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Content

Agricultural sciences

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Medical sciences

Pedagogical sciences

Pharmaceutical sciences

Philological sciences

Sociological sciences

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Agricultural sciences

ENVIRONMENTAL IMPACT OF THE MINING INDUSTRY

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Abstract

The modern scale of mining production is characterized by intensive use of natural resources, accumulation of waste and deterioration of the quality of the environment. In this regard, increasing attention is paid to the issue of economically sound and environmentally safe functioning of the mining enterprise. The specificity of the impact of a particular mining enterprise on the environment is determined by the geological and geochemical features of the deposits and the equipment and technology used for its development. The article considers an example of the analysis of the content of environmental measures and the main directions of environmental activities of a mining enterprise, and also determines the eco-efficiency of the environmental policy.

Keywords: *environment, geochemical, specificity, of natural resources, ecosystems*

Mining is an important industry for extracting valuable minerals and resources essential to modern life, from building materials to rare earth elements used in electronics. However, the industry has significant environmental impacts that cannot be ignored. This blog post aims to shed light on the harmful effects of mining on the environment, discussing its impact on ecosystems, water and air quality, and long-term sustainability.

Features of mining compared to other types of production. The main factors that make mining unique are: rigid attachment to the location, dependence of all industries on mining, large-scale impact on the lithosphere, temporary nature [3].

The main impact of mining on the environment. A significant impact on the environment is caused by dust and gas emissions into the atmosphere. The main sources of which are elements of production. Such as: various explosives, use of diesel equipment and thermal drilling [1].

List of the main harmful gases released into the atmosphere.

Nitrogen oxide is a product of internal combustion engines and mass explosions. Hydrogen sulfide is a substance released from rock during an explosion. This substance affects the nervous system, irritates the mucous membrane of the eyes and respiratory tract. Sulfur dioxide is a product of a mass explosion, affects the mucous membrane of the eyes and upper respiratory tract. Acrolein is a gas, one of the products of the internal combustion engine, affects the mucous membrane of the nasopharynx and eyes, causes dizziness, nausea, vomiting and stomach pain. Formaldehyde is a product of the internal combustion engine and thermal drilling, affects the mucous membrane of the nasopharynx, the central nervous system, causes skin neurosis. 3,4-benzapyrene is a gas that appears as a result of the release of exhaust gases of internal combustion engines [2].

The emission of dust and gases into the atmosphere of quarries and the environment is closely interconnected and is determined by the same set of uncontrollable and controllable factors. The main uncontrollable factors include climatic conditions, wind and thermal conditions of the quarry, mining and geological characteristics of the deposit, and the controllable factors include technology, equipment and organization of mining production [2].

The main objects affected by pollution are: industrial enterprise personnel, population (living and health conditions), the surrounding natural environment of the region, industrial facilities, historical and cultural monuments [4].

There is a problem associated with the migration of pollution.All natural environments are interconnected and almost all pollutants migrate from foci and sources of pollution at one speed or another. This leads to further pollution of other natural environments[1].

Sometimes the volumes of pollution are so great that they can spread over long distances. This leads to the fact that pollution covers the territory of several states or entire continents. This raises a rather important question about transboundary pollution. This issue was one of the main ones at the Pan-European Conference on Environmental Cooperation (Geneva, November 1979). At this conference, the Convention on Long-Range Transboundary Air Pollution was adopted. One of Russia's obligations is

to reduce emissions of sulfur oxides in the European territory of the country compared to 1980 by 30% in 1993, by 38% in 2000, and by 40% in 2005-2010 [3].

As a result of examining this issue, it can be said that the impact of mining production significantly affects the environment, since natural environment objects are closely intertwined and interdependent. And once again emphasizes the importance of environmental protection.

