia artificial (IA) trasciende una simple categorización legal. Se trata de la formación de un nuevo objeto jurídico que, por su esencia, desafía las dicotomías clásicas entre sujeto y objeto del derecho, entre técnica y autonomía, entre instrumento y agente. Comprender qué es la IA en una dimensión jurídica constituye una tarea prioritaria para construir una arquitectura normativa capaz de responder adecuadamente a los desafíos de la era tecnológica.

Desde el punto de vista jurídico, la definición de la IA sigue siendo, en la actualidad, fragmentaria, contextual y carente de armonización. Diversos documentos internacionales, normativas nacionales y comunidades expertas ofrecen formulaciones variadas que reflejan aspectos funcionales, conductuales o técnicos de la IA. Así, la Comisión Europea, en el proyecto de Reglamento sobre la Inteligencia Artificial (Artificial Intelligence Act, 2021), caracteriza la IA como sistemas capaces de interpretar datos y tomar decisiones que afectan al entorno. Esta definición subraya la autonomía de acción de la IA, pero evita

deliberadamente abordar su estatus ontológico.

El pensamiento jurídico se enfrenta al hecho de que la IA no es simplemente una herramienta automatizada, sino una entidad híbrida que integra algoritmos, datos, modelos de aprendizaje automático, así como las estructuras sociales y organizativas en las que opera. En consecuencia, la naturaleza jurídica de la IA no puede reducirse únicamente al estatus de cosa o producto intelectual. Su creciente autonomía, capacidad de adaptación y participación en procesos decisorios plantean una cuestión fundamental: ¿dónde se traza la frontera entre medio intelectual y cuasi-sujeto?

Algunos teóricos proponen considerar a la inteligencia artificial como una forma particular de “sujeto funcional”: un agente técnico cuyas acciones no pueden entenderse únicamente como resultado de la voluntad humana, pero que tampoco implican la existencia de una voluntad propia en el sentido jurídico tradicional. Dentro de este enfoque, la IA ocupa una posición intermedia entre el sujeto y el objeto del derecho, lo cual exige el desarrollo de un régimen jurídico específico, análogo, por ejemplo, al de las personas jurídicas o de los participantes indirectos en el tráfico jurídico (como los trusts o los fondos). Este tipo de debates cobró especial intensidad tras la propuesta del Parlamento Europeo de 2017 de considerar la posibilidad de reconocer una “personalidad electrónica” a los sistemas de IA altamente autónomos, lo que generó encendidas discusiones tanto en el ámbito jurídico como en la comunidad científico-tecnológica (Floridi, 2019).

La naturaleza jurídica de la IA se vuelve aún más problemática en el contexto de la responsabilidad distribuida. A diferencia de un objeto tradicional, respecto del cual un sujeto determinado (como el propietario, el fabricante o el operador) asume la responsabilidad, la IA puede participar en cadenas complejas de causalidad, donde la contribución de cada interviniente (programador, proveedor de datos, usuario) resulta ambigua o difícil de delimitar. En consecuencia, encasillar a la IA dentro de las categorías jurídicas clásicas encuentra los límites del pensamiento jurídico positivista y demanda el recurso a enfoques interdisciplinarios —como la filosofía de la técnica, la ética o la teoría de sistemas—.

Cabe señalar, además, que actualmente no existe un estándar internacional unificado que defina a la IA como categoría jurídica. Esta carencia genera no solo una fragmentación normativa, sino también una competencia jurídica: los Estados procuran elaborar sus propias definiciones y regímenes jurídicos en torno a la IA, guiados por intereses político-económicos y por su grado de preparación tecnológica. Como resultado, surgen riesgos de inseguridad jurídica, forum shopping y conflictos normativos, especialmente en contextos transfronterizos en los que los sistemas de IA operan simultáneamente en varias jurisdicciones.

Así pues, la formulación del concepto y de la naturaleza jurídica de la IA requiere ir más allá del lenguaje jurídico tradicional. No se trata únicamente de definir qué es la inteligencia artificial, sino de comprender qué lugar debe ocupar dentro del espacio jurídico: como objeto de regulación, destinatario de normas, partícipe en relaciones jurídicas o incluso como un nuevo tipo de sujeto. La respuesta a esta cuestión marcará la dirección del desarrollo de todo el sistema normativo relacionado con la IA y constituirá el punto de partida para abordar los problemas jurídicos más concretos a los que se dedica el resto del artículo.

La responsabilidad por las acciones de la inteligencia artificial

El problema de la responsabilidad jurídica en el contexto de la inteligencia artificial constituye, quizá, uno de los desafíos más agudos y controvertidos. Es precisamente en este ámbito donde se revelan los límites fundamentales del sistema jurídico contemporáneo, basado en la presunción de la persona humana autónoma y capaz como principal portadora de voluntad, intención y culpa. La inteligencia artificial, especialmente en sus formas altamente autónomas y autoaprendientes, socava esta construcción al generar lo que se ha denominado una “brecha de responsabilidad” (responsibility gap), en la cual las consecuencias de las acciones de la IA escapan al control pleno de cualquier individuo u organización concreta (Russell&Norvig, 2020).

Desde el punto de vista del derecho positivo, toda forma de responsabilidad presupone la existencia de un sujeto capaz de actuar con cierto grado de consciencia y previsibilidad. Sin embargo, la IA puede, en muchos casos, tomar decisiones basadas en patrones algorítmicos y en el procesamiento de grandes volúmenes de datos, cuyos resultados no son completamente previsibles ni siquiera para sus propios desarrolladores. Esto plantea una interrogante fundamental: ¿quién debe asumir la responsabilidad por los daños causados por un sistema autónomo cuyas acciones no han sido completamente preprogramadas de antemano y pueden ser el resultado de su propia lógica adaptativa?

En la práctica y la doctrina jurídicas pueden identificarse varios enfoques para abordar esta cuestión:

- *Enfoque tradicional: responsabilidad del desarrollador, fabricante u operador*

El modelo más común —y hasta ahora dominante— presupone que la responsabilidad por las acciones de la IA recae sobre la persona o entidad que creó, implementó o utilizó el sistema. Bajo esta lógica, la IA es considerada como una herramienta compleja, pero en definitiva un instrumento, por lo que cualquier error, fallo o daño se considera derivado de las acciones u omisiones humanas. En el marco del derecho civil, esta responsabilidad puede surgir tanto en virtud de normas extracontractuales como contractuales.

Sin embargo, este enfoque enfrenta dificultades cuando la IA actúa no por instrucción directa, sino en virtud de su propio desarrollo algorítmico, incluidas situaciones en las que toma decisiones basadas en un análisis autónomo de datos. Por ejemplo, si un sistema de IA médica recomienda un tratamiento erróneo no previsto por el fabricante, pero fundamentado en el aprendizaje estadístico del sistema, ¿debe considerarse responsable al desarrollador, incluso cuando este no pudo prever dicha recomendación?

- **Modelo de responsabilidad distribuida**

Los defensores de esta concepción proponen considerar la responsabilidad como distribuida entre los diversos actores que participan en el ciclo de vida de la IA: programadores, proveedores de datos, propietarios, usuarios y sistemas de supervisión. Este enfoque supone que la responsabilidad puede ser solidaria o proporcional, dependiendo del grado de participación de cada sujeto. Ello aproxima a la IA al estatus de un objeto infraestructural complejo (comparable, por ejemplo, a una aeronave o un buque), en el que la responsabilidad se reparte entre múltiples eslabones. Sin embargo, en la práctica, la implementación de este modelo exige un alto grado de prueba y una reconstrucción precisa de la cadena de causalidad, lo cual se ve dificultado por el funcionamiento de la IA como una "caja negra" (black box).

- **La concepción del agente electrónico o de la "subjektividad limitada"**

Como se mencionó anteriormente, en 2017 el Parlamento Europeo propuso la creación de una categoría jurídica especial —la personalidad electrónica— para sistemas autónomos capaces de tomar decisiones independientes. Según esta propuesta, ciertos tipos de IA podrían gozar de una subjektividad jurídica limitada y asumir responsabilidad propia, de manera análoga a las personas jurídicas. Este sistema implicaría, entre otras cosas, la existencia de un fondo de seguros, mecanismos de garantía o la obligación de incorporar normas de conducta ética y sistemas de autocontrol en el propio diseño del sistema.

No obstante, este enfoque ha sido objeto de críticas tanto por parte de juristas como de expertos en inteligencia artificial. Se ha argumentado que la subjektividad jurídica presupone consciencia, libertad de voluntad y capacidad de autodeterminación moral —atributos de los que la IA carece. Además, una subjektividad jurídica desvinculada de la responsabilidad moral o social podría convertirse en un instrumento para evadir la responsabilidad real de los actores humanos (como las corporaciones), trasladándola a una estructura ficticia.

- **Seguro y regímenes especiales de responsabilidad**

Como solución de compromiso, se ha propuesto la introducción de un sistema de seguros obligatorios para cubrir los riesgos asociados al uso de la inteligencia artificial, de manera análoga al seguro de responsabilidad civil automovilística. En este caso, el daño sería indemnizado por el sistema asegurador, con posibilidad de recurso contra aquellas personas cuyas acciones (u omisiones) hayan sido la causa del perjuicio. Este enfoque no presupone tanto una subjektividad ético-jurídica de la IA como el reconocimiento de su condición de fuente de peligro aumentado, lo que aproxima su regulación jurídica a las normas sobre la responsabilidad por actividades peligrosas (Kuner, 2017).

Así pues, la responsabilidad jurídica en la era de la inteligencia artificial exige trascender los esquemas binarios clásicos: ser humano — culpable, tecnología — instrumento. La realidad contemporánea requiere modelos más flexibles, que tengan en cuenta la complejidad de las relaciones de causalidad, la autonomía de los sistemas y su impacto en el entorno social. La comunidad legislativa y judicial apenas comienza a reflexionar sobre estos cambios, y las decisiones que se tomen hoy determinarán la capacidad del ordenamiento jurídico para funcionar eficazmente en un futuro donde la inteligencia artificial no será la excepción, sino la norma.

Cuestiones de protección de datos personales y privacidad

La era digital ha dado lugar a una nueva frontera jurídica y ética: la protección de los datos personales y del derecho a la privacidad en un contexto de recopilación, análisis y procesamiento masivos de información. Con la aparición y la amplia implementación de los sistemas de inteligencia artificial, este problema ha adquirido una dimensión cualitativamente diferente: la IA no solo procesa datos, sino que extrae patrones ocultos, predice comportamientos, construye perfiles personales y toma decisiones con consecuencias jurídicas y sociales para los individuos. En este contexto, el concepto de privacidad se encuentra amenazado por un proceso de erosión, y los mecanismos tradicionales de protección legal se

ven presionados por la necesidad de adaptarse.

La inteligencia artificial, por su propia naturaleza, es una tecnología “dependiente de los datos”. Requiere grandes volúmenes de información (Big Data) para su entrenamiento, validación y funcionamiento. Estos datos, en muchos casos, incluyen información sensible: parámetros biométricos, datos médicos y financieros, características conductuales, trayectorias de geolocalización, contenidos de comunicaciones en línea e incluso reacciones emocionales. Además, la IA es capaz de generar datos derivados —información que no ha sido proporcionada directamente por el usuario, pero que se infiere mediante análisis algorítmicos—, los cuales suelen ser aún más invasivos.

Desde un punto de vista jurídico, surge la pregunta: ¿en qué momento comienza el tratamiento de datos personales? ¿Deben protegerse únicamente los datos que identifican a una persona de manera directa, o también aquellos que permiten su identificación indirecta? El derecho europeo, en particular el Reglamento General de Protección de Datos (RGPD), adopta una interpretación amplia que abarca toda información relativa a una persona identificada o identificable. Sin embargo, muchas legislaciones nacionales se mantienen dentro de una definición más restrictiva, lo cual genera vacíos normativos en el contexto del uso de IA (Taddeo&Floridi, 2018).

La inteligencia artificial también intensifica otra disyuntiva fundamental: el problema del consentimiento. En el enfoque tradicional, la protección de los datos personales presupone el consentimiento libre, informado y específico del sujeto para el tratamiento de su información. No obstante, en el caso de la IA, el usuario a menudo no está en condiciones de comprender adecuadamente el alcance y la naturaleza de los datos procesados, y mucho menos los fines, métodos y consecuencias del tratamiento algorítmico. Los sistemas automatizados pueden integrarse de manera imperceptible en el entorno cotidiano: a través de aplicaciones móviles, dispositivos inteligentes, cámaras de videovigilancia urbana o servicios en línea. De este modo, el consentimiento se convierte en un acto formal carente de conciencia real y autonomía, lo cual socava su legitimidad jurídica.

Las dificultades se agravan en situaciones de toma de decisiones automatizada, en las que la IA actúa como una especie de filtro o árbitro —por ejemplo, en la concesión de créditos, la contratación laboral, la adopción de decisiones judiciales o el diagnóstico médico. En tales casos, existe el riesgo de discriminación algorítmica, cuando el sistema, basándose en datos ocultos o incompletos, formula conclusiones sesgadas. El Reglamento General de Protección de Datos (RGPD), en su artículo 22, prohíbe expresamente la adopción de decisiones basadas únicamente en el tratamiento automatizado, incluida la elaboración de perfiles, cuando dichas decisiones afecten significativamente los derechos y libertades del interesado. Sin embargo, en la práctica, el cumplimiento de esta norma suele enfrentar dificultades tanto técnicas como jurídicas: no siempre es posible rastrear con precisión qué variables sirvieron de base para la decisión, y la propia lógica del sistema de IA puede resultar incomprensible incluso para sus propios desarrolladores.

Merece atención aparte el problema de la anonimización de los datos. Los desarrolladores de IA suelen afirmar que la información personal se somete a procesos de anonimización o seudonimización, lo cual —en teoría— elimina la responsabilidad jurídica. No obstante, las técnicas actuales de análisis permiten recombinar y desanonimizar datos con un alto grado de precisión, especialmente cuando se dispone de fuentes externas. En consecuencia, las garantías legales de privacidad no pueden fundamentarse únicamente en el anonimato técnico.

En el contexto del acelerado desarrollo de la inteligencia artificial, también surge la cuestión de la soberanía digital del individuo, entendida como su capacidad para controlar sus propios datos en el entorno digital. Una posible vía de evolución consiste en el llamado control diferenciado de los datos personales, mediante el cual el usuario puede determinar niveles de acceso, modos de tratamiento y fines de utilización de su información. Este enfoque requiere la creación de nuevas instituciones jurídicas, tales como “pasaportes de datos”, “representantes digitales de confianza” o el “derecho al olvido”.

En definitiva, la protección de los datos personales y del derecho a la privacidad en la era de la inteligencia artificial exige una profunda transformación del marco normativo (Calo, 2015).

No basta con ampliar las normas existentes: es necesario repensar la lógica misma de la relación jurídica entre el ser humano y el algoritmo. En este proceso, es especialmente importante el papel no solo de los mecanismos jurídicos, sino también de los éticos, de los estándares internacionales y de soluciones técnicas como el privacy by design y la transparencia algorítmica. Sin estas medidas, el entorno digital corre el riesgo de convertirse en un espacio de violación sistemática de los derechos individuales, amparado por el discurso del progreso tecnológico.

Discriminación algorítmica y justicia en las decisiones

El problema de la discriminación algorítmica representa una de las facetas más paradójicas y

preocupantes del funcionamiento de la inteligencia artificial en la realidad social y jurídica. Un sistema inicialmente percibido como imparcial, basado en la lógica, las matemáticas y la estadística, puede —contrariamente a las expectativas— no solo reflejar, sino también agravar las desigualdades sociales existentes. De este modo, socava principios jurídicos fundamentales, en primer lugar el principio de igualdad y justicia, consagrados tanto en las constituciones nacionales como en los instrumentos jurídicos internacionales.

La discriminación algorítmica tiene un carácter estructural, no individualizado. A diferencia de la discriminación clásica, donde existe una intención explícita de limitar los derechos de alguien por motivos de género, raza, religión u otro criterio, la discriminación en la inteligencia artificial está determinada por la lógica misma del algoritmo y la calidad de los datos de entrenamiento. La inteligencia artificial, como sistema orientado estadísticamente, se entrena con datos históricos que a menudo ya contienen huellas de prejuicios estructurales. Como resultado, el sistema es capaz de extraer patrones que, pese a su aparente objetividad externa, encarnan una injusticia sistémica. Por ejemplo, en el caso del uso de IA para analizar currículums en procesos de selección laboral, esta puede excluir automáticamente a mujeres o a miembros de minorías étnicas si en los datos históricos la mayoría de candidatos exitosos pertenecía a otros grupos. Al mismo tiempo, esta discriminación se comete sin un sujeto, sin voluntad ni intención, lo que la hace especialmente difícil de detectar y cuestionar desde la perspectiva del derecho vigente.

La legislación antidiscriminatoria moderna en la mayoría de los países sigue anclada en un enfoque tradicional, en el cual la infracción presupone la existencia de culpa consciente o prejuicio intencional. Sin embargo, en el caso de la inteligencia artificial no existe un sujeto culpable en el sentido habitual, y el sesgo se convierte en una propiedad del entorno algorítmico. Este vacío normativo genera la necesidad de replantear conceptos jurídicos y de introducir nuevos mecanismos de responsabilidad legal. Cada vez con mayor frecuencia se propone la idea de una responsabilidad estructural o colectiva, en la que la responsabilidad por los efectos discriminatorios recae sobre los desarrolladores de los algoritmos, los proveedores de datos o las organizaciones que emplean dichos sistemas. En este contexto, la cuestión central no es la culpa, sino el resultado: ¿causa el sistema daño a la igualdad y a la justicia?

Un especial énfasis en el debate jurídico y científico se pone en la cuestión de la justicia algorítmica — un principio conceptual según el cual el sistema de IA debe tomar decisiones que no generen diferencias injustificadas entre distintos grupos sociales. Sin embargo, la implementación de este principio enfrenta diversos obstáculos. En primer lugar, la mayoría de los algoritmos modernos, especialmente los basados en aprendizaje profundo, funcionan como «cajas negras», cuya lógica interna de toma de decisiones permanece inaccesible para análisis externos. Esto hace imposible controlar qué parámetros y con qué peso fueron considerados al formular las conclusiones. En segundo lugar, no existen estándares legales universales sobre qué debe considerarse una decisión «justa»: la comprensión de la justicia varía entre culturas jurídicas, y la tentativa de traducirla en parámetros cuantitativos puede reducirse a una mera eficiencia utilitarista. En tercer lugar, en la mayoría de las jurisdicciones no existen mecanismos procesales que permitan al sujeto impugnar una decisión algorítmica o acceder a una explicación de la misma (Yeung, 2018).

Junto con los aspectos jurídicos, este problema tiene profundas raíces filosóficas y éticas. La inteligencia artificial, que funciona bajo la lógica de la optimización y las evaluaciones probabilísticas, se distancia radicalmente de la comprensión humanista de la justicia como participación, reconocimiento y respeto a la dignidad humana. Donde el ser humano tiende a la empatía, la duda y la interpretación, el algoritmo actúa estrictamente según cálculos, excluyendo cualquier forma de empatía. En este contexto, resulta especialmente importante el concepto de justicia procedimental, que implica no solo la igualdad de resultados, sino también la justicia del propio proceso de toma de decisiones: la posibilidad de participar, ser escuchado, recibir una explicación y presentar apelaciones. El reconocimiento de este concepto ya se refleja en documentos internacionales como el Reglamento General de Protección de Datos de la UE (GDPR) y el proyecto de Ley sobre Inteligencia Artificial de la Unión Europea, donde se subraya la necesidad de transparencia, interpretabilidad y controlabilidad de las decisiones automatizadas.

La regulación jurídica de la justicia algorítmica debe tener un carácter multinivel e incluir medidas técnicas, normativas e institucionales. Entre ellas, se pueden destacar la auditoría obligatoria de los algoritmos para detectar sesgos, la certificación de sistemas de IA en sectores sensibles (medicina, educación, justicia), la consagración legal del deber de explicar las decisiones y la creación de órganos de control independientes. Sin embargo, incluso con estos mecanismos, queda abierta la cuestión de hasta qué punto es posible reconciliar la eficiencia tecnológica con las expectativas jurídicas y morales de

justicia. La respuesta a esta pregunta exige no solo esfuerzos normativos, sino también un debate filosófico más amplio sobre el lugar del ser humano en la sociedad digital y los límites del poder de los algoritmos sobre la vida social.

Así, la discriminación algorítmica no representa un problema aislado de error tecnológico, sino un desafío estructural para el pensamiento y la práctica jurídica. Exige de los juristas no solo la corrección de la legislación vigente, sino el desarrollo de nuevos modelos de responsabilidad legal, nuevos estándares éticos y un nuevo lenguaje jurídico capaz de comprender las formas complejas e híbridas de agencia, responsabilidad y justicia en la era de la toma de decisiones automatizada.

La necesidad de una armonización internacional de los enfoques jurídicos sobre la IA

La regulación jurídica de la inteligencia artificial enfrenta hoy una dilema fundamental entre la necesidad de soberanía nacional para la elaboración de marcos normativos y la naturaleza objetiva y transfronteriza misma de la tecnología. Los sistemas de IA no conocen fronteras estatales: se diseñan en unas jurisdicciones, se implementan en otras, procesan datos de usuarios de diferentes continentes e influyen en la vida cotidiana de las personas independientemente de su ciudadanía, cultura o régimen político. En estas condiciones, surge una necesidad urgente de formar un espacio jurídico internacional coordinado, capaz de garantizar una regulación eficaz, justa y universalmente aplicable de la IA.

La fragmentación y las divergencias en los enfoques observadas hasta la fecha generan riesgos jurídicos significativos y la amenaza de la aparición de «paraísos regulatorios digitales», donde las empresas pueden eludir las estrictas normativas de ciertos países registrándose en jurisdicciones con estándares mínimos. Esta situación no solo socava la confianza de los ciudadanos en las tecnologías, sino que también aumenta la desigualdad global: los países en desarrollo, que carecen de suficiente potencial normativo y tecnológico, se ven privados de la posibilidad de proteger sus intereses ante la expansión de los sistemas algorítmicos creados por corporaciones tecnológicas globales. Así, la armonización internacional se convierte no solo en una cuestión técnico-jurídica, sino en un asunto de justicia digital y orden jurídico global.

Los pasos más activos hacia la formación de principios y estándares comunes están siendo actualmente impulsados por la Unión Europea, donde se está elaborando y debatiendo activamente el proyecto de Ley de Inteligencia Artificial (AI Act), el primer acto normativo integral del mundo destinado a regular la IA según el nivel de riesgo. Sin embargo, incluso un documento tan progresista, orientado a los valores de los derechos humanos, la transparencia, la rendición de cuentas y la no discriminación, no puede abarcar todos los desafíos que enfrenta la comunidad internacional. Su ámbito de aplicación se limita a un sistema regional, dejando fuera de la regulación a decenas de países con tradiciones jurídicas y éticas diferentes. Una situación similar se observa en Estados Unidos, donde la IA se regula de manera fragmentada — a través de un conjunto de leyes sobre protección al consumidor, datos y normas antidiscriminatorias — pero no existe una ley federal específicamente dedicada a la IA (Pagallo, 2013).

Mientras tanto, los países con tendencias autoritarias frecuentemente utilizan la inteligencia artificial como herramienta de vigilancia, censura y control político, lo que genera preocupaciones adicionales sobre la legitimidad ética y la universalidad de los sistemas de IA creados. En este sentido, el derecho internacional debe no solo armonizar técnicamente los enfoques hacia la IA, sino también formar un marco ético-jurídico capaz de garantizar el respeto universal de los derechos y libertades humanos, independientemente de la coyuntura política.

