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# BOTANY

## USE OF HERBAL MEDİCİNES İN THE CONTROL OF HİGH BLOOD PRESSURE

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**Abstract**

Traditional medical systems encompass diverse ethnopharmacological practices that predate modern biomedical science and have been preserved for centuries as vital components of community health care. Medicinal plants constitute a major source of bioactive compounds used in preventing and managing cardiovascular disorders resulting from dysfunctions of the heart and vascular system, including hypertension, ischemic heart disease, and heart failure. Persistent high arterial pressure impairs myocardial performance, induces endothelial dysfunction, and accelerates atherosclerosis, thereby increasing the risk of stroke and myocardial infarction. Although numerous classes of synthetic antihypertensive agents—such as ACE inhibitors, beta-blockers, calcium channel antagonists, and diuretics—are available, their clinical use is frequently limited by adverse effects. In contrast, medicinal plants contain phytochemicals such as alkaloids, flavonoids, and terpenoids with vasodilatory, diuretic, antioxidant, and cardioprotective properties. Therefore, phytotherapeutic agents represent promising alternatives or adjuncts in the management of hypertension. This review highlights selected medicinal species with documented antihypertensive efficacy supported by experimental and clinical findings.

**Keywords**: Ethnomedicine; Herbal therapy; Control of hypertension; Cardiovascular disorders.

### Introduction

Cardiovascular diseases are a leading cause of disability and premature death worldwide, posing a significant public health challenge. High blood pressure, often termed the “silent killer,” results from complex interactions between genetic and environmental factors that impair normal vascular regulation. Hypertension is the most common risk factor for acute myocardial infarction and accounts for approximately 16.5% of global deaths annually. By 2025, it is estimated that nearly 29% of adults—about 1.56 billion people—will be affected by hypertension. Clinically, hypertension is defined as systolic blood pressure (SBP) ≥140 mmHg and diastolic blood pressure (DBP) ≥90 mmHg, based on the average of at least two accurate seated measurements (1).

Various pharmacological agents, including diuretics, ACE inhibitors, calcium channel blockers, β-adrenergic antagonists, and vasodilators, are widely used to manage hypertension. However, these drugs are often associated with side effects such as fatigue, dizziness, muscle cramps, arrhythmias, renal dysfunction, and edema. These limitations have fueled interest in alternative therapies, including herbal-based treatments, which are used by 75–80% of the global population, particularly in developing countries, due to their affordability, accessibility, and better tolerance.

Medicinal plants contain diverse bioactive compounds that can regulate blood pressure and support cardiovascular health. Many plant-derived compounds have served as the basis for over half of modern pharmaceuticals. This review summarizes studies on medicinal plants with documented antihypertensive properties and highlights their potential in managing hypertension (table 1.).

Conventional antihypertensive medications are often accompanied by various side effects. As a result, research increasingly supports the integration of lifestyle interventions with the use of selected medicinal plants to manage elevated blood pressure. Certain bioactive secondary metabolites found in herbs and spices demonstrate notable antihypertensive activity. These herbal remedies typically lower and regulate blood pressure through multiple mechanisms, including antioxidant, anti-inflammatory, and anti-apoptotic effects, stabilization of endothelial barrier function, and stimulation of angiogenesis (1).

Nigella sativa, or black cumin, has long been used in traditional medicine for its diverse pharmacological effects. Scientific studies show that its bioactive compounds have significant antihypertensive potential. Clinical trials demonstrate that taking 100–200 mg/day of N. sativa seed oil for eight weeks can lower systolic and diastolic blood pressure by about 10 mmHg.

Its blood pressure–lowering effects are due to several mechanisms: relaxation of vascular smooth muscle by inhibiting calcium influx, diuretic action reducing blood volume, and antioxidant and anti-inflammatory properties that protect vascular function and reduce arterial stiffness (2).

Preclinical studies also suggest that N. sativa enhances nitric oxide bioavailability, improving vasodilation and vascular health. Overall, it offers a promising natural or complementary option for managing hypertension, particularly for individuals seeking alternatives to conventional drugs.

Carrot (*Daucus carota L.*) has been traditionally valued for its ability to lower blood pressure. It enhances endothelial function, regulates fluid balance, and provides antioxidants that protect blood vessels.

The potassium content also helps maintain normal vascular tone and electrolyte balance.

Research shows that carrot compounds such as DC-2 and DC-3 reduce arterial pressure in rats by inhibiting calcium channels, leading to vasodilation. These findings indicate that *Daucus carota* acts through several mechanisms to support cardiovascular health and may serve as a complementary therapy for hypertension (3).

Celery (*Apium graveolens*) has demonstrated strong potential in lowering blood pressure and improving cardiovascular health. Studies on hypertensive rat models show that celery seed extracts, especially the hexane-soluble fraction, significantly reduce systolic and diastolic pressure by lowering catecholamine levels and decreasing vascular resistance.

Its rich flavonoid content provides antioxidant and anti-inflammatory effects, protecting blood vessels from oxidative stress and endothelial damage. These combined actions—vasorelaxant, antioxidative, and anti-inflammatory—make celery a promising natural complement to conventional hypertension treatments. Further research is needed to clarify its mechanisms and determine effective clinical dosages (4).

Chinese sage (*Salvia miltiorrhiza*) is a traditional medicinal herb known for its strong cardioprotective and antihypertensive effects. It promotes vasodilation, reduces oxidative stress by enhancing antioxidant enzyme activity, and prevents vascular remodeling by inhibiting vascular smooth muscle cell proliferation (5).

Cinnamon (*Cinnamomum zeylanicum*) has shown strong potential in managing hypertension. Studies in animal models and patients with prediabetes or type 2 diabetes demonstrate that its bark extracts can significantly lower systolic blood pressure. This effect is linked to improved endothelial function, nitric oxide (NO) signaling, and activation of potassium ($K^+$ ATP) channels.

By enhancing NO bioavailability and promoting vasodilation, cinnamon helps regulate blood pressure and support vascular health. Overall, *C. zeylanicum* represents a promising natural adjunct for hypertension management, especially in individuals with metabolic risk factors.

Cocoa (*Theobroma cacao*) is rich in flavonoids that provide strong cardiovascular protection. By enhancing nitric oxide (NO) production, cocoa improves endothelial function, promotes vasodilation, and reduces oxidative stress.

Regular consumption of cocoa or dark chocolate (40–105 g daily) can lower systolic and diastolic blood pressure by about 5 and 3 mmHg, respectively. These effects highlight cocoa's potential as a natural supplement for managing hypertension and supporting cardiovascular health when included in a balanced diet (5).

Coriander (*Coriandrum sativum*) has long been used to treat cardiovascular conditions and shows strong antioxidant activity that supports vascular health. Experimental studies reveal that coriander seed extracts significantly reduce systolic, diastolic, and mean arterial pressure by blocking calcium channels, resulting in vasodilation (6).

Table 1.

Comparative Overview of Antihypertensive Effects of Selected Herbal Extracts

| Scientific Name | Main Effect | Mechanism of Action | Clinical/Experimental Outcome |
|---|---|---|---|
| Nigella sativa | Antihypertensive | Inhibits Ca2+ influx, diuretic action, antioxidant and anti-inflammatory effects, enhances NO bioavailability | ↓ SBP & DBP by ~10 mmHg (100–200 mg/day for 8 weeks) |
| Daucus carota L. | Antihypertensive | Inhibits Ca2+ channels, improves endothelial function, provides antioxidants, regulates fluid balance | ↓ Arterial pressure in rats |
| Apium graveolens | Antihypertensive | Lowers catecholamines, reduces vascular resistance, antioxidant and anti-inflammatory effects | ↓ SBP & DBP in hypertensive rats |
| Salvia miltiorrhiza | Cardioprotective, antihypertensive | Promotes vasodilation, reduces oxidative stress, inhibits vascular remodeling | Preclinical and clinical studies support effect |
| Cinnamomum zeylanicum | Antihypertensive | Improves endothelial function, enhances NO, activates $K^+$ ATP channels | ↓ SBP in prediabetic and diabetic patients |
| Theobroma cacao | Antihypertensive, cardioprotective | Enhances NO production, improves endothelial function, reduces oxidative stress | ↓ SBP by ~5 mmHg, ↓ DBP by ~3 mmHg |
| Coriandrum sativum | Antihypertensive | Blocks Ca2+ channels, antioxidant, diuretic effects | ↓ SBP, DBP, MAP in animal studies |
| Allium sativum | Antihypertensive | Enhances NO, reduces oxidative stress, inhibits ACE, prevents vasoconstriction | ↓ SBP by ~10 mmHg, ↓ DBP by ~8 mmHg |
| Zingiber officinale | Antihypertensive | AT1 receptor antagonist, ACE inhibition, vasodilation, lipid reduction | Preclinical and clinical evidence |
| Allium cepa | Antihypertensive | Quercetin-induced antioxidant and endothelial-protective effects | ↓ BP by ~5 mmHg |
| Hibiscus sabdariffa L. | Antihypertensive | Increases NO, blocks Ca2+ channels, activates $K^+$ ATP, diuretic, antioxidant, ACE inhibition | ↓ SBP & DBP in hypertensive and prehypertensive individuals |
| Crocus sativus L. | Antihypertensive | Antioxidant, anti-inflammatory, inhibits NF-κB and TNF-α, improves vascular function | ↓ SBP by ~11 mmHg, ↓ MAP by ~5 mmHg (400 mg/day, 7 days) |
| Rhus coriaria | Antihypertensive | Antioxidant, promotes NO-mediated vasorelaxation | Preclinical evidence |
| Camellia sinensis | Antihypertensive | Antioxidant, anti-inflammatory, enhances NO signaling | ↓ SBP & DBP by ~2 mmHg (green > black) |
| Curcuma longa | Antihypertensive | Reduces AT1R expression, decreases vasoconstriction, antioxidant and anti-inflammatory effects | Preclinical evidence supports efficacy |

Its diuretic properties also help regulate blood pressure by reducing fluid volume. Together, these antioxidant, vasorelaxant, and diuretic effects make *C. sativum* a promising natural option for hypertension management.

Garlic (*Allium sativum*) is well known for its strong blood pressure–lowering effects, with reductions similar to standard antihypertensive drugs. Clinical studies show that supplementation can lower systolic and diastolic blood pressure by about 10 and 8 mmHg, respectively, with aged garlic extract (AGE) being especially effective.

Garlic's antihypertensive action involves multiple mechanisms: enhancing nitric oxide production, reducing oxidative stress, and inhibiting angiotensin-converting enzyme (ACE) activity. It also prevents vascular smooth muscle proliferation and vasoconstriction. These combined antioxidant, vasodilatory, and anti-inflammatory effects make *A. sativum* a valuable natural adjunct in hypertension management (7).

Ginger (*Zingiber officinale*) is widely used in traditional medicine and contains potassium, which helps regulate blood pressure and heart function. Its key compounds, (6)-gingerol and (6)-shogaol, produce a sustained reduction in blood pressure, with (6)-gingerol acting as an angiotensin II type 1 (AT1) receptor antagonist.

Ginger also lowers cholesterol and triglyceride levels and inhibits angiotensin-converting enzyme (ACE) activity, promoting vasodilation. These combined actions make *Z. officinale* an effective natural option for supporting cardiovascular health and managing hypertension (8)

Onion (*Allium cepa*) exhibits strong antihypertensive effects, largely due to its organosulfur compounds that maintain arterial elasticity, reduce blood viscosity, and prevent thrombosis. Its major flavonoid, quercetin, lowers blood pressure by about 5 mmHg through antioxidant and endothelial-protective actions.

Roselle (*Hibiscus sabdariffa L.*), commonly consumed as tea, has proven antihypertensive effects. Clinical studies show that dried calyx extracts or hibiscus tea significantly reduce systolic and diastolic blood pressure in hypertensive and pre-hypertensive individuals.

Its blood pressure–lowering actions involve increased nitric oxide (NO) production, calcium channel blockade, and activation of potassium ($K^+$ ATP) channels. Roselle also acts as a diuretic, antioxidant, and ACE inhibitor, preventing LDL oxidation and vascular smooth muscle proliferation. These combined mechanisms make *H. sabdariffa* an effective natural option for hypertension management and cardiovascular protection (9).

Saffron (*Crocus sativus L.*) has demonstrated notable antihypertensive effects. Clinical studies show that taking 400 mg/day for seven days can lower systolic and mean arterial pressure by about 11 and 5 mmHg, respectively. In animal studies, its key compound crocin reduces oxidative stress and boosts antioxidant enzyme activity.

Saffron also inhibits inflammatory pathways such as NF-κB and TNF-α, improving vascular function and supporting blood pressure control. These antioxidant and anti-inflammatory actions make *C. sativus* a promising natural therapy for hypertension and cardiovascular protection (10).

Sumac (*Rhus coriaria*) is traditionally used for cardiovascular health due to its strong antioxidant properties that protect blood vessels and reduce oxidative stress. Its hydrolyzable tannins promote vasorelaxation through nitric oxide (NO)-mediated mechanisms, aiding blood pressure control (11).

*Camellia sinensis* (tea) is a widely consumed beverage known for its antihypertensive, antioxidant, and anti-inflammatory properties. Clinical studies show that regular green tea intake lowers systolic and diastolic blood pressure by about 2 mmHg, with green tea being slightly more effective than black tea (12).

*Curcuma longa* (turmeric) is a medicinal plant rich in curcumin, a compound known for its antioxidant and anti-inflammatory properties. Curcumin protects against cardiovascular diseases, including hypertension, by reducing angiotensin II type 1 receptor (AT1R) expression in arteries, which decreases vasoconstriction and improves vascular function. Its modulation of oxidative stress and inflammatory pathways highlights turmeric's potential as a natural agent for managing high blood pressure and related cardiovascular disorders (13).

**Conclusion.** The evidence reviewed in this study highlights the significant potential of herbal medicines as effective and safe adjuncts in the prevention and management of hypertension. Numerous plant species—such as *Nigella sativa*, *Daucus carota*, *Apium graveolens*, *Salvia miltiorrhiza*, *Cinnamomum zeylanicum*, *Theobroma cacao*, *Allium sativum*, *Zingiber officinale*, and *Hibiscus sabdariffa*—demonstrate consistent antihypertensive effects through multiple mechanisms. These include inhibition of calcium influx, enhancement of nitric oxide bioavailability, modulation of the renin–angiotensin system, antioxidative and anti-inflammatory actions, and improvement of endothelial function.

Compared with conventional antihypertensive agents, herbal remedies are generally well tolerated, more accessible, and possess a lower risk of adverse reactions, making them attractive complementary options for long-term blood pressure management. Nevertheless, while preclinical and clinical data support their efficacy, standardized formulations, dose optimization, and rigorous randomized controlled trials remain essential to validate their therapeutic potential and ensure safety.

Overall, integrating scientifically proven herbal therapies into modern treatment strategies could enhance cardiovascular protection, reduce hypertension-related complications, and promote global public health, especially in resource-limited settings.

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# COMPUTER SCIENCES

## PARADIGMS OF APPLICATION OF ERP SYSTEMS AND BUSINESS INTELLIGENCE IN BUSINESS

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**Abstract**

The purpose of this research paper is to systematically analyze and consider, based on a successive search of relevant literature, the main effects of digital business transformation through projects introducing ERP (Enterprise Resource Planning) systems and applying sophisticated business intelligence technologies. The basic characteristic of modern business is that today companies and business systems have access to huge amounts of data, but unfortunately only 5 to 10% of all that data is used for business purposes. Recent research, supported by practical results, shows that digital business transformation, i.e. the implementation of ERP systems as well as software, methods, techniques and tools based on business intelligence (BI), greatly helps companies gain a competitive advantage. The results of the research show that in the process of applying ERP systems and business intelligence, a good knowledge and understanding of the functionality of business processes is important and crucial, precisely a complete understanding of business processes is possible by conducting a business analysis and obtaining the information needed for the implementation of business intelligence processes in companies. Representative research indicates that in the process of implementing ERP systems and business intelligence, good knowledge and understanding of the functionality of a company's business processes are important and crucial, followed by support from top management, clear goals and vision, selection of adequate software solutions, upgrade options, etc. Current research indicates that although there is a certain number of scientific works, that is, research in this area, there are still doubts in the process of introduction, that is, in the project management segment of the ERP system and business intelligence, about the process methodology of the introduction itself. The research results show that in this sense it is particularly important that business systems and organizations are able to correctly set up data in everyday business operations and that this business data significantly assists them in the business decision-making process. Starting from the aforementioned research problems and based on the insufficient number of conducted empirical research at the global level, the device raises the question of how the application of the concept of ERP system project management and business intelligence contributes to the efficiency of business process management.

**Keywords:** ERP sistem, artificial intelligence, business intelligence.

### 1. INTRODUCTION

Some authors state that part of the changes related to the application of information-communication technologies in business are related to the phenomenon of globalization, which, according to some authors, has initiated teamwork in real conditions in business systems, where it is created on the basis of teamwork, with the involvement of all employees in their organizations, in the execution of tasks and work tasks (Mockaitis, Zander, & De Cieri, 2018). Positive changes depend on the vision and strategy of the company, i.e. the quality of the decision-making process, where the so-called "good decisions" must in principle be based on the knowledge and experience of direct managers and which are crucial for the decision-making process and require accurate, timely and reliable information( Denić N., 2016). According to the results of research by some authors Kielstra, the most important attributes of information needed for decision-making are: quality (65%), com-

pleteness (18%), timeliness (13%), and price (5%). Research indicates that the introduction of a business intelligence system is one of the riskiest information technology investments, which, due to its complexity, requires cooperation between the IT sector and business management, accounting and finance staff, and company managers at the operational level in order to create business value (Wagner & Weitzel, 2012). As many as 54% of business users cannot find the information they need, 43% are not sure whether the information they receive is accurate, while 77% claim that bad decisions are made solely due to a lack of information. In the latest representative literature, some eminent authors emphasize that business intelligence strives to make creative people want to be even more creative, that is, to strive for success and consider it the most important value in their lives, and creativity is the key to knowledge necessary for achieving success (Deuze, 2018), while the use of ERP systems in business systems is a response to the demands for faster and more efficient business operations. In the literature, it is emphasized that the ERP system should essentially be software that, through the application of information technology, unifies all business processes of the company. (Maditinos, Chatzoudes, & Tsairidis, 2012)

## 2. SPECIFICITIES OF MANAGEMENT OF ERP SYSTEM IMPLEMENTATION PROJECTS

In the latest representative literature, it is pointed out that the process of introducing software projects often faces certain problems such as resistance to changes, resistance of end users in adapting to new technology, inadequate requirements and lack of management support (Salim, Suleiman & Salisu, 2015), also some authors emphasize that in the introduction of a new ERP system, the business system must also take into account certain key success factors (Ngai et al., 2008). ERP systems are built to provide a centralized and comprehensive view of an organization's data. In the literature, it is stated that ERP, i.e. enterprise resource planning systems, represent a complete, integrated platform that manages all aspects of enterprise operations such as production, distribution, accounting and finance, controlling, human resources, and others (Stojanović et al., 2024). However, managing ERP system implementation projects can be a very complicated activity and requires strong managerial leadership and project management because the project must often be evaluated (Motiwalla & Thompson, 2012). In many recent studies, it can be clearly seen that many companies that have introduced ERP systems have not upgraded or fully utilized this system to create business success (Zhu et al., 2010). Numerous ERP systems are available in Serbia, from global solutions such as SAP S/4HANA, Microsoft Dynamics 365, Oracle NetSuite, to flexible options such as Odoo, which are increasingly used in small and medium-sized enterprises(Denić N., 2024). Botta - Genoulaz and Millet (2006) indicate that apart from ERP being focused on the enterprise and resources, it goes beyond the planning function and also includes other tasks such as financial control, operations management, analysis and reporting, and routine decision support. Practice shows that ERP systems provide transparency in the entire business process by monitoring all aspects of production, logistics and finance(Denić N., 2023). Modern ERP systems often include real-time analytics, cloud deployment, and mobile access to enable seamless collaboration and decision-making across teams.We will summarize the trends expected in the ERP information services market according to an article by one of the largest suppliers of ERP services, Oracle NetSuite (Jenkins, 2025): cloud ERP service, two-tier ERP services - level 2, digital transformation, integration of other technologies with ERP systems, personalization, artificial intelligence, predictive analytics and mobile ERP application. The choice of ERP system depends on the size and specific needs of the business, with different options available to support different processes, such as finance, sales, inventory management and human resources. In recent literature reviews, scholars have identified critical success factors (CSFs), which have mostly been investigated from a generic perspective (Lech, 2016; Saade & Nijher, 2016). In his article, Roket (2022) lists 4 main sources for the formation of KFU, namely: KFU specific to the industry; Strategy, Industry Position and Geographic Location and Environmental Factors. Theory and examples in practice unequivocally indicate that despite the existing literature on ERP systems, there is a noticeable lack of research on the success of project management of the introduction of business intelligence and ERP systems from the user's perspective, that is, there is an extremely limited number of researches available considering the user's perception of the ERP system implementation process(Vujović, V., 2020). What is emphasized in the latest research is that people dealing with business intelligence must be creative, look for new solutions (original), think and often look for how to adapt the system to different situations (flexible) (Kennett et al., 2018), have the ability to express in words (Dwight et al., 2018) and be especially creative thinking (Mastria et al., 2018).

## 3. RESEARCH METHODOLOGY

In this research, we use several research methods, so that we can get a complete approach to solving the selected problems. In the introductory theoretical part, the descriptive method was used, with which we introduced ourselves and presented the basic concepts in the field of ERP systems and business intelligence - their functionality, suppliers, trending methods and implementation strategies. This part contains a detailed comprehensive theory - an analytical review of the reference scientific literature and scientific works of well-known foreign experts of recent date. Given the research topic and issues, and the particularly pronounced multidisciplinary character of the research, a combination of qualitative and quantitative research methods was used for the purposes of the research (Radovanovic, 2020).

## 4. RESULTS

ERP systems can be tailored to businesses of all sizes and industries, offering flexibility, scalability and efficiency. In earlier research, a high percentage of ERP implementation failures was recorded, and other researchers often referred to the results of these studies,

which emphasized the risk in the implementation project. Well-known authors estimate that up to 70% of failures are in the establishment of ERP systems (Iskanius, 2010). In this sense, it is said that in companies according to Davenport et.al. (2007), 47% of respondents adapted their ERP systems. This is supported by research conducted by the Gartner group, including 1,300 companies, of various types of activity and structure, where it was determined that 32 ERP system projects exceeded the installation time. However, despite the fact that the latest research in the world indicates that, for example, out of 43 American companies that participated in the research, 46% achieved 100% or less return on investment, 34% between 101% and 1000%, and 20% around 1001% and more, they are still not applied in SMEs in Serbia to the necessary and sufficient extent. Similarly, the Standish Group Report indicates that the implementation took 2.5 times longer than the companies expected, which caused the lack of expected effects. Research regarding the return on investment period indicates the following situation: 49% of companies recovered their invested BIS funds in one year or less, 32% in the period from one to three years, 19% in three or more years. Research results in the world indicate that a typical business intelligence project has an average return of over 430%, however, despite this, companies in Serbia decide to purchase new equipment and software to follow fashion trends and thus impress their business partners, rather than truly believing that new IT, both in terms of hardware and software, can make their work easier, which is especially pronounced in socially owned companies. A study by Meta Group, in which 200 companies participated, revealed that the implementation of an ERP system will cost an average of about 1% of corporate costs, and that 70% of that will go to paying for human resources. The following is an example of Nestle's Globe project, which was designed to standardize supply chain processes and involved more than 230,000 employees, cost more than 2.4 billion dollars. Meta Group, however, estimates that the average project duration is about 20 months. In a research study involving 66 companies, Soja found that 50% of projects lasted less than a year. Deloitte (1999) found in a study involving 66 companies, of various types of activities and business programs, randomly selected from 500, that the average length of ERP system implementation is up to four years. As business strategies and markets change, ERP systems must be adapted to these new, changed conditions. The research "KMPG's Business intelligence Survey" attempted to answer certain key questions related to business intelligence systems and their use. The results of this research show that; 19% of managers make their decisions on the basis of intuition, i.e., they base more than 50% of their decisions on intuition. The next 19% of managers, 30% to 50% of decisions also make decisions without the support of information. Less than 10% of managers base their decisions largely on data from a business intelligence system. The number of decisions made by managers based on data is shown in the following figure (Figure 1).

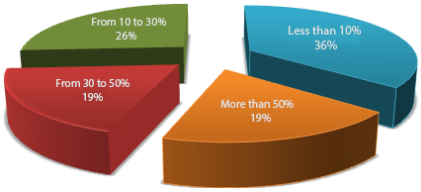


*Fig. 1. How many decisions made by managers are based on data?*
*Source: (KPMG, 2019)*

## 5. DISCUSSION OF RESULTS

Many well-known authors in their research emphasize that a successfully introduced ERP system brings many strategic, organizational, management and technological advantages (Zhu, Li, Wang & Chen 2010), but also disadvantages that are mainly of a technical and business nature. The purpose of ERP software is to help organizations improve productivity, make data-driven decisions, improve collaboration, and achieve better overall efficiency. Existing recent literature and research by well-known experts on unsuccessful ERP system implementation projects in most countries of the world simply explains the failure in terms of lack of resources of sufficient skills, lack of technology, lack of money, user resistance and other cultural issues (Bitsini, 2015). Practice shows that achieving benefits from an ERP investment is not the same for all companies. Some companies immediately saw the benefits they expected, but unfortunately for the majority of companies this was not the case. In a good part of the literature, you can find the results of the research on the effects of the implementation of the ERP system, which show that on average approximately 53% of the companies achieved less than 50% of the benefits they expected from the implementation of these projects. In the implementation of a new ERP system, it is evident that there are errors and problems, in this regard, many researchers believe that identifying and adhering to CSFs will reduce or eliminate problems and increase the likelihood of successful preparation and implementation of an information solution (Ram & Corkindale, 2013). Some authors state that lack of management support, insufficient support and involvement of management can negatively affect the success of ERP implementation (Rajapakse and Thushara, 2023). Lack of adequate employee training can lead to resistance and inefficient use of the system (Rajapakse and Thushara, 2023). A well-known author states that during the ERP system implementation process it is necessary to have: support from top management, a clear vision and measurable goals, quality of business data, selection of an adequate ERP solution, continuous improvements, etc. (DeBriere, 2024). A business example from the practice of the company "Obilić Petrol" shows that when people

buy a sandwich, 72% also buy coffee, but this percentage drops rapidly in June, July, August and September and is only 23%, i.e. sandwich sales are still the same, but they do not take coffee with it. The managers of the company "Obilić Petrol" realized that during those months when the temperatures were significantly higher, customers would rather have something refreshing than buy coffee. They decided to make the right move and, in addition to coffee, introduced the sale of lemonade into regular sales during those four months. Customers responded favorably to this and now, in those four months, lemonade sales have compensated for the losses from unsold coffee..

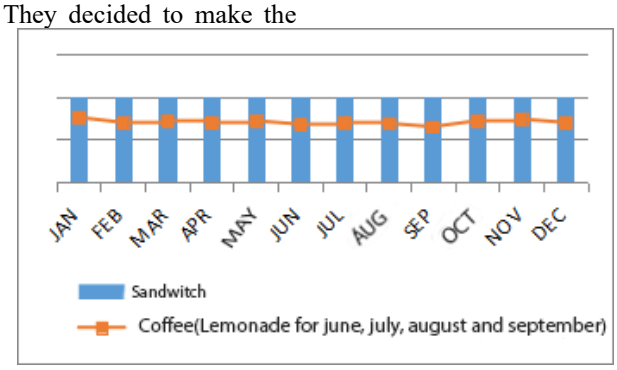


*Fig. 2. Selling sandwiches, coffee and lemonade*
*Source: author's research.*

## 6. CONCLUSIONS

The result and scientific contribution of this research will be reflected, among other things, in the qualitative and quantitative analysis of relevant literature and the current practice of introducing business intelligence systems and ERP systems in the function of improving business, in particular, leading to more efficient business decision-making through efficient data management and more precise event prediction. Today, business managers have at their disposal appropriate tools based on intelligent systems, artificial technology - neural networks, expert systems, genetic algorithms, phase systems and others, which help management and decision-making bodies of companies in complex business processes. Today, small and medium-sized enterprises can benefit from the accessibility and modularity of solutions such as Odoo, Zoho or Acumatica, while large corporations may prefer the depth and complexity of platforms such as Oracle NetSuite, SAP S/4HANA, or Microsoft Dynamics 365. Nevertheless, due to its versatility and price, Odoo remains one of the most interesting open source ERP solutions on the market, and due to its adaptability, it is suitable for small, medium-sized and larger companies (Emley, 2024). ERP tools for small businesses are usually located in the Cloud and are quickly installed, in this sense, today the obvious choice for implementing ERP in the Cloud because this solution reduces initial costs, is easy to customize, updates automatically, allows you to access your ERP from anywhere and anytime( Denić N., 2014). The Standish Group report on ERP implementation projects, which states that these projects exceeded the planned project budgets by approximately 178%, lasted 2.5 times longer and provided only 30% of the promised profit or planned profit. The latest research shows that 40% of major decisions are not made based on facts, but on the manager's feelings. Based on a review of the relevant literature, the strengths can be mainly divided into operational, managerial, strategic, technical and organizational, while the weaknesses are mainly business and technical. The largest regional player is the Novi Sad company M&I Systems. Followed by AB Soft, ASW inženjering and Europos. UPIS ERP of the Serbian company IIB also works in Serbia, the region and several African countries. We believe that the thesis offers practical insights into the challenges and good practices of ERP implementation, which can be helpful to all companies that are embarking on the path of digital business transformation. The success of the implementation of the solution is not guaranteed. In the literature, it is stated that in 2024, 72% of companies had problems with the digital transformation process. As the ERP market continues to evolve in 2025, cloud solutions remain the dominant trend, offering scalability, real-time insight and lower infrastructure costs. In this sense, the most common problem they cite is lack of knowledge or appropriate personnel (52%), followed by lack of financial resources with 43%, and with 37%, the reason companies identified was that their business could not adapt to changes in the environment. However, research in practice shows that half of companies and business systems still believe that digital transformation is not necessary for successful business. Statistics also showed that ERP is used by 29% of companies, of which 29% are small, 59% are medium and 82% are large companies. The key to a successful ERP implementation lies in understanding the specific needs of your organization and choosing a platform that aligns with your long-term goals.

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# CONSTRUCTION AND ARCHITECTURE

## ІНСТРУМЕНТАРІЙ ГЕОПРОСТОРОВОГО МОНІТОРИНГУ ВИКОРИСТАННЯ ЗЕМЕЛЬ ЖИТЛОВОЇ ТА ГРОМАДСЬКОЇ ЗАБУДОВИ РЕГІОНІВ

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## TOOLS FOR GEOSPATIAL MONITORING OF LAND USE FOR RESIDENTIAL AND PUBLIC BUILDINGS IN REGIONS

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**Анотація**

Актуальність теми дослідження обумовлена необхідністю формування й застосування інструментарію геопросторового моніторингу використання земель житлової та громадської забудови регіонів.

Запропоновано визначення геопросторового моніторингу використання земель житлової й громадської забудови регіонів як системної категорії, що характеризується сукупністю функціональних, типологічних, інструментальних, інформаційних, оцінних, геоінформаційних, організаційних напрямів, та визначається впливом просторового, екологічного, містобудівного, нормативно-правового забезпечення й спрямований на перманентне відстеження та контролю за змінами, що відбуваються у системі земельних відносин у сфері житлової й громадської забудови.

**Abstract**

The relevance of the research topic is determined by the need to develop and apply tools for geospatial monitoring of land use for residential and public buildings in regions.

It is proposed to define geospatial monitoring of land use for residential and public development in regions as a systemic category characterised by a set of functional, typological, instrumental, informational, evaluative, geoinformation, and organisational directions, and determined by the influence of spatial, environmental, urban planning, and regulatory and legal support, and is aimed at permanent tracking and control of changes occurring in the system of land relations in the field of residential and public development.

**Ключові слова:** геопросторовий моніторинг, геоінформаційні системи, використання земель, землі житлової та громадської забудови, методи і моделі.

**Keywords:** geospatial monitoring, geoinformation systems, land use, residential and public development land, methods and models.

**Introduction.** Ensuring the efficient use of land is an important task for the development of regions and the state, which shapes the national wealth of the country. In European countries, on average, the structure of land use is determined by its largest implementation in agriculture (43.5% of the total level of land use). Forestry, recreational and residential, industrial and other land use in the European Union accounts for 32.4%, 5.7%, 3.4% and 15.0%, respectively [1]. The European countries with the highest agricultural land use are: Belgium – 51.8%; Great Britain – 63.5%; Denmark – 63.9%; Ireland – 71.5%; Lithuania – 52.9%; Luxembourg – 51.1; Netherlands – 56.9; Germany – 52.0; Poland – 51.6; Romania – 60.3; Hungary – 61.8; France – 54.0; Czech Republic – 50.2 [1]. The land area of Ukraine is almost 6% of that of Europe. At the same time, black soil reserves in this context are estimated at 33.3%. The share of land area in Ukraine compared to European countries and the area of arable land is 9% and 11.7%, respectively. The analysis presented indicates the growing importance of rural land use in European Union countries. Ukraine has a high level of black soil and the intensity of land use is increasing. However, the land market is not fully developed and is rudimentary in nature, with the cost of land resources being the lowest among European countries.