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Astronomy

SEPARATION OF ICE BODIES PREDICTED MAXWELL, 1856 AND MAGNETIC ANISOTROPIC ACCRETION PROCESS IN THE ORIGIN OF SATURN'S VISIBLE DENSE RINGS

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Abstract

There is still no consensus on the origin of Saturn's visible dense rings. Cassini measurements show that the icy bodies of Saturn's visible dense rings are diamagnetic. JWST has also recently confirmed the existence of water around forming planets and that magnetic fields play an important role in shaping planetary environments. It follows that Saturn's visible dense rings could arise from the ice bodies of a protoplanetary cloud the size of the Roche limit under the mutual action of a diamagnetic expulsion force created by Saturn's magnetic field, together with the action of Saturn's gravitational and centrifugal forces. As a result, the Kepler's orbits of the ice bodies of the protoplanetary cloud move into the plane of Saturn's equator and origin highly compressed stable system of the visible dense rings with separate individual ice bodies. With the same orientation of parallel diamagnetic ice bodies, their repulsion and separation occurs due to their magnetization by Saturn's magnetic field. Ice bodies are also attracted to each other due to their own gravity. At the balance of the both forces, the ice bodies remain at an equilibrium distance in between them. This provides important evidence of the nature of J. C. Maxwell's discovery in 1856 that the visible dense rings of Saturn are not continuous, but composed of individual bodies. This theory can provide an explanation of the origin of Saturn's visible dense rings and their structure observed by Cassini probe in 2004-2017. It could also improve purely gravitational models of the origin of Saturn's visible dense rings, which can only show how additional ice could penetrate the visible dense rings, and cannot convincingly explain their origin and structure.

Keywords: *Origin of Saturn's visible dense rings, Saturn's magnetism, diamagnetism of ice in space*

1. Introduction

Existing purely gravitational models of the origin of Saturn's visible dense rings of Saturn are not able convincingly explain their origin and observed features [1-10]. These include their stability and strong flatness at Saturn's equator, their fine structure, and equilibrium separation of ice bodies within their entire system. Cassini measurements concluded that the ice bodies of the visible dense rings have diamagnetic properties [11, 12] and the ratio of deuterium and hydrogen isotopes in them is the same as that of Earth's ice [13]. Recently, JWST confirmed the existence of water around forming planets [14]. Also it shown that magnetic field plays an important role in the formation of planets [15].

It follows that visible dense rings could arise from ice bodies of a protoplanetary cloud the size of the Roche limit under the mutual action of the force of diamagnetic expulsion created by Saturn's magnetic field, together with the action of its gravitational and centrifugal forces. As a result, the Kepler's orbits of the ice bodies of the protoplanetary cloud move into the plane of Saturn's equator and origin stable system of the visible dense rings with separate individual ice bodies. The Coriolis force is not active at the equator. This provides important evidence of the nature of J. C. Maxwell's discovery in 1856 that the rings of Saturn are not continuous, but consist of individual bodies. This theory provides an explanation of the origin of highly compressed disk of Saturn's visible dense rings at its equator and their structure observed by Cassini probe in 2004-2017. It may also improve existing purely gravitational models of the origin of Saturn's visible dense rings, which can only show how additional ice could penetrate the visible dense rings, and cannot convincingly explain their origin and structure.

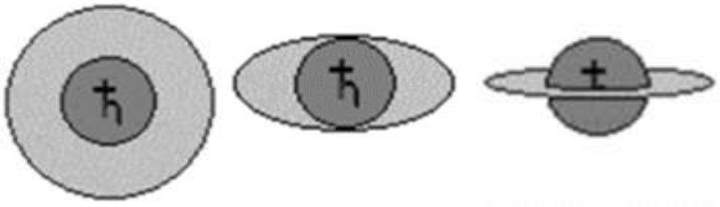
2. Magnetic anisotropic accretion as additional process to gravitational accretion in the origin of Saturn's visible dense rings at its equator. The Tchernyi-Kapranov effect.

G. Kuiper proposed the bodies of visible dense rings made up of ice. The Cassini space probe discovered that they consist of 90–95% water ice [8, 9]. The Cassini measured the ratio of the heavy and light hydrogen isotopes of the ice of visible dense rings is the same as of ice on the Earth [13]. Then we can choose Earth's ice XI which is stable below 73K and it is diamagnetic [11, 12]. Saturn has a spherically symmetric gravitational field and an axisymmetric magnetic field with magnetic equator. For Saturn magnetic equator coincides with geographical one [16]. In the region where visible dense rings are located, Saturn's magnetic field is stable and its dipolar component predominates [17].