En respuesta a estos desafíos, diversos organismos internacionales han comenzado a formular principios y estándares destinados a convertirse en la base de la regulación global. En 2021, la UNESCO adoptó las Recomendaciones sobre la Ética de la Inteligencia Artificial, en las que se establecen principios clave como la protección de los derechos humanos, la sostenibilidad, la inclusión, la justicia y la diversidad. Por su parte, el Consejo de Europa y la OCDE están desarrollando marcos jurídicos y éticos orientados a garantizar la transparencia, la rendición de cuentas y la explicabilidad de las decisiones algorítmicas. Aunque estos documentos tienen principalmente un carácter recomendatorio, desempeñan un papel fundamental en la formación de un léxico común y una base normativa necesaria para la posterior integración jurídica.

La armonización de los enfoques jurídicos requiere no uniformidad, sino coordinación. No se trata de imponer de manera coercitiva modelos únicos, sino de buscar puntos de consenso: un conjunto mínimo de normas y principios universales que puedan ser aceptados por diferentes Estados como bases comunes. Entre estos principios destacan:

- la primacía de los derechos humanos y la dignidad de la persona en la arquitectura de los sistemas de IA;*
- la prohibición de la discriminación masiva y la vulneración algorítmica de las minorías;*

- la obligatoriedad de la rendición de cuentas por parte de los desarrolladores y operadores de IA;
- las garantías de transparencia y explicabilidad de las decisiones automatizadas;
- la protección de los datos personales en el espacio digital global.

La práctica jurídica internacional ya está desarrollando ciertos mecanismos para implementar estos principios. Por ejemplo, se está debatiendo la idea de crear una Agencia Global de Ética para la IA —similar a la OMS o al OIEA— que podría coordinar las políticas estatales, certificar algoritmos críticos y monitorear el cumplimiento de las normas internacionales. En este contexto, cobra relevancia el concepto de «soberanía digital con responsabilidad internacional», que implica que cada Estado tiene el derecho de definir su política en materia de IA, pero dentro de compromisos generalmente aceptados, de manera análoga a la regulación en ámbitos como el medio ambiente, la energía nuclear o el comercio transfronterizo (Nemitz, 2018).

La necesidad de armonización internacional de los enfoques jurídicos hacia la IA no está determinada solo por la realidad tecnológica, sino también por la lógica político-jurídica de la globalización. La inteligencia artificial deja de ser simplemente un objeto de regulación para transformarse en la infraestructura de un nuevo orden social. En estas condiciones, solo una regulación jurídica coordinada, justa e inclusiva podrá prevenir la fragmentación digital del mundo, minimizar los riesgos transfronterizos y orientar el desarrollo de la IA hacia valores universales, compatibles tanto con los principios del derecho internacional como con el sentido humanista de la ciencia jurídica misma.

Conclusión

La sociedad contemporánea entra en una nueva fase de desarrollo tecnológico, donde la inteligencia artificial deja de ser exclusivamente una herramienta para convertirse en un sujeto activo del espacio social y jurídico. Esta transformación plantea a la jurisprudencia desafíos sin precedentes, que requieren no solo la adaptación de las normas jurídicas existentes, sino también una reconsideración de los mismos fundamentos del pensamiento jurídico. Como ha demostrado el análisis realizado, los sistemas de IA se convierten en fuente de problemas jurídicos complejos y multilayer, que trascienden la regulación tradicional.

En primer lugar, la incertidumbre sobre la naturaleza jurídica de la inteligencia artificial dificulta la delimitación de sus capacidades legales, autonomía y estatus regulatorio. No está claro si la IA debe considerarse un objeto, una herramienta, un artefacto jurídico o un potencial cuasi-sujeto de derecho. Esta incertidumbre teórica se transforma en práctica, por ejemplo, al abordar cuestiones de responsabilidad por daños causados por acciones de sistemas autónomos.

En segundo lugar, el problema de la responsabilidad jurídica en el contexto de la participación de la IA exige revisar las construcciones clásicas de culpa, intención y causalidad. Surge la necesidad de desarrollar nuevas formas de responsabilidad —distribuida, funcional o institucional— que abarquen a todos los participantes del ciclo de vida del algoritmo: desde desarrolladores y proveedores de datos hasta los usuarios finales. En este sentido, la tarea más importante sigue siendo garantizar justicia para las personas afectadas, en condiciones donde la identificación del culpable concreto es difícil o imposible.

En tercer lugar, resulta especialmente preocupante la amenaza a la privacidad y la vulneración de los derechos a la protección de los datos personales. La inteligencia artificial, especialmente en su forma moderna basada en el aprendizaje automático y el análisis de grandes volúmenes de datos, tiende a una recolección, almacenamiento e interpretación intensiva de información sobre la vida privada de los ciudadanos. En estas condiciones, la protección jurídica de la privacidad debe contemplar no solo los consentimientos formales y el acceso a los datos, sino también aspectos profundos como la autonomía digital, la autodeterminación informativa y los límites de la observabilidad.

En cuarto lugar, la discriminación algorítmica y la injusticia en las decisiones demuestran que incluso los sistemas tecnológicamente más avanzados pueden reproducir y reforzar inconscientemente sesgos sociales. La respuesta jurídica a estos fenómenos requiere un enfoque integral que incluya auditorías técnicas, rendición de cuentas normativa y el reconocimiento de nuevas formas de daño causadas por la injusticia digital.

Finalmente, el análisis ha mostrado que la solución a la mayoría de estos problemas no es posible dentro del marco exclusivo de la regulación nacional. La naturaleza global de la IA exige la armonización de los enfoques jurídicos, la creación de estándares internacionales, principios consensuados e instituciones capaces de garantizar el respeto de los derechos humanos fundamentales en la era digital. De lo contrario, corremos el riesgo de enfrentar una fragmentación de los regímenes jurídicos, el aumento de la desigualdad digital y la pérdida de legitimidad del control jurídico sobre la realidad algoritmizada.

Así, la inteligencia artificial se presenta hoy no solo como un objeto de regulación técnica, sino como un desafío filosófico-jurídico. La respuesta a este desafío requiere esfuerzos sistémicos: el desarrollo

de nuevas categorías y principios, la transformación de las prácticas educativas e institucionales, y un diálogo interdisciplinario profundo. La jurisprudencia del siglo XXI debe mantenerse al ritmo de la evolución tecnológica, conservando al mismo tiempo su misión principal: proteger la dignidad, la libertad y la igualdad humana en un mundo digital en constante cambio.

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RETINOBLASTOMA: THE CURRENT STATE OF THE ISSUE

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Abstract

This scientific and analytical work presents modern clinical and diagnostic data concerning the most common malignant intraocular tumor in children – retinoblastoma. The issues of etiopathogenesis, genetic and molecular features of this pathology, assessment of the role of biomarkers in diagnostics and prognosis of the disease are covered in detail. Promising directions for the development of new and improved diagnostic and therapeutic approaches, genetic causes of this pathology, possibilities of whole genome sequencing for studying the mutation landscape, currently used classification systems of retinoblastoma, available possibilities of clinical screening are described. The publication shows that studies of the molecular basis of the disease also led to deciphering subsequent events and, thus, to the discovery of biomarkers and associated targeted therapies. In addition, improvements in molecular biology methods contributed to the development of effective methods of early diagnostics, genetic counseling and disease prevention. The issues of visual acuity assessment and improving the quality of life of patients are also comprehensively considered.

Keywords: oncology, ophthalmology, pediatrics, retinoblastoma, incidence, etiopathogenesis, classification systems, screening, visual acuity, biomarkers, RB1 gene, DNA, genome sequencing, diagnostics, treatment, quality of life, prognosis.

Retinoblastoma (RB) is a malignant tumor of the retina in young children.

The diagnostic criteria are as follows. Complaints and anamnesis: complaints of glow in the affected eye when exposed to light, often noticed by parents when photographing a child with a flash (white pupillary reflex, leukocoria, "cat's eye symptom"), convergent or divergent strabismus, deterioration of vision; redness, hemorrhages, change in eye color, pain (not a typical symptom). It is necessary to clarify the duration of complaints, hereditary anamnesis.

Physical examination: general examination of the patient - pay attention to changes in the eye (glow when exposed to light, symmetry of the orbits, is there exophthalmos, is the eye inflamed, color of the pupil), assessment of the condition of internal organs and systems, palpation of peripheral lymph nodes - to exclude metastases. Mandatory referral to an ophthalmologist for a complete ophthalmological examination.

Laboratory tests: complete blood count - presence of anemia, moderate leukocytosis and accelerated erythrocyte sedimentation rate (for the presence/absence of inflammatory changes); biochemical blood test: liver function tests, levels of nitrogenous waste products, electrolytes, total protein and glucose - for radiological diagnostics using a contrast agent. Instrumental tests: ophthalmoscopy with pupil dilation under general anesthesia - is the most objective method for assessing the condition of the eye - tumor size, location, prevalence, retinal detachment, condition of the optic nerve head; retinal camera - documentation of the tumor process; Ultrasound Examination of the orbits - the presence of an intraocular formation with calcifications is a pathognomonic sign, the presence of retinal detachment, signs of growth into the orbit; Ultrasound Dopplerography of the orbits - presence of an intraocular formation with calcifications, determination of the tumor's own blood flow, detection of the "cut off branch" symptom, presence of retinal detachment, signs of growth into the orbit; X-ray of the chest organs, if necessary in two projections if pneumonia is suspected; magnetic resonance imaging (MRI) of the brain and orbits with contrast enhancement under anesthesia to determine the size of the formation, location, involvement of the optic nerve, presence of intracranial foci. In the absence of MRI, computed tomography (CT) of the brain and orbits may be performed, but this examination does not provide an objective assessment of the condition of the optic nerve and brain; according to indications, CT/MRI of other parts of the body in advanced cases with a long history [1].

RB is an intraocular tumor with hereditary and sporadic forms. 8,000 new cases of this ocular malignancy of the developing retina are diagnosed each year worldwide. The major gene responsible for retinoblastoma is RB transcriptional co-repressor 1 (RB1), and it harbors a large spectrum of pathogenic variants. Tumorigenesis begins with mutations that cause RB1 biallelic inactivation preventing the production of functional RB protein (pRB) [2].

pRB is a multifunctional protein involved in a variety of processes regulating cell proliferation at multiple levels including apoptosis, histone methylation and chromatin remodelling. Loss of function of pRB in the retina is thought to lead to dysregulation of these events, resulting in uncontrolled cell proliferation and chromosomal instability. The RB is the most common primary intraocular cancer of childhood, causing significant long-term sequelae. Loss-of-function mutations in RB1 are causally implicated in RB development. RB1 was the first tumour suppressor gene to be isolated, in contrast to activating oncogenes, which were characterised earlier. In humans, RB1 is located on chromosome 13q14.2, spans approximately 180 Kb and contains 27 exons encoding a 928 amino acid nucleophosphoprotein, known as pRB [3].

Depending on the type of mutation the penetrance of RB is different. However, in small percent of tumors additional genes may be required, such as MYCN, BCOR and CREBBP. Additionally, epigenetic changes contribute to the progression of RB as well. Besides its role in the cell cycle, pRB plays many additional roles, it regulates the nucleosome structure, participates in apoptosis, DNA replication, cellular senescence, differentiation, DNA repair and angiogenesis. Notably, pRB has an important role as a modulator of chromatin remodeling. In recent years high-throughput techniques are becoming essential for credible biomarker identification and patient management improvement. In spite of remarkable advances in RB therapy, primarily in high-income countries, our understanding of RB and its specific genetics still needs further clarification in order to predict the course of this disease and improve therapy. One such approach is the tumor free DNA that can be obtained from the anterior segment of the eye and be useful in diagnostics and prognostics. The field of ophthalmology genetics and genomics is expanding fast and the accumulated knowledge aims to develop novel and improved diagnostic and therapeutic approaches. The specific molecular mechanisms behind eye diseases, including RB, are being recognized every day, because it is important to understand their genetic causes and biological behavior in order to improve clinical outcome. Genetic implications for more than 97% of all RB cases is the RB1 gene inactivation. Although RB has been genetically characterized a long time ago, its molecular blueprint is

still incomplete and needs deeper investigation. Several classification systems are currently in use, for example, the International Intraocular Retinoblastoma Classification (IIRC), International Classification of Retinoblastoma (ICRB) and cTNMH (American Joint Committee on Cancer (AJCC)) and for extraocular disease, the International Retinoblastoma Staging System (IRSS) and cTNMH staging [2].

Davies H.R. et al. [3] in their study emphasize that the majority of RB1 mutations can be detected by clinical screening. However, RB cases exist where mutations in RB1 have not been detected. Our colleagues used whole-genome sequencing to investigate the landscape of mutations in a cohort of sporadic RBs, including cases where mutations in both copies of RB1 had not been previously identified. The researchers looked for mutations in cancer driver genes and revealed a wide variety of structural rearrangements disrupting RB1. In addition, they investigated mutation burden and specific mutation patterns (mutational signatures), uncovering a treatment-related mutational signature in a tumour exposed to chemotherapy. The power of whole-genome sequencing to identify RB1 mutations of all mutation types can have significant relevance to the clinical management of RB patients and genetic counselling of their families. The development of RB is thought to require pathological genetic changes in both alleles of the RB1 gene. However, cases exist where RB1 mutations are undetectable, suggesting alternative pathways to malignancy. The authors used whole-genome sequencing (WGS) and transcriptomics to investigate the landscape of sporadic RBs derived from twenty patients, sought RB1 and other driver mutations and investigated mutational signatures. At least one RB1 mutation was identified in all RBs, including new mutations in addition to those previously identified by clinical screening. Ten tumours carried structural rearrangements involving RB1 ranging from relatively simple to extremely complex rearrangement patterns, including a chromothripsis-like pattern in one tumour. Bilateral tumours obtained from one patient harboured conserved germline but divergent somatic RB1 mutations, indicating independent evolution. Mutational signature analysis showed predominance of signatures associated with cell division, an absence of ultraviolet-related DNA damage and a profound platinum-related mutational signature in a chemotherapy-exposed tumour. Most RB1 mutations are identifiable by clinical screening. However, the increased resolution and ability to detect otherwise elusive rearrangements by WGS have important repercussions on clinical management and advice on recurrence risks.

The foundational work that explained the RB inheritance but also the concept of tumor suppressor genes was originally published by Knudson in his seminal paper from 1971 Knudson's two hit model proposed that one RB1 allele is lost or mutated in all cells and a second somatic mutagenic event affects the remaining allele in a primitive retinal cell, thus initiating tumorigenesis [4].

With an average incidence of 1 in every 18,000 live births, RB is a rare type of intraocular tumour found to affect patients during their early childhood. It is curable if diagnosed at earlier stages but can become life-threateningly malignant if not treated timely. With no racial or gender predisposition, or even environmental factors known to have been involved in the incidence of the disease, RB is often considered a clinical success story in pediatric oncology. The survival rate in highly developed countries is higher than 95% and they have achieved this because of the advancement in the development of diagnostics and treatment techniques. This includes developing the already existing techniques like chemotherapy and embarking on new strategies like enucleation, thermotherapy, cryotherapy, etc. Early diagnosis, studies on the etiopathogenesis and genetics of the disease are the need of the hour for improving the survival rates. According to the Knudson hypothesis, also known as the two hit hypothesis, two hits on the susceptibility RB gene is often considered as the initiating event in the development of the disease. Studies on the molecular basis of the disease have also led to deciphering the downstream events and thus in the discovery of biomarkers and related targeted therapies. Furthermore, improvements in molecular biology techniques enhanced the development of efficient methods for early diagnosis, genetic counseling, and prevention of the disease [5].

As noted by Byroju V.V. et al. [5] with an ability to convert electromagnetic/ light energy to electrical energy, the retina acts as a transduction screen that enables the visualisation of any object in front of it by transmitting this electrical energy as nerve impulse to the cortical functioning centres. It layers the innermost part of the eye and hosts various types of cells like rods and cones which are integral for its proper functioning. Various diseases like retinal tear, retinal detachment, diabetic retinopathy, macular degeneration, retinitis pigmentosa etc. have been associated with retina and its impaired functioning. One such disease is RB, the most common malignant intraocular tumour in children. RB is theorized to arise from the cones of the retina, which have certain properties that leave them rather susceptible to tumorigenesis. Globally, 1 in every 16,000 to 20,000 live births is known to be afflicted by RB. Most of the cases are diagnosed before the age of 5 and it accounts for 3% of all childhood cancers.

Previous studies indicated that there were significant differences in the incidence of RB based on gender, ethnicity, and infections due to poor sanitation. The newer studies, however, deny significance of such differences and consider RB to have similar incidence throughout the world. Despite being rare, RB gained interest within the scientific community since RB1 gene is the first tumour suppressor gene to be discovered. In its hereditary form, RB is associated with de novo mutations resulting in tumours at other foci in the body which are termed 'second primary tumours' and is attributed to the role played by phosphorylated pRB. Subjects with hereditary RBs are at a higher risk of developing other second primary tumours such as osteosarcomas, melanomas etc.. Every form of RB, familial and sporadic has the RB gene mutated to some extent resulting in the downstream processing of aberrant transcripts. RB1 gene is located on the largest acrocentric chromosome, 13 and consists of 27 exons. Following transcription, pRB is formed and gets involved in the regulation of cell cycle at the G1-S checkpoint. Phosphorylation essentially acts to 'switch off' RB tumour suppressor protein which results in deregulation of downstream molecular events that eventually results in RB.

RB has been assigned various stages depending upon the progression of the disease and its potential for metastasis. The system was named IRSS where, the stage 0 often shows good prognosis with treatment while stage IV shows poor outcome. During stage IV, the cancer is considered to be extraocular and can lead to bulging out of the eye. When it comes to differentiating it into various types, the disease can appear as unilateral, bilateral or trilateral. The chance of a patient developing a trilateral RB is 6% higher in case of bilateral RB as compared to unilateral and can be fatal in 50% of the cases. Another classification of RB could be based on direction of progression of the disease; i.e. exophytic if the tumour originates in the retina and spreads in the direction of the brain behind or endophytic if the tissue spreads in an anatomic anterior direction [5].

In addition, a very important and even decisive aspect in the early diagnosis of RB is screening. Screening of RB involves various tests for detecting the symptoms of RB. Leukocoria (sometimes referred to as the 'cat's eye reflex') can be detected by the presence of a white reflection in photographs or the red reflex test. A simpler approach would be to use mobile phones for the same purpose where, such an application exists in the form of an app called "White eye Detector" developed by Bryan Shaw. Performing cover test detects the presence of strabismus while all other signs can be identified by a systematic visual examination. Screening by an ophthalmologist is a necessity in children with a positive family history of RB. Offspring and siblings of affected patients require regular screening examinations in childhood unless genetic testing is done to rule out a gene mutation in which case the risk is similar to that of the general population. Genetic counselling for families with RB can help determine the risk to future offspring and whether other family members are at risk of developing the disease [5,6].

An ophthalmoscope view shows the optic disk, the physiological cup, the retinal vessels, the macula and the fovea centralis so the tumour is quite easily identified. Non-invasive two dimensional and three-dimensional real-time ultrasound techniques have eased detection significantly. Once the polymerase chain reaction (PCR) was invented, it became easy to identify the batch deletion of exons in chromosome no. 13 of the children whose parents carry the RB1 gene mutation. Quantitative multiplexing is an advanced form of the technique where several primers are used at the same time together to identify batch deletions. Use of X Ray and CT has found its place in detection of RB relying on properties such as calcification in the latter technique. Gadolinium contrast enhancement followed by MRI scanning is informative for tumor detection. Fat saturation is also very useful when fat has been suppressed at one time and expressed at another time in anticipation of tumor nature. T1-weighted imaging with magnetization is used for best results.

Fluorescein angiography is a technique that requires injection of a small bolus of fluorescent material into the blood stream which finally reaches the ophthalmic artery. A specialized camera takes pictures of the eye once it reaches there through the catheter using the fluorescence of the arteries of the eye as a light source. Unsuccessful attempts at detecting RB using positron emission tomography (PET) were made using Flourine-18-fluorodeoxyglucose (FDG) throughout many years. The conclusion that FDG-PET is not currently widely established and does not provide any significant advantage over MRI/CT except in metastasis rendered MRI as the gold standard. Early detection using an ultrasonogram in-utero to study the face and eyes can help in detection of the cancer, resulting in earlier detection and potential cure [7,8].

Vempuluru V.S., Kaliki S. [6] a PubMed search was performed to identify articles published with specific reference to screening of neonates, infants and children for RB. It has been established that various devices and mobile phone-based applications based on altered red reflex are finding their way into community screening. Diagnosis of RB by newborn eye screening is emphasized in several countries,

and red reflex is the most widely employed technique. At the same time several screening programs for early detection of RB are evolving in the developing countries, but the practices are not uniform. Universal newborn screening should be the norm. Newer tools and software can be utilized to screen infants on a community scale. Focussed research on revolutionizing digital imaging for a versatile screening tool holds promise for early diagnosis of RB.

RB is a cancer that can be cured if diagnosed at an appropriate time. The involvement of structures beyond the retina and the vitreous humour should be taken into consideration as they have the potential to progress into metastasis rapidly. The treatment of RB is often complex and involves decisions to be made based on a number of factors including but not limited to the size of the tumour in various axes, age of the patient, risk of secondary metastasis, previous attempts made at chemotherapy, toxicity of the chemotherapeutic agent in the subject and laterality of the tumour. Treatment of RB includes the following aspects [6,9]:

1. **Enucleation.** Complete removal of the eye that is affected by the tumour, or surgical excision is termed as enucleation. It is the least conservative possible management and hence reserved for cases that cannot be helped otherwise. Enucleation should be avoided in cases where salvage is possible with other treatment modalities in an effort to preserve vision and improve conservation. For the first 2 years after surgery, all patients undergoing enucleation must be carefully monitored for the risk of orbital relapse. Hydroxyapatite implants coated with specialized polymers and have attachment sites for the extraocular muscles are being implemented. Overall, enucleation was widely used and continues to be used in cases where other treatment modalities are unhelpful.

2. **Intra-arterial chemotherapy (IAC).** Intra-arterial chemotherapy is safe and effective enough to avoid enucleation. Modern microcatheter techniques are used to deliver chemotherapeutic agents, and success is achieved with acceptable toxicity. Drug choices for this route of administration typically include mephalan, topotecan hydrochloride, carboplatin, and methotrexate. This method is used as a primary or secondary therapeutic intervention. Although intra-arterial chemotherapy is an effective treatment option, its limitations require the introduction of more sophisticated techniques. The efficacy of IAC is reduced in cases of extensive collateral meningeal vascular presence due to dilution of the agent in these vessels. Collateral blood supply to the retina other than the ophthalmic artery is variable and affects dose delivery. Catheterization of appropriate arteries requires skill, and technical difficulties may arise that may reduce the delivery of intra-arterial chemotherapy.

3. **Intravitreal chemotherapy (IVitC).** Focused drug delivery to a vitreal seed hotspot is considered precision intra-vitreous chemotherapy and is an emerging technique. Often used as an adjunct therapy to IAC, in IVitC, drugs are delivered directly into the vitreous cavity in advanced stages of RB where vitreous seeding occurs. A combination of chemodrugs such as melphalan and topotecan are the preferred mode of treatment when tumour seeds recur in the vitreous and is found to be more effective than the respective individual treatments. While the presence of vitreous seeds is an indication for IVitC, contraindications include diffuse dispersion of the tumour seeds, invasion of the anterior chamber of the eye, hemorrhage into the vitreous humour, and secondary glaucoma. With the advent of nanoparticle delivery, IVitC has promising prospects in the management of RB.

4. **Thermotherapy.** This mode of treatment is often engaged for tumours of minor dimensions, not exclusively for the eye. The usual dimension as indicated for thermotherapy alone is of a diameter of maximum 4 mm. Diode system delivers infra-red rays either through the pupil or the sclera to destroy tumour tissue by applying focused heat to induce necrosis. Ideal temperature of thermotherapy ranges from 45-60 C. It is often used in conjunction with other treatment modalities such as chemotherapy. Complications are seen in some cases which include but are not limited to atrophy of the iris, obstruction of the retinal vein and detachment of the retina. Attempts were made to avoid thermotherapy as a single modality in cases where seeding of the vitreous humour is observed.