Land for residential and public development accounts for a significant share of the total structure. Problematic aspects of land use, the efficiency of land allocation and development, and the possibilities for taking into account environmental, urban planning and other parameters are highlighted.

In this context, there is a need to apply European experience in land use, using geospatial monitoring (GM) tools for land use (LU) for residential and public development at the regional level. Therefore, the research topic is relevant and timely.

**Literature Review.** Existing scientific research lacks a unified approach to defining geospatial monitoring of land use. As a result of systematising theoretical approaches to substantiating land use monitoring, a definition has been proposed that is characterised by a combination of legal, constructive, complex, organisational, functional and instrumental directions aimed at forming information, analytical and spatial support regarding the state and level of land and natural resource use with the application of mathematical modelling methods, which creates a quantitative basis for permanent tracking and control of the use of natural reserve fund objects [2].

Land monitoring is characterised from the point of view of functional features and parameters, which is aimed at observing the state of land for the timely detection of changes, their assessment, prevention and elimination of negative phenomena [3].

Land monitoring is defined as an important functional tool for the systematic collection and updating of information on the state and use of land resources for the implementation of measures for their use and protection [4].

The areas of application of geospatial support for land use monitoring have been identified. Particular attention is focused on the application of geographic information systems [5].

Comprehensive characteristics of land use monitoring have been identified [6, 7].

Characterising the classification features of LU, the factors influencing its development and use have been identified: external: socio-economic; legal; political; technical; territorial; internal: organisational; production and technical; financial [8].

A functional approach to defining land monitoring, which characterises the directions and features of its implementation, is presented in works [9, 10].

For the implementation of LU, within the framework of the instrumental approach, its definition is characterised from the point of view of the application of a system of technical and technological components and the level of use of geographic information systems [8].

As a result of the generalisation of theoretical provisions, the following approaches to the definition of geospatial monitoring of land use for residential and public development are justified:

– functional: characterised by the directions and features of the application of monitoring procedures in the system of land use for residential and public development;

– typological: the structural components of monitoring and types of residential and public development are determined to form a quantitative basis for monitoring;

– factorial: the focus is on identifying factors that influence the implementation of geospatial monitoring of land use for residential and public development;

– instrumental: technological and instrumental aspects of the functioning of geospatial monitoring of residential and public land use are identified and characterised;

– informational: information support for geospatial monitoring of land use is identified and characterised;

– systemic: GM is considered as a complex system in which a set of elements interact;

– evaluative: directions for assessing the level of application of geospatial monitoring of land use for residential and public development are developed and characterised;

– geoinformation: the significance and possibilities of applying geoinformation systems for monitoring procedures are determined;

– stakeholder: the level of interaction and influence of stakeholders on the implementation of geospatial monitoring of land use for residential and public development is characterised;

– organisational: the organisational aspects of the formation and application of geospatial monitoring of land use for residential and public development are determined;

– ecological: focuses on environmental factors that influence the formation and application of GIS;

– regulatory and legal: characterised by regulatory and legislative support for the formation and application of geospatial monitoring of land use for residential and public development;

– urban planning: urban planning factors influencing the formation and application of GIS for residential and public development are identified.

Thus, it is proposed to define geospatial monitoring of land use for residential and public development in regions as a systemic category characterised by a combination of functional, typological, instrumental, informational, evaluative, geoinformation, and organisational aspects, and is determined by the influence of spatial, environmental, urban planning, and regulatory and legal support, and is aimed at permanent monitoring and control of changes occurring in the system of land relations in the field of residential and public development.

At the same time, issues remain unresolved regarding the formation and application of geo-ecological monitoring of the use of land for public and residential development at the regional level.

**Purpose and objectives of the study.** The purpose of the study is to substantiate the tools for geo-ecological monitoring of land use for public and residential development at the regional level. To achieve this goal, the following tasks are to be accomplished:

– substantiation of models for geospatial monitoring of land use;

– identification of methods that influence the formation of GM LU.

**Main part.** The directions for the formation and use of geo-ecological monitoring of land use are determined:

1. Modelling of summary indicators.

2. Creation of a geodatabase of land use indicators.

3. Selection of a spatial basis and linking of defined indicators.

4. Distribution of zones for the formation of integrated and summary indicators of land use by region.

5. Analysis of integrated and summary indicators.

6. Visual representation of the analysis data for integrated and summary indicators on a monitoring GIS map.

7. Formation of a spatial basis for the indicator of change in gross regional product per unit area.

8. Construction of a monitoring GIS map of the indicator of change in gross regional product per unit area.

9. Development of a monitoring GIS map of forecast values of the indicator of change in gross regional product per unit area depending on changes in the integral factor of land use.

The method of geoinformation monitoring at the regional level includes: formation of remote sensing data; ground monitoring; preliminary processing of remote sensing data; processing of operational observation data; processing of archived observation data; conducting geospatial analysis and modelling; data presentation; data storage; interaction with users [11].

Regional GIS models have been developed based on the use of geoinformation tools [12, 13].

To carry out geospatial monitoring of land use for residential and public development, a quantitative basis is formed based on methods for assessing land use factors and the results of mathematical modelling.

An integrated method for assessing the territorial development of land use, which includes the following stages:

1. Formation of a complex of spatial, urban planning, investment and environmental factors that influence the territorial development of land use in the region based on existing scientific and methodological developments and regulatory and legal support.

2. Construction of a multi-level system of factors.

3. Selection of factors that most influence the territorial development of land use in the region by applying the expert assessment method.

4. Formation of a multi-level system of indicators by applying quasi-metric methods of transition from the proposed factors to the corresponding spatial, urban planning, investment and environmental indicators, taking into account the values of the assessment coefficients.

5. Evaluation of the system of spatial, urban planning, investment and environmental indicators of the third level based on the application of analytical and expert assessment methods.

6. Determination of second-level spatial, urban planning, investment and environmental indicators by constructing mathematical models based on the method of evaluating the geometric mean.

7. Construction of a mathematical model for determining the integral spatial, urban planning, investment and environmental indicators of territorial development of land use in the region.

8. Determination of weight coefficients characterising the importance of spatial, urban planning, investment and environmental indicators in the system of territorial development of land use in the region based on the application of the hierarchy analysis method.

9. Determination of integral spatial, urban planning, investment, and environmental indicators of territorial development of land use in the region.

10. Assessment of the integral indicator of land use in the region.

11. Development and justification of a scale of levels of territorial development of land use in the region.

12. Interpretation of the results obtained [14].

Mathematical modelling methods for forming a quantitative basis for geospatial monitoring of land use for residential and public development include the following areas:

– forming information and analytical support for mathematical modelling;

– determining the level of influence of factors on the generalising criterion for the development and use of geospatial monitoring of land use for residential and public development;

– development of mathematical models that characterise the cause-and-effect relationships between factors;

– determination of the adequacy criteria for the developed mathematical models;

– interpretation of the results obtained.

The formation of information and analytical support for mathematical modelling is carried out on the basis of a preliminary assessment of factors and a generalising factor of the level of development and use of geospatial monitoring of land use for residential and public buildings.

The level of influence of factors on the generalising criterion is determined on the basis of correlation (R) and determination (D) coefficients. The correlation coefficient is determined using the Statistica software package and shows the degree of influence of factors on the generalising criterion. The value of the coefficient varies from – 1 to 1, and the sign characterises the type of relationship: direct or inverse. If the value of the correlation coefficient approaches 1, the influence of the factors on the generalising criterion increases accordingly, and vice versa.

The coefficient of determination is determined by the model:

$$D= R^2. \quad (1)$$

The development of mathematical models characterising the cause-and-effect relationships between factors is carried out taking into account the influence, type of relationship, and determined regression coefficients in linear and nonlinear form.

The criteria for the adequacy of the developed mathematical models are as follows:

Student's t-test characterises the quality of the established cause-and-effect relationships. The calculated value of the presented criterion is compared with the normative (tabular) value. If the value of the calculated indicator exceeds the normative value, the quality of the established relationships is confirmed; if not, the factor is excluded from the mathematical model and the established relationships are inadequate.

Fisher's F-criterion shows the significance of the established cause-and-effect relationships. The determined value of the presented criterion is compared with the normative (tabular) value. If the value of the actual indicator exceeds the tabular value, then the conclusion is made about the significance of the established cause-and-effect relationships. If the actual value of Fisher's F-criterion is less than the normative value, then the mathematical model is inadequate and cannot be used to form a quantitative basis for geospatial monitoring of the use of land for residential and public development.

The Durbin-Watson criterion is used to determine the autocorrelation of residuals, its value varies according to the minimum and maximum values. If the actual value of this criterion is less than the minimum normative value, then the positive autocorrelation of residuals is confirmed. If the actual value exceeds the maximum normative value within the range of criterion values, then there is no autocorrelation of residuals. If the actual value is between the minimum and maximum normative values, it is impossible to conclude whether autocorrelation is present or absent.

Testing for homoscedasticity or heteroscedasticity (homogeneity or heterogeneity of residuals). This is done on the basis of the relevant criteria. In particular, Spearman's criterion is applied and its actual value is compared with the normative value of Student's t-criterion. If the actual value of Spearman's criterion exceeds the normative value of Student's t-criterion, then a conclusion is made about the heterogeneity of the residuals of the mathematical model. If the actual value of Spearman's criterion is lower than the normative value of Student's t-criterion, the homogeneity of the residuals is established and a conclusion is made about the adequacy of the mathematical model.

Checking the mathematical model for multicollinearity, which is carried out for multifactorial mathematical models. The phenomenon of multicollinearity characterises the degree of relationships between independent variables. A high level of multicollinearity leads to a shift in the modelling results and increases the level of inadequacy of the established relationships.

**Conclusions.** Thus, the proposed methods and models for the formation and use of a quantitative basis for the development of GM LU for residential and public buildings in regions. This provides opportunities to improve the modelling and forecasting system in the context of making informed decisions to improve the efficiency of land use in the field of residential and public buildings.

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# ECONOMY

## МЕТОДОЛОГИЧЕСКИЙ ПОДХОД К КОМПЛЕКСНОМУ ОБЕСПЕЧЕНИЮ ЭКОНОМИЧЕСКОЙ БЕЗОПАСНОСТИ СУБЪЕКТОВ ПРЕДПРИНИМАТЕЛЬСТВА

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## A METHODOLOGICAL APPROACH TO COMPREHENSIVE ECONOMIC SECURITY FOR BUSINESS ENTITIES

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**Аннотация**

В статье рассматриваются сущность экономической безопасности предпринимательских субъектов, элементы и критерии оценки уровня безопасности и методические подходы к ее комплексному обеспечению. Обоснована важность обеспеения экономической безопасности на фоне современных рисков, механизмов конкуренции, макроэкономических изменений и рисков, угроз, возникающих в экономических отношениях и бизнес-среде. По результатам исследований предлагается системная модель обеспечения экономической безопасностью субъектов предпринимательства.

**Abstract**

This article examines the essence of economic security for business entities, the elements and criteria for assessing security, and methodological approaches to its comprehensive provision. The importance of ensuring economic security is substantiated against the backdrop of modern risks, competition mechanisms, macroeconomic changes, and risks and threats arising in economic relations and the business environment. Based on the research results, a systemic model for ensuring economic security for business entities is proposed.

**Ключевые слова:** предпринимательство, экономическая безопасность, угроза, риск, подход к обеспечению безопасности.

**Keywords:** entrepreneurship, economic security, threat, risk, approach to ensuring security.

**Введение**.

Глобализация, цифровая трансформация, нестабильные мировые рынки и геополитические процессы привносят новые риски и вызовы в деятельность субъектов предпринимательства, причем на всех уровнях. В современных условиях успешного функционирования и долголетия предприятий определяются не только прибыльностью и конкурентными преимуществами, но и уровнем экономической безопасности. Экономическая безопасность является важным интегральным показателем, отражающим экономическую устойчивость деятельности хозяйствующих субъектов, ее финансовую устойчивость, рациональное использование ресурсов, устойчивость к вредным, рискованным воздействиям, а ее обеспечение требует обоснованного методического подхода к данной проблеме.

Формирование методологических основ комплексного обеспечения экономической безопасности субъектов предпринимательства обусловливает раскрытия, пояснения и обобщения сущности экономической безопасности и уточнения ее отдельных характеристик. Суть обеспечения экономической безопасности субъектов предпринимательства заключается в реализации комплекса мер, обеспечивающих их устойчивое функционирование и устойчивое развитие. Эти меры охватывают организационно-экономические, снабженческие, управленческие, технико-технологические, интеграционные, реформаторские, установление и развитие торгово-экономических отношенийв и связей и другие вопросы. Системный подход предприятия к решению этих вопросов и его эффективная реализация с точки зрения стратегических целей обеспечивают защиту его экономических интересов от внешних и внутренних опасностей, угроз и рисков, создают основу для благоприятной деятельности. Возможность нормальной и застрахованной от опасностей среды деятельности гарантирует пред-

принимательским субъектам формирование способности увеличивать доходов, повыщать конкурентоспособности, качества продукции и услуг, увеличивать объемов производства, продлевать жизненный цикл своей деятельности на рынке, достигать других целей и задач.

Проблемы экономической безопасности хозяйствующих субъектов возникают не только в кризисных ситуациях, вызванных различными причинами. Трудности такого характера проявляются и в рамках нормальных и стабильных экономических условий.

**Актуальность темы**. Нестабильность мировой экономической ситуации, рост цен, напряженность, вызванная различными событиями, колебаня валютных курсов и др. оказывают краткосрочное и долгосрочное негативное влияние на экономическую ситуацию в процессе ведения бизнеса. В то же время, широкое внедрение и использование цифровых и инновационных технологий привело к активизации кибератак, что позволило к увеличению рисков, угроз и опасностей. Такая ситуация ослабляет устойчивость субъектов предпринимательства, имеющих ограниченные финансовые ресурсы и технологии управления, к угрозам. Указанные факторы требуют разработки методического подхода к обеспечению экономической безопасности субъектов предпринимательства. Тема посвящена методическому подходу к комплексному обеспечению экономической безопасности субъектов предпринимательства и ее актуальность не вызывает сомнений.

**Цель исследования.** Целью исследования является разработка комплексного методологического подхода к защите экономики субъектов предпринимательства от негативных факторов внешней и внутренней среды, обеспечению их экономической безопасности.

**Объект и предмет исследования.** Объектом исследования является методологический подход к обеспечению экономической деятельности субъектов предпринимательства и ее безопасности.

Предметом исследования является формирование механизма методологического подхода, создающего основу для комплексного обеспечения экономической безопасности.

**Материалы и методология исследования.** В процессе исследования использовались отечественные и зарубежные исследования, публикации и электронные научные источники по вопросам обеспечения экономической безопасности субъектов предпринимательства.

**Методы исследования.** В исследовании использовались методы сравнительного анализа, системного подхода, экспертной оценки, обобщения, синтеза.

**Обсуждение**. Под экономической безопасностью понимается ситуация, которая позволяет защитить финансово-экономические интересы предпринимательских субъектов от внешних и внутренних рисков и угроз, обеспечить их функционирование и устойчивое развитие на рынках, реализовать их стратегические цели и миссию на благоприятных условиях [4, с. 48].

Одним из основных понятий в обеспечении экономической безопасности субъекта предпринимательской деятельности любого вида является понятие «угроза», которое рассматривается как фактор, создающий риск для достижения экономической миссии, целей и интересов субъекта. Основным источником опасности считаются угрозы экономической безопасности субъекта, как внутренние, так и внешние. [1].

Следует отметить, что проблема экономической безопасности вытекает из условий экономических отношений современной эпохи и объективных противоречий в условиях рыночной экономики, в том числе возникающих в процессе организации производства на предприятиях, предложения и реализации на рынке продукции и услуг [6]. Таким образом, подход к экономической безопасности как к самостоятельной экономической категории и раскрытие ее специфических концептуальных особенностей создает повод для рассмотрения всей цепочки деятельности предприятия.

Экономическая безопасность представляет определенную угрозу для хозяйствующих субъектов, функционирующих на всех уровнях национальной экономики, поскольку они являются субъектами единых национальных экономических систем, взаимосвязанных и взаимозависимых между собой, и выступают в качестве элементов этой системы, как предприятия, сферы деятельности (производства, обслуживания), регион, хозяйства [5].. Поэтому с методологической точки зрения понятие экономической безопасности должно как выражать общую сущность, присущую каждому из этих уровней и элементов, так и отражать специфическое для каждого элемента содержание, обусловленное особенностями уровней экономической иерархии.

Некоторые исследователи трактуют экономическую безопасность как комплекс мер по противодействию угрозам обороноспособности страны, а также государственную политику, направленную на защиту здоровья и жизни ее граждан [7]. Другой подход рассматривает проблему экономической безопасности с точки зрения постоянного повышения качества продукций и услуг, уровня жизни населения [2].

Иногда экономическую безопасность характеризуют по следующей группе характерных признаков и уровню системы предпрнимательства:

- экономическая безопасность предполагает обеспечение безопасности всех субъектов сферы деятельности;

- экономическая безопасность субъекта отождествляется с безопасным и благоприятным состоянием экономической системы в целом;

Иногда экономическую безопасность характеризуют следующим набором признаков и системным уровнем:

-подразумевает обеспечение безопасности всех субъектов сферы деятельности;

-отождествляется с безопасным и благоприятным состоянием экономической системы в целом;

-понимается как система, формируемая под воздействием внешней среды;

-ценится как важный компонент системы национальной безопасности государства.

Помимо этого, существует множество различных подходов к сути термина «экономическая безопасность». Существуют также подходы к экономической безопасности как совокупности условий, позволяющих защитить экономику от угроз различного рода внутреннего и внешнего происхождения, ситуации, позволяющей защитить экономические и национальные интересы, способности экономических условий противостоять негативным и деструктивным факторам.

Экономическую безопасность можно также представить как состояние финансово-хозяйственной деятельности, характеризующееся устойчивостью к различным угрозам и сезонным колебаниям, а также способностью обеспечивать реализацию собственных экономических интересов, минимизации или отсутствия возможных финансовых рисков и угроз различного происхождения в процессе деятельности субъекта, а также защищенность экономических возможностей от угроз и негативного воздействия различных факторов при реализации его целей.

Как видно, каждый из этих подходов базируется на определенных признаках. Обобщая все эти подходы, можно сформулировать мнение, что под экономической безопасностью субъектов предпринимательства понимается создание условий, способствующих предотвращению возможных или вероятных угроз, опасностей и рисков и защите от них на должном уровне, обеспечивающих основу для гарантированного и устойчивого развития сферы хозяйственной деятельности и субъектов совокупной экономической системы. также учитывать следующие специфические и конкретные факторы, влияющие на обеспечение экономической безопасности предпринимательства:

- уровень теневой экономики;
- налоговая политика;
- ставки по кредитам;
- состояние распределения государственных субсидий;
- доступность использования факторов производства;
- доступность финансовых ресурсов и т. д.

Одним из условий функционирования и конкурентоспособности субъектов предпринимательства в экономически безопасных условиях является наличие доступа ко всем видам ресурсов, создающих основу для технологического, технического, научно-теоретического и практического развития, обеспечения кадровым потенциалом, имеющим современный образ мышления [8]. В рамках этих условий обеспечивается достижение субъектами стратегических целей, рациональное использование ресурсов, безопасные условия функционирования и развития. Поэтому одной из основ успешной деятельности хозяйствующих субъектов в современную эпоху является формирование оптимального механизма создания и управления средой экономической безопасности. Этот фактор сохраняет свою актуальность для большинства предпринимательских предприятий, особенно на фоне быстрых изменений, вызванных влиянием глобализации.

Обеспечение экономической безопасности в различных средах деятельности требует выполнения различных превентивных мер и управленческих операций [3]. Целью в обоих случаях является предотвращение угроз экономической безопасности, снижение минимизация порога ее негативных последствий.

Следует отметить, что процесс обеспечения и управления экономической безопасностью субъектов деятельности является достаточно сложным процессом. Эта сложность в основном связана с измерением влияния различных факторов и выявлением их взаимосвязей и взаимозависимостей с основными экономическими показателями субъекта.

Формирование эффективной системы, создающей основу обеспечения экономической безопасности субъектов предпринимательства, требует выделения ключевых элементов и разработки механизма методологического подхода к данному вопросу.

Исследования показывают, что экономическая безопасность предприятий обеспечивается безопасностью следующих трёх основных элементов:

1.Трудовых ресурсов-персонала;

2.Обеспеченности ресурсами, соответствующими характеру деятельности;

3.Защищённости от внешних и внутренних угроз различного происхождения.

Состояние безопасности этих элементов позволяет субъектам добиваться конкурентных преимуществ, увеличивать доходы и прибыль, достигать поставленных целей, выполнять свои обязательства в срок, увеличивать объемы производства, улучшать качество услуг и продукции, а также получать другие преимущества.

Целью создания системы управления экономической безопасностью субъекта предпринимательства, является формирование механизма методического подхода к обеспечению экономической безопасности и обеспечение эффективной, устойчивой и надежной деятельности, устойчивого развития в текущем периоде и ближайшем будущем, повышение экономико-финансового потенциала субъекта, защита его трудового потенциала от разрушительных факторов внешней и внутренней среды.

Методический подход к обеспечению экономической безопасности предполагает осуществление мероприятий на основе определенного алгоритма. К таким мерам относятся:

1.Определение уровня безопасности среды деятельности: на этом этапе анализируются и оцениваются внутренние и внешние факторы, создающие угрозу. Применение методов SWOT и PESTEL анализа позволяет более реалистично оценить среду безопасности, определить степень воздействия вероятных угроз.

2.Следующий этап методического подхода предполагает выявление и конкретизацию критериев и показателей безопасности, характерных для сферы деятельности хозяйствующего субъекта. К ним относятся: финансовая (уровень и потенциал финансовой безопасности, показатели ликвидности, объем задолженности, оборачиваемость капитала), маркетинговая (состояние постоянного совершенствования рыночной стратегии, эффективность маркетинговых исследований, доля предприятия на рынке, динамика продаж, уровень использования электронных, персональных платформ и каналов продаж и т.д.), цифровая безопасность (устойчивость к кибератакам, надежность защиты баз данных).

3.Оценка уровня безопасности проводится на основе балльной системы и сравнения с нормативными показателями, а по результатам составляется карта рисков для безопасности субъектов.

4.Планирование превентивных мер безопасности является одним из важных этапов методического подхода. Эти мероприятия предполагают внедрение методов и инструментов управления в кризисное время, диверсификацию рисков, механизма организации страхового дела, построение и постоянное совершенствование системы внутриведомственного контроля и аудита.

5.Следующий алгоритм предполагает применение мер безопасности, в том числе оптимизацию системы управления финансовыми потоками и финансовыми операциями предприятия, усиление системы внутреннего контроля на предприятии, внедрение инновационных и цифровых стандартов безопасности, реализация мер безопасности, обновление маркетинговых, конкурентных, инвестиционных, управленческих и других стратегий.

6. Последний алгоритм процесса предполагает мониторинг методологического подхода к обеспечению безопасности и внесение в него корректировок. На основе установленных критериев регулярно анализируются показатели безопасности, выявляются новые источники рисков и реализуются превентивные меры. Вносятся необходимые коррективы для выявления и устранения проблем в механизме подхода.

Деятельность по данному алгоритму является одной из оптимальных моделей системного обеспечения и эффективного управления экономической безопасностью субъектов предпринимательства.

**Заключение**. Роль предпринимательских субъектов в обеспечении экономического развития и роста на современном этапе, в установлении и расширении экономических отношений и связей на макро-и микроуровнях неоспорима. Повышение роли и значения этих субъектов в развитии экономической системы обусловлено, главным образом, их экономической безопасностью. Устойчивое повышение экономического потенциала субъектов, усиление их финансовой устойчивости, способности противостоять экономическим кризисам и колебаниям становится возможным именно в условиях, когда экономические угрозы и риски минимальны. Поэтому обеспечение экономической безопасности входит в число важных факторов эффективной деятельности субъектов предпринимательства.

Проведенное исследование показывает, что экономическая безопасность предпринимательских субъектов является одним из основных условий их эффективной, устойчивой деятельности. При этом безопасность не ограничивается только финансовой стабильностью и устойчивостью и требует комплексного подхода к вопросу. Предложенный методический подход позволяет субъектам установить более системный, гибкий и планомерный механизм обеспечения и управления экономической безопасностью.

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# АУТСОРСИНГ БУХГАЛТЕРСКИХ УСЛУГ: ПРОБЛЕМЫ И ПУТИ ИХ РЕШЕНИЯ

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# OUTSOURCING OF ACCOUNTING SERVICES: PROBLEMS AND SOLUTIONS

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**Аннотация**

В статье рассматривается роль аутсорсинга бухгалтерских услуг в финансовом учёте современных организаций. Анализируются основные проблемы: снижение контроля, задержки передачи данных, риски конфиденциальности и кадровые трудности. Предлагаются пути решения через цифровизацию, внедрение регламентов, контроль качества и согласованную учетную политику, что повышает эффективность и надёжность бухгалтерского учёта.

**Abstract**

This article examines the role of outsourcing accounting services in the financial accounting of modern organizations. The main challenges are analyzed: reduced control, delays in data transfer, confidentiality risks, and personnel issues. Solutions through digitalization, implementation of regulations, quality control, and a consistent accounting policy are proposed to enhance efficiency and reliability in accounting.

**Ключевые слова**: Аутсорсинг, бухгалтерские услуги, финансовый учёт, риски, цифровизация, контроль качества, оптимизация процессов.

**Keywords**: Outsourcing, accounting services, financial accounting, risks, digitalization, quality control, process optimization.

## 1. Introduction

Outsourcing accounting services is one of the key tools for optimizing the financial processes of modern companies. Organizations face increasing reporting requirements, rising costs, and the need for higher accounting quality. Transferring some accounting functions to an external specialist allows companies to focus on core operations, reduce staffing expenses, and improve efficiency.

However, outsourcing also introduces a number of challenges that may reduce its effectiveness if not properly managed. Issues such as delays in document submission, reduced internal control, confidentiality risks, and inconsistencies in accounting policies can significantly impact financial reporting quality and compliance.

In recent years, companies across various industries have increasingly shifted from traditional in-house accounting to hybrid or fully outsourced models. This transition is driven by the desire for greater accuracy, transparency, and alignment with international standards such as IFRS. Additionally, rapid digitalization requires organizations to implement modern tools and technologies, many of which are more efficiently handled by specialized outsourcing providers.

Furthermore, globalization and the growth of cross-border operations have increased the demand for highly specialized accounting expertise that many internal departments cannot provide. As a result, outsourcing has evolved from a basic operational service into a strategic instrument for strengthening corporate governance, enhancing financial control, and improving the overall quality of financial reporting. The purpose of this article is to identify the main problems of accounting outsourcing and propose solutions to improve the reliability and efficiency of financial accounting.

## 2. The Essence of Accounting Outsourcing

Accounting outsourcing involves transferring the functions of bookkeeping, tax accounting, payroll calculation, financial reporting, and support during tax audits to a specialized external organization.

The main advantages include:

- reduced costs of maintaining an internal accounting department;
- access to experienced professionals;
- use of advanced software and automated systems;
- reduced risks of errors through professional expertise.

Despite the benefits, the effectiveness of outsourcing depends on high-quality communication, internal controls, and properly defined procedures.

Modern outsourcing is no longer limited to routine bookkeeping tasks. Today, outsourcing providers deliver comprehensive financial solutions that combine technology, analytics, and regulatory expertise. Their services now include continuous access to financial data through integrated digital platforms, automated systems that identify tax risks and monitor compliance, full payroll administration supported by statutory reporting, and professional assistance in the implementation of IFRS, consolidation procedures, and financial transformation projects. Many providers also offer tools for scenario analysis, budgeting, and long-term financial planning, which expand the role of outsourcing beyond operational support.

As a result, outsourcing has evolved into a strategic element of corporate financial management. It enhances the quality of managerial decision-making, increases transparency, and ensures a more structured approach to the organization's financial processes.

In Kazakhstan, the development of outsourcing is significantly influenced by ongoing digital reforms. The adoption of state electronic systems such as e-SФ, automated tax reporting solutions, and online banking platforms requires high accuracy and rapid data processing. To meet these demands, outsourcing firms increasingly implement cloud-based accounting environments, robotic process automation, and machine-learning tools capable of detecting errors and inconsistencies. These technologies reduce manual workloads, minimize operational risks, and accelerate the month-end closing process.

3. Key Problems of Accounting Outsourcing

*3.1 Delayed Submission of Documents*

Late submission of primary documents by the client leads to distorted financial results, errors in tax and payroll calculations, and potential penalties. Incomplete or delayed data interferes with decision-making at the management level.

A deeper issue behind delayed primary documents is the lack of standardized internal processes within the client organization. Many companies rely on manual workflows without clear responsibilities, which leads to chaotic data collection and last-minute submissions. The outsourcing provider becomes forced to perform urgent processing, raising the risk of errors.

Moreover, delays accumulate across multiple accounting cycles, causing a chain reaction: incorrect accruals, misstatement of expenses, and unreliable cash-flow forecasts. Over time, this negatively affects financial stability and investor confidence.

*3.2 Reduced Internal Control*

When accounting functions are transferred to an external provider, the company loses control over daily operations. Management receives information only after the reporting period, which limits timely planning and analysis.

The transition to outsourcing often reveals gaps in internal governance. When management relies solely on external monthly reports, it loses access to daily operational insights necessary for budgeting, cost control, and timely decision-making.

Additionally, companies frequently underestimate the need for internal monitoring tools after outsourcing. As a result, deviations go unnoticed until quarter-end or year-end, when correction becomes more difficult and costly. Strengthening internal control should therefore remain a shared responsibility between the client and the provider

*3.3 Communication Issues*

Insufficient communication between the client and the outsourcing provider results in misunderstandings, delays, and mistakes. Frequent staff turnover within the outsourcing company increases the risk and disrupts continuity, making it more difficult to maintain consistent processes. Effective collaboration requires establishing clear communication channels, regular updates, and standardized reporting procedures to ensure that all parties are aligned, deadlines are met, and critical information is accurately conveyed.

*3.4 Confidentiality Risks*

Transferring sensitive financial information to a third party increases the risk of data breaches. Documents such as bank statements and digital signatures must be strictly protected. There is a potential risk of unauthorized access, accidental disclosure, or misuse of information if proper security measures are not in place. Companies should ensure secure data transmission using encryption and VPNs, implement strict access controls and authentication to limit data access to authorized personnel only, and regularly monitor and audit third-party data handling practices. Confidentiality can be reinforced through non-disclosure agreements and contractual clauses, while having a clear data breach response plan ensures quick containment and remediation of incidents. Additionally, organizations should practice data minimization, sharing only the necessary information with service providers, and ensure compliance with relevant data protection regulations.

*3.5 Inconsistent Accounting Policies*

Differences in accounting methods between the client and the outsourcing provider may lead to inconsistent reporting, complicating analysis and drawing attention from tax authorities.

Such inconsistencies can arise from variations in revenue recognition, expense classification, depreciation methods, or treatment of provisions and accruals. They may result in misstatements, reconciliation challenges, and delays in preparing accurate financial statements. To minimize these risks, it is essential to establish clear accounting policies, ensure alignment and communication between the client and the provider, provide detailed guidelines and training, and perform regular reviews to verify compliance with both internal standards and applicable regulatory requirements. Consistent policies help maintain the integrity of financial information and reduce the likelihood of audit issues or regulatory scrutiny.

*3.6 Personnel Challenges within the Outsourcing Company*

High employee turnover increases the probability of mistakes. Newly assigned accountants need time for training and adaptation, causing delays and inaccuracies. Additionally, frequent staff changes can disrupt continuity, reduce institutional knowledge, and complicate communication between the client and the provider. To address these challenges, companies should

ensure that the outsourcing provider has robust training programs, standardized procedures, and knowledge transfer practices in place, while maintaining regular oversight and review to quickly identify and correct potential mistakes.

*3.7 Interaction with Regulatory Authorities*

If documents are stored by the outsourcing company and communication is weak, information may not be provided to auditors or regulators on time, resulting in fines or extended inspections.

Delays or inaccuracies in responding to regulatory requests can damage the company's credibility and increase the risk of compliance violations. To mitigate these risks, companies should establish clear protocols for document access and reporting, maintain open and timely communication channels with the outsourcing provider, and conduct regular checks to ensure all required information is readily available. Ensuring alignment on deadlines, regulatory requirements, and audit procedures helps preserve transparency and reduces the likelihood of costly regulatory issues.