Because JWST confirmed existence water around forming planets [14], we can use the classical theory of the small nebula by V. Safronov [1] to study the process of the origin of Saturn's visible dense rings. Contribution of Saturn's magnetic field through the action of diamagnetic expulsion force we call as Magnetic Anisotropic Accretion (The Tchernyi-Kapranov effect) [18-22]. It works together with gravitational accretion in origin of visible dense rings.

Interaction of Saturn's magnetic field with diamagnetic ice bodies of the protoplanetary cloud creates a force diamagnetic expulsion. Under the action of this force together with the action of Saturn's gravitational force and centrifugal force, all orbits of ice bodies begin to shift to the plane of the magnetic equator, where the total energy of the diamagnetic ice bodies is minimal due to minimum value of their magnetic energy.

As a result, all the orbits of ice bodies in the protoplanetary cloud which has a Roche limit size move to the Saturn's equator plane, and create highly compressed flat structure of the visible dense rings due to the mutual action of Saturn's gravity and its magnetism. This process is on the Fig. 1.



a *b* *c*

Fig.1. Collapse of Saturn's protoplanetary cloud which has a Roche limit size and filled with diamagnetic ice bodies into a disk of visible dense rings after the mutual action of Saturn's gravitational and magnetic fields on ice bodies of the protoplanetary cloud: from a to b to c.

As a result, all ice bodies find themselves inside a three-dimensional magnetic well in the plane of Saturn's magnetic equator, which coincides with the geographic equator [16]. The ice bodies form a highly compressed flat disk-shaped structure of Saturn's visible dense rings. For ice bodies moving in orbit, acting on them gravitational force is balanced by centrifugal force and the force of diamagnetic expulsion.

We solved dynamic problem of the movement of a sole diamagnetic spherical ice body in the gravitational and magnetic fields [18, 22]. For the constant orbital radius, solution reduced to an equation for the azimuthal angle θ of the ice body motion:

$$\ddot{\Theta} + \dot{\Theta}^2 \cot\Theta - (\boldsymbol{A} + \boldsymbol{B}\cos^2\Theta)\cot\Theta = 0. \qquad (1)$$

Where A and B are the constants related to the gravitational and magnetic forces, respectively. The analytical solution of (1) equal to $\boldsymbol{\theta = \pi/2}$ shows that all the stable orbits of ice bodies trapped in the equatorial plane. Gravitational force acting on orbiting ice body counterbalanced by centrifugal force and the force of diamagnetic expulsion. This fact was established during several research missions to Saturn.

3. Separation of ice bodies in the Saturn's visible dense rings

J. C. Maxwell proved in 1856 the fact that the visible dense rings along the orbit are not continuous, but consist of individual bodies [23]. In the magnetic field of Saturn, the bodies of diamagnetic ice acquire their own magnetization, opposite in sign to the magnetic field of Saturn. This leads to their repulsion and separation due to the magnetic force. In addition, the bodies are attracted to each other due to the gravitational force. When the gravitational force and the magnetic repulsion force are equal, an expression for the equilibrium distance ro between the ice bodies is [24, 25]:

$$r_0 = \left(\frac{R}{r_{Sp}}\right)^3 \frac{m_S}{M_p} \frac{\mu - \mu_0}{\mu + 2\mu_0} \sqrt{\frac{3\mu_0}{4\pi G}} \quad (2)$$

Where μ and μ_0 are magnetic permeability of the ice body material and free space, respectively; R is the is the ice body radius, r_{Sp} is the radial distance between the centers of Saturn and the spherical ice body, M_p is the mass of ice body with magnetic moment m_p, ms is the magnitude of magnetic moment of Saturn, G is the gravitational constant.