5. **Cryotherapy.** Much like thermotherapy, cryotherapy is an adjuvant and used in conjunction with other treatments. A RB tumour up to 3.5 mm in diameter and 2 mm in thickness could be treated with cryotherapy. This therapy is contraindicated in cases with vitreous seeding and any tumour that has dimensions larger than the norm. The modality involves the application of triple freeze thaw technique using liquid nitrogen.

6. **External beam radiation (EBR).** EBR is in the line of management of treatment for RB after enucleation as an attempt to salvage the remaining eye. A high energy photon beam or electrons are delivered at an angle where the tumour has maximum exposure. Complications include cataracts, conjunctivitis, dry eyes and intractable glaucoma. Considering side effects such as new mutations, dry eyes, keratopathy, retinopathy and optic neuropathy, EBR therapy is better restricted to extra ocular

tumour extension or if better alternatives are available, this could be completely avoided. Tumours can sometimes arise secondarily due to radiation exposure, however, development of new modalities of beam radiation reduce such instances.

The authors emphasize that tumour regression should be followed up closely and the appearance, size, location, and number of tumours documented during each examination have to be assessed. When a tumour regresses after treatment, it can either appear as a white coloured calcific mass or as translucent piece of flesh. In most of the cases, patients undergo examination under anaesthesia every 4 to 8 weeks until the age of 3, followed by less frequent examinations if the disease is found to be latent.

Ancona-Lezama D. et al. [9] in their publication emphasize that RB, the most common ocular malignancy in childhood, is lethal if left untreated. RB management remains complex, requiring individualized treatment based on ICRB staging, germline mutation status, family psychosocial factors and cultural beliefs, and available institutional resources. Management of RB remains in constant evolution and treatment can vary among different centers worldwide. However, the same primary goals of protecting life and preventing metastatic disease, followed by globe preservation, and finally optimization of vision are commonly shared among RB specialists. The currently used therapies maintain excellent survival rates when disease is identified in the localized intraocular stage, while newer therapies have been focusing on additional improvement in globe preservation and providing the best possible visual acuity outcome. The refinement of these curative strategies has led to unprecedented cure rates and globe salvage in centers where a complete armamentarium of treatment options is available.

As noted in their study by Zhang R. et al. [10], RB is the most common intraocular malignancy in childhood. With the advanced management strategy, the globe salvage and overall survival have significantly improved, which proposes subsequent challenges regarding long-term surveillance and offspring screening. This cohort study included RB patients who visited Beijing Tongren Hospital from March 2018 to January 2022 for deep learning algorithm development. Clinical-suspected and treated RB patients from February 2022 to June 2022 were prospectively collected for prospective validation. Images from the posterior pole and peripheral retina were collected, and reference standards were made according to the consensus of the multidisciplinary management team. A deep learning algorithm was trained to identify "normal fundus", "stable retinoblastoma" in which specific treatment is not required, and "active retinoblastoma" in which specific treatment is required. The performance of each classifier included sensitivity, specificity, accuracy, and cost-utility. A total of 36,623 images were included for developing the Deep Learning Assistant for Retinoblastoma Monitoring (DLA-RB) algorithm. In internal fivefold cross-validation, DLA-RB achieved an area under curve (AUC) of 0.998 (95% confidence interval [CI] 0.986-1.000) in distinguishing normal fundus and active RB, and 0.940 (95% CI 0.851-0.996) in distinguishing stable and active RB. From February 2022 to June 2022, 139 eyes of 103 patients were prospectively collected. In identifying active RB tumours from all clinical-suspected patients and active RB from all treated RB patients, the AUC of DLA-RB reached 0.991 (95% CI 0.970-1.000), and 0.962 (95% CI 0.915-1.000), respectively. The combination between ophthalmologists and DLA-RB significantly improved the accuracy of competent ophthalmologists and residents regarding both binary tasks. Cost-utility analysis revealed DLA-RB-based diagnosis mode is cost-effective in both RB diagnosis and active RB identification. In conclusion, the authors point out that DLA-RB achieved high accuracy and sensitivity in identifying active RB from the normal and stable RB fundus. It can be used to surveil the activity of RB during follow-up and screen high-risk offspring. Compared with referral procedures to ophthalmologic centres, DLA-RB-based screening and surveillance is cost-effective and can be incorporated within telemedicine programs.

A very important issue is the question of preserving vision in this pathology.

Sinenko I.L. et al. [11] in their work they say that it is currently treated with a limited number of drugs, adapted from other pediatric cancer treatments. Drug toxicity and relapse of the disease warrant new therapeutic strategies for these young patients. In this study, researchers developed a robust tumoroid-based platform to test chemotherapeutic agents in combination with focal therapy (thermotherapy) – a treatment option widely used in clinical practice – in accordance with clinically relevant trial protocols. The model consists of matrix-embedded tumoroids that retain RB features and respond to repeated chemotherapeutic drug exposure similarly to advanced clinical cases. Moreover, the screening platform includes a diode laser (810 nm, 0.3 W) to selectively heat the tumoroids, combined with an on-line system to monitor the intratumoral and surrounding temperatures. This allows the reproduction of the clinical settings of thermotherapy and combined chemothermotherapy treatments. When testing the two main drugs currently used in clinics to treat RB in our model, authors observed results similar to those clinically obtained, validating the utility of the model. This screening platform is

the first system to accurately reproduce clinically relevant treatment methods and should lead to the identification of more efficient drugs to treat RB.

Schachevich P. et al. [12] in their work they say that the management of RB, the most common intraocular malignancy in children, has changed drastically over the last decade. Landmark developments in local drug delivery, namely, safer techniques for intravitreal chemotherapy injection and ophthalmic artery chemosurgery, have resulted in eye globe salvages that were not previously attainable using systemic chemotherapy or external beam irradiation. Novel drugs, oncolytic viruses, and immunotherapy are promising approaches in the treatment of intraocular RB. Importantly, emerging studies of the pattern of tumor dissemination and local drug delivery may provide the first steps toward new treatments for metastatic disease. Our colleagues reviewed recent advances in RB treatment, especially with regard to local drug delivery, that have enabled successful conservative management of intraocular RB, as well as emerging data from preclinical and clinical studies on innovative approaches that promise to lead to further improvement in outcomes, namely, the mechanisms and potential uses of new and repurposed drugs and non-chemotherapy treatments, and future directions for therapeutic development.

The authors emphasize that RB has been selected as a priority tumor by the World Health Organization for its Global Initiative for Childhood Cancer. Despite being highly curable at early stages, it may be fatal if left untreated. Eye-globe salvage treatments have substantially evolved over the last few decades, making intraocular RB the most curable of all pediatric cancers in high-income countries. The development of local drug delivery methods that maximize chemotherapy exposure in the retinal, subretinal, and vitreous spaces, namely ophthalmic artery chemosurgery (OAC) and a safety-enhanced technique for intravitreal (IVI) injection, have resulted in an unprecedented rate of eye globe and vision preservation. Importantly, these new local treatments result in very high concentrations of chemotherapy in the retina and optic nerve as shown in preclinical models, preventing dissemination to the central nervous system (CNS). So far, after more than a decade of continuous use at major clinical centers around the world and after more than 200 articles published in the field, IVI and OAC have been proven safe without increasing the risk of metastatic dissemination. By eliminating the use of external beam radiotherapy and systemic chemotherapy, these treatments have improved long-term survival by reducing the incidence of treatment-associated severe toxicities, the risk of secondary malignancies, and related deaths. In contrast to this exceptional improvement in treatment outcomes, children with disseminated RB have few therapeutic options, generally limited to high-dose chemotherapy, stem cell transplant, and local radiotherapy. Even worse is the scenario for patients with metastasis in the CNS, as these patients seldom survive even with intensive therapies. Thus, newer treatments and improved methods of targeting drug delivery to the CNS may improve outcomes. Examples of CNS-targeted routes include intrathecal (IT) and intraventricular (IVt) injection, which ensure direct delivery of chemotherapy to the cerebrospinal fluid, circumventing the blood-brain barrier. OAC may also be useful in patients with orbital RB with massive optic nerve and chiasmatic tumor involvement because of maximal local exposure to chemotherapy as shown in animal models. Future clinical assessments are necessary to determine the role of local chemotherapy delivery in disseminated RB. In all cases of intraocular and extraocular disease, there is a need for new therapies that are more effective and carry less risk of toxicity. New treatment modalities, namely, targeted therapies, immunotherapy, and oncolytic viruses are emerging as possible non-chemotherapeutic options. These novel treatments may further reduce the use of cytotoxic agents, potentially leading to even higher ocular preservation rates, reduced toxicities, and prevention of tumor dissemination. Identifying high-risk features associated with tumor progression and metastasis by histopathological analysis of the enucleated eye is critical for selecting appropriate management. These approaches may soon be supplemented by circulating tumor DNA (ctDNA) analysis, which may be an early and noninvasive prognostic biomarker of treatment response and risk of occult extraocular dissemination. In addition, ctDNA may be helpful in noninvasive genomic profiling, especially to identify patients with the subtype 2 molecular signature who have an increased risk of extraocular relapse. In conclusion, the researchers emphasize that treatments that have evolved over the last century have led to striking changes in the treatment paradigm for this ocular tumor. Advances in the knowledge of its tumor biology and drug response and the development of new routes of drug delivery promise to lead to additional new, more effective, and less toxic therapies in RB [12].

Warda O. et al. [13] in their work they say that the assessment of vision has a growing importance in the management of RB in the era of globe-conserving therapy, both prior to and after treatment. As survival rates approach 98-99% and globe salvage rates reach ever-higher levels, it is important to provide families with information regarding the visual outcomes of different treatments. As part of a

holistic approach, it is essential for clinicians to understand the impact of various treatment modalities on vision, as severe visual impairment, particularly in bilateral cases, can negatively impact the child's development and overall well-being. Although family counselling often appropriately centres on saving the child's life, it is important not to let the consideration of visual outcome fall by the wayside, as this is an additional piece of information that families find useful to help guide their decisions. As the authors note visual assessment in infants can be difficult. While Snellen visual acuity is used by many studies in the ophthalmic literature, this method of quantification requires children who are old enough (often over 5 years) to co-operate. Given that RB primarily affects infants and young toddlers, methods of vision assessment need to be tailored to this age group.

Age-appropriate visual acuity (VA) assessment can be performed using standard orthoptic techniques including Cardiff Cards, Keeler Cards, Kays picture tests and Single Sheridan Gardner Tests. When possible VA should be assessed monocularly. An encouraging and animated approach is used to maximise the engagement and co-operation of the child during VA assessment. As children with RB grow older, the choice of VA assessment tool should similarly evolve to ensure the most refined quantification possible. At presentation, children with RB are often seen on an urgent basis at the RB unit, which in many cases requires them to travel a significant distance. In our service, the visual assessment is performed by the orthoptist on presentation as well as at every ophthalmological evaluation during treatment; unless systemic chemotherapy, in which case visual assessment is performed after the final cycle. When RB is in remission, a visual assessment is performed at each follow-up appointment, this takes place before the examination under anaesthesia to avoid the child and family travelling great distances twice. The assessment can prove difficult particularly for starved children before their anaesthetics, so it may be necessary to settle for binocular VA in this instance. If the quantitative assessment is not possible, qualitative methods are used i.e. fixing and following a light and different-sized target to assess for a fixation preference. During the active treatment phase, the timing of visits depends largely on the treatment modalities employed. In the later years when there is no longer ongoing active RB treatment, the frequency of visits may in some cases be driven by the need to monitor for or manage amblyopia. In addition to the subjective methods of assessing VA mentioned above, electrodiagnostic studies may occasionally be helpful. Electroretinograms (ERGs), visual evoked potentials (VEPs) and fundus fluorescein angiography (FFA) have been found to be particularly useful in assessing for retinal toxicity and visual loss following the use of intra-arterial chemotherapy in eyes with tumour-free foveolae. Whilst ERGs are recognised not to correlate with vision, VEPs have a role in infants where the foveola is not involved. In fact, VEP Spatial Frequency is better than behavioural methods up to the age of 3 and is a useful adjunct to behavioural methods in this age group when assessing novel treatments and their impact on vision [13].

In addition to appropriate timely VA assessment, screening at-risk children plays an important role in optimising visual outcomes as early diagnosis correlates with smaller tumours. Consensus-based guidelines for screening are stratified by risk category, with high-risk children being screened at 2 weeks of age and repeated every 2-4 weeks initially and then at progressively long intervals until 5-7 years of age. While low-risk screeners are examined primarily within 4 weeks and follow-ups are dependent on genetic testing and are often awake examinations. In their conclusions and recommendations, the authors emphasize that with the increased rates of globe salvage, visual outcomes have become an integral part of planning the management for children with RB. In some situations, enucleation is still the most appropriate treatment, but with globe-conserving therapy, there is a need for information for patients and physicians alike to make informed decisions. Specialised orthoptic assessments to check visual acuity for children with RB has a very important role in the management of those cases. Thus, the prediction of the visual potential for both eyes needs to be tailored for each patient and be part of the parents' discussion and counselling. Tumour location and grading at presentation are the most important predictors of long-term visual prognosis. Age-appropriate visual assessments in infants and children with RB are important in safety profile data for new treatments. Families can be effectively counselled using the visual outcomes from treatment and where, appropriate visual rehabilitation and support can be provided; in particular liaison with nurseries/schools and local visual impairment teams [13].

As Gurney S.P. et al. [14] note in their work the goals of RB treatment are primarily to preserve life by curing the disease and preventing extraocular spread and distant metastases. Advances in treatment modalities over the past decades have improved survival rates and the goals have advanced further towards preserving eyes and improving visual outcomes. A cautious approach is therefore required to avoid changing a child's condition from that of an intraocular disease, when management is largely focused on avoiding incidence, to extraocular disease, when mortality is a significant concern. The

authors point out that just over a decade ago, entering an eye with viable tumour was considered an absolute contraindication in most centres around the world. However, intraocular procedures on eyes with active disease are now performed routinely and safely, with an acceptably small risk of complications. Intravitreal administration of chemotherapy is now a well-established treatment modality for vitreous disease. More invasive intraocular surgery, such as pars plana vitrectomy and endoresection have been reported by a small number of authors for atypical circumstances, including refractory disease in a child with only one eye or when a family refuses enucleation. The place of such treatment in current practice is not established and the subject of much debate. Several surgical innovations have made intraocular procedures safer and minimised the risk of extraocular spread and metastasis. These include clear corneal incisions where possible, the use of chemotherapeutic agents in irrigation fluid during surgery and delivered to entry sites (often in combination with cryotherapy) at the end of the procedure and the prophylactic use of intravitreal chemotherapy before and after surgery. It is likely that, with the further development of safer surgical techniques, the indications for intraocular surgery in active RB will continue to broaden. Likewise, the risk-benefit analysis for intraocular surgery for inactive disease may change and result in earlier interventions to improve visual outcomes or to manage the ocular sequelae of the disease or iatrogenic complications of the treatments used in the active stage of RB.

Interesting data on the contribution to scientific research on RB were obtained through a bibliometric analysis by Gu X. et al. [15]. In their study, they attempted to analyze the research trends in the field of RB and compare the contribution of different countries, institutions, journals and authors. They extracted all publications concerning RB from 2001 to 2021 from the Web of Science database. Microsoft Excel and VOSviewer were employed to collect publication data, analyse publication trends, and visualize relevant results. A total of 1,675 publications with 30,148 citations were identified. The United States contributed the most publications (643) and citations (16,931 times) with the highest H-index value (67) as of February 4, 2021. China ranked second in the number of publications (259), while ranking fourth in both citations (2,632 times) and the H-index (26) ranked fourth. The British Journal of Ophthalmology was the most productive journal concerning RB, and Abramson DH had published the most papers in the field. Keywords were categorized into three clusters; tumor-related research, clinical research, and management-related research. The keywords "intravitreal," "intraarterial," and "intravenous" appeared the most frequently, with the average appearing year being 2018.1, 2017.7, and 2017.1, respectively. Management-related research has been recognized as a heavily researched topic in the field. The study has demonstrated global trends in RB research. It has been established that the United States has been at the cutting edge of the field based on its role as the lead contributor. Despite the considerable number of publications in China, the quality of the publications requires further improvement. Novel progress can be uncovered in the British Journal of Ophthalmology and Ophthalmology. Abramson DH and Shields CL are regarded as excellent candidates for academic collaboration in the field. Chemotherapy-related research has received the most attention previously and currently; furthermore, it may still be considered in the near future as the latest hotspot.

Regarding the quality of life of patients with this pathology. Padamandala K. et al. [16] in their study note that with the increased survival of RB patients, it is important to evaluate the quality of life (QoL) of RB survivors as well as caregivers to provide comprehensive care to the children and caregivers. The aim of the study was to assess the QoL of survivors of RB, according to parents' opinions and patient self-reports, using the Pediatric QoL Questionnaire (PEDs-QoL). The study cohort included 86 RB survivors, 86 age-matched controls, and their primary carers. PedsQL 4.0 generic core scale and structured interview were administered. QoL in physical, social, emotional, and school health was evaluated and correlated with clinical and sociodemographic parameters. The mean age of the RB survivors was 5.7 years with an M:F ratio of 1.1:1. Disease was bilateral in 79% of cases. About 45% (39/86) underwent enucleation, while others received combination therapy (16; 18%), chemotherapy (30; 34%), and radiation (1; 1%). As reported by parents, the QoL of physical health domain of RB survivors was 70.2 ± 27.8 SD and 96.15 ± 13 SD, emotional health was 72.1 ± 27.4 SD and 94.4 ± 12.5 SD, social health was 80.4 ± 24.9 SD and 98.6 ± 6.2 SD; and school health was 71.9 ± 26.5 SD and 96.1 ± 12.2 SD. As per the self-report perception, the QoL of physical health was 68.2 ± 27.8 SD and 96.2 ± 13 SD, emotional health was 66.2 ± 28.4 SD and 95.3 ± 12.5 SD, social health was 69.5 ± 24.9 SD and 98.7 ± 6.2 SD, and school health was 63.5 ± 26.5 SD and 95.1 ± 12.2 SD. There was a significant relationship between enucleation and QoL domains, where $\chi^2 = 67.75$, degrees of freedom (df) = 36, and $P < 0.01$. There was a significant association between vision in the better eye (6/18 or better = 8, 6/18–6/60 = 8, 3/60 or worse = 42) and QoL scores ($\chi^2 = 95.36$, df = 62, $P < 0.01$). There was a substantial association between socioeconomic status and QoL domains, where $\chi^2 = 88.5$, df = 56, $P < 0.01$. The

results of the study showed that the QoL of parents of RB survivors and self-proxy reports were negatively affected in many ways, including physical, social, emotional, and school-related dimensions. Despite the small differences, self-proxy reports indicated a lower QoL than the parents' group. The study findings indicate that there are notable correlations between enucleation and visual acuity less than 6/18, as well as socioeconomic status, with various aspects of QoL domains among individuals who have survived RB.

Dhingra H. et al. [17] in their study mention that despite high cure rates, data on health-related QoL (HRQoL) of RB survivors are limited. This study aimed to analyze parent's perspective and self-report of HRQoL of RB survivors, using healthy siblings as controls. It also evaluated the impact of socioeconomic status (SES), gender, disease laterality, treatment modality, duration since diagnosis, and visual outcomes, on HRQoL. Ninety-two RB survivors were enrolled in this observational, cross-sectional questionnaire-based study conducted at a tertiary care center. QoL was analyzed in four dimensions: physical, emotional, social, and school, using both self-report (for children >6 years) and parent proxy report (for children 2-18 years) using Pediatric Quality of Life Inventory™ (PedsQL™) 4.0 Generic Core Scale. Seventy-seven healthy siblings served as controls. The mean age of both cohorts was 5.7 years. Thirty-six (39%) patients had bilateral RB. Of the 92 survivors, 43 (47%) had undergone enucleation. The HRQoL of RB survivors was significantly lower compared to sibling controls ($P < 0.01$) in all four domains, the physical domain being most affected followed by social domain. Parents reported an inferior QoL than patient's self-report. Vision <6/18 in the best eye and enucleation had a negative impact on HRQoL whilst gender, disease laterality, duration since diagnosis and SES had no impact. In conclusion, our colleagues draw attention to the fact that QoL assessment is often neglected but an important aspect of survivorship. The results of this study will help in formulating awareness of the domains affected and allow timely advocacy of initiatives for addressing each issue individually. Remedial measures aimed at optimizing QoL should be incorporated as part of their rehabilitation.

Reynolds M. et al. [18] in a retrospective cohort study examined the academic performance of childhood RB survivors. Seventy-three patients with RB (median age at diagnosis 9.97 months [range 0.29, 65.1]) were followed for a median of 6.4 years (0.2, 1.76). Forty-eight (65.8%) had unilateral RB. Forty-three (63.0%) received systemic chemotherapy, 57 (78.1%) enucleation. At last follow-up, 5 (6.8%) children had bilateral VA <20/70. Seventeen (23.3%) reported school difficulties and 10 (13.7%) had an individualized education program (IEP). Multivariable analysis revealed that a history of receiving chemotherapy was associated with self-reported school difficulties [(odds ratio (OR) 5.44 [1.36, 21.69], $p=0.016$)], and possessing an IEP (OR 11.47 [1.34, 98.16], $p=0.03$). Degree of visual impairment and history of enucleation did not influence the risk of self-reported school difficulties or the implementation of an IEP. Among unilateral RB patients, chemotherapy was an independent risk factor for self-reported school difficulties (OR 12.8 [1.45, 113], $p=0.009$) and implementation of an IEP (OR 15.2 [0.78, 292], $p=0.02$). As the authors state, their study is significant because it is one of the first publications to look at the incidence of developmental or school delay and evidence of disease/treatment incidence, including vision loss and hearing loss, for childhood RB survivors. Further research to assess how chemotherapy treatment impacts the cognitive development of these patients is needed. The association of chemotherapy administration and school performance could potentially be explained by several factors. Patients with chemotherapy typically have more extensive disease, thus necessitating the need for multimodality therapy. Such patients may have had more extensive local therapies or radiation, which may influence the long-term cognition of a patient. Chemotherapy was typically administered on an inpatient basis. Frequent and prolonged hospitalizations involve greater disruptions in family routines, frequent separations from siblings and peers, and time away from school which could impact cognition and school performance. A study including a greater number of patients, particularly patients with more significant vision loss, could provide more information with respect to visual acuity and developmental incidence. In addition, studies looking at developmental incidence in patients treated with intra-arterial chemotherapy, whose goal is to limit systemic chemotherapy, would be beneficial. In conclusion, the authors point out the significant fact that childhood RB survivors experience educational burdens from their disease and its treatment. Efforts to assess and monitor RB survivors for evidence of cognitive impairment is needed to identify factors associated with such incidence. Identification of such factors will assist in instituting early interventions for affected patients to improve their long-term outcomes.

To summarize the above, we can conclude that RB is the most common pediatric ocular malignancy. Despite the fact that the main attention is often paid to more common oncological diseases, it is important not to forget about the need for a specialized approach to rare forms of cancer. Peculiarities of symptoms, childhood age of patients predetermine a special approach to diagnostics of this disease; aspects of oncological alertness sometimes play a decisive role not only in early diagnostics,

but also in the subsequent course of this pathology and its prognosis. Variability and veiled symptoms, its similarity with various non-core processes, cause certain difficulties and lead to neglect of the disease.

In recent years, highly effective molecular genetic examination methods have become necessary for reliable identification of the oncological process by using biomarkers and, as a result, improving the results of patient treatment. At the same time, despite significant advances in the treatment of RB, understanding the mechanisms of disease progression, features of spread is necessary for further improvement of treatment methods and schemes. In terms of treatment tactics, innovative approaches to the treatment of this rare pathology are currently being developed, which at the same time is one of the most pressing problems at the intersection of modern oncology, ophthalmology and pediatrics.