4. Solutions to Identified Problems

*4.1 Implementation of Work Regulations*

Creating detailed regulations for interaction (document submission deadlines, responsibilities, communication channels, month-end closing schedule) helps minimize errors and ensures timely processing. Such regulations establish a structured workflow between the client and the outsourcing provider, reducing misunderstandings and improving accountability. They also facilitate smoother onboarding of new staff, maintain continuity despite personnel changes, and provide a clear reference for resolving disputes or clarifying procedures. Regular review and updating of these work regulations ensure they remain aligned with evolving business needs, regulatory requirements, and technological advancements, further enhancing efficiency and reliability in outsourced accounting operations.

*4.2 Digital Tools and Automation*

Using cloud services, electronic document management, and automated upload platforms simplifies data transfer. Clients can track operations in real time and reduce human error. Integration with accounting software enables automated reconciliation, reporting, and analytics, allowing for more accurate and timely financial statements. Additionally, digital tools support secure access to sensitive data, maintain audit trails, and facilitate compliance with regulatory requirements. By leveraging these technologies, companies can improve efficiency, enhance transparency, and strengthen control over outsourced accounting processes.

*4.3 Quality Control and Regular Audits*

Periodic reconciliation of accounts, verification of tax reporting, and independent audits ensure accuracy and reduce risks of violations and penalties.

A three-level quality assurance model is recommended:

1. operational control by junior/senior accountants;
2. supervisory review by team leaders;
3. periodic audits by independent specialists.

This structure minimizes the risk of material misstatements and ensures compliance with tax regulations and IFRS

*4.4 Data Protection Measures*

Non-disclosure agreements (NDAs), data encryption, access restrictions, and backup systems protect confidential information and minimize legal risks.

Companies should implement non-disclosure agreements with liability clauses and regularly train employees on cybersecurity.

Both parties should view financial data as a valuable digital asset requiring ongoing protection.

*4.5 Unified Accounting Policy*

Establishing unified approaches for revenue recognition, expense allocation, asset valuation, and advance reporting ensures transparency and consistency of financial statements.

The policy must include detailed rules for asset capitalization, allowance calculation, tax adjustments, revenue allocation, VAT treatment, and foreign-currency revaluations.

Clear instructions prevent misinterpretations and ensure stable, comparable financial statements across reporting periods.

*4.6 Appointing an Internal Responsible Employee*

Assigning a company employee to manage communication and control document delivery improves coordination and reduces errors.

A dedicated internal coordinator ensures timely submission of documents, monitors communication, and keeps management aware of current issues.

This role significantly reduces operational risks and improves cooperation quality.

Table 1.

Key Problems and Solutions in Accounting Outsourcing

| **Problem** | **Consequences** | **Solutions** |
|---|---|---|
| Delay in document submission | Errors, penalties, delayed decisions | Deadlines, regulations, electronic document management |
| Reduced internal control | Lack of transparency, risk of errors | Regular reporting, internal control, audits |
| Communication issues | Misunderstandings, delays | Dedicated responsible employee, online platform |
| Confidentiality risks | Data leakage | NDA, encryption, restricted access |
| Inconsistent accounting policies | Inaccurate reporting | Unified accounting policy |
| Personnel turnover | Errors, delays | Documentation, staff training |
| Interaction with regulators | Missed deadlines, fines | Timely document submission, digital systems |

**[Company] → Transfer of documents → [Outsourcing Provider]**
**[Company] ← Reports and reconciliations ← [Outsourcing Provider]**
**[Company] ← Quality control, audit ← [Outsourcing Provider]**
**[Outsourcing Provider] → Electronic data and reports → [Company]**

*Figure 1. Model of Interaction between the Company and the Outsourcing Provider*

**Traditional in-house accounting → Hybrid model → Full outsourcing → Digital analytical partnership.**

*Figure 2. Transition from Traditional Accounting to Outsourcing*

Conclusion

Outsourcing accounting services helps optimize expenses, increase accounting quality, and allow companies to focus on core operations. Its effectiveness depends on well-structured interaction, digitalization, quality control, information security, and consistent accounting policies. Combining these measures minimizes risks and increases the reliability of financial reporting. In addition, careful selection of a qualified outsourcing provider ensures access to skilled personnel familiar with industry-specific regulations and best practices. Regular monitoring, clear communication protocols, and defined responsibilities help prevent errors, delays, and misunderstandings.

Proper training and knowledge transfer within the outsourcing team maintain continuity despite staff turnover, while alignment with regulatory and internal standards reduces the likelihood of compliance issues or fines. The use of advanced digital tools enables real-time data access, automated reporting, and analytics that support informed decision-making and strategic planning. Strong data protection measures safeguard sensitive financial information from breaches or misuse, reinforcing trust between the client and the provider.

By integrating these practices, companies not only reduce operational and regulatory risks but also enhance the transparency, accuracy, and overall reliability of financial reporting. This allows organizations to fully leverage outsourcing as a strategic tool that supports sustainable growth, operational efficiency, and long-term business resilience.

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# MATERIALS SCIENCE AND MECHANICS OF MACHINES

## INTEGRATION OF PLC SYSTEMS AND ARTIFICIAL INTELLIGENCE AS A BASIS FOR THE IMPLEMENTATION OF THE INDUSTRY 4.0 CONCEPT

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**Abstract**

This research work is based on the analysis of relevant domestic and, above all, foreign scientific and professional literature, as well as on practical experience in the study and application of the integration of programmable logic controllers (PLC) and artificial intelligence (AI) as a key basis for the implementation of the Industry 4.0 concept. Artificial intelligence is changing the traditional automation process in many ways. The paper presents the possibilities realized by combining deterministic control with traditional programmable logic controllers, i.e. PLC systems, and adaptive decision-making based on artificial intelligence algorithms. For research purposes, a practical experiment was conducted with the aim of analyzing the impact of the integration of PLC (which were excellent for repetitive tasks) and AI on production automation processes. The paper explains the basic functions of PLC devices, the working principles of AI systems and the importance of digital transformation in modern industry. Also shown is a practical example of their application via a conveyor belt controlled by a PLC system, while the AI model analyzes engine operation data and predicts potential failures. Research results show that the application of artificial intelligence significantly improves the reliability and efficiency of production processes, reduces unplanned downtime and contributes to a greater degree of automation and sustainability of industrial systems.

**Keywords:** PLC, artificial intelligence, industry 4.0

**Introduction.** Modern automated industrial systems represent large-scale systems, which require the establishment of complex and sometimes mutually conflicting automation goals[6]. Effective management of such systems can be achieved by applying adequately organized and technically complex large-scale automated systems. Automation introduces fundamental changes in the way processes are carried out in modern industry, whereby the application of automated solutions contributes to increasing production capacity, stabilizing quality standards, optimizing operating costs, as well as providing a more consistent experience to end users[9]. Modern factories function within the Industry 4.0 paradigm, creating the so-called "Smart systems" in which different components communicate with each other [7]. Industrial production is in the process of deep transformation known as industry 4.0, which implies digitalization, connection and intelligent automation of all segments of the production system. The key goal of this transformation is to increase the efficiency, flexibility and autonomy of the process, while at the same time reducing the costs and time needed to adapt to market requirements[8]. However, traditional PLC systems, even if they are extremely stable and accurate, have limited possibilities in terms of

adaptation and decision-making in conditions of variable and complex processes [4]. On the other hand, the development of artificial intelligence, especially in the field of machine learning and data processing, enables systems to independently analyze information, recognize patterns and optimize processes without direct operator intervention. The integration of these technologies opens up new possibilities for creating intelligent production systems capable of self-learning and predicting the state of the system[17]. The combination of PLC and AI technologies represents a logical step in the evolution of industrial automation. PLC provides stability, deterministic execution and security, while AI adds the ability to analyze and make predictive decisions. This achieves a synergy between traditional control and modern intelligent methods[2]. It is known that PLC uses program code to control and monitor business processes, which enables reliable control, diagnostics, greater precision, integration, that is, reliability and flexibility in the management of industrial systems. In this context, the goal of the research is to examine the effectiveness of the integration of PLC and AI technologies in the production automation system on the contact example of conveyor belt automation, with a focus on predictive maintenance and prevention of engine failures, as well as to check whether the AI algorithm, based on the collected data on the operation of the engine, can recognize in time anomalies that indicate a potential failure and thus improve the reliability of the process.

## I. THE ROLE OF THE PROGRAMMABLE LOGIC CONTROLLER IN AUTOMATION

Programmable logic controllers (PLC) represent key components in managing industrial systems and machines, and occupy a central place in modern industry and production. Their application covers a wide range of engineering fields, including factory automation, robotics, industrial systems, transport and infrastructure[19]. Industrial controllers, and especially PLC systems, form an important technological basis for the automation of industrial processes. They are particularly suitable for managing various devices thanks to their high degree of reliability and minimal risk of failure. They function by monitoring and controlling the work of sensors and actuators through electrical signals, where they are characterized by robustness and the ability to work in demanding conditions, including open space conditions[14]. These properties - self-protection and durability - are vital for the stable functioning and control of external devices that must work continuously for many years. Over time, the basic functions of PLC systems have evolved from simple control operations to more complex functionalities, including networking, motion control, process control, distributed control, and sequential control[15].

Thanks to the mentioned properties, automation systems based on PLC controllers can be adapted in detail to the specific requirements of various industrial branches. Modern models of new generation PLC systems are designed to provide greater resistance compared to standard models, especially in terms of working in aggressive industrial environments and extreme conditions[26]. Although PLC represents the basis of industrial automation, it also has certain limitations, traditional PLC devices are primarily designed to perform deterministic logic operations and simple regulatory functions (eg PID control). In conditions when processes become more complex, variable and dynamic, the traditional PLC architecture is unable to provide adaptability and predictive decision-making characteristic of intelligent systems[27]. Also, the processing of large amounts of data (Big data) and the implementation of machine learning algorithms require significantly more processing power and memory resources than a standard PLC can provide. Therefore, in modern industrial practice, PLC systems are increasingly combined with external AI models, computers on the edge of the network (edge devices) or cloud platforms that take over the functions of analytics and decision-making [18]. This evolution indicates a transition from traditional to intelligent automation, where the PLC is no longer an isolated control device, but part of a wider network of connected and self-learning systems. This creates prerequisites for integration with artificial intelligence technologies[24].

## II. INTEGRATION OF PLC AND AI SYSTEMS

With the application of new advanced technologies in production processes, the amount of data is doubling from year to year, resulting in a large amount of unprocessed information. Using appropriate methods, algorithms and software tools, different types of data can be collected from different segments of the production environment[20]. Industry automation means connecting different types of devices and systems to collect data and improve business performance. In recent years, big data has become one of the central areas of artificial intelligence development in both academic and industrial research[1,3,11,21]. Artificial intelligence represents one of the most significant achievements of modern technological development and a key driver of the transformation of industrial systems in the era of Industry 4.0. The basic idea of AI technology is to enable computers to imitate the human ability to learn, reason and make decisions based on data and experience[10]. In an industrial context, AI enables the creation of intelligent systems that not only perform predefined tasks, but also independently analyze the state of the process, predict changes and optimize work in real time[23].

It is this ability to adapt and make autonomous decisions that makes AI technology a key element of smart factories, where the physical and digital worlds merge into a unique intelligent management system[22]. The concept of Industry 4.0 is based on an interconnected ecosystem of devices, sensors, machines and information systems that exchange data in real time[23]. In this framework, artificial intelligence plays the role of a "brain" that analyzes data, recognizes patterns and makes decisions based on analytical models. Through connection with the Internet of Things (IOT), cloud and edge technologies, AI enables decentralized management and optimization at all levels of production, which is why hybrid models are increasingly being used in practice - where combining traditional PLC control and AI analytics achieves a balance between re-

liability and intelligent decision-making. Such approaches form the basis of the integration of PLC and AI technologies [20].

The integration of programmable logic controller and artificial intelligence represents a key step in the transformation of traditional industrial automation into intelligent, self-learning and adaptive production systems[25]. While PLC provides reliable and deterministic real-time process control, AI contributes analytical capability, learning from data and making optimized decisions. The synergy of these technologies creates the basis for Industry 4.0, where physical processes, digital models and analytical algorithms are connected in a single, intelligent eco-system [5,13]. The combination of PLC and AI technologies achieves functional complementarity;

-PLC provides deterministic control, security and real-time execution

-AI enables adaptation, analytics and predictive decision making.

In this way, a two-layer structure is formed - the level of control (PLC) and the level of intelligence (AI) - which communicate with each other and exchange data, thus achieving a greater degree of flexibility and efficiency.

## III. MATERIALS AND METHOD

In order to achieve the objectives of the research and to confirm or refute the hypothesis, a methodological framework was developed that combines quantitative and qualitative research methods. This approach enables a comprehensive analysis of the phenomenon, as it includes both numerical data and qualitative insights relevant to understanding the integration of artificial intelligence and programmable logic controllers in industrial automation. The research was conducted in three phases. In the first part, data collection was carried out. In the second part, AI training was performed. In the third part, implementation and testing were carried out. Various instruments were used in the research process that enabled observation, content analysis, testing and scaling, as well as measurement of basic and organizational performance. In addition, procedures based on tables, reviews, tests of individual and team abilities and knowledge were applied, while numerical, graphic and ranking scales were used for quantitative comparison of various parameters.

## IV. RESULTS

This paper investigates and analyzes the integration of programmable logic controllers and artificial intelligence in the process of industrial automation, special emphasis is placed on the automated conveyor belt with longitudinal stops, which is used for the process of production automation. By connecting this model of the conveyor belt and different models of semi-automatic fillers or some other machines, an automatic line is obtained, which has a PLC that serves to adjust the parameters, i.e. work coordination. The results of the research showed that the AI model successfully detects more than 75% of anomalies that precede the actual failure, the average reaction time of the system is 0.5 seconds, the number of unplanned down times is reduced by 20%, as well as maintenance costs by 25%. The analysis shows that the integration of AI and PLC systems significantly improves the reliability and efficiency of the production process, the biggest effects were observed in predictive maintenance and energy efficiency. Compared to traditional methods, the AI model reacted more quickly to changes in operation, more accurately identified the occurrence of overheating and vibration anomalies. Figure 1 shows the improvement after the implementation of the integrated PLC-AI system.

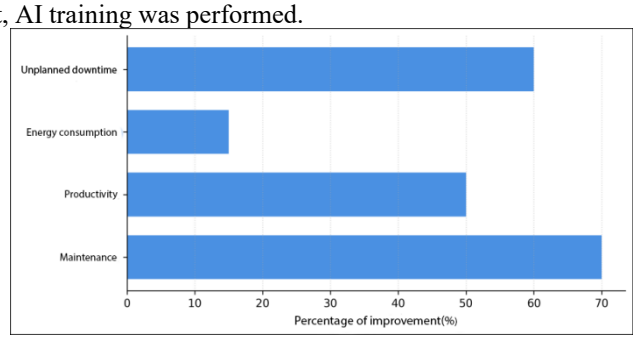


*Fig. 1 Improvement of PLC-AI integrated system*

The observed benefits of the automated conveyor belt system are; reducing unplanned downtime by 60%, reducing energy consumption and optimizing engine operation by 15%, as well as increasing productivity and reliability by 50%, and maintenance by 70%. Based on a review of recent literature, as well as practical research, it has been confirmed that the integrated management of automated devices using PLC systems and artificial intelligence methods significantly improves the efficiency and quality of the production process. The results obtained also indicate that any control system can benefit from the inclusion of PLC systems and artificial intelligence in industrial conveyor belt automation that can be used in almost any industry for a wide range of transport tasks.

## V. DISCUSSION

The main goal of modern production is the maximum engagement of all available capacities of the industrial environment, with the aim of achieving as many advantages as possible that modern technologies can provide. Research shows that PLC, that is, “Programmable Logic Controller” , is an indispensable component of industrial automation, which is essential for the control and automation of various industrial processes. Such production models usually require intensive use of available resources in the shortest possible

period of time. The functioning of automated production systems is the result of the harmonious integration of various elements of production, whereby the systems consist of interdependent components connected and united by common production, investment and development goals. In manufacturing automation, artificial intelligence integrates with robots, machines, programmable logic controllers, and smart devices, enabling faster, more accurate, and more efficient process execution, while significantly reducing the need for human supervision. The application of artificial intelligence and machine learning in PLC system programming enables process optimization based on the processing of large amounts of data. Algorithms of this type are capable of analyzing patterns, identifying anomalies and predicting future events. The achieved results confirm that the integration of PLC and AI technologies brings concrete advantages in terms of reliability and efficiency of industrial systems. The biggest advantage of the system is the ability of self-learning and adaptation, while the main challenges are still the compatibility of different systems and the security of network communication. Further development should be directed towards the implementation of AI models directly in PLC devices and better standardization of protocols for integrating intelligent algorithms into industrial infrastructure.

## VI. CONCLUSION

Industrial automation in the modern era has seen significant progress in numerous fields, with data collection and processing taking a special place. Digitization and application of intelligent methods in production processes have become necessary for modern industry. Research in practice shows that PLC represent devices that have become an indispensable part of industrial automation, enabling precise control and supervision of numerous business processes in various industries around the world. As technological progress continues to accelerate, the integration of PLC systems and artificial intelligence is expected to lead to revolutionary changes in the industry, making production systems more intelligent, faster and more adaptable, the development of industrial automation in the Industry 4.0 era has necessitated the Integration of traditional control systems, such as programmable logic controllers with advanced artificial intelligence technologies. This synergy represents a key step towards the formation of intelligent production systems capable of independently analyzing, predicting and optimizing processes in real time. During the work, it was shown that PLC, as a basic element of automation, ensures stability, accuracy and reliability in the management of industrial processes, while AI introduces the dimension of adaptive learning and predictive decision-making. The combination of these technologies achieves a significant increase in efficiency, quality and flexibility of production, while reducing costs and downtime. The results of the analysis show that the integration of PLC and AI systems brings numerous advantages – increasing productivity, predictive maintenance, energy optimization and reducing human intervention. However, numerous challenges of limitation of the processing power of PLC devices, the need for standardization of communication protocols, security risks and lack of professional staff were also observed. The research results indicate that the application of AI technologies will redefine the automation process from traditional PLC systems to more intelligent and adaptive solutions. The future of industrial automation is based on the tight integration of PLC and AI technologies, as well as the integration of the Internet of Things (IoT) and PLC programming, whereby the PLC will retain the role of a stable control core, while AI will represent the brain of the system that enables decision-making based on data analysis and experience.

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# MUSICOLOGY

## ИЗ ИСТОРИИ КАМЕРНОГО ОРКЕСТРА ЛЕНИНАКАНА

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## FROM THE HISTORY OF THE LENINAKAN CHAMBER ORCHESTRA

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**Аннотация**

В статье рассматривается история формирования и деятельности камерных оркестров Ленинакана с 1960-х годов до конца 1970-х. Представлены коллективы под руководством Сергея Мацояна, Татула Егиазаряна и Григора Даниеляна, их концертные программы, гастроли и художественные инициативы. Особое внимание уделяется успехам государственного камерного оркестра, которым в 1977–1979 гг. руководил Григор Даниелян, его знаменательным концертам, поездкам, а также ряду премьер, состоявшихся в музыкальной жизни Армении, включая первое исполнение мистерия-сонаты Бибера. Отмечается роль культурной среды Ленинакана в развитии камерного искусства и представляется широкая панорама музыкальной жизни данного периода на основе архивных материалов прессы и интервью.

**Abstract**

The article examines the history of the formation and activity of Leninakan's chamber orchestras from the 1960s to the late 1970s. It presents the ensembles led by Sergey Matsoyan, Tatul Yeghiazaryan, and Grigor Danielyan, their concert programs, tours, and artistic initiatives. Special attention is given to the achievements of the state chamber orchestra conducted by Grigor Danielyan between 1977 and 1979, its notable concerts, tours, as well as a number of premieres in Armenia's musical life—including the first performance of Biber's *Mystery Sonata*. The study highlights the role of Leninakan's cultural environment in the development of chamber music and offers a comprehensive overview of the city's musical life during that period, based on archival press materials and interviews.

**Ключевые слова**: Камерный оркестр Ленинакана, Григор Даниелян, Сергей Мацоян, камерная музыка в Армении, концерты.

**Keywords**: Leninakan Chamber Orchestra, Grigor Danielyan, Sergey Matsoyan, Chamber Music in Armenia, Concerts.

In the 1960s, two chamber orchestras operated in Leninakan. The first was conducted by Sergey Matsoyan. Sergey Matsoyan was born and spent his childhood and adolescence in Leninakan. He studied at the Kara-Murza Music College and later received his higher education at the Kyiv State Tchaikovsky Conservatory, completing postgraduate studies at the same institution. Afterward, he began working at the Odesa Philharmonic, rising from assistant conductor of the symphony orchestra to its principal conductor.

In 1967, he returned to Leninakan, initially serving as director of the Kara-Murza Music College and later as head of the Music Department at the M. Nalbandyan Pedagogical Institute. Alongside his pedagogical work, he formed a state chamber ensemble, which operated for several years but was later dissolved due to failure to meet performance quotas. Subsequently, Tatul Yeghiazaryan returned from the Baltic region to Leninakan and founded a 16-member chamber orchestra. The ensemble staged Artemi Ayvazyan's musical *"The Dentist from the East."* Concert tickets have been preserved that attest to Yeghiazaryan's active performance activities. Their repertoire included works by Haydn, Mozart, Vivaldi, Shostakovich, Komitas, and other prominent composers. Unfortunately, the orchestra operated for only two years and was disbanded due to the lack of a rehearsal space (according to an interview with musician Khachik Chalikyan, who performed in these ensembles).

Later, between 1977 and 1979, a chamber orchestra was once again established in Leninakan, this time under the direction of Grigor Danielyan (known as Daniel Musician). In an interview, he recalled those years with great affection:

"The orchestra I conducted had originally been founded by Sergey Matsoyan. I came in after Matsoyan left for Odesa," said G. Danielyan.

Everything began when he participated in — and won — the competition announced for the vacant position of opera-symphonic conductor. A week later, Edgar Hovhannisyan, who at the time was the artistic director of the Philharmonic, called him and said that there were already enough conductors at the opera. *"It would be better for you to go to Leninakan,"* he told him, explaining that Karen Demirchyan was concerned

that, after Sergey Matsoyan and T. Yeghiazaryan, the chamber orchestra in Leninakan needed a conductor. Thus, Grigor Danielyan was assigned to Leninakan.

"After Sergey Matsoyan, people would say: 'Leninakan is the second city—how can its orchestra remain without a conductor? It was second, but not secondary,'" says G. Danielyan.

Edgar Hovhannisyan later told him, *"I am your godfather—as a conductor."* This was how Danielyan arrived in Leninakan, though even before that he had been teaching at the Kara-Murza Music College. Danielyan prepared a program with the orchestra, which then had to be assessed by an artistic council. That council included prominent musicologists Robert Atayan and Margarit Harutyunyan.

The chamber orchestra of Leninakan appeared before the music lovers of the capital. For many, this was the first encounter with the only ensemble representing the chamber genre of our republic's second city. And it should be noted that this encounter left a pleasant impression. Several artists present at the concert shared their thoughts about the evening.

**Robert Atayan (musicologist):** *"The very fact of the existence of the Leninakan Chamber Orchestra is already a welcome phenomenon in our cultural life. A group of enthusiastic young musicians has undertaken a very commendable mission. Under the direction of the talented musicologist and gifted conductor G. Danielyan, they have prepared, with such a small ensemble, a tastefully selected repertoire, which this evening produced a very gratifying impression. We hope and believe that the ensemble will yet speak with its full voice, bringing aesthetic pleasure to audiences many times over."*

**Gerondi Talalyan (cellist, Honored Artist of the Armenian SSR, professor)** – *"The Chamber Orchestra of Leninakan is an ensemble endowed with great potential. Today we were once again convinced of this."*

("Yerevan Erekoyan," 10.03.1978)

"*We gave a concert at Tartu's European-standard concert hall together with S. Navasardyan and my late wife, Ruzanna Hovsepyan. That was the orchestra's first concert tour,*" recalls G. Danielyan.

There was still plenty of time before the start of the intercity Friendship Evening–Festival, yet the hall was already packed with visitors.

In addition to the nearly 120 delegates who had arrived from Leninakan, many residents of Tartu—primarily representatives of the youth of the sister city—had gathered to attend the event.

It is eight o'clock in the evening. The First Secretary of the Tartu City Party Committee, Juhanes Lott, announces the opening of the Friendship Evening.

Then, together with the Chairman of the City Executive Committee, Comrade Ilpi, he presents Certificates of Commendation from the Tartu City Party Committee and the City Executive Committee to the following: the Department of Culture of the Leninakan City Executive Committee, the Sevyan Cultural Palace's Song and Dance Ensemble, the "Aragats" Vocal-Instrumental Ensemble of the Builders' Cultural Palace, the State Chamber Ensemble, Honored Artist of the Armenian SSR A. Shaboyan, H. Sukiasyan, Honored Painter of the Armenian SSR Kh. Vardparonyan, V. Ohanjanyan, and G. Danielyan. ("Banvor," 02.11.1978)

"*We also performed with our pride and my close friend, the brilliant pianist Alexei Lyubimov,*" the maestro recalls again.

The Leninakan branch of Arkhimconcert opened its 1978–1979 concert season. The city's State Chamber Orchestra, conducted by G. Danielyan, appeared in concert. Performing as soloist was pianist Alexei Lyubimov—soloist of the Moscow Philharmonic and laureate of international competitions.

**Program:**

- J. Haydn – Concerto for Piano and Orchestra (D major)
- W. A. Mozart – Concerto for Piano and Orchestra (F major)
- A. Vivaldi – *Madrigalesco*
- P. I. Tchaikovsky – Waltz
- Ryayets – Concerto for Violin and Orchestra, soloist: G. Danielyan
- A. Shishyan – Arrangements of Armenian folk songs: *Materi* and *Pakhari*
- Provo – Concerto
- Y. Balyan – Scherzo
- A. Vivaldi – Concerto for Violin and Organ with Orchestra, organ: A. Lyubimov ("Banvor," 22.09.1978)

"*I also performed with Tigran Adamyan, who was the director of the Kara-Murza College and a wonderful cellist,*" says G. Danielyan.

The concert took place in Leninakan in 1978 and consisted of two parts:

**First Part:**

- A. Vivaldi – Cello Concerto (G major)
- A. Vivaldi – *Largo*
- A. Corelli – Trio Sonata
- G. Danielyan – *Song of Friendship Soloist: Tigran Adamyan (cello)*

**Second Part:**

- J. S. Bach – Piano Concerto No. 5
- A. Vivaldi – Concerto for Flute, Oboe, and Bassoon
- Stradella – Aria
- J. S. Bach – Fugue No. 3 from *The Art of Fugue*
- M. Yekmalyan – Excerpt from the *Pataraq* (Liturgy)
- A. Shishyan – *At the Tomb of the Unknown Soldier*, arranged by G. Danielyan

*Soloist: Diploma-holder of the 3rd Transcaucasian Competition Ruzanna Hovsepyan.*

"*I performed as soloist, playing A. Corelli. I also played the violin concerto by the contemporary Estonian composer J. Andres, during which I both performed and conducted the orchestra—this was in Estonia itself,*" recounts G. Danielyan.

"*We also gave concerts in various regions of Armenia,*" adds the maestro.

The State Chamber Orchestra of Leninakan has performed numerous times in Kirovakan, Artik, and other regions and cities of the republic, consistently earning high praise from music lovers. “Recently the orchestra performed for the music enthusiasts of Kajaran and Kapan. For the first time, accompanied by the organ (organist: laureate of the Transcaucasian Competition R. Hovsepyan), the Chamber Orchestra presented Corelli’s *Trio Sonata*. The organist then performed Bach’s Fifth *Concerto*. The horn solo in Stradella’s *Sacred Aria* was played by Vachagan Sargsyan.

The orchestra’s program also included A. Shishyan’s *At the Tomb of the Unknown Soldier*, the *Three Pieces* by Komitas–Aslamazyan, Vivaldi’s *Concerto*, Schubert’s *Barcarolle*, and other works. Among the soloists were P. Ughurlian (violin), G. Danielyan (viola), E. Khachatryan (bassoon), M. Petrosyan (cello), and others.”

(“Banvor,” 07.04.1978)

“Our orchestra had a rather interesting composition, and this had its advantages,” says G. Danielyan. “I myself made several arrangements for the ensemble—for example, Bach’s fugues. I also composed original works for the orchestra.”

“In the Chamber Orchestra,” continues G. Danielyan, “we had fourteen performers. The balance between the string and wind sections was somewhat uneven. I worked to select concert repertoire in such a way that this ‘shortage,’ so to speak, would turn into an advantage for our chamber ensemble.”

“A personal concert was held for composer Azat Shishyan,” says G. Danielyan. The concert took place on October 27, 1977, in Leninakan, again in two parts:

**Artistic Director and Conductor:** G. Danielyan

**Soloists:** Ruzanna Hovsepyan (piano), T. Adamyan (cello), Perch Ughurlian (violin), Rafik Asatryan (vocal). The concert was dedicated to the 60th anniversary of the Great October Socialist Revolution. (“Banvor,” 03.03.1978)

Danielyan also organized lecture-concerts with the orchestra, marking the 400th anniversary of Frescobaldi and the 300th anniversary of Vivaldi.

**Lecture-Concert**

On the occasion of the 60th anniversary of the Great October Socialist Revolution, a lecture-concert was organized at the House of Art Workers.

The lecture was delivered by G. Danielyan, Artistic Director of the Leninakan State Chamber Orchestra. Speaking about chamber music, he focused in particular on the life and works of the Italian violinist and composer Arcangelo Corelli.

Following the lecture, sonatas by Corelli were performed by:

the orchestra’s conductor and violinist G. Danielyan; violinists H. Mafyan and P. Ughurlian; cellist M. Petrosyan; pianist R. Hovsepyan; and cellist A. Simonyan.

In the concert section, the *Duo* for two violins by French composer Pleyel was also performed by G. Danielyan and H. Mafyan. The lecture-concert was instructive and took place in a warm and engaging atmosphere. (“Banvor,” 07.11.1977)

A musical evening dedicated to the great Italian violinist and composer Antonio Vivaldi was held at the House of Art Workers. G. Danielyan delivered a lecture on Vivaldi’s life and artistic path, after which the concert section began. Performed were the second and third movements of Vivaldi’s Concerto in G minor for flute, as well as the Concerto in A minor for violin.

The soloists were G. Danielyan (viola), P. Ughurlian (first violin), V. Terzibashyan (second violin), and M. Badikyan (flute). The concert also featured A. Simonyan (cello) and R. Hovsepyan (piano).

Many music lovers attended the lecture-concert, expressing their satisfaction with this remarkable event and congratulating the performers.

(“Banvor,” 03.02.1978)

The same program, with slight modifications, was later repeated at the Pedagogical College.

When asked why the ensemble eventually ceased its activity, the composer replied:

“Once Mansuryan came to Leninakan and told the director of the Philharmonic’s Leninakan branch, Jupiter Sargsyan: ‘Keep an eye on G. Danielyan—David Khanjyan, the chief conductor of the Armenian Philharmonic, wants to take him from Leninakan.’ Later, David Khanjyan asked me to come to Yerevan as his assistant conductor. And since I wanted to expand my professional activity, I left for Yerevan,” Danielyan explained.

During its existence, the ensemble premiered several works in Armenia. “With this orchestra, I performed in Armenia for the first time Heinrich Ignaz Franz von Biber’s *Mystery Sonata* for violin,” he recalled.

The maestro notes that working with the musicians of Leninakan came naturally to him, though there were occasional “enharmonic misunderstandings”—for instance, “I would say *d-sharp*, and they understood *e-flat*.”

Thus, from 1977 to 1979, the State Chamber Orchestra operated in Leninakan under the direction of Grigor Danielyan. In the interview, he highlighted the concert in Tartu as a particularly important milestone—the ensemble’s first international concert tour. The Chamber Orchestra performed Corelli’s *Trio Sonata* for the first time with organ accompaniment.

Concerts were also held marking the 400th anniversary of Frescobaldi and the 300th anniversary of Vivaldi. Among the orchestra’s notable performances, special attention should be given to the concert featuring the brilliant pianist Alexei Lyubimov, who performed Haydn’s Concerto in D major and Mozart’s Concerto in F major with the ensemble.

The orchestra also toured Estonia, where Grigor Danielyan appeared as soloist, performing Corelli’s works as well as the violin concerto by contemporary Estonian composer Jaan Rääts—leading the orchestra while also playing the solo part.

In Leninakan, one of the major artistic achievements of this ensemble was the Armenian premiere of Heinrich Ignaz Franz von Biber’s *Mystery Sonata* for violin.

**References**

1. “Banvor” Daily Newspaper, 1970s.