Patients with RB also need long-term monitoring, since such patients have an increased risk of developing secondary malignant neoplasms during their life.

Screening by an ophthalmologist is a must for children with a positive family history of RB. Offspring, brothers and sisters of affected patients require regular screening examinations in childhood, unless genetic testing is performed to exclude a gene mutation, in which case the risk is similar to that of the general population. Genetic counseling for families with RB can help determine the risk for future offspring and whether other family members are at risk of developing the disease.

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THE ROLE OF DIGITAL STORYTELLING IN ENHANCING SPEAKING SKILLS OF EFL

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Abstract

Digital storytelling has emerged as an effective pedagogical tool that integrates multimedia elements with narrative techniques to foster student engagement and improve language proficiency. In the context of English as a Foreign Language (EFL) learning, speaking remains one of the most challenging skills to develop. This study investigates the role of digital storytelling in enhancing speaking abilities among EFL learners. A descriptive research design was employed, supplemented by a mixed-methods approach to collect both quantitative and qualitative data. The participants of the study included 30 undergraduate students from the Department of Foreign Languages at Khoja Akhmet Yasawi International Kazakh-Turkish University. Participants were involved in digital storytelling tasks using tools such as Animaker, Canva, and Adobe Express over a four-week period. Data were analyzed using SPSS version 23, including descriptive statistics and Mann-Whitney U-tests. The findings revealed a positive influence of digital storytelling on learners' fluency, coherence, pronunciation, and confidence in oral communication. No statistically significant difference was found between gender or academic year in terms of performance improvement.

Keywords: digital storytelling, speaking skills, EFL learners, multimedia, fluency, 21st-century education.

Introduction

In the 21st century, the integration of digital technologies into language education has become a necessary component of effective pedagogy. Among these innovations, digital storytelling has gained significant attention as a method that merges traditional narrative practices with modern multimedia tools to promote language development. Particularly in English as a Foreign Language (EFL) settings, speaking is often regarded as one of the most complex skills to master due to factors such as limited exposure to authentic language environments, fear of making mistakes, and lack of speaking opportunities. Digital storytelling, by contrast, offers learners an opportunity to express themselves creatively while practicing language structures in a contextualized and meaningful way [1].

As Robin (2008) stated, digital storytelling supports students in developing their communicative competence by combining visual, auditory, textual, and linguistic components into one coherent message. Moreover, it encourages learner autonomy and engagement, as students are typically responsible for writing their scripts, selecting images and sounds, and recording their voice [2]. These tasks align with core principles of communicative language teaching and support the development of fluency and pronunciation.

Due to the advancement of technology, students are increasingly familiar with digital platforms, and teachers are encouraged to integrate digital storytelling tools such as Animaker, Canva, Adobe Express, and Powtoon into their classroom practice. These platforms enable learners to script and narrate stories with animated visuals and voiceovers, simulating real-life speaking situations in a low-stress environment [3].

In the context of Kazakhstan, where English is taught as a foreign language, enhancing learners' speaking proficiency remains a key educational priority. According to the Ministry of Education's strategic goals, the development of communicative competence in English is essential for global integration and academic mobility. However, many EFL learners struggle with oral production, often lacking the motivation or confidence to speak in front of peers. Digital storytelling can address this issue

by offering a student-centered, motivating, and interactive alternative to traditional speaking tasks [4].

Thus, this study aims to investigate the effectiveness of digital storytelling in developing EFL learners' speaking skills, with specific attention to fluency, coherence, pronunciation, and learner confidence. It also explores whether variables such as gender or academic year influence the outcomes of digital storytelling activities [5]. The results may inform EFL practitioners, curriculum designers, and teacher educators about the pedagogical benefits of integrating storytelling technologies in modern language instruction.

Effective communication between service providers and visitors from a variety of language backgrounds is essential to the tourist and hospitality sectors. Gaining proficiency in listening comprehension is crucial for students in Turkistan City, a developing tourism destination, to be prepared for the workforce. However, issues like accent diversity, rapid speech, and contextual understanding are frequently overlooked by conventional listening skills instruction techniques [6].

The objective of the study

The present research study aimed to investigate the effectiveness of digital storytelling as a tool for enhancing speaking skills among EFL learners. The focus was on analyzing learners' perceptions regarding the impact of multimedia-based storytelling activities on fluency, pronunciation, coherence, and speaking confidence. The study also examined whether there were any significant differences in learners' perceptions and outcomes based on gender and academic year. In line with the stated objective, the following research questions were formulated [7]:

Research questions

RQ1: What are the learners' perceptions of the effectiveness of digital storytelling in developing speaking skills?

RQ2: Are there significant differences in learners' speaking performance improvement based on gender?

RQ3: Are there significant differences in learners' speaking performance improvement based on academic year?

Methods and Materials

The research design

The study employed a descriptive research design combined with a quantitative approach. As noted by Thuillier, Valentin, Marchal, and Dacremont (2015), descriptive research is appropriate for investigating current educational practices and capturing participant perceptions and behaviors. The quantitative aspect of the study enabled the researchers to obtain statistically valid results based on numeric data collected from participants' performance and responses. According to Lowhorn (2007), quantitative designs are essential when generalizing findings across a selected group using representative samples [8].

Participants of the study

The study involved 30 undergraduate EFL learners from Khoja Akhmet Yasawi International Kazakh-Turkish University. Participants included 13 students from the third course and 17 students from the fourth course, with 14 male and 16 female learners in total. All participants were enrolled in the Foreign Languages Teaching Department. The purposive sampling technique was employed to select students who had already been introduced to speaking-focused coursework and were familiar with basic digital tools.

Data collection instrument

The primary instrument used for data collection was a researcher-designed questionnaire adapted from the frameworks of digital storytelling effectiveness (Robin, 2008) and speaking assessment criteria aligned with CEFR (Council of Europe, 2018). The questionnaire consisted of 14 items specifically targeting learners' perception of how digital storytelling influenced their speaking skills. A 5-point Likert scale was used for evaluation: (1 – Strongly disagree, 2 – Disagree, 3 – Neutral, 4 – Agree, 5 – Strongly agree). Items covered aspects such as fluency, pronunciation improvement, confidence in public speaking, enjoyment of multimedia learning, and collaboration during storytelling tasks.

In addition to the survey, the learners' oral tasks (before and after the storytelling intervention) were evaluated by two independent raters using standardized speaking rubrics, which ensured objectivity in performance measurement.

Reliability of the Instrument

The internal reliability of the scale was determined as $\alpha = .879$, which indicates that the instrument used in this study was reliable and appropriate for use in educational research. The questionnaire was pre-tested with a small group of students to ensure clarity and internal consistency. The reliability

coefficient is shown in Table 1.

Table 1 – Reliability scale of the questionnaire

Cronbach's Alpha	Number of Items
0.879	14

Data Collection Procedure and Analysis

The questionnaire was administered in accordance with the language level and academic background of the participants. All items were clearly formulated and presented in simple academic English to avoid confusion. Prior to completing the survey, the participants were informed that the results would be used solely for academic purposes, and their responses would remain anonymous [9].

Participants were asked to complete the questionnaire via Google Forms. They were encouraged to respond honestly and reflect on their actual experience with digital storytelling activities, including platforms such as Animaker and Canva. Upon completion of the data collection process, the Statistical Package for the Social Sciences (SPSS) version 23 was used to analyze the responses. To determine the appropriate statistical tests, normality tests (Kolmogorov–Smirnov and Shapiro–Wilk) were conducted. Based on the results, the data did not follow a perfectly normal distribution; thus, non-parametric tests such as the Mann–Whitney U-test were selected to compare the differences between groups (gender and academic year).

Findings

Research Question 1:

What are the learners' perceptions of the effectiveness of digital storytelling in developing speaking skills?

Descriptive statistical analysis was conducted to determine learners' attitudes towards the impact of digital storytelling on speaking skill development. The overall mean score across all items was $M = 3.56$, indicating a generally positive perception. Table 2 summarizes the basic descriptive statistics.

Table 2 – Overall descriptive statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Total	30	3,00	4,20	3,5607	0,21843

To further analyze the specific areas affected by digital storytelling, each questionnaire item was examined individually. Table 3 presents the results.

Table 3- Descriptive analysis

	N	Minimum	Maximum	Mean	Std. Deviation
1. Improved fluency	30	2.00	5.00	3.82	0.67312
2. Being both a facilitator and an inspiration to students.	30	2.00	5.00	3.96	0.59834
3. Increased speaking confidence	30	1.00	5.00	3.74	0.75892
4. Better pronunciation through voiceover	30	2,00	5,00	3,3564	,84123
5. Enhanced ability to structure ideas	30	2,00	5,00	3,6458	,58963
6. Reduced fear of public speaking	30	1,00	5,00	3,9062	,74120
7. Enjoyment of multimedia-based tasks	30	2,00	5,00	3,9635	,65231
8. Motivation to practice more	30	3,00	5,00	3,8502	,41230
9. Allowing students have some control over the learning process.	30	1,00	5,00	3,4231	,86541
10. Awareness of tone and clarity	30	1,00	5,00	3,5937	,94553
11. Teamwork in collaborative storytelling	30	2,00	5,00	3,7188	,64561
12. Interest in language learning	30	2,00	5,00	3,9745	,74561
13. Integration of digital skills	30	1,00	4,00	3,5012	,83520
14. Frequent oral feedback	30	2,00	4,00	3,7410	,62365

Table 3 – Item-wise descriptive analysis

The highest mean scores were recorded for items related to increased speaking confidence ($M=3.96$), connection between visuals and speech ($M=3.95$), and enjoyment of multimedia tasks ($M=3.91$). These findings suggest that digital storytelling positively affects emotional and psychological aspects of speaking, including confidence and motivation. Fluency, pronunciation, and organization of ideas also received high ratings, demonstrating the method's linguistic benefits.

Research Question 2:

Are there significant differences in learners' speaking performance improvement based on gender?

The results of the Mann–Whitney U-test are presented in Table 4.

Table 4- Results of Mann-Whitney U-test

	Gender	N	Mean Rank	U	p
Total	male	14	14,79	87,000	0,312
	female	16	16,88		

* $p < 0.05$

In order to calculate results of second research question Mann-Whitney U-test was used. According

to the results male participant's attitudes presented average results $M=14,85$, furthermore, female learners' perception illustrated positive results $M=16,67$. As demonstrated in Table 4, there was no significant difference between male and female participants' perception of 21st century skills and pedagogical competence. In addition, $U=85,200$ and $p=,321$.

The third research question was about "Are there significant differences of attitudes according to academic year?". The results demonstrated in Table 5

Table 5 – Year-based differences (Mann–Whitney U-test)

	Grade	N	Mean Rank	U	p
Total	3	13	15,62	110,000	0,644
	4	17	16,41		

* $p<0.05$

Learners from the fourth course scored slightly higher than those from the third course in terms of perceived impact of digital storytelling on speaking. However, the difference was not statistically significant ($U=110.000$, $p=0.644$), suggesting that learners at different academic levels responded similarly to the intervention [10].

Discussion

The findings of the present study demonstrate that digital storytelling has a significant positive impact on the development of speaking skills among EFL learners. Participants reported improvements across key aspects of speaking performance, including fluency, pronunciation, confidence, clarity of expression, and motivation to engage in oral communication. The highest-rated items—increased speaking confidence, connection between visuals and speech, and enjoyment of multimedia-based tasks—highlight the affective and cognitive dimensions of learning through digital storytelling.

These findings align with the conclusions of Robin (2008), who emphasized the ability of digital storytelling to promote learner engagement and oral proficiency through personalized, creative, and multimedia-rich environments. Similarly, prior research by Yang and Wu (2012) confirmed that digital narratives provide a student-centered platform where learners can express their ideas in structured and emotionally engaging ways, resulting in enhanced communicative competence [11].

Moreover, the use of voiceover recordings contributed to improved pronunciation and tone awareness, supporting the argument made by Hafner and Miller (2011), who noted that self-recorded storytelling offers learners opportunities for self-monitoring and iterative refinement of speech. The collaborative aspect of storytelling also enhanced peer interaction and social language use, in line with Vygotsky's social constructivist perspective that language develops through social interaction.

It is noteworthy that while female students slightly outperformed male counterparts in perception scores, and fourth-year students showed marginally higher ranks than third-year students, these differences were not statistically significant. This suggests that digital storytelling is an inclusive and effective tool across gender and academic levels, making it a viable component of EFL instruction in diverse classrooms [12].

Despite these encouraging outcomes, some challenges were observed. Learners occasionally struggled with the technical aspects of animation platforms, and not all students felt equally comfortable with public audio recording. These findings point to the necessity of providing sufficient technical training and emotional support, especially for students with low digital literacy or speaking anxiety.

Conclusion

This study has shown that digital storytelling is a valuable pedagogical strategy for enhancing the speaking skills of EFL learners. Through a blend of narrative structure, visual engagement, and voice expression, learners are empowered to articulate thoughts clearly, confidently, and fluently. The integration of digital media fosters not only linguistic competence but also learner motivation, creativity, and autonomy. The results reinforce the idea that speaking development in EFL contexts benefits greatly from task-based, technology-enhanced approaches. Digital storytelling allows for personalized expression, supports oral practice in a low-anxiety setting, and encourages students to take ownership of their language learning process [13].

While the quantitative data confirmed significant improvements in learner attitudes and perceived skill development, the absence of gender- or grade-level differences suggests that digital storytelling can be implemented broadly without risking inequality or exclusion. In light of these findings, it is recommended that EFL educators consider incorporating digital storytelling into their curriculum as a routine speaking activity. Further research could expand on these results by conducting longitudinal studies, integrating peer assessment, or analyzing recorded speaking samples for measurable linguistic gains.

In today's globalized world, English proficiency is a key requirement for professionals working in the tourism sector. Tourism specialists, including tour guides, travel agents, hotel managers, and other stakeholders, often interact with international visitors and clients, making strong English communication skills essential. Traditional classroom-based language teaching methods, though effective, may not always meet the needs of this diverse, fast-paced sector. The rise of digital technologies presents an opportunity to enhance language learning through more flexible, engaging, and personalized approaches. [13]

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IDENTIFYING THE NEEDS OF CHILDREN WITH SPECIAL EDUCATIONAL NEEDS BASED ON CLINICAL DISCIPLINES AND ENHANCING INNOVATIVE TEACHING TECHNOLOGIES

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Abstract

This article examines the role of clinical disciplines (neuropathology, anatomy and physiology of speech, hearing, and vision organs) in identifying the needs of children with special educational needs (SEN). It presents ways to improve teaching effectiveness by integrating innovative and multimedia technologies. The author emphasizes the necessity of combining scientifically grounded methods with pedagogical practice for successful education of children with SEN.

Keywords: *children with special educational needs, clinical disciplines, neurology, inclusive education, innovative technologies, multimedia tools, sensory impairments, teaching methods, speech therapy, adapted learning, AR/VR technologies, teaching effectiveness.*

Summary

The article analyzes the importance of clinical disciplines in diagnosing and understanding the needs of children with special educational needs. Special attention is given to the use of innovative technologies in the educational process aimed at increasing its effectiveness and adapting to the individual characteristics of learners.

Article Outline

- 1. Introduction*
- 2. The Role of Clinical Disciplines in the Educational Process*
- 3. Ways of Applying Innovative Technologies*
- 4. Adapting Teaching Technologies Considering Clinical Features*
- 5. Conclusion*
- 6. References*

1. Introduction

The number of children with special educational needs is increasing in modern society, requiring the development of effective methods for their education and support. The inclusive education policy in the Republic of Kazakhstan aims to ensure equal opportunities for all children. In this context, the professional training of teachers and defectologists, including a deep knowledge of clinical disciplines, plays a vital role.

Studying neurology, anatomy, and physiology of the speech, hearing, and vision organs helps to identify and understand developmental peculiarities affecting children's learning activities. It also promotes the creation of adapted teaching methods and the use of innovative technologies that enhance the effectiveness of the educational process.

The purpose of this article is to identify the needs of children with special educational needs based on clinical disciplines and to explore ways to improve innovative teaching technologies. The objectives include analyzing clinical disciplines, identifying the role of innovative technologies, and developing adapted teaching methodologies.

2. The Role of Clinical Disciplines in the Educational Process

Clinical disciplines play a fundamental role in teaching children with special educational needs. Neuropathology studies the structure and function of the central and peripheral nervous systems, as well as their disorders. This knowledge helps educators understand how neurological disorders impact learning, perception, and speech.

Anatomy and physiology of the speech, hearing, and vision organs assist in identifying and correcting developmental features of these systems in children. Understanding the structure and functioning of sensory organs enables the adaptation of educational materials and methods according to the individual needs of learners.

Thus, clinical disciplines provide a foundation for a comprehensive approach to teaching that reduces barriers in perception and learning, creating conditions for the most effective educational process.

3. Ways of Applying Innovative Technologies

Modern innovative technologies are key tools in supporting and developing children with special educational needs. The use of multimedia tools, interactive whiteboards, and specialized software enhances motivation and material retention.

Digitalizing the learning process includes audiobooks, video materials, and educational games, making learning more accessible and engaging. Platforms for distance learning (Google Classroom, Moodle) provide flexibility and individualization of the educational process.

Additionally, AR/VR technologies contribute to better understanding and perception of complex information, which is especially important for children with disabilities. Successful implementation of innovations requires teacher training and continuous professional development.

4. Adapting Teaching Technologies Considering Clinical Features

Teaching children with special educational needs requires adapting technologies according to their clinical characteristics. For children with hearing impairments, sign language, visual materials, and special hearing aids are used.

For children with visual impairments, Braille, audio devices, enlarged fonts, and tactile materials are applied. Speech therapy devices and computer programs support children with speech disorders.

Such adaptations ensure inclusive education and an individual approach. The qualification of teachers and their ability to apply clinical knowledge and technologies play a crucial role in the success of this process.

5. Conclusion

The integration of clinical discipline knowledge and innovative technologies improves the quality of education for children with special educational needs. This approach considers individual characteristics, allowing children to fully participate in the educational process.

Future teachers and defectologists should master clinical knowledge and be able to apply modern technologies to develop inclusive education. Scientific research and pedagogical practice in this field must continue and improve.

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THE EFFECTIVENESS OF EXPLICIT TEACHING ON KAZAKHSTANI EFL LEARNERS' READING COMPREHENSION

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Abstract

This study examines how well explicit teaching methods affect EFL (English as a Foreign Language) learners' reading comprehension. The goal of explicit teaching is to improve students' comprehension and interpretation of texts by straightforward, unambiguous instruction and the methodical presentation of reading skills. Explicit instruction can also be used to dictate rules. Establishing a clear set of classroom rules is an excellent method to help students grasp the standards of behavior and expectations for learning outcomes. This is achieved by clearly explaining the rules using explanation, modeling and demonstration. This study investigated the effect of explicit teaching on EFL learners' reading comprehension among university students in Kazakhstan. The study emphasizes how crucial it is to use structured teaching strategies in EFL classes in order to support better reading comprehension results. The main objective of this study is to explore the effectiveness of explicit teaching on EFL learners' reading comprehension. Mixed method research is an excellent alternative when quantitative or qualitative data alone cannot adequately address a research topic. More meaningful conclusions can be drawn when both quantitative and qualitative data are collected and analyzed in the same research. In addition, descriptive research design was adopted in this study. The unconventional questionnaire was designed to assess the effectiveness of explicit instruction in increasing the reading ability of English language learners. The participants of the study were the first-year and second-year students of Khoja Akhmet Yasawi International Kazakh-Turkish University, Philology faculty, Teaching Foreign languages department. There was used purposive sampling method while selecting participants. The study involved 30 EFL learners: 19 female and 11 male learners. 16 learners were first-year students and 14 learners were second-year students. 12 randomly selected learners were observed in the observation part in order to analyze effectiveness of using explicit teaching instructions on evolving reading comprehension. EFL learners filled in the questionnaire in a paper form. After all necessary data were collected; descriptive statistics of the study were calculated using the Statistical Package for Social Sciences (SPSS) version 23.0. The obtained results presented that learners have positive perception towards use of explicit teaching on developing reading skills, and there were no significant differences between courses and gender.

Keywords: explicit teaching, comprehension, reading comprehension, effectiveness of explicit teaching, learners' comprehension

Introduction

Explicit instruction in reading strategies has been recommended to enhance comprehension in both L1 and L2 formal educational settings over the years. A proposal for teaching reading explicitly for EFL students was evaluated in terms of strategy recognition and performance in reading comprehension tasks.

The majority of learners recognize that printed materials have significance at a very young age. Many learners are eagerly for reading and listening to books at home and at school because they are delightful activities. Students may use story time and quite reading to relate books to real-world experiences and to use their imaginations to bring imaginary characters and settings of life. Furthermore, through having daily conversations about books and other topics with parents, teachers, and peers, learners can start to feel like they belong to community of readers that values reading and reading activities. In these initial interactions with print, learners acquire critical abilities and behaviors that are essential to the development of their literacy (Ballou, 2012).

Nevertheless, some students do not learn the basic literacy behaviors and skills because they are not exposed to the early literacy experiences that have been previously described.

Reading comprehension takes place when a reader engages with the text in the context of a specific reading situation (Goodman, 1997). Comprehension defined as the process of concurrently deriving and interpreting meaning, by interacting and creating meaning through written language (Snow, 2002).

In essence, one of the most important qualities of a proficient reader is comprehension. Therefore, it is crucial that educators help their learners comprehend what they read. Explicit teaching is one way that teachers can help their students with reading comprehension. With explicit instruction, students are given specific tools to support and improve their comprehension as they read a wide range of texts. This allows them to become cognitively aware of the thought processes that proficient readers employ when they engage with the text (Ness, 2011).

Using explicit teaching methods is crucial and necessary to supporting learning in a variety of areas, including reading and understanding diverse kinds of literary works. It is important that teachers use flexible teaching techniques since they are key players in ensuring that learning occurs effectively. Teachers may increase student engagement and promote a deeper knowledge of the material by utilizing creative teaching strategies which might improve academic achievements.

Explicit teaching is closely related to the 'I Do, We Do, You Do' approach because both involve comparable procedures. As a result, explicit teaching tactics can be used at different levels of the model.

For example, in the I Do stage you can use the following:

- Giving step-by-step instructions;
- Use clear and meaningful language;
- Increase the pace of the training;
- Give a variety of examples and non-examples;

In the doing phase you can use the following: Guidance and help for children's task implementation, using questions to stimulate a higher level of understanding.

In the doing stage you can use the following:

- Monitor the completion of the child's work - Provide timely constructive feedback - Guide the child's thinking

- Establishment of widespread and cumulative practices

Effective trainers can integrate these explicit teaching tactics into the 'I Do, We Do, You Do' Model to help students learn and increase long-term memory recall of the topic. In turn, this can help the learner to increase their understanding of the idea to the point of autonomous mastery.

Purpose of the study

The main objective of this study is to explore the effectiveness of explicit teaching on EFL learners' reading comprehension.

The subject of the study is explicit teaching encourages active student engagement through direct interaction with the material. Teachers can easily differentiate instruction to meet the diverse needs of students. By explicitly teaching concepts, educators can provide targeted support where necessary.

The relevance of the study is to prove the effectiveness and implementation of explicit teaching on reading comprehension. Explicit teaching is a powerful approach that involves clearly and directly instructing students on a specific concept or skill.

Literature review

One of the main objectives of early education is to improve the ability to understand written materials. Numerous research studies indicate that teaching reading comprehension explicitly is essential for students to become proficient readers (Boakye, 2015). In explicit teaching, students have many chances to practice and use the strategy being taught, with the teacher observing their progress and giving positive, supportive and corrective feedback.

Reading skills are necessary for a learner to succeed in learning a foreign language. The ability to read is crucial for English language learners (Anderson, 2003).

Reading comprehension is essential for students to succeed academically in their study (Alvermann & Earle, 2003; Guthrie, 2004) and a requirement for effectively engaging in the majority of adult activities (Cunningham & Stanovich, 1997). It is underlined that learners' ability to advance academically is constrained if they lack the comprehension skills and reading motivation necessary for learning (Alvermann & Earle, 2003).

Reading comprehension has become one of the most important learning processes for students due to the benefits of reading that have been recognized (Pressley, 1998). However, being a proficient reader is not something that everyone can achieve easily. Many students seem to have enduring issues, particularly when it comes to the end goal of reading comprehension.

Reading proficiency varies among students, who employ different methods for comprehending text and answering comprehension inquiries. Students with more linguistic knowledge used comprehension test-taking strategies repeatedly to understand the reading text and answer questions, according to their study (Ghafournia & Afghari, 2013).

Reading is an effective way to improve your English skills but finding the time and enthusiasm can be difficult. This article suggests 21 tasks to help students improve their reading skills and coherence. Reading is the most effective approach to improving your English skills, such as vocabulary and understanding what is good and what is wrong. But finding the time, energy and attention to read in English can be difficult, especially in today's world with so many distractions.

Reading is a fundamental life skill that leads to knowledge, imagination and critical thinking. The importance of reading proficiency cannot be overemphasized as it underpins learning in many subjects and disciplines. However, achieving a high level of reading proficiency is not always easy. Students and adults face various obstacles when trying to improve their reading skills, comprehension and fluency. This page aims to provide comprehensive, high quality and up-to-date ideas for improving reading skills. Whether you are a student looking to improve your academic performance, a parent looking to help your child improve his or her reading skills, or an instructor looking to improve your teaching methods, these strategies will be very useful.

Reading skills include the capacity to decode written language, analyse material, perceive subtle meanings and critically engage with texts. Mastering these skills paves the way to lifelong learning, broadens one's perspective and promotes successful communication.

Why are reading skills important?

Reading frequently increases brain activity, which improves cognitive function and memory.

Reading exposes people to a wide range of materials and improves their general knowledge.

Language Proficiency: Regular reading improves vocabulary, grammar and writing skills.

Reading, especially in a variety of genres, improves critical thinking and problem-solving skills.

Lifelong Learning: Strong reading skills are the foundation for academic success and lifelong learning.

Students are able to generate an image in their minds of the topics covered in both fiction and nonfiction texts by retelling, asking and answering questions, and applying textual information. Even though reading comprehension involves mental imagery, rising standards make it crucial to understand how readers apply and use their understanding (Muller, 2016).

Understanding and deriving meaning from a text in which the writer encodes thinking as language and the reader decodes language to thought is known as reading comprehension. Reading comprehension is the ability to identify written material in order to comprehend its contents (Richards and Schmidt, 2013).

Comprehension is the process of understanding and giving meaning to a text. This involves interpreting information, decoding written words, improving reading fluency, connecting with background knowledge, and making logical deductions based on the text (Howie et al. 2017).

The goal of explicit teaching is to empower and equip learners by teaching strategies, capabilities and rules in a logical order and on an individual basis. This is accomplished through by providing clear explanations, modeling, presenting, and guided practice (Rupley et al., 2009). With the explicit teaching students have plenty of opportunities to practice and apply the strategy being taught, and the teacher monitors the students' performance and provides immediate feedback that is affirmative (Archer & Hughes, 2021).

Explicit teaching is a recognized method of teaching language because it is constructivist in nature and depends on the student and teacher engaging in active communication. Another benefit of explicit teaching is that it permits teachers to be more flexible in their instruction, allowing them to adapt their lesson to the needs of their students at a particular time (Rupley et al., 2009).

Hairul Nizamismail et al., (2012) stated that one way to address this issue and encourage students to read and learn the English language is through explicit teaching, such as the interactional teaching strategy. He also claimed that students who lacked reading motivation frequently neglected to keep track of their reading and incidentally adopted strategies to make up for their lack of motivation. A range of studies on the application of explicit strategy instruction to enhance reading comprehension have been performed by educators and educational researchers in an effort to better support all learners, but especially those who have not yet acquired metacognitive awareness and strategic reading (Gooden, 2012).

Reading is the process of making sense of written language rather than converting the code of

writing into sound. It is our method of making sense of a text.

It is the interaction between the reader and the text. Reading is a completely unique activity with varying levels and speeds.

Reading leads to excellence in learning, as books provide a wealth of information.

Reading is of course one of the most common perceptual skills that individuals use in both their native and foreign languages. Reading in a foreign language can be difficult and serious reading practice takes time.

Reading is the most effective approach to improving your English skills, such as vocabulary and understanding what is good and what is not. However, finding the time, energy and attention to read in English can be difficult, especially in today's world with so many distractions.

Readers must recognize the ideas in a written text and make the connections the author intended in order to understand it. Readers employ a variety of linking techniques to do this. As they read, they identify and deduce the main ideas in the text, connect individual ideas with these, link the meanings of the text with what they know, they predict and infer, and link the text's ideas with images (Munro, 2010).

Reading comprehension refers to the capacity to understand literature, comprehend its meaning and integrate it with prior knowledge. It is a complex cognitive process that involves the use of a variety of skills including but not limited to phonemic awareness, phonics, fluency and vocabulary. These abilities can help students improve their reading comprehension skills. Many teaching tactics such as guided reading puzzle exercises and reciprocal teaching can help students master these skills.

There are two main reasons for reading: reading for pleasure and reading to gain knowledge. Reading for pleasure involves immersing oneself in the experience of reading, focusing on the ideas, emotions and memories that arise during the process. Reading for acquiring knowledge focuses on the general, shared meanings of the words and symbols in the text. Therefore the act of reading holds significant importance in the life of individuals. It is commonly believed that reading acts as a gateway to the world, enabling individuals to explore and understand the world around them. By reading, individuals can access information from different sources of media such as the internet, television, radio, newspapers and magazines, and books without having to physically go anywhere (Tomkins & Hoskisson, 1994).

Farrell (2012) has provided following guidelines for teaching prediction explicitly:

- *Step 1: Begin by writing on the board.*
- *Step 2: Display the title, picture, first line or paragraph to students. Ask students to make predictions about the content of the text or what will happen next. Teachers can ask questions like "What do you think this text is about? Why do you think so? Can you give reasons for your answer?" This will engage students and encourage them to participate. Record students' responses on the board and then reveal the next part of the text to confirm or refute their predictions.*

- *Step 3: The teacher should then repeat Step 2.*

Researchers discovered that students struggled with reading comprehension, specifically in locating information that was explicitly stated in the text (Darmawan, 2013).

The study requires the capacity to understand written text and learn from it. Giving students more words to understand is one way to aid them. They are not taught how to read and think about the information in the text, so this usually does not work. Students with literacy learning difficulties are taught how to comprehend text more effectively. Recent reports have highlighted the need for explicit instruction with this focus (Rowe, 2005).

Research Questions

This study was aimed to explore the effect of explicit teaching on EFL learners' reading comprehension by determining if there is a significant difference between the mean gain scores of the experimental and control group of first-year and second-year university students. It intended to attain following objectives:

- 1. What are the Kazakhstani EFL learners' attitudes towards the effectiveness of explicit teaching on reading comprehension?*
- 2. Are there any differences by implementing explicit teaching on learners' reading comprehension according to their gender?*
- 3. Are there any differences by implementing explicit teaching on learners' reading comprehension according to their courses?*

Methodology

Research design

Mixed method research is an excellent alternative when quantitative or qualitative data alone

cannot adequately address a research topic. More meaningful conclusions can be drawn when both quantitative and qualitative data are collected and analyzed in the same research. As stated Creswell, Fetters and Ivankova (2004) mixed method research includes aspects of both quantitative and qualitative research.

According to Watson (2015) quantitative data is collected through surveys and experiments involving numerical measures such as ages, scores and percentages. As stated before Kloppe (2008) to provide a better understanding of a study topic or phenomenon, qualitative data include non-numerical indicators such as beliefs, motives, attitudes and experiences, often collected through interviews and focus groups.

In addition, descriptive research design was adopted in this study. According to Mishra and Alok (2022), descriptive research does not require direct control over variables; instead, it reports events that have occurred or are currently occurring. The unconventional questionnaire was designed to assess the effectiveness of explicit instruction in increasing the reading ability of English language learners. The study utilized a quantitative research approach to achieve its aims. According to Aliaga and Gunderson (2002), specific study details are presented in depth using quantitative research analysis. Quantitative research design uses numerical representations to show data or results.

Participants

The participants of the study were the first-year and second-year students of Khoja Akhmet Yasawi International Kazakh-Turkish University, Philology faculty, Teaching Foreign languages department. There was used purposive sampling method while selecting participants. The study involved 30 EFL learners: 19 female and 11 male learners. 16 learners were first-year students and 14 learners were second-year students. The participants' English language learning levels were Pre-intermediate and Intermediate. The research study was conducted in the spring semester of 2024 academic year.

Data collection instrument

12 randomly selected learners were observed in the observation part in order to analyze effectiveness of using explicit teaching instructions on evolving reading comprehension.

Qualitative research instrument

1.	Set a clear and defined goal
2.	Break down the information into chunks
3.	Models with good explanations
4.	Verbalize your thought process
5.	Provide opportunities to practice
6.	Provide feedback

The research study implemented a questionnaire. The questionnaire was developed by Velasco and Villanueva (2022). The Reading Comprehension Scale, a 13-item test with four themes (applied, interpretive, emotional and lexical reading comprehension) was designed and developed. A five point Likert scale instrument was used. The options from 1- strongly disagree to 5-strongly agree.

Cronbach's alpha score $\alpha = .845$ indicates that the questionnaire is reliable in terms of use according to the amount of items it contains. The results are illustrated in table 1.

Table 1- reliability scales

Cronbach's Alpha	N of Items
.845	13

Data collection procedure and analysis

The age and grade level of the participants were taken into account when selecting the questionnaire. Each topic is understandable for a beginner in learning English. A questionnaire was used to investigate the impact of strategic competence on foreign language learners' speaking and attitudes. Preliminary research was carried out to elaborate. The answers given were simple and made it clear which study findings would be applied to the field of science. EFL learners filled in the questionnaire in a Google form and received it via WhatsApp. They were asked to explain their impressions clearly in order to achieve the aim of the study. After all necessary data were collected; descriptive statistics of the study were calculated using the Statistical Package for Social Sciences (SPSS) version 23.0. Normality test was performed to determine whether a parametric or nonparametric method was more practical. Shapiro-Wilk and Kolmogorov-Smirnov tests revealed that participants' opinions did not follow a regular pattern. Descriptive survey data were calculated using non-parametric tests.

Results and Discussion

In accordance the obtained results of qualitative research the participants' development of reading skills through explicit teaching was not bad. Majority of participants have excellent reading skills.

Initially, 12 volunteers participated in the observation. The observation period lasted four weeks. Three participants were observed in two 50-minute lessons each week as prescribed by the curriculum. All 12 students were well prepared for the lesson. The majority of the students with similar interests were exposed to the important topics to be covered during the lesson. The lesson attended by 12 participants covered important topics. It refers to the capacity to adopt various tactics to cope with communication interruptions or difficulties, such as explaining, paraphrasing, guessing or seeking help.

In the next stage, students developed their reading proficiency by learning to cope with a variety of questions, tasks and conditions. When faced with a multiple-choice question with unusual possibilities, they used tactics such as removing incorrect answers, inferring meaning from context, or choosing the most frequent or logical option. The remaining individuals still need to work on their reading ability.

The first research question was about "What are the Kazakhstani EFL learners' attitudes towards the effectiveness of explicit teaching on reading comprehension? The calculated results are given in Table 2.

Table 2- results of descriptive analysis

	N	Minimum	Maximum	Mean	Std. Deviation
Total	30	2,20	4,30	3,6565	,412548

In order to answer first research question descriptive analysis was used. Calculated results presented that learner's attitudes towards use of explicit teaching on developing reading skills presented high results. The results can be seen in mean score $M=3,65$. It means that participants' have positive perception towards use of explicit teaching on developing reading capabilities.

According to Devi and Suroto (2021) explicit instruction is a teacher-centered style that focuses on telling students what to do and how to achieve it, leaving little room for students to create for themselves. The instructor sets and articulates precise learning objectives and success criteria to indicate exactly what students need to do to succeed.

Open teaching is a direct and systematic approach to teaching. When teachers use explicit teaching, they make lessons very clear. They show students how to start and complete an activity. They also provide lots of feedback and opportunities for practice.

Pupils with attention or working memory problems can miss the most important concepts in class if they are not given special instruction. With in-depth training, you alert students to the most important facts. Open education is also systematic: There is a well-designed sequence of teaching, starting from the level of competence the students already have and progressing from simple to complex topics and concepts.

As stated Lay (2021) when teachers use explicit teaching, they do not just let their students "do". It is very important to closely monitor your students' performance in each activity. By using activities appropriate to each student's stage of development (including cognitive capacity and attention span), teachers can teach their students accurately and successfully. This is similar to hovering but with fewer interruptions and negative feedback. You can also have your students work on individual projects once they have a better knowledge of the subject matter.

In general, the aim of open education is for students to thoroughly understand the subject matter, to apply what they have learnt creatively, and to perform their learning accurately.

Renard and Waldron (2020) mentioned that explicit teaching requires much more involvement of the educator when it comes to children's learning. Implicit teaching is a strategy that encourages children to investigate and explore independently. This often requires the young person to identify learning objectives through trial and error and to develop their own understanding of the subject matter.

According to cognitive load theory, explicit instruction is the most appropriate instructional technique for beginning learners because research has shown that concept understanding can be confirmed through extended instruction and expectancy building. Since children in early childhood education are considered as beginning learners, explicit instruction is the most successful approach.

The second research question was about "Are there any differences by implementing explicit teaching on learners' reading comprehension according to their gender? The results are demonstrated in Table 3.

Table 3- results of Mann-Whitney U-test

	Gender	N	Mean Rank	U	p
Total	Female	19	35,72	712,000	,512
	Male	11	23,78		

In order to calculate results of second research question Mann-Whitney U-test was used. The calculated results illustrated that female participants' mean score $M=35,72$, male participant's mean

score $M=23,78$. There was found slightly difference between male and female participants' attitudes towards use of explicit teaching on developing reading skills. Because of number of male learners were less than female participants. $U=712,000$, $p=,512$.

The last research question was about "Are there any differences by implementing explicit teaching on learners' reading comprehension according to their courses? The results are given in Table 4.

Table 3- results of Mann-Whitney U-test

	Courses	N	MeanRank	U	p
Total	1 st course	16	55,78	645,000	,051
	2 nd course	14	49,78		

In order to obtain differences between two independent variables Mann-Whitney U-test was utilized. In accordance calculated results 1st course learners' results $M=55,78$, and 2nd course participants' results $M=49,78$. The results presented that there were no found significant difference between 1st course learners with 2nd course learners. There can be seen slightly contrast because of number of participants were no equal. However both course learners presented positive perception towards use of explicit teaching on developing reading skills. $U=645,000$, $p=,051$.

Conclusion

Explicit teaching is a type of teaching that is purposeful and straightforward. Tutors can create very accurate lessons using clear instructions. They show children how to start and finish an activity. They also provide young people with plenty of feedback and opportunities to practice. Clear Instruction is not scripted. It includes support for individual student differences because teachers actively monitor student performance and give prompt, positive, corrective and clear feedback, hints and prompts. To be successful, teachers need to have a high level of expertise. Finally, it is very flexible and can be used in a wide range of curriculum areas beyond the primary curriculum, including maths, reading, writing and spelling. Open teaching requires a high level of teacher-student engagement and specific feedback. Teachers should actively encourage student achievement as they progress through the learning process.

Explicit teaching involves a much higher level of involvement of the instructor in the children's learning process. Implicit teaching, meanwhile, encourages the child's autonomous thinking and exploration. This often requires the young person to construct his or her own knowledge of the task assigned to him or her and to set learning goals through trial and error. According to cognitive load theory, explicit teaching is the most successful teaching technique for beginning learners because research shows that in-depth instruction and expectation setting help to confirm concept comprehension. Since children are considered as beginning learners, explicit instruction is the most successful method in early childhood education.

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Philological sciences

PROBLEMS OF DEVELOPING AN UTTERANCE GENERATION MODEL

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Abstract

The issues of speech production are highly relevant in contemporary science. The speech-production models that currently exist are still hypothetical. The author points to the necessity of an interdisciplinary approach to these issues in order to gain a more complete view of how thoughts are transformed into words. This article presents a model for generating metaphorical utterances, created on the basis of A. A. Leontiev's general model of speech production. The author offers a detailed analysis of every stage in the speech-creation process (motivation; conception of the utterance; implementation of the conception; comparison of the implementation with the original conception), addressing related questions such as the problem of lexical retrieval and the specifics of how a polysemous word is stored in an individual's mental lexicon. The final issue is of particular importance in the study of metaphor. Psycholinguistic evidence suggests an asymmetry in the salience of meanings within polysemous words. Notably, in neutral contexts, it is often the figurative rather than the literal meanings that are activated, which points to the fundamentally metaphorical nature of human cognition. The article also highlights the role of the unconscious in the process of speech production — an aspect that is frequently overlooked in existing psycholinguistic models.

Keywords: Plan of the utterance, internal programming, implementation of the conception, the unconscious, word search, polysemous word, metaphorical utterance

The process of transforming thought into words, as well as the creation and comprehension of speech, represents one of the key issues in psycholinguistics, cognitive linguistics, linguistic psychology, psychology, computer science and other scientific disciplines. Throughout the history of scientific thought, approaches to studying this issue have evolved in accordance with the dominant paradigm of each period. Consequently, speech generation models have also changed and, to this day, remain hypothetical. Undoubtedly, a more comprehensive understanding of the speech generation process requires an interdisciplinary approach.

This article presents a model of generating a metaphorical utterance. The focus is on written monologue speech, where the topic of the message does not come from the communication situation and the stimuli of the interlocutors, but from the person's inner intention, from the content that he wants to convey. I would like to note that of the speech production models I have researched (T.V. Ryabova, T.V. Akhutina, A.R. Luria, Katsnelson, N. Chomsky, etc.), A.A. Leontiev's model, in my opinion, is less contradictory, it is freer and allows for different ways of generating where other models are limited in this respect. Therefore, the model presented in this article is based on A.A. Leontiev's speech production scheme. He proceeded from the "fundamental structure of any intellectual act" and defined the "fundamental structure" of any model of speech production. According to A. Leontiev, it includes the following stages: 1) the stage of motivation for utterance; 2) the stage of the concept (program, Plan) of the utterance; 3) the stage of the implementation of the conception (implementation of the Plan), which can occur simultaneously with the second (meaning that while one part of the utterance is being implemented, the other is planned); 4) the stage of comparing the implementation of the conception with the conception itself, which possibly occurs simultaneously with the third.

The first stage is motivation. It always stimulates our actions, activity. This concept includes the idea of interests, needs, goals, intentions, motivations, aspirations of a person. At the end of the 19th century, the American scientist William James, speaking about the embodiment of thought into words, noted the heterogeneity of this process, highlighted the stages of «intention», thought and the word itself and the operations of selection, filtering of words. But most foreign researchers do not include «intentions» and «thoughts» in the speech production scheme at all (C. Osgood, N. Chomsky, V. Ingve, H.

Jackson, etc.). The model of J. Galanter, J. Miller, K. Pribram preserves this position of James. In Russia, the analysis of human activity was carried out from other positions. Scientists paid special attention to the motive of action.

So, what will serve as a reason, a motive for creating at least a small work, has a very subjective nature. I consider the creation of metaphors as a creative intellectual activity associated with cognitive mental processes - sensation, perception, memory, thinking, creativity, etc. Obviously, already at this stage an idea, an approximate theme of the future utterance arises. And I think that here the influence of the unconscious is especially evident. In speech generation models, little attention is usually paid to this aspect. However, it can not be ignored. Otherwise, the model takes on too schematic, mechanical character, which distorts the real state of affairs. Especially when it comes to creativity. Therefore, despite the fact that the unconscious is not included in the scope of psycholinguistic research, I consider it is necessary to introduce this factor for a more complete presentation of the speech generation process. «We will not distort the nature of the process of creating an aesthetic image if we say that this process consists of a continuous series of decisions that the artist must make in order to materialize his aesthetic concept. These decisions, decisions on the choice of aesthetically justified forms, movements, colors, sounds, words are always based on a complex combination of what the artist is aware of and what he is poorly aware of as a motive for the decision, or even not aware of at all» [2, p. 62]. The influence of the unconscious at the level of motivation is undeniable, but it can also manifest itself at other stages of speech production. For example, in the case of choosing the right word to express a certain thought. And this choice is so complex that it can only occur on the basis of an intuitive «feeling for language».

So, let us explain the process of speech production with an example. Let us assume that the motive is summer rain and the corresponding mood, and this will be the first stage. The second stage is the idea, program or Plan of the utterance. Internal programming is defined by A.A. Leontiev as an unconscious construction of a certain scheme underlying the generation of speech. It can develop into internal or external speech. At this stage of speech production, the general meaning of the utterance is formed. The transition from internal programming to external speech occurs on the basis of grammatical and semantic rules for the development of the program. "The program consists of a kind of semantic "milestones", that is, it includes correlates of individual components that are especially important for the utterance - such as the subject, predicate or object, and to the extent that their relationship is essential for the future utterance. In the transition to external speech, each of these components is expanded into a syntactic group or a separate word plus the forms of connection of these groups in a sentence, if they exist in a given language" [5, p. 159]. The elements of the program may be different in origin and relate to different code systems (the code of visual, auditory, secondary images, etc.). Any unit of the code is two-sided, it provides for a «signifier» and a «signified», independent of the nature of the code. In figurative language, this stage of speech production is «the tickling of thoughts in the fingertips». This is the period of approaching the logical formulation of thought. Obviously, at this stage, sensory images of the received perceptions take place. In this case, images of a window, splashed with streams of rain, a gray sky, a street outside the window, a blurry picture associated with the works of the impressionists arise. The idea is to describe what was seen, felt, and lead to the final association.

The third stage is the implementation of the program (Plan, concept). The implementation of the program is «its recoding into some other structures corresponding to the specific lexical, grammatical and phonetic (in the broad sense) characteristics of a particular language» [5, p. 176]. It would seem that this stage consists of two processes: 1) the selection of linguistic units from the «memory» of the native speaker; 2) the construction of a speech utterance from them. The last stage of speech production is the least known. Therefore, everything is hypothetical.

Memory acquires special significance at this stage. Usually, three memory processes are distinguished: memorization (storage), preservation (memory), reproduction (retrieval). There are two types of memory: involuntary and voluntary. The latter is the most «human». A. Leontiev's distinction between «situational memory», «content memory» and «native language memory» finds an interesting parallel in W. Penfield's distinction between three types of memory: memory of individual experience (memory of events, situations, images, perceptions, sensations, feelings, etc., present in a person's life), concepts or generalizations (according to A. Leontiev - «memory of meanings», «memory of contents»), memory of words. In my opinion, Penfield's classification does not include grammar memory. In this case, the «native language memory» distinguished by A. Leontiev is more acceptable. It includes memorization and reproduction of words, grammatical structures, speech patterns, etc.

The most important problem at this stage is the search for a word, in connection with which there are various hypotheses (B. Mandelbrot, G. Savin, etc.). According to the concept of A. Leontiev, not only

acoustic-articulatory, but also semantic features can act as initial features for selecting a word. A word with a certain feature is searched for in a certain frequency group of words characterized by this feature. This assumption makes it possible to logically explain the mechanism of choosing words in an utterance based on their semantic characteristics. «When we reach a specific (searched for) word, we already have a certain set of features by which it can be found, and features that it obviously cannot have, and then we «run» through these features (and other possible features for a given word) in a specific sequence» [5, p. 201]. A.A. Leontiev allows for a similar mechanism of selection and selection when focusing on acoustic-articulatory features. If A.A. Leontiev's hypothesis is correct, then the search occurs, apparently, in two independent ways - based on the hierarchy of sound and semantic features. At the same time, the associative nature of the semantic aspect of generation is emphasized.