2. Interview with conductor, violinist, musicologist, public figure, composer, Honored Artist of Armenia, and recipient of the Golden Medal of the Ministry of Culture of Armenia, Grigor Danielyan (Daniel the Musician). 25.11.2025, Gyumri

# PEDAGOGY

## TECHNOLOGY OF TEACHİNG MATERİALS ON THE CONTENT LİNE "STATİSTİCS AND PROBABİLİTY" İN VIII GRADES OF SECONDARY SCHOOLS

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**Abstract**

The article draws attention to the elements that are considered necessary to be learned by students of the Mathematics subject “Statistics and Probability Content Line” taught in the VIII grades of general education schools, the fact that their educational activities are carried out in the direction of two basic standards (5.1 and 5.2), and presents the content and structured technological approach used to implement the educational process on the identified topics. The points that should be kept in focus in the process of teaching the topics are emphasized, it is considered appropriate to systematize the tasks according to the formulated research question, to have the students of the class work frontally and in groups (or pairs) to conduct research, and to conduct assessment in the lesson by levels.

This paper presents a system of criteria and tasks that are considered acceptable for effective summative assessment.

**Keywords:** mode, median and mean of data; test; probability; collection; selection; relatively complex events; compatible and incompatible events; scatterplot; centroid; greatest difference; cluster, gap, outlier; favorable cases; correlation; bar graph, two-column bar graph, pie chart, histogram, broken line graph.

*Relevance of the topic.* It is known that the effectiveness of the activity of the educator and the learner in the real pedagogical process is conditioned by the methodological system formed and applied on the basis of a functional goal with a system-forming component. Since the formation of a methodological system is a project of the creative process (creative processes do not easily and once reveal their invariants), its improvement is an eternal didactic problem.

"Technology of teaching materials on the content line "Statistics and Probability" in the VIII grades of secondary schools" can be understood as the formation and application of a "methodological system" of teaching the said materials. Therefore, we perceive the presented research topic as a topical didactic problem.

*Materials collected on the research topic*interpretation of generalization. In the framework document of the Concept of General Education in the Republic of Azerbaijan (National Curriculum), the curriculum is defined as “a conceptual document that enables the effective organization, purposeful and consistent implementation of all activities related to the educational process”, its content includes standards, expected results, necessary minimum, requirements for the preparation of learners, technology and assessment issues. In fact, each of these issues is included in the curriculum as its integral part, important components. The interaction of these components with each other, the completion of any one of them, its logical continuation are expected as an important requirement [1; 167]. There have been various approaches to modernizing the educational process, which have their own characteristics in terms of methodological systems. The elements of “Purpose ⇔ content ⇔ means ⇔ organizational form ⇔ result” were included in the structure of the educational system in different ways with their enabling functions, in other words, they entered the system corresponding to the changing content of the principles of education. Currently, in general education schools operating in Azerbaijan, preference is given to the active/interactive learning model and its methodological system (in other words, to the learner-centered implementation of education), which is adequate to the adopted Curriculum for the implementation of education (For more information, see: [11-12].)

In mathematics, the “Statistics and Probability Content Line” was included in order for students to learn such issues as determining and calculating the average value of various numerical quantities, taking into account coincidences during selection, classifying collected materials, and conducting analysis on graphs. Through this content line, the study of issues such as performing probability experiments, collecting data, and graphically depicting them is ensured in elementary grades, and in higher grades, a foundation is created for a deeper study of statistics and its impact on daily life, and the formation of judgment and decision-making experience based on the collected data [6; 66-68].

A student who has completed his/her education in the 8th grade:

5.1. Collects, systematizes, analyzes statistical information and presents the results.

5.1.1. Formulates appropriate questions to collect the necessary statistical data.

5.1.2. Constructs a table or diagram that characterizes the change in data selected according to certain characteristics.

5.1.3. Finds the mode, median, and mean of collected numerical data.

5.1.4. Makes predictions based on data analysis.

5.2. Understands and applies the concepts of probability.

5.2.1. Determines the number of possible test outcomes.

5.2.2. Distinguishes between unlikely and likely events.

5.2.3. Finds the number of favorable cases in relatively complex events.

As can be seen, the educational activities of VIII grade students on the aforementioned content lines are carried out in the direction of two main standards - “Collects, systematizes, analyzes and presents statistical information” (5.1), “Understands and applies the concepts of probability” (5.2). The standards for mathematics cover the content that is important for all students within the general education course, describe the mathematical comprehension abilities, knowledge and skills of students, determine the issues that every student in the country can and should learn in the field of mathematics, and prepare students for the next stage of education.

Each standard objective includes several expected learning outcomes defined according to the levels of general education. As emphasized in scientific sources, in the content standard, knowledge and activity act as sides of the unit [3; 84-85].

The student can achieve the content he will master in mathematics through various activities. During his activity, he makes judgments to solve problems, proves mathematical propositions, correlates the information he has obtained, develops a general mathematical model and presents it in various ways. The indicated stages of student activity in the process of mastering the content ensure that the acquired knowledge and skills are more solid and long-lasting. Scientific sources correctly emphasize that the level of realization of the expected results of students' educational activities depends on the "dialectical unity of the educational situation (or tasks), educational operations, control and assessment elements". Educational activity is a type of human activity, a specific form of social activity of the individual, and training is an important characteristic of educational activity [2; 150].

The compilers of the mathematics curriculum and the authors of the textbook set are of the opinion that it is appropriate to implement the materials on the “Statistics and Probability Content Line” in the VIII grade on the following topics: Data collection; Data collection and presentation. Scatter diagram; Measures of central tendency and the largest difference; Probability calculation; Possible number of events; Dependent and independent events.

Based on scientific sources and our work experience, we consider it useful to apply the content and structured technological approach interpreted below in implementing the educational process on the topics in question:

1. Points to focus on in the methodological system of teaching the topic of "Data Collection".

The standard is formulated as follows: 5.1.2. Systematizes the collected data according to certain characteristics.

The teaching of the subject should create the basis for the realization of student skills, which are reflected in the following:

✠ Asks questions to gather information.

✠ In research, he explains the data that varies over a large range as a "population" and the part that is being researched as a "selection" based on the examples provided.

✠ It provides a collection and selection of examples for research.

✠ It justifies whether the prediction is correct or incorrect based on whether the choice for the collection is correct or incorrect.

✠ It makes predictions based on the results obtained from the research [7;116].

It is recommended to allocate 2 hours to teaching the topic. It is recommended to start teaching the topic by explaining the concepts of "collection" and "selection" as follows.

When the object under study has information that varies over a wide range, the study is conducted on small groups related to this object. Information that varies over a wide range is called a population (or population), and a small group selected from the population is called a sample. The results of the study conducted on the sample are applied to the population (population), a conclusion is drawn, and a prediction is made. For example, a teacher checked the notebooks of 3 students sitting in the first desks to check the level of homework completion. Here, the population is all the students in the class, and the sample is the 3 students sitting in the first desk. The selections can be random and systematic. The correct representation of the sample by the sample determines the quality of the study. In order for the students to understand what they are saying, the teacher draws their attention to two different cases. He addresses the students and says: “Let’s examine in which of the following cases the sample really represents the population.”

- To gather feedback on a new fragrance, store employees give customers a small bottle of perfume and ask for their opinions (an example of random sampling).
- One in five people entering a cafeteria during lunchtime is asked to complete a questionnaire designed to assess the quality of service (an example of systematic sampling) [4;1094].

In the next part of the lesson, students should work on assignments and acquire the skills of collecting and systematizing information. They should know that the steps involved in collecting and systematizing information are as follows:

***Step 1*** (Question formulation). At this stage, research is conducted on the formulation of the question, its sequence, and the nature of the possible answers.

***Step 2*** (Data collection). At this stage, answers are sought to the questions of when and where to collect information? How can the information be obtained

(through a written questionnaire, oral survey, observation, experiment, etc.)? How should the information obtained be initially recorded?

***Step 3*** (Analysis, systematization and presentation of information). What type of graph should be chosen to present the information? Does the chosen form clearly show the answer to the question posed?

At this stage, you can benefit from the following task examples:

**I.** Which choice allows for a more accurate prediction about the object of research? Which is random, which is systematic?

1) A cafeteria, where the majority of customers are students, asks one out of every 15 students to stick pictures of their 4 favorite vegetables in a row on the wall.

2) A mark was placed on the order receipt of one in every 10 customers to check how many minutes customers sat in the dining room during lunch.

3) The opinions of the players of a football team were asked to determine the location of a new football field to be built.

4) The city council wants to find out whether people like taking dogs out for walks in parks. To do this, they asked 50 people who keep dogs at home.

**II.**Think of a research topic. Define the population and the sample. Write an example of both random and systematic sampling. Justify that your sampling is truly representative of the population [5; 1155].

2. Points to be focused on in the methodological system of teaching the topic "Collection and presentation of information. Scatter diagram".

The standard is formulated as follows: 5.1.2. Systematizes the collected data according to certain characteristics. 5.1.4. Determines the relationship between parameters in data with two parameters in simple cases.

The teaching of the subject should create the basis for the realization of student skills, which are reflected in the following:

- Presents the information given in the table by choosing an appropriate graphic form.
- Presents information given in a graphic form by selecting another graphic form.
- A diagram solves problems related to data presented graphically.
- It presents information in a table organized according to two parameters.
- It presents the data given according to two parameters in a table.
- It presents the data given by two parameters in a bar graph. [7;120]

It is recommended to allocate 5 hours to teaching the topic.

Choosing the right graphic form to present the collected data is very important. It is recommended to prepare a poster consisting of graphic forms that reflect the forms of presentation of data. These can be bar graphs, two-column bar graphs, pie charts, histograms, broken line graphs, etc.

The formation of students' skills in choosing a convenient form for presenting the collected information depends on their involvement in activities on appropriate tasks (see: Examples of such tasks are sufficiently presented in the materials Ibrahimov FN Methodology of Teaching Mathematics in Secondary Schools Based on the Curriculum Model (Baku: Mütərcim, 2016) and Ibrahimov FN Philosophy, Didactics, and Implementation Technology of Mathematical Education in Secondary Schools (Baku: Mütərcim, 2018)).

In the further continuation of the teaching process of the subject, it is advisable to use tasks that require theoretical and practical research, aimed at developing the intended skills in students, which are applied as a means of organizing whole-class or group work.

3. Points to be focused on in the methodological system of teaching the topic "Centric measures and the greatest difference".

The standard is formulated as follows: 5.1.3. Finds quantities that characterize the limits of variation of numerical data.

The teaching of the subject should create the basis for the realization of student skills, which are reflected in the following:

- It presents clusters, gaps, and outliers that fit the data.
- It uses measures of central tendency and greatest variance to analyze data.
- Makes judgments about the change in measures of central tendency and largest variance as new data is added or subtracted.

It is recommended to allocate 2 hours to teaching the topic.

The teaching of the topic can be started by involving students in research activities. In this process, the teacher brings these to the attention of students regarding measures of central tendency and the largest difference. He states that measures such as the numerical mean, mode, median and the largest difference are widely used in the analysis of statistical data. The numerical mean, mode, median are measures of central tendency. It is more convenient to use one or another of the statistical measures in the following cases:

- *In the absence of a sharp deviation from the numerical mean;*
- *From the median - in case of sharp deviations;*
- *From mode - when there is a large number of identical data;*
- *The biggest difference is when determining the interval of data change.*

At this point, it would be useful to suggest that students complete such an assignment.

**Task.** Justify the accuracy of the selected statistical indicators.

1) The ages of 6 people in a group are: 11, 14, 12, 12,11,32. Median.

2) Monthly income for 6 months (in manats): 325, 320, 300, 325, 325, 4000. Mode.

3) Samir's daily running distance (km) over 5 days: 3, 5, 4, 5, 6. Numerical average.

In the next part of the lesson, the following information about clusters, gaps, and outliers is brought to the attention of students. Data is sometimes collected in a small interval. This interval is called a cluster. An interval where there is no data is called a gap. Data that is too large or too small in numerical value than the available data is considered an outlier. It is important to

show examples of these. For example, the teacher can create a visual basis for the explanation in the example of the scores collected by the students, thereby creating conditions for students to correctly understand the information.

In the further continuation of the teaching process of the subject, it is advisable to use tasks that require theoretical and practical research, aimed at developing the intended skills in students, which are applied as a means of organizing whole-class or group work.

3. Points to be focused on in the methodological system of teaching the topic of "Calculating Probability".

The standard is formulated as follows: 5.2.1. Understands the concepts of whether events are dependent or not, finds the probability of the product of two independent events. 5.2.2. Finds the probability of the product of two dependent events. 5.2.3. Applies the multiplication rule in problems related to calculating probabilities.

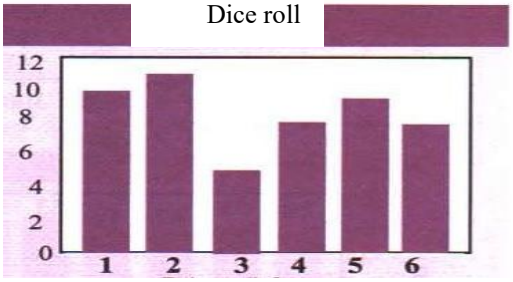
The teaching of the subject should create the basis for the realization of student skills, which are reflected in the following:

- Explains with examples his understanding of the concept of experimental and theoretical probability.
- It is understood that with the increase in the number of trials in the experimental probability, its value approaches the theoretical probability.
- Solves problems related to calculating theoretical and experimental probability and making predictions.

It is recommended to allocate 1 hour to teaching the topic. It is recommended to structure the teaching process of the topic according to the following scenario [7;132].

First, the concept of empirical probability is brought to the attention of students. The teacher explains that empirical probability is found on the basis of repeated trials of an experiment.

$$\boldsymbol{P(event) = \frac{number\ of\ times\ a\ favorable\ event\ occurs}{the\ number\ of\ tests}}$$




***Example 1.*** The bar graph shows the results of 50 dice rolls. What is the experimental probability of getting an odd number? [8; 206] The bar graph shows that 1 was rolled ten times, 3 was rolled five times, and 5 was rolled nine times. The number of favorable events is: 10+5+9=24 times an odd number was rolled.

Number of tests: 50.

$$P\ (odd\ number) = \frac{24}{50} = \frac{12}{25}$$

The empirical probability of rolling an odd number is $\frac{12}{25}$, 0.48 or 48%.

***Example 2***. Empirical probability can be used to make predictions. In March, it was rainy on 2 of the last 10 days. If this trend continues, how many rainy days can we predict will be in April?

First, let's find the empirical probability determined by observation.

$$P\ (rain) = \frac{number\ of\ occurrences\ of\ the\ event}{number\ of\ tests} = \frac{rainy\ days}{observation\ days}$$

$$P\ (rain) = \frac{2}{10} = \frac{1}{5}$$

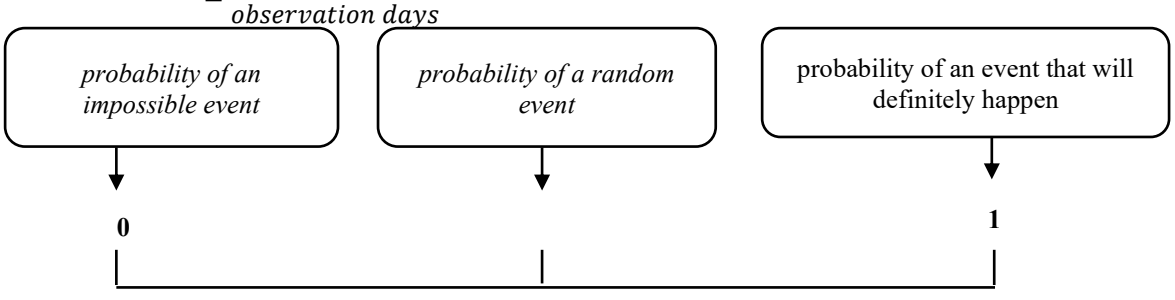
You can expect rain during the $30 \cdot \frac{1}{5} = 6$ day in April.

The teacher continues the lesson by giving students information about theoretical probability. He asks them who it is.$P\ (event) = \frac{number\ of\ favorable\ cases}{number\ of\ possible\ cases}$

The numerical value of the probability of a random event occurring varies in the interval from 0 to 1. Probability is expressed as a common fraction, decimal fraction, or percentage. The sum of the probability of an event occurring and the probability of its non-occurrence is equal to 1.

$$\mathrm{P\ (occurrence)} + \mathrm{P(non-occurrence)} = 1$$

The teacher presents an example to the students regarding the use of theoretical probability.

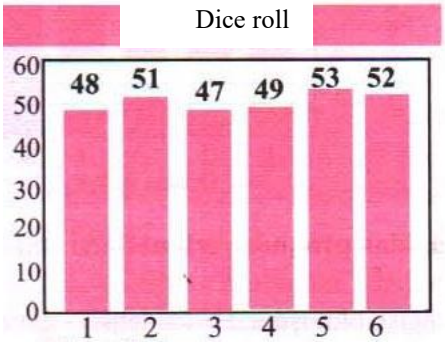


***Example 3***. The chance of winning 1000 manats when spinning the Charkhi-Felek board is – $\frac{1}{10}$. If there are 1000 manats in 3 divisions on the board, how many divisions does the board have?

*Solution*: Let the total number of partitions be n.

$$P\,(prize) = \frac{number\ of\ winning\ sections}{number\ of\ all\ parts} = \frac{1}{10};\ \frac{1}{10} = \frac{3}{n}\ ; n = 30.$$

An example of comparing theoretical and experimental probability is considered.




***Example 4.*** The bar graph shows the results of rolling a die 300 times. Find the probability of getting an odd number.

$$P\,(odd\ number) = \frac{number\ of\ times\ odd\ numbers\ fall}{number\ of\ tests} = \frac{148}{300} = \frac{37}{75} \approx 0{,}49$$

The teacher draws the students' attention to "Example 1" and suggests that they compare the experimental probabilities. It is concluded that as the number of trials increases, the experimental probability approaches the theoretical probability. When the number of trials is increased from 50 to 3000, the experimental probability also increases from 48% to 49%, approaching the theoretical probability of 50%.

4. Points that should be focused on in the methodological system of teaching the topic "Possible number of events".

The standard is formulated as follows: 5.2.3. Applies the multiplication rule in matters related to the calculation of probabilities.

The teaching of the subject should create the basis for the realization of student skills, which are reflected in the following:

- Finds the number of possible options in complex events using a branching diagram, without keeping a list, and using the multiplication rule.

It is recommended to allocate 1 hour to teaching the topic.

It is recommended to start the lesson by presenting the following information to the students. The teacher states that if an event is accompanied by the occurrence of one or more elementary events, these events are called complex events. For example, tossing two coins at the same time is a complex event. The number of possible cases in complex events can be found: 1) using a branching diagram; 2) without keeping a list; 3) using a table; 4) using the multiplication rule. In the process of teaching the topic, special attention is paid to mastering the multiplication principle, which is formulated as follows.

***Multiplication principle.*** If it is possible to choose an element *a* in *n* ways and for each such choice, it is possible to choose an element *b* in *m* ways, then it is possible to choose the pair *(a,b)* in *n·m* ways.

In order for students to better grasp the presented principle, they are involved in activities on specially selected examples [see: 5 and 9].

**Example 1** (By constructing a table). The number of possible events when a die and a coin are thrown together: 12 events. According to the multiplication principle: 2 events ($m = 2$) ( are possible with a coin, and 6 events are possible with a die. ($n = 6$)

Number of possible events: $2 \cdot 6 = 12$ [5; 1165]

**Example 2** (By constructing a branching diagram.) Number of possible events when tossing three coins: 8

According to the multiplication rule 2 events with each metal coin.

Number of possible events: $2 \cdot 2 \cdot 2 = 8$ [9; 210]

In the further continuation of the teaching process of the subject, it is advisable to use tasks that require theoretical and practical research, aimed at developing the intended skills in students, which are applied as a means of organizing whole-class or group work.

4. Points to be focused on in the methodological system of teaching the topic "Dependent and Independent Events".

The standard is formulated as follows: 5.2.1. Understands the concepts of whether events are dependent or not, finds the probability of the product of two independent events. 5.2.2. Finds the probability of the product of two dependent events. 5.2.3. Applies the multiplication rule in problems related to calculating probabilities [8; 211].

The teaching of the subject should create the basis for the realization of student skills, which are reflected in the following:

- Distinguishes between dependent and independent events.
- Calculates possible variants of dependent and independent events using the multiplication principle.
- Solves problems related to the probability of dependent and independent events.

It is recommended to allocate 2 hours to teaching the topic. During the lesson, students will perform two consecutive experiments visually.

***Experiment 1***. The teacher says that there are 2 red balls and 1 yellow ball in a bag. Imagine that you have to draw two balls from the bag in succession. Record

the color of each ball you draw and put the ball back in the bag. Create a branching diagram to find the number of possible events by writing the colors with the first letter of the letter and complete it. Find the probability of drawing a red ball in succession.

Does the color of the ball that comes out in the second toss depend on the color of the ball that comes out in the first toss? Students' opinions are listened to.

Before conducting the second experiment, students are introduced to the following information about independent events.

If the occurrence of one event does not affect the probability of the occurrence of another event, such events are called independent events. For example, when a die and a coin are thrown at the same time, the outcome of the die does not depend on whether the coin lands heads or tails. The probability of two or more independent events is equal to the product of the probabilities of these events:

It is also written as the formula. $P(A\ and\ B) = P(A) \cdot P(B)$ ; $P(A \cap B) = P(A) \cdot P(B)$

For three independent events by a similar rule [7;136-137]:

$$P(A, B\ and\ C) = P(A) \cdot P(B) \cdot P(C)$$

***Experiment 2***. The teacher presents the experiment to the students as follows: Imagine that there are still 2 red and 1 yellow balls in the bag. You take one ball out of the bag each time and note its color, but do not put the ball back in the bag. Complete the branching diagram to find the number of possible elementary events by noting the first letter of the colors. Find the probability of getting a red ball in a row. Does the color of the ball drawn in the second toss depend on the color of the ball drawn in the first toss?

Students' opinions are listened to. The teacher brings to the attention of students the information presented below regarding the dependent events and incidents.

If the occurrence of one event affects the possibility of another event occurring, these events are called dependent events.

For example, if 10 out of 100 cards in a bag are free, then one person's drawing of a free card on the first try affects the other person's drawing of a free card. The probability of two dependent events A and B is equal to the product of the probability of event A and the probability of event B occurring after event A occurs.

$$P(A\ and\ B) = P(A) \cdot$$
$$P(the\ occurrence\ of\ event\ B\ after\ event\ A).$$

In order for students to better assimilate the material presented on independent and dependent events, they are involved in activities on specially selected examples.

***Example 1*** (Independent event). A coin and a die are thrown together. Calculate the probability that the coin lands heads and the die lands heads.

The probability of getting a prime number (2,3,5) when rolling a dice is:$\mathrm{P(map)} = \frac{1}{2}$;

$$\mathrm{P(prime)} = \frac{3}{6} = \frac{1}{2};$$

$$P\ (map\ and\ prime) = \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4};$$

The probability of getting a map and a prime number is. $\frac{1}{4}, 0{,}25\ or\ 25\%$

***Example 2*** (Dependent event). Players for a TV show are randomly selected from 100 viewers. 5 of Teymur's relatives and 9 of his classmates are watching the show in the studio. What is the probability that one of Teymur's relatives is selected in the first choice and one of his classmates in the second choice? The probability of the relatives being selected in the first choice is:

$$P\ (relative) = \frac{5}{100} = \frac{1}{20};$$

The probability of his friends choosing the second option:

$$P\ (friend\ after\ relative) = \frac{9}{99} = \frac{1}{11};$$

Using the formula for calculating the probability of two dependent events, we can calculate the probability of Teymur's relative and classmate being called first among those selected in succession.

$$\mathrm{P(relative\ after\ friend)} = \mathrm{P(relative)} \cdot P(friend\ after\ relative)$$

$$\mathrm{P(relative\ and\ friend)} = \frac{1}{20} \cdot \frac{1}{11} = \frac{1}{220}.$$

In the further continuation of the teaching process of the subject, it is advisable to use tasks that require theoretical and practical research, aimed at developing the intended skills in students, which are applied as a means of organizing whole-class or group work.

It is advisable to take advantage of the small summative assessment criteria and task types listed below.

Small summative assessment criteria:

1. Asks questions to gather information.
2. Chooses a method to collect information.
3. Makes predictions based on the information obtained.
4. Solves problems based on graphically presented data.
5. Uses a line graph to visually visualize the frequency of data.
6. It makes judgments about the change in central tendency measures and the largest variance as new data is added or subtracted.
7. Solves problems based on theoretical and experimental probability calculations and forecasting.
8. It presents possible variants of dependent and independent events with a branching diagram.
9. Calculates possible variants of dependent and independent events using the multiplication rule.
10. Solves problems of calculating the probability of dependent and independent events.

***Small summative assessment tasks:***

1) The faces of the cube are colored green, yellow, and red. The cube was rolled 10 times and the result was as shown in the table below. How many faces of the cube would be more accurate to think of as yellow?500

| Colors | Green | Yellow | Red |
|---|---|---|---|
| Number | 90 | 370 | 40 |

A) 1 B) 2 C) 3 D) 4

2) During his research, Javid wants to find out which color of car buyers prefer the most. It turned out that buyers prefer white cars more. Which measure would be more accurate if Javid used to present his information?

A) median B) mode C) numerical mean D) largest difference

3) There are chocolate-covered lemon, milk, and strawberry candies in a glass jar. Shamkhal ate two of the candies. Both were milky. If Shamkhal wanted to eat two more candies, what expression can be used to find the probability that both of them will be milky?101010

A) $\frac{1}{10} \cdot \frac{1}{10}$ B) $\frac{9}{30} \cdot \frac{8}{28}$ C) $\frac{8}{28} \cdot \frac{7}{27}$ D)$\frac{7}{20} \cdot \frac{6}{21}$

4) There are 30 students in a class. If one student is selected from the class, the probability that he/she is an excellent student is -$\frac{2}{3}$. How many excellent students are there in this class?

A) 10 B) 15 C) 20 D) 5

5) The table shows the relationship between the scores students earn on the scoring system and the amount of time (in hours) they spend watching TV after school. Draw a scatter diagram for this relationship.

| TV viewing time (in hours) | Points earned | TV viewing time (in hours) | Points earned |
|---|---|---|---|
| 1 | 87 | 5 | 52 |
| 1.5 | 89 | 0.5 | 92 |
| 3 | 72 | 2 | 85 |
| 2 | 71 | 4 | 68 |
| 3 | 65 | 2.5 | 79 |

6) Systematize the given data starting from the $51-60$ interval and construct a histogram.

$56, 68, 73, 79, 82, 82, 83, 85, 87, 88, 89, 90, 90, 91, 93, 95, 100$

7) There are 4 white and 5 green balls in a box. 2 balls are removed by putting them back in the box. Find the probability that both balls removed are white.

*Scientific novelty of the research work.* The argument that determines the optimality of the methodological system of teaching training materials and the way to incorporate this argument into the activities of the educator are shown.

*Practical significance of the research work.* The inclusion of the argument that the methodological system of teaching materials is optimal in the activities of the educator has a positive impact on the effectiveness of his work.

*Result.* 1) The optimality of the methodological system of teaching materials on the content line "Statistics and Probability" in the VIII grades of secondary schools depends on the dialectical unity of its components "opportunity→action→new quality", the said dialectics determines the level of realization of the "paradigm" of the educational process; 2) a reliable way to form the components of the methodological system of teaching learning materials in a dialectical unity: (goal⇔content⇔means⇔method⇔organizational form⇔result) is a "system-structural approach" based on the "idea of system analysis" to the educational process.

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# EXPLORATION OF THE DISCIPLINARY CONSTRUCTION PATH FOR LOCAL NEWLY-ESTABLISHED UNDERGRADUATE NORMAL UNIVERSITIES —— A CASE STUDY OF THE SCHOOL OF MATHEMATICS AND STATISTICS, JINING NORMAL UNIVERSITY

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**Abstract**

Local newly-established undergraduate normal universities are an important pillar in the popularization of higher education in China, undertaking the core mission of cultivating high-quality teachers for regional basic education and serving local economic and social development. As a key normal university in the central and western regions of Inner Mongolia Autonomous Region, the disciplinary construction of the School of Mathematics and Statistics of Jining Normal University is directly related to the improvement of mathematics education quality and the supply of data application talents in Ulanqab City and surrounding areas. From the perspective of applied talent training and combined with the actual school-running situation of Jining Normal University, this paper analyzes the background and significance of disciplinary construction in local newly-established undergraduate normal universities, examines the prominent problems existing in current disciplinary construction, and puts forward targeted optimization strategies, so as to provide practical reference for the high-quality disciplinary development of similar universities.

**Keywords:** Local newly-established undergraduate normal universities; Disciplinary construction; Applied talents; Jining Normal University.

## 1 Background and Significance of Disciplinary Construction

### 1.1 Research Background

As China's higher education enters the stage of connotative development, the Inner Mongolia Autonomous Region has clearly put forward the strategic requirement of "strengthening the characteristic development of normal universities and improving the quality of basic education teacher training". As the only undergraduate normal university in Ulanqab City, Jining Normal University has always focused on the school-running orientation of "a distinctive and high-level local applied normal university in the western region" since it was upgraded to an undergraduate university. As one of the core colleges of the university, the School of Mathematics and Statistics has its disciplinary foundation rooted in the former mathematics education major at the junior college level. In the process of upgrading and transformation, it not only faces the common challenges of transforming from junior college education to undergraduate education, but also undertakes the dual tasks of adapting to the "quality improvement of basic education" and the "growing demand for regional data application" in the central and western regions of Inner Mongolia. At present, the mathematics education in primary and secondary schools in Ulanqab City has problems such as shortage of high-quality teachers and backward teaching methods. At the same time, local industries have an increasingly urgent demand for information and computing science talents in fields such as data analysis, big data, and artificial intelligence, which provides a clear direction for the disciplinary construction of the School of Mathematics and Statistics.

### 1.2 Significance of the Research

(1) Consolidate the foundation of educational quality. Disciplinary construction is a core means for the School of Mathematics and Statistics to improve teaching quality. By optimizing the curriculum system and integrating cutting-edge teaching concepts, it can promote students majoring in mathematics education to master modern teaching methods and digital teaching skills, thereby supplying high-quality mathematics teachers who are proficient in teaching and good at innovation to local primary and secondary schools.

(2) Strengthen the development of the teaching staff. A high-quality disciplinary platform can attract high-education and senior-title talents to settle in the border areas. Meanwhile, it provides a practical carrier for existing teachers to conduct academic research and teaching reform, forming a positive cycle featuring simultaneous introduction and cultivation of talents and mutual promotion of teaching and research, so as to build a high-quality teaching team that meets the needs of the region.

(3) Precisely serve local development. Disciplinary construction can realize the empowerment of mathematics education serving basic education and aligning with regional demands. On one hand, it addresses the prominent problems of insufficient quantity and low quality of mathematics teachers in local primary and secondary schools; on the other hand, it provides technical support and talent guarantees for data processing fields such as data analysis, big data and artificial intelligence in local industries of Ulanqab City.

(4) In the competitive landscape of normal universities in the autonomous region, the distinctive School of Mathematics and Statistics can become a competitive calling card of Jining Normal University. It helps the university attract high-quality students, secure research projects and policy support, and enhance its discourse power in the regional higher education system.

## 2 Problems Existing in Disciplinary Construction

### 2.1 Insufficient Adaptability Between Disciplinary Orientation and Regional Demands

There is a tendency of "generalized imitation" in the direction of disciplinary development, failing to fully combine the educational needs and industrial

characteristics of Ulanqab City and surrounding areas. For example, the mathematics education direction still focuses on the imparting of traditional disciplinary knowledge, without highlighting the particularity of mathematics teaching in Inner Mongolia; information and computing science lacks in-depth integration with local industrial fields such as data analysis, big data, and artificial intelligence, resulting in an indistinct disciplinary feature.

**2.2 Single Disciplinary Structure and Insufficient Interdisciplinary Integration**

The disciplinary layout is concentrated in traditional fields such as mathematics education and pure mathematics, with the lagging development of emerging interdisciplinary directions. The lack of distinctive interdisciplinary disciplines leads to an insignificant disciplinary cluster effect, making it difficult to meet the needs of modern educational diversification and regional development for compound talents.

**2.3 Structural Shortcomings in the Construction of the Teaching Staff**

Restricted by factors such as geographical location and treatment conditions, it is difficult to introduce and cultivate talents with high academic qualifications and senior professional titles. Among the existing teaching staff, the proportion of teachers with doctoral degrees is relatively low, and there are few teachers with interdisciplinary backgrounds and first-line teaching and practical experience. The teacher training and development mechanism is not perfect, and the scientific research ability and practical teaching level need to be improved.

**2.4 Weak Synergy between Scientific Research and Practice**

The construction of scientific research platforms lags behind, and there is a lack of characteristic research carriers that meet regional needs. As a result, most scientific research projects focus on theoretical research and are not closely combined with the reality of local basic education reform and industrial development. The scientific research incentive mechanism is not sound enough, teachers' enthusiasm for participating in applied research is not high, and the transformation rate of scientific research achievements is low.