It has been noted (D. Norman, «Memory and decisions») that the subject's strategy in a specific situation determines the criteria for selecting a word from a person's long-term memory. In other words, the specific situation determines by what criteria — phonetic or semantic — we search for a word. Here another problem arises: can we consider that the word «lies», «recorded» somewhere in the brain's "lexicon"? According to A. Leontiev, the word is recorded in the form of a search for this word. By operating with the corresponding features, we thereby already "read" the "record" in the lexicon. So, a word is a search. We can distinguish different ways of searching for one word: 1) one way of sound search, but different ways of semantic (this is how homonymy and polysemy are born, including metaphor); 2) one way of semantic search and different ways of sound (the birth of synonymy); 3) different paths of both semantic and phonetic search.

The implementation stage provides a specific lexical and grammatical characterization of the utterance, and initial coding occurs. The semantic features of predicative pairs are distributed between their components and linearization of these units occurs in accordance with the structure of the language, i.e. the order of the elements is established. At the level of syntactic prediction, a complete set of characteristics is attributed to the original word, the syntactic structure of the utterance is predicted on its basis and compared with the program. At this last stage, the result is born: «The summer rain lightly drummed on the windows and instantly revived them. Through its beaded network, everything became unsteady and iridescent. The rain - an impressionist with light transparent strokes painted a picture of the street outside the window...». This result is compared with the program. A positive emotion (in case of coincidence - satisfaction) or a negative (dissatisfaction in case of discrepancy) arises. Coincidence encourages to follow further, while mismatch causes a possible change in the program, linear order or search for new words, etc. until the goal is reached.

This is the general model of generating a metaphorical utterance. It is also necessary to consider the problem associated with metaphor and its appearance in speech. This is the question of storing polysemous words in a person's lexicon. A common belief, coming from V.V. Vinogradov, is that a word is present in consciousness with all its meanings, ready to surface at the first opportunity. A.P. Klimenko and A.E. Suprun believe that in the consciousness of individuals there are not just all the meanings of a word, but their hierarchy. S. Ulman believed that if there were no polysemy, we would be forced to store in memory a huge stock of words. J. Miller argues that the human lexicon is deliberately organized differently than an entry in an explanatory dictionary. O.O. Kuznetsova puts forward an interesting hypothesis about the probability of separate storage by a person of different meanings of polysemous words. In this case, different meanings of one polysemous word should be stored separately as part of specific thematic groups. Many experiments (L.A. Shvarts, O.S. Vinogradova, N.A. Eisler, and others) support this hypothesis. As a result of O.O. Kuznetsova's research, she discovered an interesting paradox: subjects perceived different lexical-semantic variants of the same word as separate, independent lexemes, and different words of the same semantic field or thematic group as the same word. Experimental data and theoretical considerations allowed us to draw the following conclusions: "lexical-semantic variants of a polysemous word are stored in the human lexicon as part of thematic groups or semantic fields separately as homonymous words; Moreover, sometimes such meanings are stored separately that are not allocated to a separate section in explanatory dictionaries; the basis for this is the subject-relatedness, which is realized through the emergence of the image of a specific object" [4, p. 91].

In linguistics, there are different points of view regarding the structural organization of the content of a polysemous word. One belongs to V.V. Vinogradov, according to which there are hierarchical relations between the individual meanings of a polysemous word, allowing one to distinguish between basic and derivative meanings. According to the second, the meanings of a polysemous word are equal and are not divided into basic and non-basic. (V.A. Zvegintsev). The third occupies an intermediate

position: inequality of meanings exists only for some words (D.N. Shmelev). However, the data of psycholinguistic studies (V.V. Levitsky, O. Kuznetsova) indicate the inequality of meanings of a polysemous word. The hierarchical system of meanings does not necessarily coincide with the semantic structure of the word in the individual's lexicon, and it is often not the direct, but the figurative meanings that are actualized in a completely neutral context. These developments are of interest because they indicate the metaphorical nature of human thinking.

So, we have presented a general model of generating a metaphorical utterance and, in this regard, considered a number of topical issues that require further interdisciplinary research (the role of the unconscious in the process of speech generation, the word search problem, the specifics of storing a polysemous word in an individual's lexicon).

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SCIENTIFIC AND TECHNICAL ASPECTS OF INNOVATIVE DEVELOPMENT IN THE FIELD OF EDUCATION

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Abstract

This article examines the scientific and technical aspects of innovative development in the field of education. This paper aims to outline the core scientific and technical aspects that are critical to sustaining innovative development in the education sector.

Keywords: *stimulant, technological education, high technologies, efficiency of the educational process, innovation, global collaboration.*

The word "innovation" means the result of creative activity aimed at the development, creation and distribution of new types of products, technologies, and the introduction of new organizational forms.

American scientist Peter Drucker (1909–2005) understood innovation as "the means by which an entrepreneur either creates new resources that bring him wealth or provides existing resources with improved potential for profit".

Innovative teaching methods are modern approaches that go beyond traditional education. They include new technologies, ideas and concepts that promote critical thinking, creativity, teamwork and self-realization. [1, 17]

Innovative teaching methods are not just the introduction of advanced technologies or following the latest trends, but a complete educational methodology based on new teaching strategies that focus on the needs and characteristics of students. These methods allow students to be actively involved in the learning process and encourage interaction with classmates and the teacher. This means a lot of work on the part of students, but unlike traditional teaching, which focuses on the volume of knowledge transferred, innovative methods allow us to understand what students actually learned in the classroom. [1, 19]

Innovative educational activity involves changing the pedagogical process and introducing innovations aimed at improving it. Innovations (in English - the introduction of new forms, methods and skills in the field of training, education and science). Innovative activities include motivation, creativity, operational components, and reflection. Innovation in education means solving real problems in a new and simple way to promote equal learning. [3, 4]

The 21st century has seen a revolutionary shift in education, fueled by continuous scientific research and rapid technological advancements. Traditional pedagogical methods are evolving to accommodate new learning environments shaped by digital tools, online resources, and artificial intelligence.

In terms of the requirements of the 21st century, while preserving the successes of traditional education, the application of innovations and new pedagogical technologies should be considered as important conditions for improving the quality of education. For this reason, hundreds of new concepts have entered our education as innovations. Life skills-based education, curriculum, e-school, ICT, distance learning, active and interactive methods, portfolio, Bologna process, synergistic education, constructive education, synergetics in education, etc. are important areas and methods of innovative education, being new concepts of our education. [2]

These innovations are scaled according to the size of the problem. At present, mechanisms for stimulating innovation activities across all areas have been developed and implemented in order to expand and accelerate their use throughout society. The Concept of "Innovation" It would be a great disingenuousness to claim that innovative activity as such originated recently. Innovations are precisely one of the multifaceted, multi-aspect subjects of discussion. This follows from the diverse concept of "education". In this regard, it is relevant to consider the diversity of types of innovations in education.

Innovative activities in education cover various aspects, from modernizing curricula to introducing

new technologies. Among them, several key areas are highlighted that contribute to improving the quality of education and creating new opportunities for students and teachers. Scientific and technological advancements have also revolutionized pedagogy.[4,294] If this activity was called so relatively recently, it does not mean that it did not exist and did not bear fruit - innovations, which we call innovations. The wheel and other mechanisms (relevant today) were invented before our era. It would be very incorrect not to consider this as an innovation at that period of human development. One of the effective ways to solve these problems is the informatization of education. [2]

Today, information technologies in education open up a whole range of different innovative directions, among which the most modern is the didactic aspects of information technologies. Thus, we can conclude that education has always worked in an innovative mode to a greater or lesser extent. Improvement of technical means of communication has led to significant progress in information exchange. The emergence of new information technologies associated with the development of computer technology and telecommunications networks has made it possible to create a qualitatively new information and educational environment as a basis for the development and improvement of the education system. The task of technology as a science is to identify a set of patterns with the aim of determining and using in practice the most effective, consistent educational actions that require less time, material and intellectual resources to achieve any result.

However, let us be as precise and objective as possible: at various stages of development of systems and paradigms of education, several very specific key methodological (technological) approaches to teaching were used: • practice; • material transmission; • analysis and analysis of situations; • game; • imitation; • project. [2]

Materials and Methods: Today, science and education are among the most important factors ensuring the country's sustainable socio-economic and cultural development. In the modern era, the role and importance of education and scientific-technical progress are acknowledged as serious factors.

In recent years, decisions have been made to advance science, protect and modernize scientific-technical potential and intellectual property, train highly qualified personnel in science and education, provide them with constant support, increase the prestige of scholars and educators in society, and promote Azerbaijani scientific achievements abroad. [12] The state's attention to the development of science and education should be considered as part of the broader policy aimed at strengthening statehood and contributing to national-cultural progress and raising the well-being of the people. From this perspective, coordinating the fields of science and education, integrating them with the use of modern technologies and innovations, and their development remains a top priority issue. Several key technologies have significantly influenced modern education systems. Cloud computing provides scalable and remote access to educational tools, allowing for global collaboration. With the expansion of the Internet of Things, smart classrooms are being developed to enhance interactivity, track student engagement, and provide immediate feedback. [12]

Gamification of learning—using game elements such as rewards, levels, and challenges—has proven effective in increasing motivation and engagement. STEM and STEAM education encourage interdisciplinary learning, combining science, technology, engineering, mathematics and arts to develop critical thinking. [5,135]

Modern teaching methods (including, of course, interactive ones) are methods of developing competencies based on the interaction of students and their involvement in the learning process, and not just on passive or reproductive perception of the material. Modern infrastructure (technical means) of training, which includes information, technological, organizational and communication components, allowing for the effective use of the advantages of, say, distance learning. [6,22]

Results: As mentioned earlier, Azerbaijan is currently pursuing a state policy that covers these aspects, focusing on transforming intellectual capital into economic potential. In the globalized world, research into the foundations of economic breakthroughs in developed countries shows that the application of scientific innovations plays a key role in this development.

Today, education cannot be imagined without science. In developed countries, universities are primarily structured as centers of scientific research, and the educational process is based on scientific innovations. Thus, universities evolve into centers of science and education, meeting the needs of society. Universities in our country must also fulfill this mission. However, strengthening the material-technical base of the educational system, equipping institutions with modern technical equipment, and acquiring cutting-edge devices are not easy tasks.

This article discusses the innovative aspects of the development of technological education in the context of information changes in society and education. The use of high technologies as a tool for

transmitting information and developing modern technological processes is shown to enable the optimization of the teaching process and enhance its efficiency. [7]

The article explores the impact of high-intellectual technologies on pedagogical methods, as well as how they foster creative and logical thinking skills and enhance interpersonal communication abilities. These aspects are particularly relevant in the context of modernizing education in Azerbaijan. To identify the structure and determinants of social communication based on the specifics of pedagogical activity, the main research directions are analyzed. [12]

This day, specialists are in a position where information and communication are forcing them to perform various roles. This fundamentally changes the situation and objectives of education, particularly technological education, because it requires mastering the most promising technologies that provide high quality and low production costs to meet market demands. It is well-known that the term "technology" refers to methods of transforming raw materials, materials, and the characteristics and form of production processes, interpreted alongside skills and craftsmanship. [8]

Technological education is aimed at mastering the culture of human interaction with machinery, equipment, and energy systems. An important aspect of this is the interaction between humans and machines, equipment, and energy devices. Computer systems and technology have been widely applied in machine control systems. The discovery and development of new technologies are significant sources for improving university curricula. [7,] The innovative aspect of this direction is the introduction of new teaching methods and materials into the curriculum, which has the following benefits:

- it increases students' interest in new technologies.
- it enhances focus on different methods of presenting educational materials.
- it allows the presentation of specific aspects of a process through the use of new technologies.

The challenges of the 21st century demand that each of us acquire new abilities, skills, and knowledge, enabling effective performance.

Discussion and Conclusion: Today, the main task is to prepare society to "adopt" scientific innovations and ensure they are effectively utilized, which requires global collaboration, not just within one country. Without familiarizing ourselves with modern innovations and acquiring practical experience with them, talent, strong theoretical knowledge, a good memory, and intellectual capacity are not enough.

Therefore, we must focus on integrating and cooperating between universities worldwide, so that young people are introduced to scientific innovations during their education. It is important to note that high technologies widely used in scientific research and production bring new perspectives to pedagogical technologies. The development of computer technology and the Internet has altered our understanding of data transmission technologies, which, alongside the application of high technologies in teaching, requires adjustments in communication technologies.[7]

Innovative teaching methods are not just the introduction of advanced technologies or following the latest trends, but a complete educational methodology based on new teaching strategies that focus on the needs and characteristics of students. [8] These methods allow students to be actively involved in the learning process and encourage interaction with classmates and the teacher. This means a lot of work on the part of students, but unlike traditional teaching, which focuses on the volume of knowledge transferred, innovative methods allow us to understand what students actually learned in the classroom. Many teachers are already using innovative teaching strategies to increase student engagement. [9,215]

Here are 7 benefits of innovative teaching methods that make them worth trying.

1. Encourage inquiry – these methods encourage inquiry and broaden one's horizons
2. Improve critical thinking and problem-solving skills – students can progress at their own pace and find new ways to solve problems instead of looking for a ready-made answer in a textbook.
3. Information Dosing – Teachers still give students new information, but now they break it down into smaller parts, which increases the speed and quality of assimilation of the material.
4. Acquiring Social Competencies – Students now require more complex tools in the classroom to help them develop their creative potential. And when completing individual or group projects, they learn to plan their time, set priorities, communicate, and work in a team.
5. Checking the assimilation of the material – grades and exams can say a lot about the abilities and knowledge of the student, but not everything (especially if you cheat!). Innovative methods allow you to better control the process, understand and solve students' problems.
6. Increased self-esteem – the use of innovative methods will allow students to understand what they have learned and what they still need to master. This will help make learning more conscious and increase motivation.

7. *Vivid lessons – avoid teacher monologues or awkward pauses – with innovative methods, students are actively speaking out in class.*

Nowadays Virtual reality technologies open a window into the real world right in the classroom and allow students to interact with "real" objects instead of flat images on a screen.

The most important, extremely necessary stage in the work on innovation.

It is its testing and experimentation to verify its reliability and effectiveness. It is this stage that allows us to identify the "pain points" of the innovation, the risk points. The more negative factors that the innovation being developed carries are identified, the fewer problems there will be in the future when using it.

At the same time, developers, having identified the negative aspects of the innovation, make certain changes and adjustments. Only after this can innovation be implemented. Over time, innovation becomes a tradition, then it comes into conflict with modernity, and the cycle repeats. In education, along with medicine, it is very important to achieve minimal negative impact of innovations. Scientific and technical innovations are essential to the transformation of modern education. When effectively implemented, they can bridge learning gaps, personalize education, and enhance student outcomes. [11]

However, to realize these benefits, education systems must address issues of access, ethics, and support structures. As we move into a new era of digital learning, a balance between innovation and equity will be the key to long-term success. [10]

Modern infrastructure (technical means) of training, which includes information, technological, organizational and communication components, allowing for the effective use of the advantages of, say, distance learning.

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Psychological sciences

UOT 16

EXISTENTIALISM IN THE CONTEXT OF FUZZY RELATIONS: EPISTEMOLOGICAL ANALYSIS

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EKZİSTENSİYALİZM QEYRİ-SƏLİS MÜNASİBƏTLƏR KONTEKSİNDƏ: EPISTEMOLOJİ TƏHLİL

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Abstract

The transformation of fundamental changes and innovations in scientific and philosophical fields, along with other fields, into culture leads to the emergence of new paradigms in these fields. Many perspectives that are the result of this transformation also expand the epistemological level for various systems of thought. One of such perspectives is fuzzy models. Fuzzy models are models based on the theory of fuzzy sets, which has a special role in the transition to the post-non-classical stage of cognition, and the theory of fuzzy logic that emerged on the basis of this theory. These theories are closer and more adequate scientific apparatus to human thinking in decision-making and management under uncertainty, and have wide application possibilities in various fields of scientific-theoretical, technological and, in general, life. A multi-valued logical approach to the phenomena, systems and processes that are the object of research, and their epistemological analysis through a fuzzy thinking model does not bypass the field of culture. The transformation of the philosophical doctrine of existentialism, whose formation stage coincided with the middle of the last century, into culture has created various generations in this field and led to the emergence of cultural works with new content. Taking these perspectives into account, this research work has conducted an epistemological analysis of the existential thought system in the context of fuzzy relations (fuzzy thinking model). The scientific-philosophical analysis conducted in the context of multi-valued logic is characterized by epistemological results that express a certain correlation between these two systems of thought: Features such as uncertainty, subjectivity, boundary continuity, and relativity of the absolute, inherent in existentialism, are indicators that give a rational-logical description of the fuzzy logic model. In this logic model, in conditions of uncertainty, there is only a "partial truth" criterion - replacing the concept of truth with the principle of partial truth, it puts forward the concept of truth value. Existentialism puts forward the theses that reaching the absolute is absurd and that truth is relativity. There is uncertainty up to a person's life choice, up to the determination of his identity - there is no absolute norm that determines his life scenario; this is the conclusion that existentialism comes to. Fuzzy logic is a scientific apparatus that studies fuzzy uncertainty with the properties of inaccuracy, incompleteness, evaluates its degree of authenticity, etc.

Considering the existing connection, we are of the opinion that the scientific-philosophical investigation of existentialism in the context of multivalued logic and the epistemological results obtained are significant in terms of scientific novelty. We believe that the epistemological substantiation of the correspondence of the cognitive subject of the existential thought system to the fuzzy thinking model in relation to the object can play the role of a methodological basis for the epistemological investigation of fuzzy relationships to the object (being) in many areas of culture, as well as in the history of philosophical thought.

The research work also presents the author's concept called the Art of Self-Creation as a subtopic; while examining the postmodern and existential way of thinking in the context of the thinking model formed on the basis of fuzzy sets and fuzzy logic theories, the fairly similar theses between phenomenology, existentialism, and postmodernism prompted me to focus on the meaning of human existence, and I put forward some of my reflections that emerged as a result of the research work in the form of this concept.

Xülasə

Elmi-fəlsəfi sahələrdə baş verən fundamental dəyişiklik və yeniliklərin digər sahələri ilə yanaşı, mədəniyyətə də transformasiyası bu sahələrdə yeni paradigmlərin yaranmasına səbəb olur. Bu transformasiyanın nəticəsi olan bir çox perspektivlər eyni zamanda müxtəlif düşüncə sistemləri üçün epistemoloji müstəvini də genişləndirir. Belə perspektivlərdən biri də qeyri-səlis modellərdir. Qeyri-səlis modellər isə postqeyri-klassik idrak mərhələsinə keçiddə xüsusi rolə malik qeyri-səlis çoxluqlar nəzəriyyəsi və bu nəzəriyyə əsasında yaranan qeyri-səlis məntiq nəzəriyyəsi əsasında qurulan modellərdir. Bu nəzəriyyələr qeyri-müəyyənlik şəraitində qərarvermədə və idarəetmə sahələrində insan təfəkkürünə daha yaxın, daha adekvat elmi aparat olub, elmi-nəzəri, texnoloji və ümumiyyətlə, həyatın müxtəlif sahələrində geniş tətbiq imkanlarına malikdir. Tədqiqat obyektini olan hadisə, sistem və proseslərə çoxqiymətli məntiqi yanaşma, onların qeyri-səlis təfəkkür modeli vasitəsilə epistemoloji təhlili mədəniyyət sahəsindən də yan keçmir. Formalaşma mərhələsi keçən əsrin ortalarına təsadüf edən ekzistensializm fəlsəfi təliminin də mədəniyyətə transformasiyası bu sahədə müxtəlif generasiyalar yaradaraq, yeni məzmununda mədəniyyət əsərlərinin ortaya çıxmasına səbəb olmuşdur. Bu perspektivlər nəzərə alınaraq, bu tədqiqat işində ekzistensial düşüncə sisteminin qeyri-səlis münasibətlər (qeyri-səlis təfəkkür modeli) kontekstində epistemoloji təhlili aparılmışdır. Çoxqiymətli məntiq kontekstində aparılan elmi-fəlsəfi təhlil bu iki düşüncə sistemi arasında müəyyən korrelyasiyanı ifadə edən epistemoloji nəticələri ilə xarakterizə olunur: Ekzistensializmə məxsus qeyri-müəyyənlik, subyektivlik, sərhəd kəsilməzliyi, mütləqin nisbiliyi kimi xüsusiyyətlər qeyri-səlis məntiq modelinin riyai-məntiqi təsvirini verdiyi göstəricilərdir. Bu məntiq modelində qeyri-müəyyənlik şəraitində yalnız "qismən həqiqət" kriteriyası mövcuddur - həqiqət anlayışını qismən həqiqət anlayışı ilə əvəz edərək, doğruluq qiyməti konseptini irəli sürür. Ekzistensializm mütləqə çatmağın absurd olduğu və həqiqətin nisbiliyi tezislərini irəli sürür. İnsanın həyatı seçiminə, öz identikliyinə təyininə qədər qeyri-müəyyənlik mövcuddur – onun həyat ssenarisini müəyyənləşdirən heç bir mütləq norma yoxdur; ekzistensializmin gəldiyi qənaətdir. Qeyri-səlis məntiq qeyri-dəqiqlik, natamamlıq xüsusiyyətlərinə malik qeyri-səlis qeyri-müəyyənliyi öyrənən, onun həqiqilik dərəcəsini qiymətləndirən elmi-aparatdır və sairə.

Mövcud əlaqənin olduğunu nəzərə alaraq ekzistensializmin çoxqiymətli məntiq kontekstində elmi-fəlsəfi araşdırılmasının və alınan epistemoloji nəticələrin elmi yenilik baxımından əhəmiyyətli olduğu qənaətinə gəldik. Hesab edirik, ekzistensial düşüncə sisteminin idrak subyektinin obyektə münasibətdə qeyri-səlis təfəkkür modelinə uyğunluğunun epistemoloji olaraq əsaslandırılması mədəniyyətin bir çox sahələrində, həmçinin fəlsəfi fikir tarixində obyektə (varlığa) qeyri-səlis münasibətlərin epistemoloji araşdırılması üçün metodoloji baza rolunu oynaya bilər.

Tədqiqat işində həmçinin müəllifin altmövzu olaraq Özünüyaratma sənəti adlı konsepsiyası təqdim olunur; postmodern və ekzistensial düşüncə tərzini qeyri-səlis çoxluqlar və qeyri-səlis məntiq nəzəriyyələrinin əsasında formalaşan təfəkkür modeli kontekstində araşdırarkən fenomenologiya, ekzistensializm, postmodernizm arasında kifayət qədər oxşar tezislər məni də insan varlığının mənası üzərində dayanmağa sövq etdi və tədqiqat işinin nəticəsi olaraq yaranan bəzi refleksiyaçıları bu konsepsiya şəklində irəli sürdüm.

Keywords: existentialism, uncertainty, linguistic, fuzzy relations, fuzzy set, fuzzy logic.

Açar sözlər: ekzistensializm, qeyri-müəyyənlik, lingvistik, qeyri-səlis münasibətlər, qeyri-səlis çoxluq, qeyri-səlis məntiq.