**2.5 Insufficient Guarantee and Integration Ability of Disciplinary Resources**

In terms of hardware facilities, the renewal of practical training facilities such as the mathematical modeling laboratory is not timely, and the reserve of resources including books and materials as well as professional databases is difficult to meet the needs of disciplinary development. In terms of resource integration, the cross-departmental resource sharing mechanism within the university has not yet been established, and the cooperation with local education bureaus, primary and secondary schools, and enterprises is not in-depth enough, failing to form a sound ecological environment featuring "university-local coordination and resource complementarity".

**2.6 Disconnection between Practical Teaching and Job Requirements**

The practical teaching link still mainly focuses on educational internships, and the internship content is mostly classroom teaching observation and simple teaching, lacking systematic training in teaching skills and data analysis ability for normal students. The construction of practical bases is insufficient in quantity and low in quality, and it is difficult to provide practical scenarios that match job requirements, resulting in a gap between students' practical ability and the expectations of local employers.

**3 Strategies for Disciplinary Construction of Local Newly-established Undergraduate Normal Universities**

**3.1 Anchor Regional Demands and Clarify Distinctive Disciplinary Orientation**

Conduct in-depth research on the current status of mathematics education in primary and secondary schools in Ulanqab City and the demand for data talents from regional industrial development, and formulate a "two-wheel-driven" disciplinary development plan. On one hand, focus on the quality improvement of basic education, create distinctive directions, and prioritize cultivating teachers familiar with local primary and secondary school mathematics teaching. On the other hand, align with regional development needs, build characteristic tracks, and train applied talents for local industrial fields such as data analysis, big data, and artificial intelligence. Meanwhile, integrate the disciplinary orientation into the higher education development plan of the autonomous region and the education development outline of Ulanqab City to secure policy and resource support.

**3.2 Optimize the Disciplinary Structure and Promote Interdisciplinary Integration and Development**

(1) Consolidate the advantages of traditional disciplines, deepen the connotative development of core disciplines such as mathematics education and pure mathematics, update the curriculum system, and integrate cutting-edge content such as digital teaching and core literacy cultivation.

(2) Expand emerging interdisciplinary disciplines, add interdisciplinary directions including "Data Science and Educational Big Data Analysis" and "Artificial Intelligence", and form a disciplinary layout featuring "traditional disciplines laying the foundation and interdisciplinary disciplines empowering development".

(3) Establish a disciplinary coordination mechanism, break down inter-college barriers, carry out interdisciplinary cooperation with the School of Computer Science, School of Liberal Arts, School of Life Sciences, etc., and jointly offer courses such as "Mathematical Modeling and Programming" and "Research on Mathematical Culture" to cultivate compound talents.

**3.3 Strengthen Faculty Development and Build a High-Quality Teaching Team**

(1) Optimize talent introduction policies, and jointly launch a "Special Program for Borderland Education Talents" with local governments. Provide preferential treatments such as relocation allowances, research start-up funds, and children's education support for introduced doctors and professors; focus on recruiting compound talents with primary and secondary

school mathematics teaching experience and regional data processing practice experience.

(2) Improve the teacher training mechanism and establish a trinity training model of "on-campus training + off-campus visiting studies + enterprise practice". Encourage teachers to pursue doctoral degrees and establish a joint training mechanism with universities such as Inner Mongolia University and Inner Mongolia Normal University; regularly organize teachers to participate in activities such as national mathematics education seminars; arrange teachers to take temporary positions in local primary and secondary schools and participate in practical projects in enterprises to improve their practical capabilities.

(3) Improve the incentive mechanism, incorporate interdisciplinary teaching, applied research achievements, and local service performance into the core indicators for professional title evaluation and post promotion, so as to stimulate teachers' enthusiasm for teaching, research and serving the local community.

**3.4 Build Characteristic Platforms and Enhance the Synergy between Scientific Research and Practice**

(1) Construct characteristic scientific research platforms, and jointly establish a "Regional Mathematics Education Research Center" with the Ulanqab Municipal Bureau of Education. Focus on conducting research on topics such as local mathematics teaching reform, data analysis, big data, and artificial intelligence to provide practical carriers for disciplinary development.

(2) Deepen university-local cooperation, co-construct "Mathematics Education Practice Bases" with key primary and secondary schools in Ulanqab City, and carry out cooperation such as joint teaching and research and teaching reform pilots; co-establish "Data Application Practice Bases" with local departments such as the Big Data Bureau to provide students with real project practice opportunities.

(3) Strengthen the orientation of scientific research output, encourage teachers to apply for regional projects such as educational science planning projects of Inner Mongolia Autonomous Region and science and technology plan projects of Ulanqab City, and carry out research focusing on local practical issues; establish a scientific research achievement transformation mechanism, transform research achievements into teaching cases, local development consulting reports, etc., so as to enhance the social influence of the discipline.

**3.5 Integrate Internal and External Resources to Strengthen Disciplinary Guarantee Capabilities**

(1) Optimize the allocation of internal school resources, secure special fund support from the university, and update practical training facilities such as the mathematical modeling laboratory; establish an internal shared resource library, integrate resources including books and materials, professional databases, and experimental equipment to improve the efficiency of resource utilization.

(2) Expand external resource channels, take the initiative to connect with the Department of Education of Inner Mongolia Autonomous Region and the Ulanqab Municipal Government to obtain policy inclination and fund investment; establish cooperative relations with high-level normal universities and scientific research institutes inside and outside the region to share high-quality teaching resources and scientific research platforms; attract enterprise donations and social sponsorships to broaden funding sources.

**3.6 Deepen Practical Teaching Reform and Improve the Quality of Talent Training**

(1) Construct a "three-stage progressive" practical teaching system. In the basic stage, strengthen the training of teaching skills and data processing capabilities; in the core stage, carry out immersive practice through internship bases; in the improvement stage, organize students to participate in practical training such as mathematical modeling competitions and local data processing projects.

(2) Innovate practical teaching content, compile practical textbooks integrating mathematical culture and regional data cases; add practical courses such as artificial intelligence to enhance students' ability to adapt to local positions.

(3) Improve the practical evaluation mechanism, adopt a trinity evaluation model of "school evaluation + base evaluation + industry evaluation", and incorporate practical performance and project achievements into the students' comprehensive evaluation system to ensure the quality of practical teaching.

**4 Implementation Guarantees**

(1) Organizational Guarantee: Establish a leading group for disciplinary construction, led by the dean of the college. It will include experts from inside and outside the university, responsible persons of local educational administrative departments, and backbone teachers from primary and secondary schools to coordinate the implementation of the disciplinary construction plan and process management.

(2) System Guarantee: Formulate a series of system documents such as the "Measures for the Administration of Disciplinary Construction", the "Implementation Plan for the Construction of the Teaching Staff", and the "Measures for Rewards for Scientific Research and Social Services" to standardize all links of disciplinary construction and ensure the effective implementation of strategies.

(3) Financial Guarantee: Establish a diversified financial guarantee mechanism of "university investment + local support + social fundraising", incorporate disciplinary construction funds into the college's annual budget, and give priority to guaranteeing investment in core areas such as talent introduction, platform construction, and practical teaching.

**5 Conclusion**

The disciplinary construction of local newly-established undergraduate normal universities is a long-term and systematic project. It needs to be based on their own realities, closely linked to regional needs, and take a distinctive and application-oriented development path. For the disciplinary construction of the School of Mathematics and Statistics of Jining Normal University, it is necessary not only to solve the common problems in the transformation and development but also to give full play to the regional characteristics and normal

school advantages. Through measures such as clarifying the distinctive orientation, optimizing the disciplinary structure, strengthening the faculty construction, and deepening university-local cooperation, the level of disciplinary construction will be continuously improved. In the future, the college will continue to focus on the core goal of cultivating applied talents, take disciplinary construction as the leading role, promote the coordinated development of teaching, scientific research, and social services, and provide more powerful talent support and intellectual guarantee for the quality improvement of basic education and economic and social development in Ulanqab City and the central and western regions of Inner Mongolia.

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# TƏHSİL SİSTEMİNDƏ RƏQƏMSALLAŞDIRMANIN VƏ İNNOVATİV HƏLLƏRİN TƏTBİQİNİN GENİŞLƏNDİRİLMƏSİ

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# EXPANDİNG THE APPLİCATİON OF DİGİTALİZATİON AND İNNOVATİVE SOLUTİONS İN THE EDUCATİON SYSTEM

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**Xülasə**

XXI əsrdə qlobal miqyasda baş verən texnoloji dəyişikliklər cəmiyyətin bütün sahələrinə, o cümlədən təhsil sisteminə dərin təsir göstərir. İnformasiya-kommunikasiya texnologiyalarının (İKT) sürətli inkişafı, internet şəbəkəsinin genişlənməsi, süni intellektin (AI) gündəlik həyatda tətbiqi və böyük verilənlər (big data) kimi innovasiyaların yayılması nəticəsində təhsil prosesi ənənəvi çərçivələrdən kənara çıxaraq rəqəmsal müstəviyə keçir. Bu transformasiya yalnız yeni texnologiyaların tətbiqi ilə məhdudlaşmır; eyni zamanda pedaqoji yanaşmaların yenilənməsi, müəllim-şagird münasibətlərinin dəyişməsi, təlim metodlarının çevik və fərdiləşdirilmiş formaya salınması kimi fundamental dəyişiklikləri zəruri edir. Azərbaycan üçün də rəqəmsallaşma dövlət siyasətinin prioritet istiqamətlərindən biridir. "Azərbaycan 2030: sosial-iqtisadi inkişafa dair Milli Prioritetlər" sənədində insan kapitalının inkişafı və rəqəmsal iqtisadiyyatın genişləndirilməsi əsas məqsədlərdən biri kimi müəyyən edilmişdir. Təhsil sahəsində rəqəmsallaşmanın gücləndirilməsi, xüsusilə də COVID-19 pandemiyası dövründə təhsil prosesinin davamlılığını təmin etmək üçün vacib amil kimi özünü göstərdi. Pandemiya zamanı onlayn dərslərə kütləvi keçid və "Virtual Məktəb" platformasının istifadəsi bir daha sübut etdi ki, rəqəmsal həllər olmadan müasir təhsil mümkün deyil. Rəqəmsallaşma ümumi mənada analoq məlumatların rəqəmsal formata çevrilməsi və bu məlumatların idarə olunması prosesini ifadə edir. Lakin son onilliklərdə bu anlayış yalnız texnoloji proses deyil, həm də iqtisadi, sosial və mədəni dəyişikliklərin sinoniminə çevrilmişdir.

**Abstract**

Technological changes taking place on a global scale in the 21st century have a profound impact on all spheres of society, including the education system. As a result of the rapid development of information and communication technologies (ICT), the expansion of the Internet, the application of artificial intelligence (AI) in everyday life, and the spread of innovations such as big data, the educational process is moving beyond traditional frameworks and into the digital plane. This transformation is not limited only to the application of new technologies; it also necessitates fundamental changes such as the renewal of pedagogical approaches, changes in teacher-student relationships, and the transformation of teaching methods into a flexible and personalized form. Digitalization is also one of the priority directions of state policy for Azerbaijan. The document "Azerbaijan 2030: National Priorities for Socio-Economic Development" identifies the development of human capital and the expansion of the digital economy as one of the main goals. Strengthening digitalization in the field of education has proven to be an important factor in ensuring the sustainability of the educational process, especially during the COVID-19 pandemic. The massive transition to online classes during the pandemic and the use of the "Virtual School" platform have once again proven that modern education is impossible without digital solutions. Digitalization in a general sense refers to the process of converting analog data into digital format and managing this data. However, in recent decades, this concept has become synonymous with not only a technological process, but also economic, social and cultural changes.

**Açar sözlər:** rəqəmsallaşma, inkişaf, texnoloji proseslər, texniki infrastruktur.

**Keywords**: digitalization, development, technological processes, technical infrastructure.

Təhsil kontekstində rəqəmsallaşma biliklərin əldə edilməsi, ötürülməsi və qiymətləndirilməsi üsullarını köklü şəkildə yeniləyir. Bu infrastrukturun formalaşması nəticəsində təhsil idarəçiliyi daha çevik və şəffaf hala gəlmiş, müəllim və şagirdlər arasında elektron ünsiyyət mexanizmi möhkəmlənmişdir. Bununla belə, infrastruktur sahəsində müəyyən bərabərsizliklər qalmaqdadır. Məsələn, şəhər məktəblərində texniki təminat səviyyəsi yüksək olsa da, kənd bölgələrində kompüter avadanlıqları və internet sürəti hələ də məhdud xarakter daşıyır. Bu səbəbdən "rəqəmsal uçurum" (digital divide) hələ tam aradan qalxmamışdır (OECD, 2022).

Rəqəmsal təhsil sisteminin formalaşması dörd əsas prinsip üzərində qurulur:

1. Inkluzivlik və əlçatanlıq (İnclusivity and accessibility): Bütün sosial qrupların bərabər təhsil imkanlarına malik olması. Burada təhsil resurslarına coğrafi, sosial ve fiziki məhdudiyyətdən asılı olmayaraq çıxış imkanı təmin edilir. Xususi tədris ehtiyaclı şagirdlər, kənd məktəbləri və azgəlirli ailələr üçün uyğunlaşdırılmış texnoloji həllər hazırlanır. "Virtual Məktəb", "təhsil tv" və "Rəqəmsal bacarıqlar" layihəsi regionlarda təhsilə çıxışı genişləndirməklə bu prinsipin praktik olaraq tətbiqinə nümunədir.

2. Fərdiləşmə və adaptiv Öyrənmə prinsipi (Personalized and Adaptive Learning): Hər bir şagirdin öyrənmə sürəti və tərzinə uyğun məzmun təqdim olunması. Bu prinsipin əsas məqsədi hər bir şagirdin bilik səviyyəsinə, maraq dairəsinə və öyrənmə sürətinə uyğun məzmun təqdim etmək, süni intellekt və adaptiv alqoritmlər vasitəsilə "fərdi öyrənmə xəritəsini" formalaşdırmaq eləcədə, öyrənmə prosesində motivasiya və davamlı iştirak səviyyəsini artirmaqdır. Azərbaycan kontekstində bu "Təhsil 4.0" yanaşmasında adaptiv öyrənmə modelləri və fərdiləşdirilmiş tədris metodikalarının tətbiqi əsas hədəflərdən biridir.

3. Data əsəaslı idarəetmə və şəffaflıq prinsipi (Data-driven Governance and Transparency): bu prinsipə əsasən rəqəmsal təhsil sistemi qərarverməni sübutlara əsaslanaraq həyata keçirməlidir. Təhsil nazirliyinin "Data Təhsil Analitikası" bölməsi və elektron qiymətləndirmə platformaları bu prinsipin tətbiqinə real nümunədir.

4. İnnovativ və Davamlı İnkişaf Prinsipi (İnnovation and Sustainability): Rəqəmsal mühitin ekoloji və sosial baxımdan uzunmüddətli dayanıqlığının təmin edilməsi (World Bank, 2022). Bu prinsip təhsil sistemini yeniliyə açıq, elastik və çevik hala gətirir, suni intellekt, oyunlaşdırma, mikromodul və EdTech innovasiyaların tətbiqini təşviq edir. Eyni zamanda, infrastrukturun və insan kapitalının uzunmüddətli dayanıqlığınıtəmin edir. Azərbaycan kontekstində Code Academy "İnnoland", "Edtech Azerbaijan" platforması bu prinsipin həyata keçirilməsini stimullaşdırır.

Rəqəmsallaşmanın üstünlükləri həm pedaqoji, həm də iqtisadi aspektlərdə özünü göstərir. Birincisi, öyrənmə çevikliyi təmin olunur: tələbələr istənilən vaxt və yerdə bilik əldə edə bilirlər. İkincisi, interaktivlik öyrənməni passiv prosesdən aktiv prosesə çevirir; virtual laboratoriyalar, simulyasiya proqramları və oyunlaşdırma modelləri öyrənmə motivasiyasını artırır. Üçüncüsü, analitik əsaslı idarəetmə tədrisin keyfiyyətini ölçməyə və təkmilləşdirməyə imkan yaradır (Anderson & Dron, 2017).

Rəqəmsal təhsil həm də sosial inklüzivlik baxımından mühüm əhəmiyyət daşıyır. Məsələn, inklüziv təhsil proqramları çərçivəsində xüsusi qayğıya ehtiyacı olan uşaqlar üçün adaptiv tədris mühitləri yaradılır; bu, onların təhsil prosesinə bərabər şəkildə inteqrasiyasına imkan verir (UNICEF, 2020).

Eyni zamanda, rəqəmsallaşma müəllimlərin rolunu dəyişdirir — onlar artıq bilik ötürən deyil, "öyrənmə bələdçisi" funksiyasını daşıyırlar. Müəllimlərin pedaqoji kompetensiyalarına "rəqəmsal savadlılıq", "media analizi", "onlayn mentorluq" kimi yeni bacarıqlar daxil olur (Redecker, 2019). Rəqəmsallaşmanın uğurlu tətbiqi üçün ölkələrin təhsil siyasətləri müxtəlif yanaşmalar nümayiş etdirir. Finlandiya, Cənubi Koreya, Sinqapur, Estoniya və Birləşmiş Krallıq bu sahədə qabaqcıl təcrübəyə malikdirlər.

Finlandiya modeli "Smart Education Ecosystem" adlanır. Burada dövlət, özəl sektor və universitetlər birgə innovasiya mühiti yaradır. Bütün məktəblərdə elektron dərsliklər, adaptiv test sistemləri və bulud əsaslı qiymətləndirmə alətləri tətbiq olunur. Finlandiya Təhsil Nazirliyinin (2022) məlumatına görə, bu sistem nəticəsində şagirdlərin tədris motivasiyası 18% artmışdır.

Sinqapur "Smart Nation" strategiyası çərçivəsində təhsil müəssisələrində süni intellekt və data analitika əsaslı qərar mexanizmləri qurub. Məsələn, "SkillsFuture" platforması ömürboyu təhsili təşviq edir və vətəndaşlara fərdi bacarıq profili üzrə təlim planı təklif edir (Singapore MOE, 2023).

Estoniya nümunəsi xüsusilə maraqlıdır, çünki ölkə rəqəmsallaşmanı milli identikliyin bir hissəsinə çevirmişdir. "e-Estonia" platforması vasitəsilə təhsil, səhiyyə, sosial xidmətlər və dövlət idarəçiliyi inteqrasiya olunub. Şagirdlər elektron şəxsiyyət vəsiqəsi ilə məktəb resurslarına daxil olur, valideynlər isə real vaxtda nəticələri izləyə bilirlər.

***Bu təcrübələr göstərir ki, rəqəmsallaşma yalnız texniki infrastrukturun deyil, idarəetmə modelinin dəyişməsi deməkdir. Rəqəmsal təhsilin uğuru üçün insan resurslarının hazırlanması, hüquqi baza və davamlı maliyyələşdirmə mexanizmləri mühüm əhəmiyyət daşıyır (OECD, 2022).***

***1. İnnovativ texnologiyaların təhsildə rolu: AI, VR, Big Data və EdTech tendensiyaları***

Müasir dövrdə təhsil sisteminin innovativ texnologiyalarla zənginləşdirilməsi onun effektivliyini və keyfiyyətini müəyyən edən əsas amilə çevrilmişdir. Azərbaycan Respublikasında təhsil sistemində rəqəmsallaşma prosesi son onillikdə dövlət siyasətinin prioritet istiqamətlərindən birinə çevrilmişdir. Qlobal rəqəmsal transformasiya meyilləri, dördüncü sənaye inqilabının (Industry 4.0) təsirləri və COVID-19 pandemiyasının yaratdığı yeni reallıqlar ölkə təhsilinin sürətlə rəqəmsal müstəviyə keçməsini zəruri etmişdir (UNESCO, 2021).

Azərbaycan hökumətinin sosial-iqtisadi strategiyasında rəqəmsallaşma həmiqtisadi diversifikasiyanın, həm də insan kapitalının inkişafının əsas dayaqlarından biri kimi qiymətləndirilir. "Azərbaycan 2030: Sosial-iqtisadi inkişafa dair Milli Prioritetlər" sənədində rəqəmsal iqtisadiyyat və rəqəmsal cəmiyyətin formalaşdırılması dövlətin strateji istiqamətləri sırasına daxil edilmişdir (Azərbaycan Respublikası Nazirlər Kabineti, 2022). Bu kontekstdə təhsil sektoru rəqəmsal keçidin əsas laboratoriyası rolunu oynayır. Azərbaycanın təhsil siyasətində rəqəmsallaşma prosesi mərhələli şəkildə həyata keçirilmişdir. Onun başlanğıcı 2008-ci ildə qəbul edilmiş "Elektron Azərbaycan" dövlət proqramına və "İnformasiya cəmiyyətinə keçid üzrə Dövlət Proqramı"na qədər gedib çıxır.

2013-cü ildə təsdiqlənmiş "Azərbaycan Respublikasında Təhsil Strategiyası"nda isə rəqəmsallaşma artıq "təhsilin innovasiyalaşdırılması və keyfiyyətinin artırılması" aləti kimi tanınmışdır. Bu sənədlərdə əsas məqsəd təhsil müəssisələrini informasiya-kommunikasiya texnologiyaları ilə təmin etmək, elektron idarəetməni inkişaf etdirmək və rəqəmsal bacarıqları formalaşdırmaq idi (Təhsil Nazirliyi, 2022).

Sonrakı mərhələdə — "Rəqəmsal Transformasiya Strategiyası (2022–2027)" rəqəmsallaşmanı bütün sektorlarda, o cümlədən təhsildə, milli prioritet səviyyəsinə qaldırmışdır. Strategiyanın təhsil bölməsində qeyd olunur ki, rəqəmsal transformasiyanın məqsədi "təhsilin inklüzivliyini artırmaq, biliklərin

əldə edilməsini çevik və adaptiv hala gətirmək, süni intellekt və analitika əsaslı idarəetmə sistemləri yaratmaqdır" (Nazirlər Kabineti, 2022). Rəqəmsal transformasiyanın ən mühüm komponentlərindən biri infrastrukturdur.

Rəqəmsal transformasiya dövründə təhsil sisteminin qarşısında duran əsas vəzifə texnologiyaları sadəcə tətbiq etmək deyil, onlardan innovasiya və bilik istehsalı üçün yaradıcılıqla istifadə etməkdir. İnnovasiya təhsildə həm metodoloji, həm də idarəetmə baxımından dəyişiklik yaradan dinamik prosesdir.

Təhsil innovasiyaları dedikdə, tədris metodlarının, qiymətləndirmə sistemlərinin, idarəetmə mexanizmlərinin və öyrənmə mühitinin yenilənməsi başa düşülür. Bu dəyişikliklərin mərkəzində süni intellekt (AI), adaptiv öyrənmə sistemləri, mikromodul təhsil, oyunlaşdırma (gamification) və EdTech ekosistemi dayanır (OECD, 2022).

Azərbaycan üçün bu fəsildə əsas məqsəd — mövcud rəqəmsal baza üzərində innovativ ekosistemin formalaşması və təhsilin gələcək modelinin proqnozlaşdırılmasıdır. Rəqəmsal transformasiya dövründə təhsil sisteminin qarşısında duran əsas vəzifə texnologiyaları sadəcə tətbiq etmək deyil, onlardan innovasiya və bilik istehsalı üçün yaradıcılıqla istifadə etməkdir. Bu gün təhsil yalnız informasiya ötürmə prosesi kimi deyil, həm də innovativ düşüncənin, tənqidi analiz bacarıqlarının və yaradıcı potensialın formalaşdığı bir mühit kimi dəyərləndirilir. İnnovasiya anlayışı burada həm pedaqoji metodların yenilənməsi, həm idarəetmə mexanizmlərinin çevikləşdirilməsi, həm də öyrənmə mühitinin rəqəmsal imkanlarla zənginləşdirilməsini əhatə edir. Təhsil innovasiyaları müasir cəmiyyətin ehtiyaclarına cavab verən, rəqabətqabiliyyətli insan kapitalının yetişdirilməsi üçün strateji zərurətə çevrilmişdir.

İnnovativ təhsil həlləri dedikdə, tədris metodlarının, qiymətləndirmə sistemlərinin, idarəetmə mexanizmlərinin və öyrənmə mühitinin yenilənməsi başa düşülür. Bu dəyişikliklərin mərkəzində süni intellekt (AI), adaptiv öyrənmə sistemləri, mikromodul təhsil, oyunlaşdırma (gamification) və EdTech ekosistemi dayanır (OECD, 2022). Bu alətlər vasitəsilə təhsil daha çevik, fərdiləşdirilmiş və nəticə yönümlü xarakter alır. Məsələn, süni intellekt əsasında qurulan platformalar hər bir şagirdin bilik səviyyəsini, maraq dairəsini və öyrənmə sürətini analiz edərək ona fərdi tədris planı təqdim edir. Beləliklə, hər bir öyrənən öz potensialını maksimum səviyyədə reallaşdıra bilir.

Oyunlaşdırma yanaşması öyrənmə prosesini daha maraqlı və motivasiyalı edir. Şagirdlər tədris materiallarını oyun formatında mənimsədikdə, onların aktiv iştirak səviyyəsi yüksəlir və öyrənmə nəticələri daha dayanıqlı olur. Bu yanaşma xüsusilə ibtidai və orta təhsil səviyyələrində şagirdlərin diqqətini cəlb etmək üçün effektiv vasitə sayılır. Eyni zamanda, mikromodul təhsil qısa və məqsədyönlü öyrənmə blokları vasitəsilə biliklərin mərhələli mənimsənilməsini təmin edir. Bu, ömürboyu öyrənmə (lifelong learning) konsepsiyası ilə tam uyğun gəlir və əmək bazarının dəyişən tələblərinə çevik uyğunlaşma imkanı yaradır.

Azərbaycan kontekstində innovativ həllərin genişləndirilməsi bir neçə strateji istiqamətdə həyata keçirilə bilər. İlk növbədə, rəqəmsal infrastrukturun gücləndirilməsi vacibdir. İnternetə çıxış imkanlarının bərabər təmin olunması, məktəblərin texnoloji avadanlıqlarla təchiz edilməsi və müəllimlərin rəqəmsal bacarıqlarının artırılması bu prosesin əsas şərtlərindəndir. İkincisi, müəllim hazırlığı və peşəkar inkişaf proqramlarında innovativ pedaqogika və texnologiya inteqrasiyası xüsusi yer tutmalıdır. Müəllimlər yalnız texnologiyadan istifadə edən deyil, həm də onu tədris prosesinə yaradıcı şəkildə tətbiq edən mütəxəssislər olmalıdır.

Üçüncü istiqamət kimi, EdTech startaplarının və yerli innovasiya ekosisteminin inkişafı göstərilə bilər. Dövlət, özəl sektor və universitetlər arasında əməkdaşlıq bu sahədə mühüm rol oynayır. Yerli startapların dəstəklənməsi, pilot layihələrin məktəblərdə sınaqdan keçirilməsi və beynəlxalq təhsil texnologiyaları ilə tərəfdaşlıq ölkədə rəqəmsal təhsil mühitinin genişlənməsinə töhfə verə bilər. Bu sahədə Estoniya, Sinqapur və Cənubi Koreya kimi ölkələrin təcrübəsi nümunə kimi göstərilə bilər — onlar təhsil innovasiyalarını dövlət siyasətinin əsas istiqamətlərindən birinə çevirərək yüksək nəticələr əldə ediblər.

Dördüncü istiqamət kimi, məlumat əsaslı idarəetmə və analitika mexanizmlərinin tətbiqi xüsusi əhəmiyyət kəsb edir. Süni intellekt və "big data" texnologiyaları vasitəsilə təhsil prosesindən əldə olunan məlumatların təhlili, təhsil siyasətinin elmi əsaslarla formalaşdırılmasına imkan verir. Məsələn, tələbə performansının proqnozlaşdırılması, məktəb və müəllim fəaliyyətinin səmərəliliyinin ölçülməsi və təhsil resurslarının optimal bölüşdürülməsi kimi proseslər bu yanaşma ilə həyata keçirilə bilər.

Nəhayət, innovativ təhsil sisteminin inkişafı üçün etik, hüquqi və sosial çərçivənin yaradılması vacibdir. Texnologiyanın sürətli tətbiqi ilə yanaşı, şəxsi məlumatların qorunması, alqoritmik qərəzin qarşısının alınması və rəqəmsal bərabərliyin təmin olunması məsələləri diqqət mərkəzində olmalıdır. Təhsil innovasiyaları yalnız texnoloji tərəqqi deyil, həm də insan yönümlü dəyərlərə əsaslanmalıdır.

Beləliklə, təhsil sistemində innovativ həllərin genişləndirilməsi perspektivləri Azərbaycan üçün strateji prioritet hesab edilməlidir. Rəqəmsal transformasiya prosesində əsas məqsəd — texnologiyanı məqsəd deyil, maariflənmə, yaradıcılıq və inklüziv inkişafın vasitəsinə çevirmək olmalıdır. Bu istiqamətdə ardıcıl siyasət, elmi-tədqiqat potensialı və cəmiyyətin innovasiya mədəniyyətinin formalaşdırılması ilə təhsil sisteminin gələcəyi daha çevik, səmərəli və davamlı ola bilər.

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# INTERPRETATION OF LEARNING ACTIVITIES BY THE LEARNER AND THE EDUCATOR AS ASPECTS OF THE UNIT

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**Abstract**

The article focuses on the continuous and gradual development of the civilization process in accordance with the challenges of industrial revolutions, the formation of adequate bases and superstructures, the main features of the "techno-democratic-information society" that exists in the modern era and currently makes people stronger, the education system, the concepts that reveal its nature, among which the concept of "teaching activity" is given a particularly laconic scientific interpretation. It is stated that teaching activity is one of the most important elements of the process of implementing education, understood as a system, and this element has an important "enabling function" in the efficiency of the system in question. It is emphasized that in the process of implementing education, "interest↔ action ↔ a new qualitative state of the improvement of the party involved in the process to the desired level of development, education and upbringing" determines the vector of management.

In the research work, teaching activity is considered as a type of personality activity, a specific form of social activity, and itsThe essence and functions of the components in its structure - 1) teaching situation; 2) teaching operations; 3) control; 4) assessment (evaluation) are clarified; the interpretation of the transformation (dialectics) of the aforementioned components into the sides of the unit in the organization and management of the joint educational activity of the learner and the educator, and their enabling functions are given.

**Keywords:** Base and superstructure; education; teaching activity; teaching situation; task; opportunity; action; cognitive operations; measurement and evaluation.

**Relevance of the research topic.** It is known that educational activity includes creative acts that exist between the educator and the learners in the process of implementing education, this type of activity has a complex structure, and the effectiveness (quality level) of the implementation of the educational process is determined by the transformation of the educational activities of the learner and the educator into the parties of the unit. The regulation (facilitation) of the emphasized state in the process of implementing education directly depends on the understanding of the essence of the concept of educational activity. Therefore, we argue for the relevance of conducting research on the topic "Interpretation of the educational activities of the learner and the educator as parties of the unit".

Interpretation of generalizations on the study. As is known, the process of civilization has been continuously formed in response to the challenges of the "Industrial Revolutions", systems of socio-economic relations have been established on the basis of dialectical conditioning of one another (logical expectation), and superstructures based on the aforementioned bases have been formed. Currently, there is such a system-basis as a "techno-democratic-information society" that makes a person stronger, the implementation of information services at a sufficiently high level is a specific feature of the society in question. The information society, unlike the industrial society, is a more intellectual society and creates conditions for the highly educated, skilled, determined, and comprehensive development of people.

According to our subjective understanding, members of the "Techno-democratic-information society" are characterized by information culture (this is the knowledge, intellectual skills and habits necessary for a person to adapt to the information society) and technological literacy (this is the ability of people to use various digital technologies, analyze information and operate safely in a digital environment. The development of digital skills is essential to ensure their safe and effective interaction with digital technologies in the future [9;78-94].

A comprehensive and integrated approach by education systems is needed to support all learners in developing their skills to be active and ethical users of digital technologies.[12; 57-79]. Digital education enables people to participate independently in social life. In addition, the reality of digital education and the digital revolution requires fundamental changes in the forms and methods of moral education, leading to the emergence of digital skills as the most important competence [11;58-64]. There is no doubt that the development of digital skills of learners will lead to their more active participation in society as digital citizens in the future. [10], [12; 57-79]

This skill is not limited to just using a computer and the internet, but also includes: 1) Complying with digital security and cybersecurity rules; 2) Working with artificial intelligence and automation; 3) Digital analytics and data processing skills; 4) Using cloud technologies; 5) Must have new technologies (involving quick adaptation), otherwise, they will not be able to assert themselves as active and creative members of the society in question.