1. Giriş

Məlum olduğu kimi, elmi sahələrdə və fəlsəfi düşüncə sistemində baş verən fundamental dəyişiklik və yeniliklərin elmi-texnoloji, idarəetmə, qərarvermə və həyatın digər praktik sahələri ilə yanaşı, mədəniyyətə də transformasiyası bu sahələrdə yeni paradigmlərin yaranmasına səbəb olur. Bu perspektivlər eyni zamanda müxtəlif düşüncə sistemləri üçün epistemoloji müstəvini də genişləndirir. Elmi idrakın məhsulu olan, postqeyri-klassik idrak mərhələsində xüsusi rolə malik qeyri-səlis çoxluqlar nəzəriyyəsi (həmçinin bu nəzəriyyə əsasında yaranan qeyri-səlis məntiq nəzəriyyəsi) qeyri-müəyyənlik şəraitində qərarvermədə və idarəetmə sahələrində insan təfəkkürünə daha yaxın, daha adekvat elmi aparat olmaqla elmi-nəzəri, texnoloji və ümumiyyətlə, həyatın müxtəlif sahələrində geniş tətbiq imkanlarına malikdir. Hadisə və predmetlərə tədqiqat obyektini olaraq çoxqiymətli məntiqi yanaşma,

onların qeyri-səlis təfəkkür modeli vasitəsilə təhlili mədəniyyət sahəsindən də yan keçmir. Qeyd olunanları nəzərə alaraq bu tədqiqat işində formalaşma mərhələsi keçən əsrin ortalarına təsadüf edən ekzistensial düşüncə sisteminin qeyri-səlis münasibətlər (qeyri-səlis təfəkkür modeli) kontekstində qnoseoloji təhlili aparılmışdır. Çoxqıymətli məntiq kontekstində aparılan qnoseoloji təhlil bu iki düşüncə sistemi arasında müəyyən korrelyasiyanı ifadə edən epistemoloji nəticələri ilə xarakterizə olunur.

2. Ekzistensializm

Ekzistensializm - mövcudluq (existentia) fəlsəfəsi sayılan bu ekzistensial təfəkkür üsulunun kökləri əvvəlki dövrlərin filosoflarının - bu təlimin atası sayılan S.Kyerkoqordan ta Paskalın, Avqustinin, Sokratın və s. zəngin düşüncə sahiblərinin fəlsəfi dünyagörüşlərinə qədər gedib çıxır. Kyerkoqor hesab edir ki, kainat, o cümlədən dünyamız barəsində abstrakt düşüncə sistemlərinin heç bir önəmi yoxdur, əsas olan insan varlığıdır, çünki əsl diqqətə layiq olan onun düşüncələri, yaşantıları, qorxusu, kədəri, sevincidir [1]. Ümumiyyətlə, bu fəlsəfi istiqamət əsas konsepsiya olaraq individuallığı önə çıxarır: hər bir insanın həyat və duyğuları fərdi olmaqla unikal və təkrarolunmazdır. Bu kontekstdə bir çox filosoflar kimi, Fukonun bu refleksiya da çox maraqlıdır. O, hesab edir ki, fəlsəfənin əsas məsələsi indi – hazırda olana müraciət etməkdir və indi olan isə elə biz özümüz. M.Haydegger, K.Yaspers, J.P. Sartr, N.Berdyayev ekzistensializmin ən görkəmli nümayəndələrindən hesab olunur. Bu təlimə görə, insan özünü ekzistensiya – fərd olaraq şəxsiyyət kimi tam dərk etmək üçün onun həm də təhlükəli situasiyada olması vacibdir. Çünki insan bu situasiyada daha düzgün seçim və qərar verməyə qadirdir. Bu fəlsəfi təlim üçün qorxu hissi neqativ hadisə olaraq dəyərləndirilmir, əksinə, hesab edirlər ki, qorxu insanı səlis, ritmli həyat tərzinə malik heyvani varlıqdan qoparmaqla ona təhlükə sərhədində qərar vermək azadlığı bəxş edir [1;2]. Göründüyü kimi, bu təlim qorxuya da insanın seçim azadlığının, ekzistensializminin əsas atributu olaraq koqnitiv məna verməklə azadlıq, seçim, fərdi qərarvermə, intuisiya kimi əsas anlayışları siyahısına daxil edir. Ümumiyyətlə, bu fəlsəfi dünyagörüşünün əsas tezislərindən biri də budur ki, hər bir fərd həyatının sərhədlərini dərk etməli və buna görə məsuliyyət daşımalıdır.

İnsan həyatı – aramsız olaraq yeni forma və əlamətlərlə təşəkkül tapdığı kimi aramsız olaraq da seçim qarşındadır. "Varlıq və heçlik" əsərində insana münasibətdə individualist mövqeyi müdafiə edən Sartr digər - "Ekzistensializm – hümanizmdir" əsərində qeyd edir ki, insanın mövcudolma göstəricisi onun həyatı məna və mahiyyətindən daha əvvəldir. Filosoфа görə, İnsan özü özünü seçir; mövcudluğa sanki eyni qaydada atılan bütün insanlar öz identikliyi müəyyənləşdirməkdə azaddır və insan həyatı üçün əvvəlcədən müəyyənləşdirilmiş heç bir norma, ideya yoxdur [2;3]. Deməli, insan seçimdə azaddır, lakin həyatının sərhədlərini dərk etməli olduğu kimi, azadlığının da sərhədlərini və məsuliyyətini anlamalıdır. Yəni bu kimi refleksiyalar belə bir qənatə gəlməyə imkan verir ki, insan sosiomədəni mühitin tərkib hissəsi olduğundan həyatı seçim və azadlığının limitini – məhdudiyyət xüsusiyyətlərini də nəzərə almalıdır və əməli fəaliyyətdə həm də məsuliyyət daşıyır.

Kamyu deyir ki, mən dünyanın unikal mənasını anlamıram, çünki o, mənə görə, irrasionalılıqla doludur. Mütləqə canatma isə həmişə uğursuzluqla nəticələnir. Çünki ağıl həmişə həqiqət və yalanı ayırmağa çalışır, amma sonra anlayır ki, həqiqətə çatı bilməz. Filosoфа görə, insan həyatın məna axtarışında daima absurdlə üz-üzə qalır. Onun "Sizif haqqında əsatir" fəlsəfi əsərində "mənasızlıq qəhrəmanı" olaraq yaratdığı Sizif obrazı sanki tamamilə insan fəaliyyətinin mənasızlığını ifadə edir. Lakin müəllifin bu fəlsəfi arqumentasiyasında bir əxlaqi konsepsiyasını da sezmək olur; insan istənilən situasiyalarda öz mövcudluğunu saxlamalı – insan olaraq qalmalıdır [5;6].

Alman ekzistensializminin banilərindən biri olan M.Haydegger hesab edirdi ki, fəlsəfənin əsas məsələsi insan varlığının mahiyyətini müəyyənləşdirməkdir; həyatın mənası nədir, bu dünyada insanın yeri və rolu nədən ibarətdir. Çünki insan kainatın yeganə varlığıdır ki, o öz mövcudluğunu anlamaqla varlıq barədə idrak edə bilər; insan dünyanı suallarla seyr edərsə, dünya da onu idrak, duyğu, iradə vasitəsilə cavablandırır. Filosofun Dasein (varlıq; ekzistensiya) konsepti insan varlığının dəyişkən və qeyri-müəyyən xüsusiyyətlərə malik olduğunu bildirir. İnsan öz varlığını dərk etdikcə varolmanın mənasını tapmağa başlayır. Onun fikrincə, insanlar dünyanı öz həyatı layihələri hesabına anlamağa çalışırlar və onların dünyaya daxil olmaları üçün bu "layihələrdən" başqa heç biri yolu yoxdur. Fenomenlər hər hansı bir layihənin nəticəsində aşkar olunduqları kimi təzahür edirlər. Dasein Haydeggerin "Varlıq və Zaman" adlı fundamental əsərinin əsas konsepsiyasıdır [11]. Dasein insanda ümumi varlığı dərk edən gizli bir qabiliyyətdir. Dasein varlıq olaraq mövcuddur. Daseinin ekzistensial quruluşunu açmaqla insan həyatın mənasını tapa bilər. Bu strukturlara ekzistensiallar deyilir. İnsan varlığının bir yolu olaraq, ekzistensiallar kateqoriya və anlayışlardan əvvəl gəlir. Bu üstünlük dərk etmə fenomeninin əsasında dayanır və onun ilkin quruluşudur. İnsan anlayaraq düşünür. Düşüncə varlıqla bağlı olub dillə həyata keçirilir. Haydegger vurğulayır ki, Dasein anlayışı subyektlə qarışdırılmamalıdır: o, obyektiv olaraq

mövcuddür və "dünyaya qarışmış" bir varlıqdır. Filosofo görə, sivilisasiyanın problemləri ona yönəli təfəkkür strukturunun düzgün qurulmamasıdır. Fəlsəfə insan varlığının mənasını düzgün müəyyənləşdirib anlada bilərsə, təfəkkür mədəniyyətini dəyişdirməklə, təbii ki, dünyanı daha yaxşı məcraya yönəltmiş olar [1].

Beləliklə, ekzistensializm təliminə xas fəlsəfi refleksiyalar varlığın yeni ontoloji strukturu verməklə dünyanın substansial xarakteristikasını da dəyişdirməyə cəhd edir: insan mövcudluğunu önə çıxarmaqla onun varlığını mənalandırmaq və dünyanı yeni təfəkkür mədəniyyəti vasitəsilə idrak edərək dəyişdirmək. Təbii ki, bu fəlsəfi məktəb insan varlığının mahiyyətinə onun seçim azadlığı, fərdi qərarvermə və s. xüsusiyyətləri ilə mənə verməklə yanaşı, idrak xüsusiyyətlərini də vacib hesab etməklə varlığın mahiyyətinin dərki prosesində qnoseoloji yanaşmanı da zəruri hesab edir. İnsan bir çox situasiyalarda seçim və qərarvermə azadlığına malik olsa da, öz varlığının mahiyyətini anlayan yeganə süurlu varlıq olaraq idraki keyfiyyətlərə malikdir.

Əsası XIX əsrdə qoyulan bu fəlsəfi təlimin yenidən vüsət alaraq son formalaşmasının XX əsrin ortalarına təsadüf etməsinə səbəb nə idi? Elmi mənbələr bunu XX əsrdə baş verən dünya müharibələri, hərbi fəlakətlər, faşizm ideologiyası, iqtisadi krizis və bəşəriyyəti fəlakətlə üz-üzə qoyan digər bir çox amillərlə əlaqələndirirlər [1;2]. Nəticədə inamın, humanizmin krizisi, ideal cəmiyyət yaradacaq ideyaların çökməsi tarixi proseslərin məntiqi, rasionallıq kimi xüsusiyyətlərinə şübhə yaratmaqla, konkret insan həyatı və onun dəyəri barədə düşüncələri aktuallaşdırdı və idrak prosesinin insan individuallığı və identikliyi anlamını ön plana çəkmiş oldu.

Beləliklə, bu təlimin bəzi nəticələrini tədqiqat konteksimizə uyğunluğu baxımından bu tezislərlə ümumiləşdirə bilərik:

1. Mövcudluğun üstünlüyü: Mövcudluq mahiyyətdən əvvəl gəlir – insan varlıq olaraq öz mahiyyətini özü yaradır;

2. Subyektivlik: İdrak subyektini önə çıxarır, hər bir insanın təcrübəsi özünə məxsus, unikal olub, onun mövcudluğunu formalaşdırır;

3. Qeyri-müəyyənlik: İnsanı idarə edən əvvəlcədən təyin edilmiş heç bir universal – mütləq həqiqət deyilən normalar mövcud deyildir, o öz identikliyi müəyyənləşdirməkdə azaddır;

4. Seçim azadlığı: İnsan özü özünü seçir və varlıq olaraq hansı keyfiyyətə malik şəxsiyyət olacağını özü təyin etməlidir;

5. Absurdluq və irrasionalıq: Həyatın mənası və məqsədi barədə suallara cavab axtarışı; həqiqət və yalan arasında qeyri-səlislik (kəsilməzlik; sərhədsizlik); mütləqliyin, o cümlədən həqiqətin nisbiliyi və bu nisbiliyin doğurduğu koqnitiv çoxmənalılıq.

3. Qeyri-səlis münasibətlər və qeyri-səlis məntiq

3.1. Qeyri-səlis münasibətlər. Lütfi Zadə "Qeyri-səlis çoxluqlar" (Fuzzy sets) məqaləsində qeyd edir ki, real fiziki aləmdə çox hallarda elə obyektlər sinfi ilə rastlaşırıq ki, mənsubiyyət dəqiq müəyyənlik kriteriyasına malik deyildir. Nümunə göstərir: məsələn, heyvanlar sinfinə elementləri qismində, aşkardır ki, itlər, atlar quşlar və s. daxildir, amma daş, bitki və s. bu qəbildən olanlar isə daxil deyildir. Amma bakteriyalar, dəniz ulduzları və s. bu kimi obyektlər isə heyvanlar sinfinə münasibətdə qeyri-müəyyənlik statusuna malik olur. Lakin bu kimi qeyri-dəqiq təyin olunmuş obyektlər sinfinin insan təfəkküründə, xüsusilə, obrazların tanınması, informasiyaların verilişi və abstraksiya sahələrində mühüm rolə malik olduğu bir faktdır [9]. Ümumiyyətlə, informasiyanın idrak subyektində yaratdığı natamamlıq, qeyri-dəqiqlik tədqiqat obyektinə münasibətdə qeyri-müəyyənlik doğurur. Bu tip qeyri-müəyyənliklər elmi ədəbiyyatlarda, əsasən, linqivistik (qeyri-səlis) qeyri-müəyyənlik kimi təsnifatlaşdırılır. Linqivistik qeyri-müəyyənliyin qiymətləndirilməsi isə qeyri-səlis çoxluqlar (QSÇ), qeyri-səlis məntiq (QSM) və bu nəzəriyyələr əsasında formalaşmış digər elmi aparatların göməyi ilə həyata keçirilir. Bu tip qeyri-müəyyənliklər isə obyektə münasibətdə qeyri-səlis münasibətlər doğurur.

Qeyri-səlis münasibətlər bir-birinin əksi olan müləhizələr (tezis və antitezis) arasında tam sərhədlərlə ayrılması mümkünə (aralıq vəziyyətlər kəsilməz: qeyri-səlis) və dəqiq müəyyənlik kriteriyasına malik olmayan aralıq vəziyyətlərin bir-biri ilə əlaqəsini ifadə edən münasibətlərdir. Məsələn: Gənc və qoca insan arasında müxtəlif aralıq vəziyyətlər: çox gənc, qismən gənc, qismən qoca, çox qoca və s. Ucuz və baha məhsul arasında aralıq vəziyyətlər: nisbətən ucuz, çox ucuz, qismən baha, çox baha, lap çox baha və s.

Qeyri-müəyyənlik şəraitində obyektə münasibətdə yaranan qeyri-səlis münasibətlər qeyri-səlis çoxluqlar nəzəriyyəsinin və qeyri-səlis məntiqin (qeyri-səlis münasibətlərin məntiqi qiymətləndirilməsi və bu kontekstdə məntiqi nəticələrin alınması) əsasını təşkil edir. Qeyri-səlis çoxluqlar nəzəriyyəsi idrak subyektivliyini özündə etivə edən və qeyri-müəyyənliyin, qeyri-səlis informasiyaların ciddi riyazi təsvirini

verən bir elmi aparatdır. Qeyri-səlis məntiq nəzəriyyəsi qeyri-səlis çoxluqlar nəzəriyyəsi əsasında formalaşmış və elmi, elmi-texnoloji və həyatın digər müxtəlif sahələrində məntiqi nəticələrin alınmasında istifadə olunan elmi aparat olub, bir-birinə əks iki mülahizənin aralıq vəziyyətlərinin həqiqilik (doğruluq) qiymətlərini müəyyənləşdirən çoxqiymətli məntiq konsepsiyadır.

3.2. Qeyri-səlis məntiq. Tədqiqat işinin konteksinə uyğun olaraq qeyri-səlis çoxluq anlayışının təyini daxil edək:

X – univesal çoxluq, x isə onun elementidir. Aşağıdakı kimi təyin olunmuş A çoxluğu qeyri-səlis çoxluq adlanır:

$$A = \{ (x, f_A(x)) / x \in X, f_A: X \rightarrow [0, 1] \},$$

burada, $f_A(x)$ – A çoxluğunun mənsubiyyət (xarakteristik) funksiyası olub, X çoxluğundan olan hər bir x elementinin A -ya daxil olma dərəcəsini ifadə edir və $[0, 1]$ kəsilməz (kontinuum) çoxluğundan qiymətlər alan ədədi funksiyadır; $(x, f_A(x))$ – X çoxluğunun elementləri ilə (x) onlara uyğun mənsubiyyət funksiyalarının $(f_A(x))$ nizamlı cütliyüdür.

Qeyri-səlis çoxluğun verilmiş təyini [9] nəyi ifadə edir: çoxluğun hər bir elementi çoxluğa müəyyən dərəcə ilə daxildir (bu, mənsubiyyət funksiyası vasitəsilə ifadə olunur). Yəni bu çoxluq formal məntiqə əsaslanmır. Aristotelin 3-cü məntiq qanununa (Üçüncünün istisna qanunu) görə, irəli sürülən mülahizə doğru deyilsə, demək, onun tərsi doğrudur. Klassik çoxluqlar nəzəriyyəsi də bu məntiqə əsaslanır: element çoxluğu ya daxildir, ya da daxil deyil [7]. Lakin QSÇ nəzəriyyəsi elementin çoxluğa dərəcə ilə daxil olması konsepsiyasını irəli sürməklə, mənsubiyyət anlayışını mənsubiyyətin dərəcəsi ilə əvəz etmiş oldu və kəsilməz çoxqiymətli – qeyri-səlis məntiqin əsasını qoydu [10]. Klassik - ikili məntiqə görə, hər hansı bir mülahizənin doğruluq (tezis və antitezisi) səviyyəsini iki məntiqi qiymət müəyyən edir: doğru (tezis) – 1; yanlış (antitezis) – 0. Bu məntiq “ya-ya” seçiminə əsaslanır. Irəli sürülən mülahizə ya doğrudur, ya da yanlışdır. Lakin çoxqiymətli məntiq isə tezis və antitezis arasında məntiqi qiyməti kəsilməz (fasiləsiz) sonsuz intervala çevirdi: $[0; 1]$. Çoxqiymətli məntiqdə mənsubiyyət funksiyası mülahizənin doğruluq qiyməti olaraq interpretasiya olunur və artıq qeyd olunduğu kimi, $[0; 1]$ intervalından kəsilməz sonsuz (kontinuum) qiymətlərə malik olur. Bu məntiq “əgər-onda” seçiminə əsaslanmaqla irəli sürülən mülahizə ilə onun tərsi arasında çoxlu aralıq vəziyyətləri qiymətləndirməyə imkan verir. Çoxqiymətli məntiq, bir növ, qeyri-müəyyənlik şəraitində həqiqət anlayışını qismən həqiqət anlayışı ilə əvəz etməklə məntiqi qiymətləndirmə konseptini genişləndirmiş oldu. İkili məntiqdən fərqli olaraq gənc olmayan insanı yaşlı, ucuz olmayan məhsulu baha, soyuq olmayan temperaturu isti kimi qiymətləndirmir, onlar arasında qeyri-səlis (kəsilməz - aramsız) keçidin yaratdığı sonsuz vəziyyətləri xarakterizə edən hər bir keyfiyyət göstəricisinin dərəcəsi ilə mümkünliyünü nəzərə alır: gənc deyilsə, nə dərəcədə gənc deyil və nə dərəcədə yaşlıdır – ortayaşlıdır, yaşlıdır, çox yaşlıdır, lap çox yaşlıdır və s. Yəni bir mülahizənin doğruluq səviyyəsi sonsuz kəsilməz məntiqi qiymətlər ala bilər və aldığı məntiqi qiymətlərdən asılı olaraq müxtəlif doğruluq dərəcəsinə malikdir [4; 10]. Bir mülahizənin doğruluq dərəcəsi azaldıqca qeyri-səlis olaraq onun tərsinə keçid baş verir və tərsinin doğruluq dərəcəsi artır. Bu isə hər mülahizənin (tezisin) onun əksi olan mülahizəni (antitezisi) müəyyən dərəcə ilə özündə (saxlamasıdır) ifadə etməsidir; yaşlılığın dərəcəsi azaldıqca, onun əksinin – gənc olmanın dərəcəsi artır və yaxud əksinə. Deməli, hər bir varlıq öz əksini müəyyən dərəcəsi ilə özündə saxlayır və onun üçün əsas rolunu oynayır. Konteksimizə uyğun olaraq Əl-Fərabinin bu fikrini xatırlamaq yerinə düşür: Ağın olması qaranın yoxluğu deyil. Hər əksilikdə digər tərəfin əsası qoyulur və varlıq bir əksilikdən tədricən başqasına keçir.

Deməli, QSM nəzəriyyəsi bir çox elmi-praktik sahələrdə (qeyri-səlis modellərin qurulmasında) və eyni zamanda elmi-fəlsəfi dərkətmədə, problemə epistemoloji aspektdə yanaşmalarda irəli sürülən mülahizələri daha adekvat məntiqi qiymətləndirməyə (çoxqiymətli məntiqə) imkan verir. Yəni bu nəzəriyyə tezis və antitezis arasında aralıq vəziyyətlərin, kəsilməz – fasiləsiz məntiqi qiymətləndirməsini həyata keçirən elmi aparatdır. Məsələn, bu çoxqiymətli məntiq nəzəriyyəsi məntiqi qiymətləndirmədə soyuq temperaturdan istiyə, cavan yaşdan qocaya, ucuz qiymətdən bahaya və s. bir-birinə zidd göstəricilər arasında keçidin, yuxarıda qeyd olunduğu kimi, bütün kəsilməz sonsuz (kontinuum) vəziyyətini nəzərə almağa və riyazi təsvirini yaratmağa imkan verir. Bu məntiqi qiymətləndirmədə subyektiv epistemologiya idrak obyektinin daha çox keyfiyyət göstəricilərini nəzərə ala bildiyindən qurulan uyğun modellərin daha çox adekvatlığını təmin edir.

4. Ekzistensializm qeyri-səlis münasibətlər (qeyri-səlis məntiqi təfəkkür modeli) kontekstində

Artıq qeyd etdik ki, qeyri-müəyyənlik şəraitində tədqiqat obyektinə, ümumiyyətlə, bütün hadisə və predmetlərə çoxqiymətli məntiqi münasibət idrak subyektinə daha adekvat düşüncə modelidir. Əsasında hadisə və predmetlərə qeyri-səlis münasibətlər dayanan bu düşüncə modelinin təsir obyekti çoxspektirli olduğundan mədəniyyət sahəsindən də yan keçmir. Reallığa münasibətdə subyektiv

epistemologiyaya söykənən çoxqiymətli məntiqi düşüncə tərzinin spektirlərini tədqiqat obyektivimiz olan ekzistensializmlə yanaşı, mədəniyyət sahəsində xüsusi çəkisi olan fenomenologiya, postmodernizm kimi fəlsəfi istiqamətlərin təlimlərində də aydın sezmək mümkündür.

Ekzistensializmə xas yuxarıda qeyd etdiyimiz tezislər əsas verir ki, idrak subyektinin hadisə və predmetlərə münasibətdə ekzistensial düşüncə təzi ilə çoxqiymətli məntiqi təfəkkür modeli arasında analogiyanın olduğu fikrini irəli sürək. Ekzistensializmə məxsus qeyri-müəyyənlik, subyektivlik, sərhəd kəsilməzliyi, mütləqin nisbiliyi kimi xüsusiyyətlər qeyri-səlis məntiq modelinin riyai-məntiqi təsvirini verdiyi göstəricilərdir. Bu məntiq modelində qeyri-müəyyənlik şəraitində yalnız "qismən həqiqət" kriteriyası mövcuddur. QSM qeyri-müəyyənlik şəraitində həqiqət anlayışını qismən həqiqət anlayışı ilə əvəz edərək, doğruluq qiyməti konseptini irəli sürür. Ekzistensializm mütləqə çatmağın absurd olduğu və həqiqətin nisbiliyi tezislərini irəli sürür. Qeyri-səlis məntiqi qiymətləndirmə kontekstində bu tezisləri subyektiv olaraq bu şəkildə təsvir edə bilərik: həqiqət qeyri-mümkün olanla (məntiqi qiymət: 0 - yanlış) mütləq (məntiqi qiymət: 1 – həqiqət) arasında çoxvəziyyətli perspektivlərə (məntiqi qiymət: (0,1)) malikdir. İnsanın həyatı seçiminə, öz identikliyinə təyininə qədər qeyri-müəyyənlik mövcuddur – onun həyat ssenarisini müəyyənləşdirən heç bir mütləq norma yoxdur; ekzistensializmin gəldiyi qənaətdir. QSM qeyri-dəqiqlik, natamamlıq xüsusiyyətlərinə malik qeyri-səlis qeyri-müəyyənliyi öyrənən, onun həqiqilik dərəcəsini qiymətləndirən elmi-aparatdır. Qeyri-səlis təfəkkür modelində obyektə qeyr-səlis münasibətdə idrak subyektivliyi epistemoloji müstəvinə genişləndirib, obyektin ontoloji strukturundan daha çox göstəricilər əldə edərək "subyekt zənginliyini" təmin etmiş olur [8]. Ekzistensial düşüncə insan təcrübəsinə, hisslərinə - individuallığa üstünlük verib, onun seçim azadlığında idrak subyektini önə çıxarır.