Due to the rapid development of technology, the knowledge and skills that students acquire during their

education are outdated by the time they graduate. In order to help develop and shape the use of today's fastest-growing technologies in scientific and technical education, it is necessary to train students and prepare them for the digital environment. Adapting to a rapidly changing environment will make it necessary for students to stay in touch with educational institutions even after graduation, providing both workers with updated skills and young students (and faculty) with a new direction related to the rapidly changing realities of the industrial and corporate sectors.[13; 25-30], [14; 579-592]

Education, which is a process of sharing human experience, has been formed on a basis that includes the characteristics of industrial revolutions in stages as a product of social practice. According to our subjective understanding, the formulation of the aforementioned sharing process as "the process of mastering systematized knowledge, skills and habits in accordance with the needs of the state, society and the individual and its result" is aimed atis appropriate. [5;260]. "General education", an important stage of the education system, has taken its place in the superstructure of the base formed based on the challenges of the Fourth Industrial Revolution and has become a "system formulated as a student-centered "SS" in general education schools". The establishment of a new pedagogical thinking and the successes achieved in the field of the concept of activity have led to the emergence of many concepts related to education, which can be interpreted with the concepts of "value", "process", "result", "system", and a change in views on it. conditioned.The concept of "teaching activity" is also included among the aforementioned concepts.

Teaching activity is one of the most important elements of the process of implementing education, understood as a system; this element has an important "enabling function" in the effectiveness of the system in question.

By the way, let's clarify the concept of "enabling function." In doing so, we argue that the concept of "teaching activity" includes the creative activity that exists between the educator and the learners in the process of implementing education.

It is known that something cannot come from nothing, and the new can only arise from certain preconditions, the essence of which is laid in the bosom of the old. The potential existence of the new is precisely the possibility. The possibility arises in the existing reality and is realized, embodied in the new reality. Being hidden tendencies expressing various directions in the development of an object, possibilities characterize reality in terms of its future. Dialectics assumes that development does not consist in expanding the set of ready possibilities, but in the process of the constant emergence of possibilities within reality and their transformation into a new reality. The process of realization of possibilities, their transformation into reality is possible thanks to activity and communication. Possibility does not mean action in itself. It is absurd to talk about a new quality if there is no idea that causes action. By "idea" we understand an idea that has risen to a high degree of objectivity, completeness and concreteness and is at the same time directed towards practical implementation [6; 16-17]. As a variation of one of the interesting ideas of ancient Greek philosophers, we should say that a teacher affirms himself when he has the possibilities of action that condition his creative searches. From his mixed, vague ideas, clear pedagogical thinking emerges. It is appropriate to say here that the idea that causes action is a vital being that creates a new model of development. It is appropriate to draw attention to the very relevant analysis of Professor R.F.Mustafayev on the internal unity of opportunity, action and personality. He rightly emphasizes that the concept of "opportunity" plays a special role in our thinking and is in a certain sense equivalent to our existence, our everyday life. Being acquires essence when it has the possibilities of action. Moreover, the latter is impossible without deep creative searches. Where there is opportunity, this means action. In turn, this creates a dialectical unity between particles and the whole. The idea that causes action is a vital being that forms a new model of development. [4; 88]

It is undeniable that interest is always an opportunity. It is interest that drives opportunity. Interest can be transformed by the inner world of the personality and acquire value in its actions. Personality is always an opportunity. In our opinion, in the process of implementing education, "interest↔action↔a new qualitative state of the rise of the party involved in the process to the desired level of development, education and upbringing" determines the vector of management. In this process, the "selection" factor is of particular importance. At least algorithmic and heuristic activity ratios are related to choice. In the process of implementing education, not "probabilities", but "opportunities" correspond to the function of belonging. In this process, the "choice" factor is of particular importance. At least the algorithmic and heuristic activity ratios are related to choice. In the process of implementing education, "opportunities", not "probabilities", correspond to the function of belonging.

In our opinion, we can talk about the "specificity function" by referring to Lutfizadeh's idea, which allows modeling human thoughts, finding methods in various options, and implementing accepted decisions. Determining what is most consistent with the specificity functions in the process of implementing education actually means revealing the essence of this process.

By the way, let us emphasize that "teaching activity" is multifaceted. Although training is an important characteristic of teaching activity, it does not cover all its aspects. Training, in the broad sense of the word, involves the acquisition of new knowledge, skills and habits. However, acquisition and teaching activity are essentially different phenomena. Acquisition is not only the learning process, but also an integral part of every field of activity, for example, play or labor. Teaching activity is a type of activity, a specific form of social activity of the individual.[2 ;150]

The concept of educational activity (D.Velkonin, V.V.Davydov, etc.) distinguishes the following components in the structure of educational activity: 1) educational situation; 2) educational operations; 3) control; 4) assessment (evaluation). Educational activity is a type of

activity, a specific form of social activity of the individual[15].

Educational activity is a type of activity of both the teacher and the student in the "S↔S" ("subject" ↔ "subject") system, which makes it impossible to imagine these types of activity outside of assessment. It's absurd.

In the pedagogical process, the joint activity of the educator and the learners begins to take place when the goal set by the educator becomes the goal of the learner.[7;130-134]. In other words, when the part of human experience, which is adequate for the purpose of presentation by the educator and which should become the subject of the learner, which has been developed and systematized on scientific-pedagogical grounds, becomes the object of satisfying his cognitive needs, the event of implementing education in one form or another – the joint creative activity of the learner and the educator begins, the learners are ready to accept the educational task of the educator.[8; 289-290].

Educational activity begins with the solution of educational tasks. The question is: "What do they mean when they say educational tasks?" Although its essence is reflected in the meaning of the task, its character is connected with the meaning of "educational". Educational tasks are distinguished from any scientific, military, sports, etc. Tasks by one important feature. Educational tasks involve the discovery and mastering of educational-general solution methods (principles, regularities) by students (students).

By presenting teaching tasks, the teacher places students in a unique teaching situation: in this situation, they become familiar with the content of general methods for solving teaching tasks, taking into account all specific and concrete options, and acquire the appropriate knowledge, skills, and habits.

By the way, let us note that the meaning of knowledge (information) includes the following: certain facts, terminology; methods of selecting facts; conceptual symbols; development trends; classification; criteria for verification and evaluation; research methods applied in a relevant field or problem; general concepts, structures and theories; principles and regularities necessary to explain and interpret phenomena and foresee their future development; knowledge of theories and structures.[4;152]

There are many specific features of educational tasks, but one thing is clear: in order to solve them, students must master the necessary educational operations. Educational operations are diverse. Many of them are of a general nature and are used almost equally in the mastering of various educational materials. Some educational operations are more typical for the mastering of certain educational materials (mathematical, linguistic, etc.). Educational operations applied in special cases are also distinguished. Intellectual processes – analysis, composition, comparison, generalization, etc. Are always carried out by applying them to the content of a certain subject (mathematics, grammar, etc.) and therefore appear in the form of various subject operations (for example, mathematical). From this point of view, the formation of educational operations is directly related to the mastering of mental activity principles by students.

As a side note, J. Guilford distinguished 120 intellectual abilities in the structure of intelligence ("SOI"). Analyzing experimental materials, he came to the conclusion that intellectual abilities differ from each other in three parameters: 1) the nature of intellectual operations; 2) the content of intellectual processes and 3) the products of intellectual activity. J. Guilford distinguished 5 operations, 4 types of content and 6 types of products of intellectual activity and considered them separately as factors. Thus, in J. Guilford's model, 120 intellectual abilities are characterized by 15 (5+4+6) factors. Of the three parameters distinguished in the "SOI" model, the first (the nature of intellectual operations) is of greater importance. The second and third parameters can be explained precisely on its basis. J. Guilford distinguished the following according to the nature of mental operations: cognition, memory, divergent productive thinking, convergent productive thinking, and evaluation (evaluative thinking) [2;43-44].

The structural analysis of the intellect has shown that its core is thought. This provision had a special scientific and methodological significance for the concept of developmental education. In order to develop students intellectually, it is necessary, first of all, to develop thinking in them. In this process, it was necessary to take into account the genetic and functional interaction of thinking with emotions and perception, on the one hand, and with memory, and finally, with imagination, on the other. In the structural model of J. Guilford, thinking was systematically considered, its genetic and functional connections with various cognitive processes were explained.

By the way, let us also emphasize that the formation of learning operations in learners is a major requirement of modern times. The successful implementation of the principles of developmental learning depends, first of all, on the solution of this issue (for more information, see: [1]).

Control also plays a significant role in the formation of educational activity. The effectiveness of the activity is directly related to the level of control, as well as to the educational operations. From this point of view, it seems that two aspects should be noted separately: 1) The student compares the educational operations he performs and their results with the purpose of his activity, identifies and eliminates his own mistakes. It is necessary to always draw the attention of students to this aspect – the results of educational operations, teach them to mentally plan educational operations, primarily to carry them out internally and analyze their results. When analyzing metacognitive functions, Flavell distinguished two aspects in terms of control: in the first case, the student controls himself by organizing his attention, and in the second case, he controls the problem-solving process (problems are solved through cognitive issues). Both functions are of particular importance in educational activity.

2) When control is effective, the student's educational activity is carried out as a manifestation of his will: he makes efforts to overcome the difficulties encountered, shows special activity for the implementation of the goal, and the direction of this activity is already conditioned by mediated interest. In this situation, control gradually turns into self-control, begins to develop effec-

tively on the basis of reflection. Control is directly related to assessment, which is an important component of educational activity. The question may be asked: "What is the difference between assessment and control?" When examining educational activity from this perspective, it is necessary to distinguish its two sides – the final result and the methods of achieving the result. In the control process, more attention is paid to the extent to which these methods are effective and adequate. In other words, in the control process, not the final result of educational activity, but the results of individual educational operations are examined. However, in the evaluation process, the final result of educational activity is analyzed, and its compliance with the purpose of educational activity is determined.

The assessment situation is characterized by psychologically complex features. In this situation, more than the grade itself, perhaps the aspects that emphasize the teacher's attitude towards the student with emotional overtones play a special role.

When assessment is psychologically effective, it gradually turns into self-assessment, playing an important role in the formation of the student's self-awareness. It creates radical changes in the dynamics of the student's level of assertion in the field of assessment. It creates qualitatively new features in his learning motivation. Psychologically favorable conditions are created for the actualization of cognitive interests in educational activity.

During the monitoring and evaluation of pedagogical processes and events, the activities of students and educators, one often encounters the problem of measuring one or another quality indicator. Therefore, the question "Is it possible to measure the quality indicators of processes in numbers?" worries many specialists. In this regard, the American scientist J. Morrisey showed that the most difficult problem is to prevent the emotional opinions of people working in the field of management about the quantitative assessment of quality, such as "there are no accurate and reliable methods for quantitative assessment of creative work", and to monitor the solution of this problem and develop new approaches to their solution [3;38].

To solve these and similar problems, it is first necessary to become more familiar with the concepts of "measurement" and "measurement scale." Measurement is the implementation of appropriate algorithmic operations to express the observed states of an object (process, event) with appropriate symbols (units, numbers, or symbols).

As a result of the measurement, information is obtained about the object under study, in other words, the state of the object under study is assessed. Depending on the purpose of the measurement (assessment), such rules for measurement are selected and determined that allow assessing the main properties of the object. Each such rule requires the definition of its own "measurement scale". Currently, the following measurement scales and their modifications, accepted by specialists, are used: nominal scale; ranked scale; interval scale; ratio scale; absolute scale[3;39].

***Scientific novelty and practical significance of the research.*** 1. A concise scientific explanation of the impact of the main features of the "techno-democratic-information society" that makes a person stronger at the current stage of civilization development on the education system, on the concepts that reveal its nature, among which the concept of "educational activity" in particular; 2. The attention of educational theorists and practitioners was drawn to the fact that educational activity includes creative acts existing between the educator and the students in the process of implementing education, and that the effectiveness (quality level) of the implementation of the educational process is determined by the transformation of the educational activities of the student and the educator into parts of the unit; The direct dependence of the correct regulation of the emphasized state in the process of implementing education on the understanding of the essence of the concept of educational activity was emphasized; 3. The interpretation of the educational activities of the student and the educator as parts of the unit will greatly facilitate the work of the educator in terms of the systematic selection of creative acts existing between them in the real pedagogical process (in the process of implementing education).

**Result.**

*1. Educational activities* is one of the most important elements of the process of implementing education, understood as a system (as well as a process, result, value), this element has an important "enabling function" in the effectiveness of the system in question; 2. In the process of implementing education, "interest↔ action ↔ a new qualitative state of the rise of the party involved in the process to the desired level of development, education and upbringing" determines the "vector" of Management, which is a type of personality activity, a peculiar form of social activity of educational activity (its components - educational situation; educational operations; control; assessment (assessment) as a component of the process of implementation of Education serves as the basis for directing the functions of transformation (dialectics), accessibility of the unit in the organization and management of the joint activities of the learner and the educator.

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# МИСТЕЦТВО СЛУХАННЯ ТА ТЕНДЕНЦІЇ КОМУНІКАТИВНОЇ ПОЛІТКОРЕКТНОСТІ У СТУДЕНТІВ МАГІСТРАТУРИ

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# THE ART OF LISTENING AND TRENDS IN COMMUNICATIVE POLITICAL CORTRECTNESS AMONG GRADUATE STUDENTS

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**Анотація**
Статтю присвячено особливостям процесу сприйняття інформації магістрами. Зокрема, проаналізовано масив літератури, що стосується когнітивних особливостей студентів в умовах академічної комунікації. Авторка робить спробу теоретичного обґрунтування процесу слухання як складного високотворчого когнітивного уміння людини. Здійснено огляд і порівняння змісту поняття «мистецтво слухання» в контексті комунікативної політкоректності. Описано ситуації, які чудово демонструють, як активне слухання магістрів і політкоректність у взаємодії покращують якість комунікативного мовлення студентів.

**Abstract**
The article is dedicated to the peculiarities of information perception by master's students. In particular, a wide range of literature is analyzed, concerning the cognitive peculiarities of students in the context of academic communication. Moreover, the author makes an attempt to theoretically substantiate the process of listening as a complex, highly creative cognitive skill of a person. Content review and concept of «the art of listening» comparison in the context of communicative political correctness is conducted. The given situations demonstrate how active listening by master's students and political correctness interact to enhance the quality of students' communicative speech.

**Ключові слова:** мистецтво слухання, комунікативна політкоректність, когнітивні процеси аудіювання, студенти магістратури.

**Keywords**: the art of listening, communicative political correctness, cognitive processes of listening, graduate students.

**Визначення проблеми.** Мистецтво слухання можна розглядати як активний процеес, коли людина не просто чує, але й уважно сприймає інформацію, враховуючи контекст та емоції співрозмовника. Це допомагає будувати довіру, уникати непорозумінь та покращувати комунікацію загалом. Відтак, тенденція на глобалізацію й інтернаціоналізацію випускників ВНЗ зумовлює необхідність підготовки фахівців, які володіють уміннями інтегрувати інформацію, виокремлювати необхідне, аналізувати та трансформувати її. Відповідно до вимог XXI ст. зростає портеба не лише у володінні високим рівнем англомовних мовленнєвих навичок, а й у навичках одночасного сприйняття та опрацювання інформації. Майбутні фахівці мають навчитися відокремлювати важливу інформацію й синтезувати її (Ohta, 2018).

Формування мовленнєвих компетентностей у процесі навчання магістрів іноземної мови є однією з ключових цілей навчання мови загалом. Серед таких компетентностей – аудитивна (здатність до розуміння сприйнятого на слух усного мовлення).

Слухання є складним когнітивним умінням, що залучає кілька взаємопов'язаних когнітивних процесів; є активним та усвідомленим актом, під час якого слухач виокремлює значення, використовуючи у якості підказок контекстуальну інформацію і наявні знання та спираючись на численні стратегічні ресурси, щоб виконати завдання (Field, 2008; Holden, 2002; O'Malley, & Chamot, 1990).

Розуміння у процесі слухання – високоактивний творчий процес і зводиться до інтегрування слухачем особистісного смислу почутого. Навички та вміння слухання, які забезпечують розуміння почутого через зустрічну внутрішню активність слухача, складають мовленнєву компетенцію в аудіюванні. Компетенція в аудіюванні не може не бути чітко професійно-орієнтованою, отже йдеться про навчання іноземної мови як спеціальності. Це означає, що така компетенція перш за все повинна забезпечувати усне професійне спілкування магістрів – як на рівні виконання основних та безпосередніх обов'язків (заняття з іноземної мови), так і на рівні професійного усного спілкування, наприклад, комунікація із зарубіжними колегами.

З точки зору психофізіології слухання трактується як перцептивна розумова мнемічна діяльність. Перцептивна тому, що здійснюється сприйняття/ рецепція/ перцепція; розумова – тому що пов'язана з основними розумовими операціями: аналізом, синтезом, індукцією, дедукцією, порівнянням, абстрагуванням, конкретизацією; мнемічна – тому, що відбувається виділення і засвоєння інформативних ознак мовних і мовленнєвих оди-

ниць, реформування образу і впізнавання як результат зіставлення з еталоном, який зберігається в пам'яті (White, 1998).

Аудіювання базується на природній здатності, яка удосконалюється у процесі індивідуального розвитку людини і дає їй можливість розуміти інформацію в акустичному коді, накопичувати її в пам'яті чи на письмі, відбирати та оцінювати її згідно з інтересами чи поставленими завданнями. Важливими факторами формування такої здатності, на думку автора, є: а) перцептивні та мовленнєвомоторні передумови; б) загальні інтелектуальні передумови; в) фактичні знання; г) знання та вміння в рідній мові; д) іншомовні знання; ж) мотивація (Bress, 2006).

Сприйняття будь-якого аудіоповідомлення можна поділити на сенсорний та перцептивний рівні. Сенсорний рівень – це кодування зовнішніх впливів у коді нервових зв'язків. На перцептивному рівні здійснюється переведення закодованої у нервовій системі інформації у предметні образи сприйняття. Перцептивний рівень складається з перцептивних дій (виявлення, розрізнення, ідентифікації слів, синтагм, інтонації тощо) та розумових операцій: первинного синтезу – аналізу – вторинного синтезу, які дозволяють "скласти" цілісне повідомлення з окремих елементів, інтегрувати особистісний смисл поваідомлення (Brown, 1977). На перцептивному рівні здійснюється переведення закодованої у нервовій системі інформації у предметні образи сприйняття. Саме розумові операції відображають роль мислення в процесі аудіювання. Але вони, як і в інших видах мовленнєвої діяльності, багато в чому залежать від мотивації та емоцій. Наприклад, відсутність мотивації сприйняти усне повідомлення може призвести до зриву комунікації, тому що розумові операції не активуються і слухач ніби слухає, але не чує. Сильні емоції, з іншого боку, можуть стати причиною перекрученого сприйняття, коли інтегрується той смисл повідомлення, який слухач хоче або прогнозує почути, а не той, який є адекватним сказаному.

Слід зазначити, що на просунутому етапі вивчення іноземної мови у вищому навчальному закладі досягається удосконалення, "шліфування" мовленнєвої компетенції в аудіюванні за рахунок максимального розширення можливостей сприйняття найскладніших аудіотекстів з точки зору використаного в них мовного та мовленнєвого матеріалу.

Спираючись на попередні дослідження (Field, 2008), А. Руксон і Т. Брунфаут (2015) зробили висновок, що аудіювання охоплює рецептивні, конструктивні та тлумачні аспекти пізнання, що надають змоги розуміти усне мовлення. Крім того, аудіювання передбачає когнітивну обробку тексту і відбувається не лінійно, а в інтерактивній формі, зокрема одночасне сприйняття та інтерпретація потоку інформації, та враховує не лише знання в галузі мовознавства, але й загальні уявлення про оточення.

На думку Дж. Філда (Field, 1998), аудіювання складається з двох основних операцій – декодування та розпізнавання значень. У зв'язку з цим, І. Білянська пропонує такі психологічні механізми до цих етапів:

*мовленнєвий слух* – здатність до впізнавання звуків мовлення та співставлення їх з відповідними їм фонематичними одиницями;

*внутрішнє промовляння* – беззвучна мовленнєва діяльність, що передбачає перетворення звукових образів на артикуляційні;

*ймовірнісне прогнозування* – здатність передбачати структурне, лінгвістичне та смислове наповнення, обираючи між можливими варіантами сенсу висловлення, враховуючи контекст, аудиторію, власні переконання тощо;

*осмислення* – процес аналізу контекстів, встановлення семантики слів і фраз, аналіз синтаксичної структури тексту, розпізнавання засобів вираження емоцій, ідей та інших понять, висловлених вербально;

*оперативна пам'ять* – система психічних процесів, що використовується для короткочасного утримання інформації, необхідної для виконання мовленнєвих завдань та інших когнітивних функцій (Білянська, 2018).

Основними авторка зазначає процеси розрізнення та впізнавання, але збій у будь-якому з етапів прослуховування означатиме погіршення загального результату слухання.

Метакогнітивні процеси слухання охоплюють етапи, пов'язані з контролем і регулюванням процесу пізнання, а саме (Bruner, & Tagiuri, 1954):

- підготовку до прослуховування;
- вибіркову увагу;
- цілеспрямовану увагу;
- загальне розуміння тексту;
- оцінювання розуміння.

Крім того, процес сприйняття інформації пов'язаний із обробленням текстової інформації слухачами, оскільки під час сприйняття інформації студенти можуть зіткнутися з певними проблемними факторами, як-от: потенційний словниковий запас, умови сприйняття, фонетичні особливості мовлення, надлишковість аудіоматеріалів та їх типи, джерела мовлення, шуми та відстань під час слухання тощо (Rost, 1990).

Процес аудіювання пов'язаний із необхідністю автоматичного оброблення тексту (Buck, 2001; Field, 2008), а оброблення в режимі реального часу часто змушує реципієнтів почуватися некомфортно.

Сприйняття мовлення на слух супроводжується подоланням труднощів, викликаних переважно трьома факторами: індивідуально-психологічними особливостями слухача, умовами сприймання та мовними особливостями мовленнєвого повідомлення (Ур, 1992).

Дж. Річардз пропонує комунікативну таксонімію, яка складається із 18 мікронавичок, необхідних для успішного сприйняття іншомовних аудіотекстів, залучаючи до цього короткочасну пам'ять, уміння розпізнавати інтонеми, уміння правильно

ставити наголос, звертати увагу на темп мовлення, обсяг повідомлення, скорочені форми слів, уміння розпізнавати граматичні структури, головні й другорядні члени речення, розпізнавання комунікативних інтенцій мовця, використання знань реального світу, антиципації, індукції, дедукції, ілюстрування, розрізнення буквального значення та конотацій, використання невербальних підказок та стратегій розуміння (Richards, 1983). F A результатом успішного процесу аудіювання є репрезентація мовлення в пам'яті.

Мистецтво слухання в контексті комунікативної політкоректності займає неабияке місце у методиці вивчення й удосконалення іноземної мови.

Політкоректність, у свою чергу, стосується мовних і поведінкових практик, що спрямовані нга повагу до різноманіття та уникання образливих висловлювань. Серед студентів магістратури можна відмітити їх прагнення бути чутливими до культурних, ґендерних та інших відмінностей.

Хочемо зазначити, що ці два аспекти дійсно переплітаються в навчальному середовищі та тісно пов'язані між собою. Наприклад, методи активного слухання, як-от парафразування, уточнення та емпатійне слухання, допомагають студентам краще розуміти один одного й уникати неточностей у комунікації. Водночас політкоректність розвиває повагу та чутливість, що робить комунікацію більш інклюзивною та безпечною. Методики розвитку цих навичок включають тренінги на емпатію, рольові ігри, обговорення кейсів і практині вправи, що дозволяють магістрам відточувати вміння слухати та реагувати з урахуванням різних точок зору.

У професійній комунікації ці навички сприяють побудові більш відкритого та довірливого середовища, де всі учасники комунікації відчувають себе почутими і поважаними. Це, своєю чергою, покращує командну роботу та ефективність взаємодії учасників спілкування. Командна робота на заняттях з іноземної мови допомагає членам команди краще зрозуміти культурні нюанси, уникати непорозумінь і формувати позитивну атмосферу співпраці. Політкоректість гарантує, що кожен учасник відчуває себе комфортно і поважно сприйнятим. Так, наприклад, у груповій дискусії англійською мовою студенти можуть обговорювати різні точки зору щодо культурних відмінностей. Один студент може поділитися досвідом своєї культури, а інший студент уважно слухає, потім перепитує, щоб уточнити деталі, і використовує нейтральну ввічливу мову, щоб уникнути непорозумінь. Ще один приклад: під час симуляції переговорір студенти можуть практикувати усне слухання, ставити відкриті питання і враховувати чутливість до культурних відмінностей співрозмовники. Відтак, вони формують повагу та довіру, що є ключовими для успішної професійної комунікації.

Запропонуємо приклади ситуативних вправ:

**Ситуація 1:** Під час обговорнння міжнародного проєкту один студент ділиться досвідом своєї культури, кажучи: '*In my culture, we value indirect communication and harmony in discussions.'* У відповідь інший студент може зреагувати таким чином: '*I appreciate that perspective. Could you help me understand how we can balance directness and respect in our meetings?'*

**Ситуація 2:** У груповій роботі студент пропонує ідею, яка може бути новою для інших: '*I believe we should consider this approach as it might bring fresh insights.'* Інший студент може відповісти: *'Thank you for sharing that. Let's explore how this idea aligns with our goals and how we can implement it respectfully.'*

**Ситуація 3:** Під час дебатів про етичні питання студент може сказати: *'In my view, we should prioritize ethical considerations in our decisions.'* А інший студент, використовуючи політкоректність може відповісти: *'I understand your perspective and agree that ethics are crucial. Let's also consider different viewpoints to ensure a balanced approach.'*

Ці вправи демонструють, як студенти можуть поєднувати активне слухання з політкоректністю, щоб створити конструктивну та поважну комунікацію. Політкоректність у запропонованих ситуаціях значно впливає на те, по-перше, як студенти слухають і взаємодіють, оскільки така комунікація сприяє більшій емпатії та уважності (студенти намагаються уникати образливих висловлювань і виявляють повагу до різноманіття думок); по-друге, політкоректність допомагає створювати безпечніше середовище, де кожен почувається почутим, де його думку цінують, що в свою чергу, покращує якість спілкування.

Треба також наголосити на значенні вправ цього типу для проєктної роботи студентів. Аудіювання слугує для слухання й розуміння мовлення інших учасників проекту з тим, щоб мати можливість самому взяти участь у подальшому обговоренні, звітуванні, висловлюванні своїх поглядів тощо.

Наведемо декілька ситуацій, які чудово демонструють, як активне слухання магістрів і політкоректність у взаємодії покращують якість комунікативного мовлення студентів.

**1. Cultural exchange presentation:** студенти діляться особливостями своїх культур у форматі презентації, і решта групи уважно слухає та ставить уточнюючі питання.

**2. Group debate on ethical issues:** студенти обговорюють етичні питання, де кожен має висловити свою думку, дотримуючись політкоректності.

**3. Collaborative project planning:** під час планування спільного проекту студенти свої ідеї, демонстручи повагу до різних точок зору.

**4. Feedback session:** студенти надають і отримують зворотний зв'язок, уважно слухаючи та реагуючи з емпатією.

**5. Conflict resolution workshop:** студенти практикують вирішення конфліктів, активно слухаючи своїх колег та знаходячи компроміси з урахуванням чутливості.

Завдяки таким вправам студенти стають більш відкритими до чужих поглядів, краще реагують на різні думки та активніше шукають компроміси. Це також зменшує ризик емоційних конфліктів і допомагає зберегти конструктивний тон обговорення.

Постає наступне питання – як ми розуміємо конструктивний тон обговорення і яким чином студенти магістратури при проєктивному слуханні та комунікативній політкоректності зберігають цей констуктивний тон обговорення? Розглянемо ці питання.

Конструктивний тон обговорення означає підтримку поваги, відкритості та спрямованості на пошук рішень. Це означає, що учасники дискусії дотримуються ввічливості, уникають особистих нападок і зосереджуються на обговоренні ідей, на не на особистості. Щодо студентів магістратури це вбачається в тому, що активно слухаючи, магістанти вдосконалюють слухову пам'ять та фонематичний слух, підтверджують глибинне ситуативне розуміння, ставлячи уточнюючі питання та реагуючи на думки інших з емпатією. Студенти також прагнуть знайти спільні точки дотику, навіть якщо є розбіжності. Відтак, констуктивний тон обговорення допомагає магістрам зберігати позитивну атмосферу на занятті, сприяє ефективному обміну думками та допомагає знаходити конструктивні рішення, навіть у складних мовленнєвих ситуаціях.

Конфлікт зазвичай означає суперечність або зіткнення інтересів, поглядів чи потреб між людьми, що може виникати через різні переконання або ресурси. Конфлікт не обов'язково є негативним; він може стимулювати розвиток і покращення.

Конфронтація – більш прямий і часто напружений підхід до вирішення різниць, коли сторони відкрито виражають свої позиції. Конфронтація може бути як конструктивною, так і деструктивною, залежно від того, як вона ведеться.

Давайте розглянемо на прикладах:

**Ситуація 1: Конфлікт:** студенти мають різні погляди щодо підходу до проекту. Один мтудент віддає перевагу аналітичному підходу, інший – творчому. Для вирішення конфлікту вони можуть провести спільну сесію обговорення, де обидві точки зору будуть враховані.

Student A: *'I believe our approach is more effective because it's data-driven.'*

Student B: *'I hear that you value data-driven methods. Could you help me understand how this approach addresses our creative goals?'*

**Ситуація 2: Конфронтація:** двоє студентів мають суперечку щодо розподілу завдань. Вони відкрито висловлюють свої претензії та очікування, і для вирішення конфронтації магістри можуть використати тухніки медіації, щоб знайти компроміс.

Student A: *'I strongly disagree with your perspective.'*

Student B: *'I appreciate your honesty. Let's explore our differences and find common ground.'*

**Ситуація 1: Конфлікт та конфронтація разом:** у групі магістрів виникає конфлікт через різні методи дослідження. В процесі обговорення може статися конфронтація, але за допомогою конструктивного діалогу та поваги до думок один одного вони можуть знайти спільне рішення.

**Висновки і перспективи дослідження.** У статті висвітлено досягнуті цілі дослідження.

Виокремлено особливості процесу сприйняття інформації магістрами.

Здійснено огляд і порівняння змісту поняття «мистецтво слухання» в контексті комунікативної політкоректності.

Завдяки аналізу поглядів провідних фахівців-лінгводидактів в Україні та Європі визначено методи активного слухання, серед яких: парафразування, уточнення та емпатійне слухання; використання знань реального світу, антиципації, індукції, дедукції, ілюстрування, розрізнення буквального значення та конотацій, використання невербальних підказок та стратегій розуміння.

Представлено ситуації для для проєктної роботи студентів.

Перспективними навпрямками дослідження є: простеження закономірностей впливу когнітивних процесів пам'яті студента на репрезентативне мовлення, контроль мисленнєвих процесів і здатність магістра до саморефлексії; створення окремих методик та технологій навчання інтегрованого аудіювання студентів мовних спеціальностей.

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# TEACHER EDUCATION IN THE POST-PANDEMIC PERIOD: IMPACTS OF DISTANCE EDUCATION ON THE WORLD EDUCATION SYSTEM AND NEW REALITIES

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**Abstract**

The COVID-19 pandemic has brought about serious changes in the global education system, necessitating a rethinking of the nature of the teacher training process. The rapid transition of traditional classroom activities to an online environment has led to the formulation of new strategies by both students and higher education institutions engaged in teacher training. This period has proven the importance of distance learning opportunities, as well as teachers' digital skills, and has created an important experience base for continuous improvement in the post-pandemic phase.

The crisis situation that arose in the world education system during the COVID-19 pandemic, especially the prolonged closure of schools and the extraordinary transition to a distance (distance) mode of education, led to a rapid transformation of the teaching profession and teacher training systems.

The article analyzes the effects of distance education on teacher training in the post-pandemic period, the main challenges encountered, and new realities, and indicates the importance of redesigning teachers' digital competencies, pedagogical approaches, and professional development mechanisms, referring to international reports and recent studies.

The aim of the article is to systematically examine these changes and formulate practical recommendations for teacher training.

**Keywords:** post-pandemic, teacher training, distance learning, professional development, digital skills, inclusion.

The COVID-19 pandemic disrupted education systems globally in 2020–2022. More than 1.6 billion students were left without education, and the most vulnerable family groups in many countries around the world were hit the hardest. This rapid transition forced teachers to urgently teach remotely, and in this process, the shortcomings of teacher training systems inevitably became apparent. Despite the reopening of schools in the post-pandemic period, the experience of distance learning and the new pedagogical and technological needs it created permanently changed the requirements of the teaching profession.

During that period, teacher training programs were organized through online platforms in a short time. Universities began to widely use platforms such as Moodle, Google Classroom, Microsoft Teams and Zoom. This process provided students with practical knowledge in digital pedagogy, online lesson design and virtual classroom management.

In order to prevent monotony in online classes, applications such as Kahoot, Padlet, Mentimeter began to be widely used in international practice. These tools have created a great opportunity to adapt interactive methods in teacher training programs to the virtual environment.

As psychological tension among students increased during the pandemic, higher education institutions organized seminars on psychological support, stress management, and the development of self-regulation skills. It can be said that this factor increased the importance of the social-emotional learning (SEL) component in teacher training.

The normative framework for organizing distance learning in Azerbaijani higher education institutions was rapidly improved. ADPU, UNEC, BSU, and other higher education institutions implemented online practice models for teacher training, and training packages were developed to improve teachers' digital skills. The Ministry of Education's "Virtual School" platform created an additional practice environment for teacher candidates.

In the post-pandemic stage, the most effective model is considered to be a combination of classroom and distance learning. If we focus on the advantages of hybrid learning, we will see that teaching in this format both increases flexibility and provides future teachers with the ability to operate in various teaching environments.

During the pandemic, the world’s education system adopted the term “emergency remote teaching” and this approach was characterized as an unplanned forced measure. The World Bank and other international organizations have drawn lessons from this experience and put forward consistent principles and strategies for the future for long-term results. For example, World Bank analyses show that when the availability of technology and content is not matched by the teacher’s ability to teach remotely, the results are not favorable (1, p.17).

OECD and other reports on the world’s education system note that the pandemic has accelerated digital education innovations. However, this transformation requires continuous professional development of teachers, online education and necessary investment in technological infrastructure.

Digital learning does not end with the rapid development of technology alone - it calls for teachers to acquire pedagogical skills in this area, use new teaching methods and tools, alternative assessment mechanisms and develop students' knowledge, skills and habits through modern technologies.

UNICEF, UNESCO and other organizations emphasize that distance education can exacerbate existing educational inequalities, especially in areas with limited infrastructure, devices and access to the Internet. This context requires the inclusion of socio-cultural sensitivity and alternative teaching strategies in teacher training.

The pandemic situation has required teachers to integrate technology into lesson design, which has required teachers not only to master the use of platforms, but also to develop new pedagogical skills for online lesson structures, interactive activities and assessment. OECD reports show that successful countries in this area have strengthened targeted professional development programs, online teacher communities and resource sharing (2).

As a result of the pandemic, traditional training (short workshops, seminar-sessions) has expanded to online platforms and new models such as micro-learning and virtual mentoring have begun to be implemented. In their studies, the World Bank and UNESCO note that such models provide more flexible and sustainable professional development opportunities.

Distance learning activities have for some time been a source of both professional and personal stress for teachers (until they adapt to the current conditions). Technical problems, family responsibilities and reduced physical contact with learners have affected the psychosocial well-being of teachers. This has made it necessary to include emotional intelligence and stress management skills in teacher training programs (3).

One of the biggest challenges in distance education is the issue of assessment validity and fairness. Online assessment, formative monitoring and data-based interventions have created new demands for teachers.

Research shows that teacher training programs should serve the purpose of ensuring continuity of education at any point in time, in accordance with the realities of the times, and systematize content on online lesson planning, hybrid pedagogy, virtual assessment and the skillful use of digital tools. This should be reflected consistently throughout the entire program, not just at the level of a single course.

Previously, pedagogical practice in schools was replaced by online observations, video lessons and interactive simulations during the pandemic. Students learned to evaluate and reflect on their lesson plans using video analysis methods. This further strengthened their critical approach to the teaching process.

The conclusion reached in this area is that pedagogical practices should be organized not only in the classroom, but also in online and hybrid environments. Mentor-school collaborations and virtual observation systems should be implemented so that students gain experience in real online management (4, p.25).

Pedagogical psychology, one of the important areas of psychology, is a scientific field that studies the psychological processes occurring in the practical activities of a teacher, teacher-student relationships in the educational environment, motivation, development and consideration of individual characteristics. In this regard, pedagogical psychology in teacher training programs promotes both the acquisition of theoretical knowledge and the formation of practical pedagogical skills.

The psychological preparation of a teacher directly determines the quality of pedagogical activity, the classroom environment, student achievements, motivation and the effectiveness of the educational process. Therefore, pedagogical psychology is considered an integral part of the teacher training process.

A modern teacher is a person who creates motivation, understands the needs of students, and reveals individual potential. Psychological competencies are necessary for the fulfillment of these functions. Pedagogical psychology provides the teacher with skills such as organizing training in accordance with the age characteristics of students, applying psychological influence tools, forming motivational strategies and developing emotional intelligence.

Studies show that 30–40% of student achievement depends on the quality of the relationship with the teacher.

Each student has individual psychological characteristics: temperament, motivation type, learning style, emotional reactions are different. Pedagogical psychology allows the teacher to recognize these differences, individualize training and provide psychological support in inclusive education.

The teacher makes psychological decisions at every step, from lesson planning to assessment and behavior regulation. Pedagogical psychology explains the scientific basis of these decisions, ensuring that the teacher acts more objectively and effectively.

Modern reforms in the field of teacher training have further increased the importance of the psychological component. In university programs, pedagogical psychology is implemented in the form of theoretical lessons, practical classes, observations during pedagogical practice at school, psychological trainings and seminars.

As a result of these activities, students gain practical skills that can be applied in a real classroom setting, along with psychological knowledge.

Micro-courses, modular training, virtual mentoring programs and professional learning platforms can respond to the rapidly changing needs of teachers. OECD and UNESCO state that such models enhance networking and local-global exchange of experience.

Teacher training programs and state education policies in this area should provide teachers with appropriate devices, stable connectivity and access to learning content for the effective organization of the teaching process. These steps are necessary in terms of creating and maintaining equal opportunities in education.

Teacher training programs should include digital pedagogy, assessment, inclusive strategies and psycho-

social support modules. These modules should be supported by practical, project-based and simulated online classroom activities.

Agreements between universities and schools should serve to create online mentoring, virtual observation and feedback mechanisms. This will also serve to gain online management experience for learners.

The conducted analyses raise such a reasonable idea that courses that can support appropriate management, emotional intelligence and work-life balance should be organized within the framework of professional development. Schools should especially strengthen psychological and counseling services.

In order to improve the process, open educational resources, microcertification programs and online professional learning tools should be created for teachers at the national and regional levels. Such platforms are invaluable in ensuring the rapid sharing of best practices (5, p.12).

Teachers should be trained in formative assessment and data analysis skills, and universities should be provided with practical tools for monitoring student achievement.

The post-pandemic period has created both challenges and new opportunities for teacher training. In particular, at this stage, there were a number of difficulties, such as the weakening of teacher well-being, the continued risk of infection, and the process of adaptation to new conditions was somewhat slow due to stress and strain.

At the same time, digital educational innovations, online communities and new professional development models have emerged, which are capable of providing opportunities for more flexible implementation of teacher training.

The main condition for the path to success is a continuous learning model designed with policy-program alignment, infrastructure investments and the active participation of teachers. International reports show that successful country experiences are among those that implement these principles.

The pandemic has forced the rapid introduction of distance learning and has made it necessary to adapt teacher training to new realities. The main conclusion is that teacher training programs should no longer only systematically cover subject knowledge, but also digital pedagogy, assessment, psychosocial support and inclusive approaches (6, p.35).

Subjects such as the use of digital tools, online lesson design, and creation of multimedia resources should be constantly strengthened in teacher training programs. Digital literacy should now be considered one of the main competencies of a teacher.

Online practice models obtained during the pandemic should be systematized and standardized. This will allow future teachers to observe different school environments and gain broader experience.

Developing students' research skills is an integral part of the educational process. Research on the effectiveness of online and hybrid teaching, the application of digital methods and the quality of the learning process can be included in the programs.

Taking into account Azerbaijan's "Digital Education Strategy (2021–2025)" and "Education Innovation Program", teacher training programs should be updated in line with national digitalization priorities. This will not only improve the quality of education in the country, but also accelerate the process of integration with international standards.

The pandemic period was marked by flexibility in teacher training, digital transformation, and the emergence of new pedagogical models. These experiences have created the basis for a more innovative, sustainable, and flexible organization of teacher training in the post-pandemic period. A synthesis of global and national experience shows that the integration of digital pedagogy, hybrid education model, and socio-emotional support into teacher training programs will be one of the main factors determining the quality of the future education system.

As we noted above, the professionalism of a teacher in the modern education system is not limited to subject knowledge alone. The 21st century school is based on a student-centered learning philosophy, and the psychological preparation of the teacher plays a decisive role in this process.

Priority areas for the state and educational institutions are: investment in infrastructure, transition to hybrid pedagogical practices, continuous micro-learning opportunities, and support for teacher well-being. Without the implementation of these mechanisms, the effectiveness of distance and hybrid education models will not be fully ensured in the near future.

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# PHILOLOGY

## THE IMPORTANCE OF USING AUTHENTIC MATERIALS IN ENGLISH LANGUAGE TEACHING

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**Abstract**

Authentic materials play a vital role in effective English language teaching by exposing learners to real-life language use and meaningful communicative situations. This article investigates the integration of authentic resources—such as newspapers, films, podcasts, and online content—into classroom practice. It examines the theoretical underpinnings of authenticity in language learning, emphasizing its contribution to learners' communicative competence, cultural understanding, and motivation. Additionally, the paper considers the challenges teachers face in selecting and adapting authentic materials to suit different proficiency levels. The study concludes that deliberate and thoughtful use of authentic materials significantly enhances language learning outcomes and prepares students for confident engagement in real-world communication.

**Keywords**: authentic materials, language teaching, communicative competence, motivation, cultural awareness, classroom practice.

In recent years, English language teaching (ELT) has seen a notable shift toward methodologies that prioritize authentic materials. These resources—ranging from texts and audio recordings to videos and social media content—are originally created for real-life communication by native speakers, rather than for instructional purposes. Examples include newspaper articles, podcasts, restaurant menus, and advertisements. Incorporating these materials into classroom instruction gives learners direct exposure to English as it is genuinely used, providing more accurate and nuanced representations of vocabulary, grammar, and cultural contexts compared to conventional textbooks.

Using authentic materials in the classroom has been shown to increase learners' motivation, engagement, and overall language proficiency. Interaction with real-world texts helps students improve reading, listening, speaking, and writing skills while also offering essential cultural and social insights. By bridging the gap between academic learning and practical application, authentic materials make language instruction more relevant and effective. This article explores the value of authentic materials in ELT, highlighting their diverse benefits, potential challenges in implementation, and practical strategies for integrating them successfully into various learning environments.

Research consistently highlights the significant role of authentic materials in enhancing language learning. As Gilmore (2007) notes, authentic materials expose learners to language as it is naturally used in everyday communication, in contrast to the simplified or artificial language often found in textbooks. This exposure not only strengthens students' fundamental language skills but also fosters pragmatic awareness, enabling them to understand how language functions appropriately and effectively in real social contexts.

The motivational benefits of authentic materials are well documented. For example, Peacock (1997) found that learners showed higher levels of engagement and interest when working with real-world texts compared to standard classroom exercises. Authentic materials also ensure that learners are exposed to contemporary vocabulary, idiomatic expressions, and a variety of grammatical structures that traditional coursebooks may not reflect.

Beyond linguistic development, authentic materials contribute to cultural competence. Language and culture are deeply intertwined, and real-world texts provide learners with insights into the social norms, values, and behaviors of the target language community. According to Tomlinson (2012), incorporating culturally rich materials helps students develop intercultural understanding, preparing them to communicate effectively in international contexts.

However, some challenges exist in implementing authentic materials. Unedited texts can be difficult for lower-proficiency learners, potentially causing frustration. Bacon and Finnemann (1990) suggest that these challenges can be mitigated through pedagogical strategies such as using graded materials, scaffolding activities, and guided comprehension exercises. With careful planning, teachers can make authentic materials accessible and effective for learners of all levels.

Overall, the literature strongly supports the use of authentic materials as an essential component of modern language pedagogy. These resources provide meaningful opportunities for learners to engage with language in ways that mirror real-world use, bridging the gap between classroom instruction and practical communication.

Integrating authentic materials into the English language classroom offers a wide range of pedagogical benefits, enhancing motivation, skill development, cultural understanding, and critical thinking. These advantages collectively contribute to a more effective and engaging language learning experience.

1. Increased Motivation and Engagement

One of the most immediate advantages of authentic materials is their ability to capture students' interest. Real-world texts—such as news articles, podcasts, and social media content—carry relevance and meaning

that often surpass standard textbook exercises. As Richards (2001) notes, exposure to genuine resources boosts intrinsic motivation, encouraging students to participate actively in discussions, seek clarification, and engage in self-directed learning. When learners see the practical value of language in daily life, the classroom experience becomes more meaningful, transforming language learning into a skill applicable beyond the academic setting.

2. Development of Language Skills

Authentic materials support the integrated development of all four core language skills: listening, speaking, reading, and writing.

Listening and Speaking: Audio recordings, video clips, and live reports expose learners to natural speech patterns, intonation, and pronunciation variations. Tasks based on these materials, such as summarizing information or participating in discussions, promote communicative competence and confidence in real-world communication.

Reading and Writing: Engaging with newspapers, professional correspondence, or online articles introduces learners to current vocabulary, idiomatic expressions, and complex grammatical structures that traditional textbooks may not cover. Writing tasks inspired by these materials—such as composing emails, reviews, or formal letters—allow learners to practice context-appropriate language and real-world writing skills.

Furthermore, the rapid evolution of language makes authentic materials especially valuable. For instance, the Oxford English Dictionary updates entries four times a year, introducing new words such as reiterate or kudos. Coursebooks, often published years earlier, may not reflect these changes. To address this, teachers can bring recent articles from sources like BBC News into the classroom. By carefully selecting content aligned with students' interests, educators ensure that learners encounter relevant and engaging material, increasing both comprehension and motivation.

3. Enhancing Cultural Awareness

Language learning is inseparable from cultural understanding. Authentic materials provide insights into the social, historical, and cultural nuances of the target language community. By analyzing real-world texts, learners gain intercultural competence, understanding social norms, customs, and values embedded within language use. Tomlinson (2012) emphasizes that culturally rich materials help learners develop empathy and a broader worldview, preparing them to interact appropriately across diverse cultural contexts.

4. Encouraging Critical Thinking and Problem-Solving

Unlike simplified textbook exercises, authentic materials challenge learners to interpret, analyze, and evaluate information. Real-world texts often contain ambiguity, implicit meaning, or conflicting viewpoints, requiring students to think critically. Activities such as summarizing news articles, comparing opinions in editorials, or evaluating persuasive techniques in advertisements foster analytical skills, enhance learner autonomy, and prepare students for complex communication beyond the classroom.

5. Preparing for Real-Life Communication

Authentic materials mirror the language demands students will encounter outside the classroom, from understanding public announcements to navigating job postings or following current social media trends. By engaging with real-world texts, learners bridge the gap between theoretical knowledge and practical application, building confidence and competence for meaningful interactions in daily life.

In conclusion, the use of authentic materials in English language teaching represents a significant shift toward more practical, real-world instruction. The integration of these resources offers numerous benefits, including heightened student motivation, improved proficiency across all four language skills, enriched cultural and pragmatic awareness, and the development of critical thinking and problem-solving abilities.

By consistently exposing learners to language as it is genuinely used outside the classroom, authentic materials effectively bridge the gap between theoretical study and real-life communication. This approach ensures that students are not only grammatically competent but also capable of engaging in meaningful and context-appropriate interactions across diverse global settings.

Although challenges such as managing the difficulty level for lower-proficiency learners and the additional time required for selecting suitable materials exist, these can be addressed through strategic pedagogical practices, including graded materials, scaffolding, and guided comprehension activities. When implemented thoughtfully, authentic materials empower learners, foster autonomy, and significantly enhance the overall learning experience.

Ultimately, authentic materials are an indispensable tool in modern language education, providing both linguistic depth and cultural insight. Their thoughtful incorporation into classroom practice prepares learners to navigate real-world communication confidently and effectively, making them an essential component of effective English language teaching.

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# PHYSIOLOGY OF ANIMALS

## MORPHOLOGY OF LAYING HEN AND QUAIL EGGS

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**Abstract**
The effect of the combined use of two forms of benzoic acid and mannanoligosaccharides on the weight and morphology of chicken eggs was studied. The impact of varying doses of the Sal-Zap organic acid complex on quail egg weight and morphology was examined in the study. The results helped identify optimal application rates. A combination of 750 g of concentrated benzoic acid, 200 g/t of coated benzoic acid, and 400 g of Actigen per 1 ton of laying hens' feed demonstrated the most significant results. The use of Sal-Zap at a dosage of 750 g/t in quail feed yielded the highest results. These levels can be recommended for nutritionists specializing in laying hens and quails.
**Keywords:** benzoic acid, coated benzoic acid, mannanoligosaccharides, Actigen, Sal-Zap, laying hens, quails, eggshell, yolk, albumen.

Eggshells are approximately 95% calcium carbonate, 3.5% organic compounds, and the remaining 1.5% other minerals and non-mineral elements [1]. The eggshell is the first line of defense against external influences and microbial invasion. In addition to the membrane beneath the eggshell, the shell contains internal components such as the albumen and yolk [2]. Shell strength is critical for both table and hatching eggs. The quality and integrity of commercial eggs depend largely on the strength of their shells during collection, storage, and transportation.

The yolk stores energy and other nutrients. The yolk's natural function is to provide complete nutrition to the embryo during embryogenesis. The yolk serves as the body's immune defense and serves as an antioxidant. It contains proteins - building material for the cells and tissues of the future chick, fats - a source of energy for growth and development, carbohydrates - providing energy for the first days of life, vitamins - regulating metabolic processes and ensuring the normal functioning of the body, minerals - the formation of bones, blood and other tissues [3].

Egg albumen is a complex mixture of water (over 85%) and a variety of high-quality proteins (ovoalbumin, ovotransferrin, lysozyme, and others) with minimal fat and carbohydrates. The protein is the basis for embryonic nutrition, provides physical and chemical protection for the yolk, and has bactericidal properties. The protein also contains B vitamins [4].

Benzoic acid belongs to the group of simple aromatic carboxylic acids. Benzoic acid has been shown to increase live weight gain and improve feed conversion in broiler chickens; however, high doses of benzoic acid have been reported to negatively impact productivity. Benzoic acid, protected by a fatty membrane and appearing as white granules, unlike the concentrated unprotected form, dissociates primarily in the lower parts of the intestine, which helps maintain the pH in the duodenum and jejunum at a low level favorable for the beneficial microflora characteristic of the small intestine [5].

Research results demonstrate the positive impact of mannanoligosaccharide-based products derived from yeast cells on the stability of intestinal microflora and poultry productivity [6]. In-depth practical knowledge gained in recent years in the feed industry through studies of the mechanism of action of mannan-based products (in particular, Bio-Mosa) has enabled the development of a product designed to achieve maximum effectiveness – Actigen, a unique bioactive fraction obtained from the outer cell wall of the yeast strain Saccharomyces cerevisiae [7].

The complex acidifier Sal-Zap is a mixture of propionic, acetic, and sorbic acids. In the feed industry, one of the main sources of Salmonella is animal proteins, particularly fishmeal. Sal-Zap has proven itself to be an effective inhibitor of pathogenic microflora growth during fishmeal production [8].

The literature we reviewed demonstrates positive performance improvements in poultry when using feed acidifiers and immunostimulants. However, data highlighting the in-depth study of organic acids and mannan-saccharides in terms of their impact on egg weight and morphology is almost absent. This underscores the novelty and relevance of our study.

**The purpose of the study** was to evaluate the effect of benzoic acid, mannanoligosaccharides, and Sal-Zap in compound feed for laying hens and quail on egg weight and morphological parameters.

To achieve this goal, the following objectives were set:

- to study the effect of benzoic acid in different forms, concentrated and coated, on the morphology of chicken eggs;
- to determine the effect of different doses of Sal-Zap on the morphological parameters of quail eggs.

**Materials and Methods.** The study on laying hens was conducted in the experimental poultry house of the Bashkir State Agrarian University, Ufa, Republic of Bashkortostan, Russia, from January to September 2025. The experiment lasted 9 months.

The quail experiments, lasting 7 months, were conducted from March to September 2025 at a quail farm in the Davlekanovsky District of the Republic of Bashkortostan.

For the first experiment, four groups of SuperNik laying hens, each containing 21 birds, were randomly selected. The birds were 245 days old at the beginning of the experiment. The second experiment was conducted on Manchurian quail. Fifty 46-day-old quail were selected. During the experiments, the birds were kept in standard windowless poultry houses, and the technological parameters of rearing, feeding, and maintenance complied with generally accepted standards.

The experiments were divided into two phases: preparatory and reporting. The preparatory phase (7 days before feeding the experimental feed) involved feeding all groups a base diet containing no micronutrients. During the reporting phase, the control groups also consumed the base feed, while the experimental groups were fed the following diets:

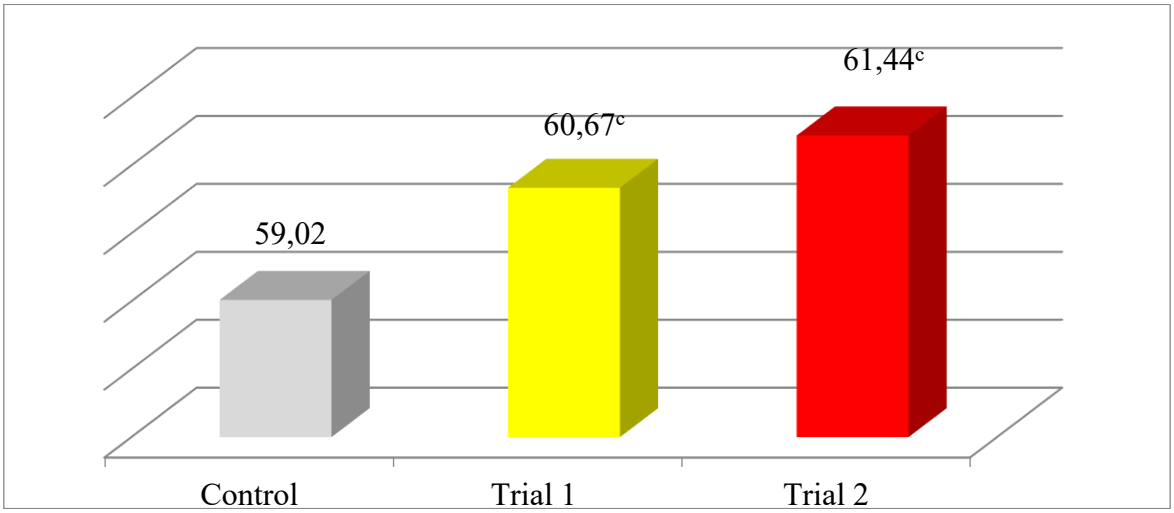
Experiment 1 (layers):

- Trial 1: 750 g concentrated benzoic acid per ton of feed + 200 g/t coated benzoic acid;
- Trial 2: 750 g concentrated benzoic acid + 200 g/t coated benzoic acid + 400 g/t mannanoligosaccharides as Actigen;

Experiment 2 (quail):

- Trial 1: Sal-Zap 500 g/t feed;
- Trail 2: 750 g/t;
- Trial 3: 1000 g/t.

Egg weight was determined gravimetrically every month, and egg morphology was determined in the final week of the experiment. The resulting digital data was processed using variation statistics in Microsoft Office Excel. The significance and magnitude of differences were assessed using Student's t-tests. Our research revealed a positive effect of using a combination of two forms of benzoic acid and the addition of mannanoligosaccharides on egg weight in laying hens (Figure 1). In the Trial 1, which tested a mixture of protected and concentrated benzoic acid, a significantly positive difference was observed compared to the control (+2.8%, $p<0.001$). In the Trial 2, in addition to benzoic acid, we tested Actigen at the dosage that had shown the best results in the previous experiment. This combination resulted in an even greater increase in egg weight (+4.1% compared to the control, $p<0.001$).




*c - p<0,001*

*Figure 1. Egg Weight of Laying Hens, g*

A detailed morphological analysis of the chicken eggs is presented in the Table 1. Absolute shell weight in the experimental groups significantly exceeded that in the control group (by 4.50% and 6.99%, $p < 0.001$). The relative shell weight to total egg weight was also higher in the experimental groups. Increased shell weight is an indirect indicator of the shell's potential for impacts on the egg collection production line. Generally, higher shell weight indicates greater shell thickness, which, in turn, may predict greater shell strength. We also studied these parameters, found a positive correlation, and the data have been published elsewhere.

Table 1.

Morphological composition of laying hens' eggs

| Indicator | Group | | |
|---|---|---|---|
| | Control | Trial 1 | Trial 2 |
| Eggshell weight, mm | 6,03±0,04 | 6,3±0,04$^{c}$ | 6,45±0,05$^{c}$ |
| % to control | - | 104,50 | 106,99 |
| The ratio of eggshell mass to egg mass, % | 10,26±0,06 | 10,41±0,07 | 10,52±0,06$^{b}$ |
| % to control | - | 101,46 | 102,61 |
| Yolk weight, g | 17,83±0,12 | 18,61±0,13$^{c}$ | 18,92±0,15$^{c}$ |
| % to control | - | 104,37 | 106,14 |
| The ratio of the mass of the yolk to the mass of the egg, % | 30,23±0,13 | 30,66±0,13$^{a}$ | 30,81±0,14$^{b}$ |
| % to control | - | 101,42 | 101,95 |
| Albumen weight, r | 35,14±0,27 | 35,77±0,21 | 36,08±0,3$^{a}$ |
| % to control | - | 101,77 | 102,65 |
| Ratio of protein mass to egg mass, % | 59,54±0,16 | 58,94±0,15 | 58,66±0,15 |
| % to control | - | 98,99 | 98,53 |

a - p<0,05, b - p<0,01, c - p<0,001

Egg yolk weight is important from a nutritional perspective, as the majority of an egg's nutrients are concentrated in the yolk. In Experimental Trials 1 and 2, we observed significantly higher yolk weight than in the control group: by 4.37% and 6.14%, respectively ($p < 0.001$).

Furthermore, morphological analysis of the eggs revealed that the increase in shell and yolk content was due to a decrease in protein content (by 1.01% in Experimental Trial 1 and by 1.47% in Experimental Trial 2). However, as noted above (Figure 1), the total egg weight in the experimental groups was significantly higher than in the control.

In the quail laying experiment, in which Sal-Zap was tested as a feed acidifier at various dosages, we examined the same parameters as in the first experiment on chickens. Figure 2 shows the dynamics of changes in egg weight depending on the level of acidifier introduced into the feed.

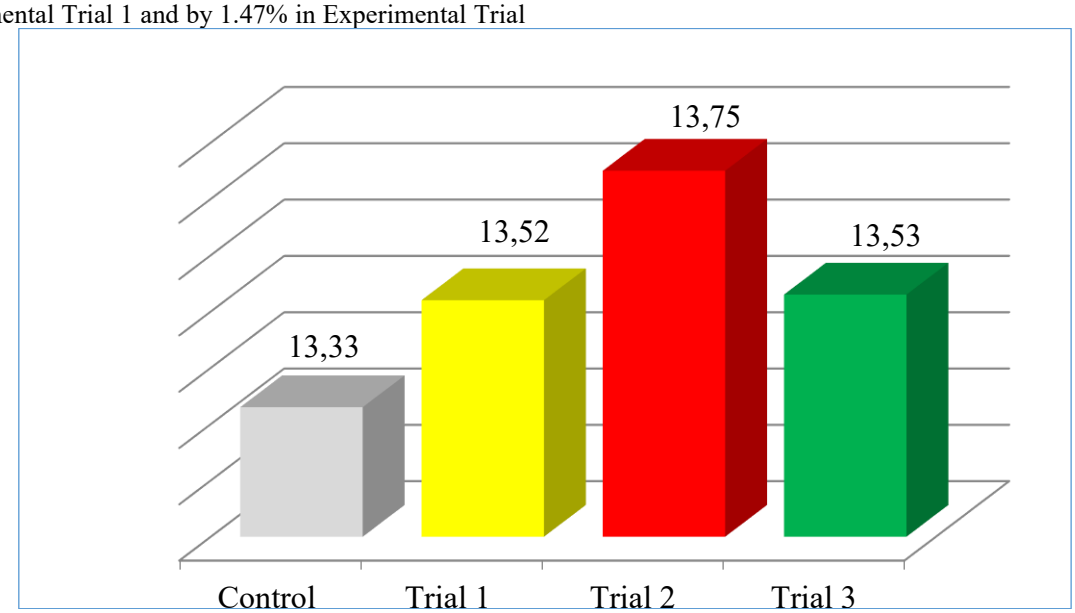



*Figure 2. Weight of quail eggs, g*

The experimental groups with the tested dosages of 500 g/t, 750 g/t, and 1000 g/t outperformed the control group by 0.16 g (+1.43%), 0.42 g (+3.15%), and 0.17 g (+1.50%), respectively. We observed no additional benefits from using the highest of the tested dosages (1000 g/t), and the optimal dosage was determined to be 750 g of Sal-Zap per ton of compound feed.

Table 2 shows the changes in the morphological composition of quail eggs identified during the experiment. In quail egg farming, the issue of shell quality is even more pressing than in industrial chicken egg production, as the low shell strength of quail eggs is a naturally occurring factor. Although not a direct, eggshell weight is a reliable indicator of eggshell strength, so we carefully studied this parameter. Eggshell weight in the experimental groups was 0.75-2.99% higher than in the

control group, indicating improved nutrient metabolism in the groups consuming the Sal-Zap organic acid complex.

Table 2.

Morphological composition of quail eggs

| Indicator | Group | | | |
|---|---|---|---|---|
| | Control | Trial 1 | Trial 2 | Trial 3 |
| Eggshell weight, mm | 1,34±0,02 | 1,35±0,01 | 1,38±0.02 | 1,36±0.01 |
| % to control | - | 100,75 | 102,99 | 101,49 |
| The ratio of eggshell mass to egg mass, % | 10,05±0,04 | 10,06±0,08 | 10,09±0,06 | 10,07±0,06 |
| % to control | - | 100,1 | 100,4 | 100,2 |
| Yolk weight, g | 4,10±0,05 | 4,17±0,05 | 4,28±0,06* | 4,19±0,05 |
| % to control | - | 101,71 | 104,39 | 102,2 |
| The ratio of the mass of the yolk to the mass of the egg, % | 30,75±0,12 | 30,91±0,19 | 31,13±0,16 | 30,97±0,12 |
| % to control | - | 100,52 | 101,24 | 100,72 |
| Albumen weight, г | 7,89±0,09 | 7,99±0,11 | 8,09±0,12 | 7,98±0,09 |
| % to control | - | 101,27 | 102,53 | 101,14 |
| Ratio of protein mass to egg mass, % | 59,20±0,13 | 59,03±0,23 | 58,78±0,19 | 58,96±0,13 |
| % to control | - | 99,71 | 99,29 | 99,59 |

a - $p<0,05$

Improved absorption of feed nutrients, including vitamins, trace elements, and amino acids, was also reflected in yolk weight. The highest yolk weight among the tested doses was observed with the 750 g/t dose: 4.28 g versus 4.10 g in the control (+4.39%, $p < 0.05$).

Protein weight in the experimental samples was 0.29-0.71% lower than in the control, consistent with the results of the experiment on laying hens.

These data indicate that feeding egg-laying quail with the complex acidifier Sal-Zap provides significant benefits in terms of improved egg morphology. Sal-Zap, administered at 750 g/t, demonstrated the best results among the tested doses. Experiments have shown that feed acidification has a positive effect on egg weight, shell weight, and protein content in chicken and quail eggs produced for human consumption. These results indicate improved nutrient absorption due to modification of the bird's intestinal microflora by lowering the pH of the gastrointestinal tract. These observations are of practical importance for egg producers.

**Conclusion.** Studies of various feed acidifiers at varying dosages revealed positive trends in improving egg weight, shell weight, and yolk weight. The use of a combination of biologically active additives in laying hens' feed, including concentrated benzoic acid at 750 g/t of feed, coated benzoic acid at 200 g/t, and mannanoligosaccharides at 400 g/t, yields the best results. In quail feed, the complex preparation Sal-Zap is most appropriately used in the amount of 750 g/t of feed.

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# PSYCHOLOGY

## MANIFESTATION EMOTIONAL BURNOUT SYNDROME IN THE PEDAGOGICAL ENVIRONMENT

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**Abstract**

The rapid socio-economic changes of the modern era and the increasing psychological burden in the work environment have led to the widespread occurrence of emotional burnout syndrome among teachers. Emotional burnout is a complex psychological process that occurs as a result of prolonged stress and professional demands gradually depleting the internal resources of the individual. The syndrome manifests itself in three main components: emotional exhaustion, depersonalization, and a decrease in the sense of personal achievement. Emotional exhaustion is characterized by a decrease in energy and motivation, depersonalization by distance and indifference in social relationships, and a decrease in the sense of personal achievement by a weakening of belief in the value of activity.

Symptoms of emotional burnout manifest themselves at the physiological, psychological and behavioral levels. Physiological signs include chronic fatigue, sleep disturbances and weakened immunity. Psychological symptoms include apathy, anxiety and attention problems. At the behavioral level, there is a decrease in work performance, social isolation and avoidance of communication.

Burnout develops in stages: from an initial stage of enthusiasm to stages of stagnation and apathy. This process is deepened by the interaction of individual, social and organizational factors. Social factors include societal expectations and workload, psychological factors include perfectionism and stress management, and organizational factors include peer support and the quality of the work environment.