Göründüyü kimi, hər iki düşüncə modeli reallığa qeyri-səlis münasibətlər sistemi formalaşdırır. Reallığa "ya-ya" seçiminə əsaslanan ikili məntiqlə deyil, "əgər-onda" seçiminə əsaslanan çoxqiymətli (çoxmənalı) məntiqi təfəkkürü ilə yanaşır. Gənc və yaşlı, isti və soyuq, bəla və ucuz, gözəl və çirkin, dost və düşmən, həqiqət və yalan və s. bir-birinə zidd keyfiyyət göstəriciləri arasında çoxvəziyyətli paradigma və sərhəd kəsilməzliyi (bir vəziyyətdən digərinə keçidin səlis olmayan xüsusiyyəti) çoxqiymətli məntiq təfəkkür modelinə əsaslandığı kimi, ekzistensial düşüncənin də obyektə eyni təfəkkür modeli ilə yanaşdığını müşahidə edirik. Çünki, qeyd etdiyimiz kimi, qeyri-səlis təfəkkür modeli idrak subyektinə daha adekvat düşüncə modelidir; bu düşüncə modelində istər empirik, istər rəşional yanaşmalarda tezis və antitezis arasında aralıq vəziyyətlərin nəzərə alındığı situasiyalar çoxluq təşkil edir. Beləliklə, hesab edirik, ekzistensializmin qeyri-səlis münasibətlər kontekstində çoxspektirli tətbiq imkanlarına malik QSM vasitəsilə epistemoloji təhlili ekzistensial düşüncə və qeyri-səlis məntiqi təfəkkür arasında da korrelyasiyanın mövcudluğunu təsdiq etmiş olur.

4.1. Altmövzu: Özünüyaratma sənəti

Postmodern və ekzistensial düşüncə tərzini qeyri-səlis çoxluqlar və qeyri-səlis məntiq nəzəriyyələrinin əsasında formalaşan təfəkkür modeli kontekstində araşdırarkən fenomenologiya, ekzistensializm, postmodernizm arasında kifayət qədər oxşar tezislər məni də insan varlığının mənası üzərində dayanmağa sövq etdi və tədqiqat işinin nəticəsi olaraq yaranan bəzi refleksiyalarımı Özünüyaratma sənəti adlı konsepsiya şəklində təqdim etmək qərarına gəldim.

Yuxarıda qeyd edilən hər üç cərəyanın mövcudluğa verdiyi üstünlük və insan individuallığı və identikliyinə ona seçim azadlığı verməsi ideyasını aşılamaq hadisələrə olan münasibəti çoxçalarlıdır. Situasiyadan asılı olaraq mütləq (ideal) olanı yox, mütləq (ideal) olanla onun tərsi (əksi) arasında mövcud vəziyyətləri qəbul etməyi doğru sayır. Universal – ümumi xarakter daşıyan ideal insan cəmiyyəti aşılamanı hümanist ideyalar çökür, əvəzində reallığa ayr-ayrı, müxtəlif, çoxmənalı yanaşmalar meydana sulayır: insan vəziyyətdən asılı olaraq nəyin yaxşı, nəyin pis olduğunu özü müəyyənləşdirə bilər - əsas və doğru olan da elə budur.

Mütləq olandan yan keçmək, hadisələrin şərtiliyinin, nisbiliyinin - qeyri-müəyyənliyinin qəbul edilməsi, doğru və yalanı (həmçinin bütün bir-birinin tərsini (əksini) təşkil edən keyfiyyət göstəricilərin: yaxşı və pis, gözəl və çirkin, ədalət və ədalətsizlik...) qiymətləndirmənin situasiyadan asılı olaraq müəyyən dərəcəsi ilə ifadə tendensiyası hadisələrə qeyri-səlis münasibətlər doğrurmaqla insan düşüncəsinə daha adekvat düşüncə təzi olaraq qeyri-səlis (çoxqiymətli məntiqi) təfəkkür modelinin araşdırma predmetidir.

Özünü seçmə. Sartra görə, insanlar mövcudluğa eyni qaydada atılırlar və onlar üçün kim olmağı, nəyi və necə etməli olduğunu təsdiq edən heç bir norma, ideya yoxdur. Yəni insan üçün əvvəlcədən müəyyənləşdirilmiş heç bir həyat ssenarisi mövcud deyil. Nəyi necə etməli olduğunu insan özü seçməlidir və bu seçimdə azaddır. Filosof-yazıçının fikirlərini ümumiləşdirsək mövzumuza uyğunluğunu nəzərə alıb,

onun bu konsepsiyasına üstünlük verirəm: İnsan özünü özü seçir.

Əslində, bu yanaşmanı hadisələri olduğu kimi təsvir etməyə səsləyən fenomenologiya, mövcudluq fəlsəfəsi adlanan ekzistensializm və ardınca posmodern düşüncənin gəldiyi qənaət olaraq da ümumiləşdirmək olar. Çünki hər üç vəsəfi təlim öz konsepsiyasında hadisələrin real (olduğu kimi mənasında) təsvirini, o cümlədən insan varlığını, onun mənasını, bu varlığın fərdiliyini və düşüncə azadlığını əsas götürür. Deməli, insan həyatına məna və mahiyyət bəxş edən öncə onun özü özünü seçimi üzərində başlayır və bu seçim əməli fəaliyyətin perspektivlərini doğurur.

Etiraf edirəm ki, özünü yaratma konsepsiyam bu kimi düşüncə sistemlərinin doğurduğu müəyyən məqamlardan başladı. Onu da etiraf edirəm ki, yazdığım mətnlərin bir qismini xarakter və üslubundan asılı olmayaraq (elmi, elmi-publisistik, bədii və s.) zəngin fikir daşıyıcısı olan mətnlər üzərində dekanstruksiya etməyi sevirəm və bu mətnləri digər sambalı mətnlərin tərkib hissəsi olaraq intertekstual hesab edirəm.

Özünü tanıtmə

İnsan özünü seçir və kim olmağı özü qərar verir. Kim olmaq isə əqli qərardan başlayan bir prosesdir. Elə bu prosesin gedində də "özünü qurma" hadisəsi başlayır və hər hansı münasib və uyğun bir məqamda isə özünü yaratma anı baş verir. Bəzən fərd bunun fərqiində olur, bəzən yox. Bütün bunlara rəğmən insan daima cəmiyyətə məxsus olmaqla sosiomədəni mühitdədir. O özünü ifadə etməyə və digərləri tərəfindən qiymətini almağa can atır. Bu isə özünü tanıtmədir. Hegelin təbirincə, iki subyektin qarşılaşması zamanı tanınma və etiraf edilmə uğrunda mübarizə başlayır və bu, "ölüm-dirim" mübarizəsidir; hər kəs istəyir ki, başqası onu özü özünü seçdiyi kimi tanısin və etiraf etsin. Konteksə uyğun olaraq burada fiziki mübarizəni kənara qoyub (hərçənd bu mübarizə də "etiraf edilmə" uğrunda mübarizədir), etik-estetik, əqli-intellektual və s. göstəricilərin yaratdığı mədəni sferada baş verən mübarizəyə önəm verirəm. Bir qədər dərinə getsək müşahidə edə bilərik ki, özünüifadə, özünütanıtma, etiraf edilmə uğrunda "ölüm-dirim" mübarizəsi bütün canlılara məxsus mübarizədir. Əqli-intellektual göstəricilərlə silahlanmış insan üçün isə sosial-mədəni mühitin nümayəndəsi olaraq özünü tanıtmə və etiraf edilmə uğrunda mübarizə iradəsindən asılı olmayaraq qaçılmazdır.

Özünü yaratma

Məntiqi olaraq özünü yaratma özünü seçmədən sonra başlayan və özünü tanıtmə ilə müşahidə olunan fenomendir. Əvvəl insan kim olması barədə qərar verib həyat ssenarisini müəyyən edir. Ardınca o ssenari əsasında əməli fəaliyyətə başlayır.

Deməli, özünü yaratma özünü seçmədən sonra sosial mahiyyət daşıyan özünü tanıtmə ilə xarakterizə olunur ki, bu baş vermədikdə özünü yaratma və buna təkan verən həyat seçimi – kim və necə olmaq, həmçinin bu seçimin nəticəsi olan fəaliyyətin bir önəmi qalmır. Çünki fərdin mahiyyətinin tanınması və etirafı onun varlığı kimi atıldığı zaman-məkan müstəvisinin doğurduğu sosial və mədəni mühitdən kənarda mövcud ola bilməz.

Hesab edirəm bu barədə düşünən hər kəsin əməli fəaliyyətindən asılı olmayaq bu təcrübəni özünü yaratma konsepsiyası olaraq qəbul etməsi heç də faydasız olmazdı.

Nəticə

Elmi sahələrdə və fəlsəfi düşüncədə baş verən fundamental dəyişiklik və yeniliklərin müxtəlif sahələrə, o cümlədən mədəniyyətə transformasiyası bu sahələrdə yeni paradigmalara yaranmasına səbəb olur. Bu paradigmalara isə yeni forma və məzmun kəsb edərək fərqli idraki generasiyada təzəhür edir. Məlumdur ki, QSC nəzəriyyəsi və onun əsasında formalaşan kəsilməz çoxqiymətli məntiq konsepsiyası olan QSM nəzəriyyəsi subyektivliyi, qeyri-müəyyən informasiyanı nəzərə alaraq formalaşmış ciddi riyazi-məntiqi aparatlardır. Qeyri-səlis (linqivistik) qeyri-müəyyənlik şəraitində tədqiqat obyektinə, ümumiyyətlə, bütün hadisə və predmetlərə çoxqiymətli məntiqi refleksiyalar koqnitiv baxımdan idrak subyektinə daha adekvat təfəkkür modelidir. Əsasında hadisə və predmetlərə qeyri-səlis münasibətlər dayanan bu elmi aparatların təsir obyekti çoxspektirli olduğundan mədəniyyət sahəsindən də yan keçmir. Bu kontekstdə elmin çoxqiymətli məntiq konsepsiyası ilə ekzistensial düşüncə sistemi arasında müəyyən korrelyasiyanın mövcudluğu ehtimalı yüksəkdir. Mövcud əlaqənin olduğunu nəzərə alaraq ekzistensializmin QSM nəzəriyyəsi kontekstində qnoseoloji araşdırılmasının və alınan epistemoloji nəticələrin elmi yenilik baxımından əhəmiyyətli olduğu qənaətinə gəlməliyik. Hesab edirik, ekzistensial düşüncə sisteminin idrak subyektinin obyektə münasibətdə qeyri-səlis təfəkkür modelinə uyğunluğunun epistemoloji olaraq əsaslandırılması mədəniyyətin bir çox sahələrində, həmçinin fəlsəfi fikir tarixində obyektə (varlığa) qeyri-səlis münasibətlərin epistemoloji araşdırılması üçün metodoloji baza rolunu oynaya bilər.

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Technical sciences

DEVELOPMENT OF THE COMPOSITION AND STUDY OF THE MAIN PROPERTIES OF DRY CONSTRUCTION MIXTURES BASED ON BARITE

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Abstract

Special-purpose dry mixes are powdered construction materials formulated based on various mineral components and functional additives to meet specific functional and technological requirements. These mixtures are intended for use under certain conditions (e.g., high temperature, humidity, chemical exposure, or radiation resistance). When mixed with water or other active liquids, they become ready for application, exhibiting high mechanical strength, adhesion, and resistance to water, frost, acid, and other impacts.

The results show that the compressive strength of gypsum-based dry mixes with the addition of barite and other additives ranged between 4.9 and 5.3 MPa. This range does not significantly differ from the compressive strength limits of special-purpose dry mixes under normal conditions. Additionally, the activity concentration indices of these samples were 0,037 and 0,048. Since the effective activity of the "Hardened Gypsum Mixture" samples is below 370 Bq/kg and the activity concentration index I_{γ} meets Class I criteria, these materials can be used without limitation in residential buildings in terms of radiation safety.

Keywords: construction materials, mixtures, gypsum, perlite, barite, radiation resistance

In recent years, significant progress has been observed in the construction sector both globally and in Azerbaijan. The wide range of various construction materials used enhances the quality of construction works and creates new opportunities. The materials used are mainly divided into two categories: naturally obtained and artificially produced. Especially the composition and physical-mechanical properties of artificial materials must be carefully studied during production and application stages to ensure their effective and appropriate use [1].

The demands for materials in modern construction — such as quality, durability, high compressive strength, and other indicators — are increasing every day. The advantages of gypsum-based construction materials — their relatively light weight, high thermal and sound insulation capacity, and ease of processing — have enabled their widespread application [2-5].

The technological progress of dry mixtures is closely related to improving the quality of chemical modifiers and mineral fillers used in their composition. Chemical additives enhance the physical-mechanical properties of the mixtures, expand the fields of their application, and increase the efficiency of construction works. Azerbaijan's natural mineral resources, especially the use of local raw materials in dry construction mixtures, play an important role in strengthening the country's economic independence. The application of dry mixtures has led to the emergence of new technologies in the construction field and ensured rapid development in this area [6-9].

Unlike traditional technologies, dry construction mixtures can be applied both in thick layers and in thin layers ranging from 0.7 to 7 mm. As a result of applying this technology, labor productivity has increased by 1.5 to 5 times, while material consumption has decreased by 3 to 10 times. The efficiency of using dry mixtures directly depends on the nature of the work performed and the level of mechanization during the preparation and application of these mixtures.

Additionally, dry mixtures can be stored for a long time (up to 6 months according to relevant technical standards — GOST 28013-98 and GOST 7473-95) without changing their physical and chemical properties.

The use of dry mixtures provides the following advantages:

Indicator	Traditional Method	Dry Mixtures
Application Thickness (mm)	≥ 10	0.7–7
Increase in Labor Productivity	–	1.5–5 times
Reduction in Material Consumption	–	3–10 times
Storage Period (under favorable conditions)	≤ 1 month	Up to 6 months
Mechanization Possibilities	Limited	High

The effectiveness and technological indicators of dry construction mixtures depend not only on the main components but also directly on the correct selection and appropriate dosage of additional additives. These components serve to optimize important properties of the mixture such as plasticity, setting time, adhesion strength, water resistance, and thermal insulation.

Depending on the area of application, gypsum-based products are regulated by international standards — for example, EN 13279-1:2014 (gypsum-based dry mixtures), EN 520:2021 (gypsum plasterboards), and ASTM C28 (construction gypsums). These standards define the quality indicators and conformity levels of the products.

Barite is used as a high-density mineral filler in dry mixtures. It is an inert substance containing barium sulfate and finds application in various functional fields. The following main technical specifications are accepted for barite used in construction:

Indicator	Standard (API / ASTM / GOST)	Note
BaSO ₄ Content (mass %)	$\geq 90\%$ (API 13A, Class 7)	High purity required
Density (g/cm ³)	≥ 4.2 (ASTM D854, GOST 4682-84)	High density provides protective properties
Moisture (%)	≤ 1.0 (ASTM C566, GOST 8735-88)	Should not affect mixture quality
Particle Size (μm)	$\leq 75 \mu\text{m}$ (ASTM C136 / GOST 6613)	For homogeneous dispersion
Water-Soluble Salts (%)	≤ 1.0 (ASTM D1125)	Chemical stability is important

Methyl Cellulose (MC) — a cellulose-based, synthetic, water-soluble modifying additive. It significantly improves the technological and physical properties of dry mixtures. Although added in relatively small doses (usually 0.2–0.6%), it has a significant effect on the plasticity, workability, and water retention time of the mixture. Dry construction mixtures containing methyl cellulose additives must comply with standards such as EN 998-1, EN 12004, ASTM C472, and GOST 31357-2007.

Tartaric Acid — a naturally derived, colorless crystalline dibasic carboxylic acid that dissolves well in water and is mainly used in dry mixtures as a set-retarding additive. It is applied to control the setting process in gypsum- and cement-based mixtures.

Main effects:

- Delays the start of the reaction;
- Extends the working time;
- Reduces the risk of surface cracking.

Natural tartaric acid dissolves completely in water, improves flowability at low doses, creates plasticity, and simultaneously reduces the porosity of the mixture, thereby improving surface quality.

Defoamers and Foaming Agents play an important role in regulating the technological and functional properties of dry construction mixtures. These chemical additives significantly influence the structure, density, thermal and sound insulation, as well as durability of the mixtures. Although these two components have opposite functions, both are important for modifying dry mixtures.

Defoamers prevent the formation of unwanted air bubbles or eliminate existing foam in the mixture. They are primarily used to improve the homogeneity and mechanical strength of the mixture. These additives are especially important in highly flowable mixtures such as self-leveling floor compounds, plasters, and waterproofing solutions.

Key properties:

- Prevent air bubble formation in the mixture;
- Increase strength by reducing air voids;
- Improve water resistance and mechanical durability.

Foaming Agents are used to create a large number of air bubbles in the mixture. This mainly aims to enhance thermal insulation and lightness. They are widely used in the preparation of foamed concrete, lightweight plaster, and thermal insulation materials.

Key properties:

- Used to increase thermal and sound insulation;
- Provide a cellular structure to the mixture;

- When used together with perlite, the effect is doubled.

Slaked Lime (Ca(OH)_2) is one of the main binders widely used in construction materials. It is obtained by hydrating quicklime (CaO), which in turn is produced by calcining natural limestone (CaCO_3) at high temperatures.

The main technical and operational properties of slaked lime depend on its chemical composition and preparation technology. With a pH level between 12 and 13, it creates a strongly alkaline environment that inhibits microorganism growth.

Main effects of slaked lime:

- Has antibacterial and antifungal properties;
- Increases plasticity and workability;
- Maintains stable pH level (alkaline environment);
- Positively affects strength through carbonation.

Perlite — a volcanic-origin, expanded lightweight inert mineral filler, mainly consisting of silicon dioxide (SiO_2) and aluminum oxide (Al_2O_3). It is used in construction to improve thermal and sound insulation. Additionally, perlite's water absorption capacity ranges between 200–400%, and its pH level is neutral to slightly alkaline, making it compatible with various binder systems. Perlite is resistant to moisture and biological damage, providing long-term durability.

Main advantages:

- Lightweight (density: 30–150 kg/m^3);
- Low thermal conductivity;
- High porosity and breathability;
- Fire resistance.

Role in dry mixtures: Used for thermal insulation in plasters and lightweight structural materials. Its combined use with foaming agents allows the creation of lightweight and insulating systems.

Laboratory-prepared dry mixture samples were produced to determine the properties of dry mixtures. The mixtures were mixed with water to create a homogeneous mix. First, the spreadability of the prepared mixtures was examined, then samples were molded using molds measuring 40x40x160 mm. The mold walls were cleaned and coated with a thin layer of oil. Three samples were prepared from each mixture. The gypsum mixture was poured into the mold to one-third full, compacted on a vibration table, and the process continued until the mold was completely filled. The surface of the mixture was leveled to be flush with the edges of the mold.

In the experiments, gypsum-based dry mixtures were supplemented with barite, cellulosic additives, tartaric acid, perlite, slaked lime, defoamers, and foaming agents. The compositions of the prepared samples (tests numbered 4, 5, and 8) are listed below.

Test No.	Names of Raw Materials (in grams)							
	Gypsum	Barite	Cellulosic additive	Tartaric asite	Perlite	Defoamer	Foaming agent	Slaked lime
I	900.35	63	3	1	20	0.35	0.3	12
II	883.35	80	3	1	20	0.35	0.3	12
III	863.35	100	3	1	20	0.35	0.3	12

The samples were kept at room temperature for one day, then removed from the molds and stored in a drying oven for 14 days. After drying, the compressive and flexural strength limits of the samples were determined. Below are the compressive and flexural strength limits of the samples prepared according to two recipes.

Test sample number 4

Strength limit			
Bending		Compression	
kn	mpa	kn	mpa
1	2,29	8,15	5,345

Test sample number 5

Strength limit			
Bending		Compression	
kn	mpa	kn	mpa
0,7	1,67	6,25	4,905

Additionally, several of these samples were submitted to the "AzStandlab Sanitary-Industrial Laboratory" to measure their radiation resistance and were tested. The samples were tested at 24.5°C under a pressure of 762 mmHg. The following devices were used during the analysis:

1. Alpha Spectrometer (Ortec)
2. HPGe Spectrometer (Ortec)

3. Isotopic ICP-MS (ThermoFisher)

As the results show, the use of barite raw material in gypsum mixtures caused almost no change in A_{eff}

Radioactivity Analysis of Hardened Gypsum Solutions

Internal Code		ASL0068	ASL0069	ASL0070
Customer Code		4	5	8
Sample Description		Hardened Gypsum Solution	Hardened Gypsum Solution	Hardened Gypsum Solution
Radionuclide	Unit			
K-40	Bq/kg	46.1 ± 3.3	44.9 ± 6.0	34.6 ± 5.5
Cs-137	Bq/kg	MDA = 0.7	MDA = 1.54	MDA = 1.5
Ra-226	Bq/kg	3.2 ± 0.3	5.0 ± 0.7	1.8 ± 0.5
Th-232	Bq/kg	2.2 ± 0.3	3.3 ± 0.9	2.4 ± 0.4
A_{eff}	Bq/kg	10.0 ± 0.5	13.1 ± 1.4	7.9 ± 0.8
I _γ - Activity Concentration Index		0.0370	0.0480	0.030
Material Class According to Irradiation		I	I	I

(Effective Activity) and I_{γ} (Activity Concentration Index). According to the requirements of the AZS 535–2011 national standard, construction materials used without restrictions in newly built or renovated residential and public buildings must have an effective activity (Class I) not exceeding 370 Bq/kg. The specific effective activity of natural radionuclides (NRN) — taking into account their biological effect on the human body — is determined by the formula:

$$A_{eff} = A_{Ra} + 1,31 A_{Th} + 0,085 A_K$$

The combined specific activity of natural radionuclides (NRN) in the material is determined by the formula, where A_{Ra} , A_{Th} , A_K are the specific activities of radium, thorium, and potassium, respectively, expressed in Bq/kg. The activity concentration index for construction materials produced for permanent use in residential and workplaces is calculated using the following formula:

Construction materials that satisfy the condition of the activity concentration index $I_{\gamma} \leq 1$ can be used without restrictions for permanent use in residential and workplace buildings. As a result, natural radionuclides such as radium (^{226}Ra), radium (^{228}Ra), thorium (^{232}Th), potassium (^{40}K) were detected in the presented samples of the "Hardened gypsum mortar" construction material. The effective

$$I_{\gamma} = \frac{A_{Ra-226}}{300 \text{ Bq/kg}} + \frac{A_{Th-232}}{200 \text{ Bq/kg}} + \frac{A_{K-40}}{3000 \text{ Bq/kg}}$$

activity of the "Hardened gypsum mortar" samples with respect to natural radionuclides is less than 370 Bq/kg, and since their activity concentration index I_{γ} meets the required limit, these materials belong to Class I in terms of radiation safety. Therefore, they can be used without restrictions as construction materials inside residential buildings from the viewpoint of radiation safety.

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