Individual and organizational measures are necessary to prevent emotional burnout. Individual strategies include stress management and motivation enhancement, while social interventions include social support and collaboration with colleagues. Organizational approaches include workload optimization and strengthening psychological services.

Consequently, burnout has a serious impact on teachers' professional performance and psychological well-being. It is important to implement both individual and organizational measures to prevent it.

**Keywords:** emotional burnout, occupational stress, depersonalization, sense of personal accomplishment, Maslach model, preventive measures.

### Introduction

The rapid socio-economic changes of the modern era, the increase in psychological burden in professions that require close contact with people, and the uncertainty in the work environment have led to the widespread spread of emotional burnout syndrome. Emotional burnout syndrome was first used by H.J.Freudenberger in 1974, and later put into a scientific framework by Maslach and Jackson.

The emotional intensity of pedagogical activity, constant communication, high social responsibility and evaluation pressure put teachers at risk of emotional burnout. In this regard, it is of particular importance to investigate the nature, symptoms, stages and prevention of the syndrome.

Emotional burnout is a psychological syndrome characterized by exhaustion, indifference to activity, emotional detachment from interpersonal relationships, and decreased efficiency of professional activity as a result of prolonged emotional, intellectual, and social overload. To understand the essence of burnout, it is important to consider it not only as an emotional state, but also as the result of a whole range of neurophysiological and socio-psychological processes.

In psychological literature, emotional burnout is explained as an adaptation disorder resulting from the gradual depletion of internal psychological resources by the constant demands faced by a person during his professional activity. This process usually develops slowly, in stages, and a person often realizes that he has fallen into a state of exhaustion too late, because the initial symptoms of the syndrome begin with a loss of motivation, emotional fluctuations, and psychological fatigue.

The essence of emotional burnout is also related to the mutual imbalance of emotions, motivation and personal value systems. When there is a mismatch between the demands of professional activity and the psychological and physiological capabilities of a person, a person begins to feel increasingly powerless and ineffective. At this time, emotional energy decreases, communication becomes difficult, negative emotions towards work are formed, and a person shows a distant, sometimes cold attitude towards his professional role.

Modern approaches consider emotional burnout not only as a result of individual characteristics, but also as a product of interaction with the work environment, social relations, organizational structure and expectations of society. That is, the syndrome arises as a result of a combination of both personal, organizational and social factors. Depending on the profession, the forms of manifestation of burnout may vary, especially in the social sphere - in professions that are in close

contact with people, such as teaching, medicine, psychology, social service, management, emotional burnout is observed at a higher level.

The level of emotional burnout can also be linked to Hans Selye's "general adaptation syndrome", which studies the body's response mechanisms to stress and deals with physiological reactions and changes occurring in the body. "According to Selye, it has 3 phases: 1) general danger and warning phase - the excitement phase; 2) resistance phase; 3) shock phase" [4, p.6]. "H. Selye called stress a non-specific defense reaction against any extraordinary impact" [3, p.346].

Emotional burnout syndrome, unlike ordinary fatigue or ordinary work stress, is a long-term and systemic multifaceted psychological process that negatively affects a person's personal well-being, professional productivity, social relationships, and overall psychological health. A proper understanding of its essence allows for the effective organization of both diagnostics and preventive and corrective measures.

To fully understand the psychological nature of burnout syndrome, the three-component structure proposed by Christina Maslach and her colleagues is considered the main theoretical framework. According to this model, burnout is not just an expression of general fatigue, but a complex psychological phenomenon consisting of systemic changes that occur in three main areas of a person's emotional, social and professional functioning. Below is a detailed explanation of each component:

**Emotional exhaustion** - is the main component characterized by the fact that a person exhausts his emotional energy against the background of prolonged tension, emotional overload and high responsibility. At this stage, a person feels chronically tired, “psychologically exhausted”, emotionally weak and vulnerable. Emotional exhaustion is more related to the reduction and depletion of internal psychological resources. Thus, a person has difficulty responding emotionally as before, has difficulty finding motivation for himself, and his tolerance to stress is sharply weakened.

Clinical manifestations of this component can manifest themselves in the form of sleep disorders, a constant feeling of physical fatigue, headaches, psychosomatic reactions, a decrease in overall energy levels, and emotional fluctuations. In the professional field, emotional exhaustion results in a decrease in the quality of work, a slowdown in the decision-making process, and a loss of attention. In this sense, emotional exhaustion is considered the initial and most critical indicator of the syndrome.

**Depersonalization** - is characterized by maintaining emotional distance from people with whom a person interacts in their professional activities, treating them as objects, and forming an indifferent attitude. This component is especially pronounced in people working in “person-to-person” professional fields. For professionals such as teachers, psychologists, doctors, and social workers, depersonalization can also play the role of an emotional defense mechanism. That is, a person maintains distance in relationships to protect themselves from further burdening.

In the depersonalization stage, a person has difficulty showing empathy towards others, develops intolerance towards communication, and sometimes even develops negative and sarcastic attitudes. There is apathy towards professional activity, a decrease in faith in the meaning of work, and a cooling of relations with colleagues and students. This both creates a tendency to conflict in the work environment and sharply reduces the quality of interpersonal relationships.

**Decreased sense of personal accomplishment** - It is characterized by a person's undervaluation of their professional achievements, seeing themselves as incompetent, less productive, and less influential. In this case, the person is unable to objectively evaluate their work results, belittles their achievements, and their professional self-confidence is significantly weakened.

A decrease in the sense of personal achievement leads to both a weakening of professional motivation and a loss of self-confidence. These changes are usually accompanied by a decrease in performance, a decrease in initiative, a fading interest in new ideas, and a weakening attitude towards the learning process. This situation manifests itself in teachers as a decrease in interest in applying new approaches to the lesson, a weakening of motivation for personal professional development, and a devaulation of the results of their own activities.

Maslach's three-component model is the most widely used scientific framework for both diagnostic and corrective treatment of burnout. This structure:

- allows you to determine at what level and in which area the burn is most pronounced;
- enables targeted planning of corrective and preventive measures;
- serves as the main theoretical basis for explaining the interrelationships between emotional exhaustion, depersonalization, and a decreased sense of personal accomplishment;
- It is a valid model for studying specific manifestations of burnout in professional fields.

This model also forms the basis of an internationally accepted diagnostic tool (emotional exhaustion assessment) such as the **Maslach Burnout Inventory (MBI)**. Therefore, the assessment of emotional burnout in research, organizational psychology, and psychological assistance is almost always based on this tripartite structure [1, p.146].

Since emotional burnout syndrome is a multidimensional psychological phenomenon, its effects are not limited tois not limited to the emotional sphere. It causes disturbances in the physiological, psychological and behavioral systems of a person that interact with each other. These manifestations allow us to determine the depth and stage of burnout and are especially clearly observed in professional groups that carry a high stress load, such as teachers.

**Physical symptoms.** According to Freudenberger and Richelson, people experiencing burnout are generally talented, confident, energetic, enthusiastic about their work, working overtime, and achieving high performance despite insomnia in their early years. Over time, for various reasons, these individuals' metabolisms begin to malfunction, sapping their energy. The depletion of energy individuals project onto their work

and their surroundings can lead to serious physical problems. Burnout initially manifests itself as mild symptoms. These include fatigue and exhaustion, headaches, lethargy, and sleep disturbances. If precautions are not taken, persistent colds, decreased resistance to infections, weight loss or obesity, difficulty breathing, general aches and pains, gastrointestinal disorders, high blood pressure, high cholesterol, muscle tension, heart palpitations, and skin conditions can develop. If these and similar conditions persist, individuals should not ignore these symptoms and should take preventative measures promptly. These symptoms can be a sign of burnout.

**Psychological symptoms.** "Psychological symptoms are less pronounced than other symptoms that can be observed in individuals experiencing burnout. These symptoms include feelings of frustration and irritability, vulnerability to psychological injury and psychological problems, unexplained restlessness and anxiety, impatience, decreased self-confidence, hostility toward the environment, powerlessness, loss of energy, hopelessness related to work, criticism of others, apathy, increased family problems, dissatisfaction, the development of negative attitudes toward life, a decrease in positive emotions such as kindness, respect, and friendship, uncertainty and confusion in thoughts, unfounded suspicions and paranoia, depression, feelings of guilt, and helplessness. Psychological symptoms of burnout also manifest as thoughts of quitting work and frequent reluctance to go to work. When these symptoms occur, an individual's sense of accomplishment is damaged. When an individual's self-confidence and appreciation for accomplishment diminish, the groundwork for other burnout symptoms is laid, and recovery from this state becomes much more difficult. Because the individual believes wholeheartedly that he is unsuccessful and useless due to the feelings of disappointment, frustration and guilt he experiences" [2, p.30-31].

**Behavioral symptoms.** Behavioral symptoms of burnout are more easily observed by others than physical and psychological symptoms. These symptoms can manifest as general reactions such as forgetfulness, feelings of failure, family conflicts, decreased concentration, irritability, sudden outbursts, frequent crying spells, a desire for solitude, resentment, and feelings of being unappreciated. Some work-specific symptoms can also be considered. These include: slowing down work, tendencies to steal, disengagement, deterioration in the quality of service, inappropriate interventions against clients and an increase in complaints from clients, document fraud, poor job performance, cynicism and accusation toward colleagues, job dissatisfaction, a tendency to seek new professional training, late arrivals and absences, decreased organizational commitment, increased turnover, increased absences and late arrivals due to illness, and a desire to leave the job and transfer to other job positions. Due to such symptoms, individuals who can't find peace of mind, find no pleasure in anything they do, struggle to maintain their work, and habitually jump from one task to another, often focusing on other things to forget their problems. These include overeating, consuming so much tea and coffee that it threatens their health, and consuming alcohol to the point of becoming an alcoholic. Furthermore, insomnia can cause significant distress, and to reduce the tension, individuals may resort to tranquilizers and narcotics. All of these factors exacerbate health problems and reduce work productivity. If burnout symptoms aren't recognized and addressed promptly, they can worsen. Initially presenting as headaches, decreased self-confidence, and irritability, they can eventually develop into more harmful and destructive symptoms, sometimes even resulting in suicide.

Emotional burnout syndrome is not a sudden process. This process is formed gradually and is characterized by the gradual depletion of a person's psychological, emotional and behavioral resources. Although there are various stage divisions in the literature, in the context of pedagogical activity, a classical model consisting of four stages is most often applied: enthusiasm, stagnation, frustration and apathy. These stages are closely related to the dynamics of teacher activity, the intensity of emotional load and the level of stress in the professional environment.

**The stage of enthusiasm and excitement**. The initial stage of the burnout process is usually characterized as a period of high motivation and strong ideals. This stage is especially observed in teachers who are just starting their profession, as well as in specialists who are starting work with a new position or class. During this period, a person feels high energy and strong internal enthusiasm; devotes himself completely to work, sometimes putting personal needs on the back burner; strives for perfection in his activities, tries to build a flawless and exemplary work model; forms very high expectations of both himself and the profession and has difficulty assessing the correspondence of these expectations to reality.

While this situation may seem positive at first glance, it is precisely this excessive idealism and excessive use of resources that creates the basis for burnout in later stages. As the teacher acts without considering the long-term consequences of the energy he or she expends during this period, his or her emotional balance begins to deteriorate, but he or she does not yet realize it.

**Stagnation stage.** After the enthusiasm stage, the first decline in motivation occurs as the individual faces the challenges of real work conditions. In the stagnation stage, the gradual depletion of energy and emotional resources begins; the previous enthusiasm for work weakens; it becomes clear that high expectations do not coincide with the real work reality; the individual's motivation level decreases, and the previous meaning of professional activity begins to be undermined.

In teachers, this stage is usually accompanied by an increase in teaching workload, difficulties in classroom management, communication problems with students, parents and colleagues, and the additional stress of the assessment process. The person feels the initial signs of emotional exhaustion, but may normalize it and not pay much attention to it due to the normalization of the situation.

**Frustration stage**. The frustration stage is a deeper and more severe period of the burnout process. At this stage, the feeling of dissatisfaction with work

intensifies, the person is not satisfied with his or her activity; emotional exhaustion manifests itself more prominently, energy reserves are significantly reduced; the person begins to feel unsuccessful, ineffective and burdened; negative emotions towards the teaching profession - irritation, resentment, distrust and even aggression - can form.

At this stage, symptoms of depersonalization become more apparent. The teacher's relationships with students and colleagues are characterized by a weakening of emotional attachment, a distant and cold attitude, a decrease in empathy, and a more formal nature of the teaching process. As the person feels that he or she is not achieving his or her ideals, internal tension increases, which accelerates emotional burnout.

**Apathy stage**. Apathy is considered the last and most severe stage of emotional burnout. At this stage, the person falls into a state characterized by complete emotional detachment and indifference; previous interest in work is completely extinguished, motivation drops to a minimum level; social isolation increases, communication with colleagues and students is limited; only minimal energy is spent on professional activity; the sense of personal achievement is completely weakened and the person considers himself worthless.

The apathy stage, if not intervened, can pose serious risks to the teacher's psychological health. This situation can sometimes lead to depressive disorders, the development of psychosomatic diseases, and long-term occupational stress. As the stage progresses, the likelihood of the teacher withdrawing from the profession, quitting work, or experiencing severe emotional disturbances increases.

The formation of emotional burnout syndrome in teachers is a multifactorial process and arises as a result of the interaction of social, psychological and socio-psychological factors. These factors are determined not only by the individual characteristics of the teacher, but also by the structure of the educational environment, relationships within the school, the expectations of society and the dynamics of academic relations. Each factor can lead to a systematic decrease in the teacher's emotional resources, intensification of stress in professional activity and, as a result, a deepening of the burnout process.

**Social factors** refer to the broader social and institutional environment in which a teacher operates and are among the most powerful influencing factors of burnout. The sharp increase in bureaucratic obligations, paperwork, electronic reports and inspections in the modern education system prevents teachers from devoting sufficient time to teaching, research and other academic activities, which increases the workload and creates the basis for emotional exhaustion. Low salaries and poor social security weaken teachers' work motivation, reduce their satisfaction with their professional activities and increase the risk of burnout by making them more vulnerable to daily stress.

Overcrowding of classes complicates pedagogical control, classroom management and individual approach, forcing the teacher to work under constant psychological stress. In modern times, the weakening of the teacher's authority in society compared to previous years is also an important social factor that contributes to emotional burnout, because the level of value, support and respect given to the teacher's work seriously affects his internal motivation. In addition, high expectations from society for teachers - responsibility for the results of all students, control over behavior, the requirement to satisfy the wishes of parents - keep the teacher under constant psychological pressure. The presence of family and household stresses, economic difficulties and insufficient social support also weaken emotional resources and create an important social environment that accelerates burnout.

**Psychological factors** is related to the individual characteristics of the teacher and internal emotional regulation mechanisms and is considered the main intrapsychic factors in the development of burnout syndrome. Perfectionism, i.e. excessive demands on oneself, causes the teacher to try to perform every task ideally, and failure to meet these expectations in reality creates internal dissatisfaction and fatigue. Constant anxiety, self-criticism and negative self-esteem make the teacher more vulnerable to stress and facilitate burnout.

Poor stress management skills, difficulty in managing emotions, and ineffective problem-solving strategies keep teachers in a state of constant tension in the face of work pressure. Low self-esteem leads to subjective devaluation of professional achievements, feelings of incompetence, and loss of meaning in their activities. High emotional sensitivity, on the other hand, leads to a more acute reaction of teachers to the behavior of students, parents, and colleagues. Excessive empathy, on the other hand, leads to the loading of other people's problems onto the person's internal emotional system, which in the long run causes serious emotional exhaustion.

**Socio-psychological factors** determine the interaction between the social environment in which the teacher operates and his or her psychological state and constitutes one of the most critical areas of the burnout process. Conflicts with students, indiscipline in the teaching process, aggressive behavior and lack of motivation increase the emotional tension in the teacher and can gradually lead to depersonalization tendencies. Misunderstandings in parent-teacher relationships, excessive intervention or accusatory approach further aggravate the teacher's emotional burden.

Weak peer support, i.e. the lack of solidarity, cooperation and mutual assistance among teachers, creates a fertile psychological environment for burnout. Unhealthy principal-teacher relationships, unsupportive and critical approach of management cause teachers to feel unsafe. Lack of psychological safety in the work environment, i.e. the teacher's inability to freely express his/her opinions, fear of criticism and mobbing, constant tension and conflicts in the team further intensify emotional burnout.

Mobbing, intrigues, groupings, and negative relationships within the teaching staff disrupt the psychological climate and turn the work environment into a source of chronic stress. Each of these factors, complementing each other, can lead to the consistent depletion of a teacher's emotional resources, a decrease in motivation and productivity, and a more severe manifestation of burnout syndrome.

Preventing burnout in teachers requires a comprehensive approach, and in this process, strengthening individual resources, improving the social environment, and providing institutional support by educational institutions are of great importance. In order to effectively reduce burnout, it is necessary to apply preventive, psychological, and organizational interventions in parallel.

**Individual (personal) strategies** consists of personal measures that a teacher takes to protect his or her emotional resources and manage work stress. Improving stress management skills plays an important role in the prevention of emotional burnout. For this purpose, breathing techniques, relaxation exercises, meditation and muscle relaxation methods help restore teachers' psychological balance. Maintaining emotional boundaries is also of particular importance, since creating a balance between a teacher's personal and work life significantly reduces his or her risk of burnout. Time management skills, proper prioritization, workload planning and reduction of unnecessary tasks allow a teacher to manage his or her daily activities more effectively and stress-free.

Professional development strategies, i.e., attending trainings, learning new methods and innovative pedagogical approaches, increase the teacher's motivation and give him renewed energy in his work. Maintaining a healthy lifestyle - sufficient sleep, balanced nutrition, regular physical activity - reduces the physiological risks of emotional exhaustion and strengthens the overall psychophysiological state of the teacher.

**Social strategies** is aimed at strengthening the support received by the teacher from the environment and serves as an effective mechanism against burnout. Increased social support from family and close circle helps to reduce the emotional burden of the teacher, make him feel valued and understood. Joining professional communities - methodological associations and educational forums - allows teachers to exchange experiences, feel solidarity and prevent a sense of professional isolation.

Strengthening collegial cooperation, that is, effective communication with colleagues, joint activities, and strengthening support mechanisms, improves the psychological environment within the school and prevents teachers from struggling with stress alone.

**Psychological intervention strategies**. Psychological interventions include forms of professional support that are particularly effective in the deeper stages of emotional burnout. Psychological counseling and psychotherapeutic assistance allow the teacher to understand the causes of emotional burden, develop self-regulation skills, and restore internal resources. Diagnostics based on the Maslach Burnout Inventory objectively determine the level of burnout, allowing the psychologist to refine the intervention plan.

Stress management training introduces teachers to stress resilience strategies and provides practical skills. Emotional regulation and self-awareness programs help teachers better understand their emotions, express them in a healthy way, and maintain internal balance. Cognitive-behavioral training helps teachers restructure negative automatic thoughts, correct irrational beliefs about work, and reduce emotional burden.

**Organizational (institutional) interventions**. Organizational interventions are systematic measures taken by educational institutions to improve teachers' working conditions and ensure their psychological well-being. Optimizing teachers' workload - reducing documentation requirements, balancing teaching hours and limiting additional tasks - significantly reduces the risk of burnout. Strengthening psychological service offices in educational institutions and implementing regular psychological prevention programs support the protection of teachers' emotional health.

Providing psychological safety in the work environment, that is, allowing teachers to freely express their opinions and be free from fear of criticism and mobbing, increases teacher motivation and job satisfaction. A supportive leadership model, empathetic and understanding management approaches help teachers feel valued and develop a positive attitude towards their professional activities. Expanding teachers' motivation systems - reward, appreciation mechanisms, career development opportunities - are important institutional tools that strengthen the protection of their emotional health and prevent burnout.

**Conclusion**

Emotional burnout syndrome is a significant psychological problem that limits the effective functioning of teachers in the modern education system. The essence of the syndrome is characterized by emotional exhaustion, depersonalization, and a decrease in the sense of personal achievement. Its physiological, psychological, and behavioral manifestations cover all aspects of pedagogical activity.

The development of burnout occurs in stages - from enthusiasm to apathy, and each stage requires careful observation. The social, psychological and socio-psychological factors that influence emotional burnout in teachers are complex. Therefore, it is important to apply intervention strategies at both the individual and organizational levels.

Scientifically based preventive measures not only improve the psychological well-being of teachers, but also improve the quality of the teaching process. When psychological health is considered a priority in the education system, the effects of emotional burnout are minimized and the continuity of teacher activity is ensured.

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# WORLD LITERATURE

## BİOGRAPHY OF NİZAMİ GANJAVİ İN THE RESEARCHES OF MİRZA RAHİM FANA

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**Abstract**
The article studies a document preserved in the personal archive of Mirza Rahim Fana—an Azerbaijani intellectual active in artistic, scholarly, and pedagogical spheres during the late 19th and early 20th centuries—currently kept at the Mahammad Fuzuli Institute of Manuscripts of the Azerbaijan National Academy of Sciences. The material in question is the author's autograph manuscript devoted to exploring the life and literary heritage of the prominent Azerbaijani poet Nizami Ganjavi. Analyzing this manuscript makes it possible to identify the challenges that existed in researching Nizami's biography in Soviet Azerbaijan during the 1920s–1930s. The Nizami-related documents preserved in M. R. Fana's archive further demonstrate that the most trustworthy sources for studying classical figures like Nizami are the autobiographical references embedded in their own works.
**Keywords:** Mirza Rahim Fana, Nizami Ganjavi, manuscript, personal archive materials, biography.

**Introduction.**

Nizami Ganjavi (1141–1209) stands as one of the leading figures in Azerbaijani and broader Eastern literary traditions. His global renown largely stems from the "Khamsa," the five-poem collection composed in Persian between 1174 and 1203. Nizami's literary heritage profoundly influenced not only Persian- and Turkish-language literature across the East but also major European writers such as Dante Alighieri, Giovanni Boccaccio, and William Shakespeare. From the late 17th century onward, his works began to be translated into English, German, French, Italian, and Spanish, resulting in numerous publications that further enhanced his international reputation. By the end of the 19th century, Nizami and his writings became central subjects of scholarly inquiry in Western Europe and Russia, particularly within studies of Persian-language literature. His life and literary legacy have also been extensively investigated in Azerbaijan, although these efforts began comparatively later due to the country's repeated involvement in conflicts. The reason for this is that the country has persistently become a battlefield because it is in the sphere of interest of great empires. The early 20th century marked the first attempts to develop a professional literary historiography in Azerbaijan. Among the pioneering Azerbaijani researchers who examined the heritage of the celebrated poet Nizami Ganjavi was Mirza Rahim Fana (1844–1931).

**Brief information about Mirza Rahim Fana**.

Rahim Mammadbagir oglu Mirzayev, better known by his pen name Mirza Rahim Fana, was born in Shusha in 1848. He received his initial education at a three-class madrasah in his hometown. Later, he studied the theoretical foundations of poetic art under the prominent Karabakh scholar and teacher, the sage Mirza Abulgasim Ghazi, and at the age of sixteen began composing poetry under the pseudonym "Ashiq." Gifted with strong organizational abilities, the young Rahim gathered several talented peers in 1862 and formed a small literary circle of three members, with whom he held literary gatherings and creative discussions. Alongside Arabic and Persian, he also mastered Russian, and between 1866 and 1872 he worked in the civil service of Tsarist Russia in Shusha. From 1872 to 1901, he served as the household keeper at the palace of Khurshidbanu Natavan, daughter of Mehdigulu Khan, the last independent ruler of Karabakh. During this period, he also acted as a secretary of the literary association "Majlisi-uns" (Assembly of Companionship), led by Khan's daughter. In 1901, Fana moved to Baku, where he continued his literary and scholarly pursuits. After Soviet rule was established in Azerbaijan, he became an active participant in the Azerbaijan Literary Society (established in 1925–1927) and contributed to research on the lives and works of Eastern classical authors. He passed away in 1931. [2]

**Mirza Rahim Fana's personal archive.** Mirza Rahim Fana's personal archive, listed as No. 13 and comprising 62 storage units, is preserved in the collection of the Muhammad Fuzuli Institute of Manuscripts of the Azerbaijan National Academy of Sciences. Among the diverse materials protected in this archive, his research-oriented writings on leading Eastern classical authors—such as Rudaki, Ferdowsi, Nizami, Saadi, Hafez, Fuzuli, and others—hold particular significance. These documents indicate that Persian-language poetry and works composed in the aruz metrical system were being studied in Azerbaijan during the first decade of Soviet rule (1920–1930). Within this archive, the materials devoted to the study of Nizami Ganjavi's life and legacy stand apart from the works produced by Fana's contemporaries on the same topic. As a poet himself, fluent in Persian and deeply knowledgeable about medieval sources, Mirza Rahim Fana approached Nizami studies with a more nuanced perspective. In his research, he compared the information recorded in biographical anthologies (tazkiras) with the autobiographical elements found in Nizami's own writings. This method enabled him to reach more precise and reliable conclusions.

**Mirza Rahim Fana's researches on Nizami studies.** Mirza Rahim Fana undertook extensive research on Nizami's legacy, examining each of the poet's works individually and, when relevant, offering

his own assessments of opinions expressed about Nizami by other notable figures. The researcher documented his analysis of Nizami's works across five notebooks, demonstrating his characteristic meticulousness. Ragub Karimov, who first prepared Fana's works for publication, explains Fana's engagement with Nizami's biography as follows: *"Mirza Rahim's intellectual friends and colleagues, fully aware of his expertise and literary abilities, deemed it essential for him to contribute to this work (the preparation of Nizami's biography) and hoped he would help address a complex issue for his time."* [3]

The first notebook assembled by M.R. Fana, titled *"Kitabi-Makhzan-al-asrar,"* contains 25 pages. On its cover, beneath the heading *"Meanings Intended in the Biography of Sheikh Nizami"* (or *"Points Requiring Clarification in the Biography of Sheikh Nizami Ganjavi"*), Fana outlined a plan to systematically address and interpret the topic.

1. Who is he? Whose son is he? Where is his homeland?

2. What information is there about his birth and death dates, his grave?

3. What do we know about his upbringing and morality, and his profession?

4. What are his religious and philosophical views and what are his main works? [4]

M.R. Fana approached his research with great diligence, emphasizing the importance of referring to Nizami's own works to obtain the most reliable information about the poet: *"The most reliable source about the Sheikh is his own works. From here, one can obtain information about both his personality and the date of writing of his works"* [4]. In his article *"Kitabi-Makhzan-al-asrar,"* Fana analyzes Nizami's *The Treasure House of Mysteries*, referring to it as a "treasure of truth." He observes that each section of *Makhzan-al-asrar* provides valuable insights for readers. Notably, this work consists of 20 articles, each accompanied by a story that illustrates and reinforces the moral-philosophical concept presented in the corresponding article. Fana further notes that the other four poems in Nizami's *Khamsa—Khosrow and Shirin*, *Layla and Majnun*, *Seven Beauties*, and *Iskandarnamah*—depict events of human life, thereby offering readers guidance on the world and the principles governing it. From this perspective, the entire *Khamsa* can be understood as a comprehensive treatise aimed at the cultivation of moral understanding. In essence, Nizami elaborated on the moral-philosophical concepts introduced in *The Treasure House of Mysteries* through illustrative examples in his other poems.

M.R. Fana concluded that Nizami, the subject of his research, possessed exemplary moral character. This conclusion was based on the assessments of Nizami by his contemporaries and later followers, some of which Fana highlighted in his work. Under the section titled *"On the Virtue of Sheikh Nizami,"* he presented examples from various poets: one verse by Jalaluddin Rumi, two by Hafez Shirazi, one by Mektebi Shirazi, one by Vusal Shirazi, eight by Abdurrahman Jami, twelve by Vahshi Kirmani, two by Muhammad Fuzuli, and one by Alisher Navoi. As an example, Fana cites a verse from a ghazal by Hafez:

چو سلک در خو شابست نظم تو حافظ گه گاه لطف سبق میبرد زنظم نظامی

Which can be translated as: *"How pleasant your poetry is, Hafez, for you have learned the lesson of order from Nizami's works"* [4].

**Mirza Rahim Fana as one of the first biographers of Nizami Ganjavi.** M.R. Fana attempted to restore the poet's biography. He determines the date of birth and death of Sheikh Nizami based on the information provided by the prominent orientalist Huseyn Danish (1870-1943) and compares this information with another source, the encyclopedic source called "Buaqkha": *"In his book about Persian writers, Huseyn Danish wrote that the Sheikh was born in 535 AH, corresponding to 1140-41 AD, and died in 599 AH, corresponding to 1199 AD. In "Lughati-umumiye-Buaqkha" it is written that he was born in 1140-41 and died in 1203 AD. According to these two sources, the Sheikh's life span is not 63 years, but 64 years, which is consistent with what the Sheikh himself said."* (Huseyn Danish, in his book about Persian-speaking literary figures, gives the Sheikh's birth date as 535 AH with the AH date.) This makes it 1140-1141 AD. He wrote the date of the poet's death as 599 AH, that is, 1199 AD. However, in the encyclopedic reference book "Buaqkha", the date of the Sheikh's death is written as 1203 AD. According to both sources, the poet lived a total of 63 years. This information is consistent with the autobiographical notes in the poet's works.) [4].

M.R. Fana writes that there is no information about Nizami's childhood and youth, upbringing and education. He blames historians for this. In his opinion, classical historians were not inclined to write world events, but preferred writing only stories of murder, robbery, and quarrels. Therefore, the author was disappointed that he could not find a reliable source on this subject. Fana, after these notes, determines where and from whom Nizami received his education not based on facts, but on his own logic. Based on the logic that other famous Azerbaijani poets who were contemporaries of the poet - Khagani Shirvani (1121-1199), Falaki Shirvani (first half of the 12th century), Zulfigar Shirvani (1190-1291) and others reached perfection thanks to the meliku-shuara (master of poets) of their time, Abul-Ula Ganjavi (11th century), he assumes that Nizami could also learn from him. He expresses his opinion as follows: *"Sheikh Nizami may have acquired knowledge in the presence of the aforementioned master, and there is no information about whether he was educated in Azerbaijan or Iran."* (Sheikh Nizami could also have learned science in the presence of the master mentioned above. Thus, there is no information about who his master was in Azerbaijan or Iran) [4].

M.R. Fana also touches on the issue of Nizami's nationality and literary identity. He specifically notes that Nizami was born and raised in Ganja, and spent his entire life in this city. The scholar states that considering that he was born and lived in a region where the population spoke Turkish, that is, his circle of influence consisted of Turks, Nizami also spoke Turkish and adhered to Turkish customs and traditions. This led to the fact that, despite the fact that the language of his works

was Persian, the influence of the Turkish language and Turkish customs and traditions were sometimes felt in "Khamsa". In general, M.R. Fana, who is an admirer of Nizami's works, highly appreciates the poet's artistic world. The scholar proudly notes that Nizami was a supernaturally creative person, a deeply thoughtful philosopher-poet. He wants to convey Nizami's prodigy to the readers by giving numerous examples from "Khamsa": *"The Sheikh's poems, written with masterful skill in a refined literary style and imbued with a musical quality, also carry profound meaning. Through the depiction of various events and the artistic expression of different states of the human soul, the poet's works have served for centuries as a source of great spiritual and aesthetic pleasure."* [4].

M.R. Fana, an enthusiast and connoisseur of classical Eastern literature, tried to determine the place and position of the great Nizami in the entire Eastern world under the title "Summary of Sheikh Nizami's Life and Legacy" (A Brief Overview of Sheikh Nizami's Literary Position). He tried to evaluate Nizami's legacy in comparison with other Eastern classics, his predecessors and successors. He stated that Nizami holds a special place in the background of the works of poets such as Ferdowsi, Anvari and Saadi. He notes that just as Nizami respectfully remembered and praised his predecessors Ferdowsi and Khagani, the great poets of the East who came after Nizami, Jalaluddin Rumi, Hafez Shirazi, Abdurrahman Jami, Alisher Navoi, Muhammad Fuzuli and others, also respected him and described him in the most beautiful expressions. [4].

**Conclusion.** Among the materials on Nizami Ganjavi preserved in M.R. Fana's personal archive, the study entitled "Meanings Intended in the Biography of Sheikh Nizami" (*Points Requiring Clarification in the Biography of Sheikh Nizami Ganjavi*) is of particular importance. This work is one of the important examples of the first stage of Azerbaijani Nizami studies. This article allows us to obtain information about how searches were conducted in Soviet Azerbaijan at the beginning of the 20th century to clarify the dates of Nizami's birth and death, and to determine the literary environment in which the poet lived and worked. The assessment of Nizami's legacy in this study in the background of the works of his predecessors, contemporaries and successors can be assessed as M.R. Fana's contribution to Nizami studies. The inclusion of verses about the poet, whom the followers of the Nizami literary school considered their sage, in the study indicates both the love of the author of the study for his research object and the high appreciation given to Nizami by important figures of Eastern literature.

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