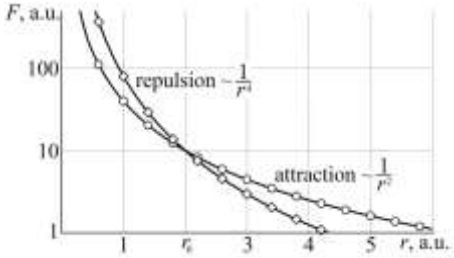


Fig.4. Dependence of the repulsion and attraction forces of ice bodies on distance between them.

4. Conclusion

In the present theory, there is no rejection of various gravitational and any other theories of the origin of Saturn's visible dense rings. We have considered only additional contribution of Saturn's magnetism to the dense rings origin process due to diamagnetism of ice bodies and try to apply it to explanation of the peculiarities observed by Cassini in rings. It has been shown that the magnetization of diamagnetic ice bodies of the protoplanetary cloud and the effect of magnetic anisotropic accretion with the action of the force of diamagnetic expulsion extend our knowledge of nature of the origin of Saturn's dense rings. This also can give an explanation of unexplainable yet separation of ice bodies in the visible dense rings by gravitational models.

J. C. Maxwell, the founder of the theory of electromagnetism, was close to a final solution to the problem of the origin of Saturn's visible dense rings when in 1856 he proved that the orbits of the rings were not continuous, but consisted of individual bodies. However, the Cassini probe received information that individual bodies of visible dense rings consist mainly of diamagnetic ice only 150 years later during its outstanding Cassini mission around Saturn in 2004-2017.

It is now clear that discussions about the age of Saturn's rings will only become valid if they initially take into account not only the influence of Saturn's gravity, but also the role of Saturn's magnetic field. It allows us to explain phenomena in the visible dense rings observed by the Cassini probe, such as the origin of their stable, highly compressed flat structure at the equator of Saturn, and calculate the equilibrium distance between ice bodies in the dense rings.

Taking into account Saturn's magnetism suggests that the age of the visible dense rings may be almost the same as the age of Saturn's magnetic field. This coincides with the conclusion of [10] that Saturn's visible dense rings may be as old as entire Saturn's system.

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Economic sciences

ASSESSMENT OF THE POSSIBILITIES OF LIBERALIZING THE AZERBAIJANI ENERGY MARKET

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Abstract

The article assessed the possibilities of liberalizing the energy market of Azerbaijan. The processes of developing the energy sector in the world were analyzed. The processes of liberalizing the energy sector were investigated. The issues of liberalizing the national energy sector of Azerbaijan were considered. The advantages of creating and developing a liberal market energy model were given. The existing opportunities in this area were analyzed and evaluated. Taking into account global challenges, the possibilities of liberalizing the energy market in Azerbaijan were assessed and proposals were made in this regard.

Keywords: *Azerbaijan, energy sector, energy market, energy market liberalization, assessment of energy market liberalization opportunities, assessment, liberalization.*

It should be noted that in world practice, many countries have preferred maximum liberalization of the energy sector in order to ensure their energy security more reliably, while maintaining only certain management and regulatory functions in a centralized manner [1]. On the other hand, it is necessary to take effective measures to strengthen energy security, transparently disclose the existing problems of the national energy sector, identify solutions, and create a liberal energy market. One of the important issues in this regard is the formation of a favorable liberal energy market model and ensuring its development [2]. For example, in China, where the state control and management system are strong, in addition to state control over the activities of electricity generating enterprises, a fairly wide range of stimulating activities and support mechanisms are applied. In short, in most countries of the world, the development and application of new mechanisms for improving the existing mechanisms of energy security and intensifying the development of the national energy sector can be considered as the main trends. The main goal is to ensure the maximum rapid development of the energy sector and create favorable conditions for activities based on the liberal market model [3].

In Norway, the highest level of liberalization of the electricity sector was achieved during the reforms carried out in this industry. However, when developing the program for the liberalization of this sector, privatization issues were not even considered. In the USA, the industry is almost completely privatized, and the regulation of the activities of companies is carried out at the state level. Despite this, a full-fledged liberal market has not been created in many states. In most EU countries, the electricity sector operates either on the basis of state (Italy, Ireland, Greece, France, Denmark) or mixed ownership (Germany, Portugal, Austria, the Netherlands, Finland, Sweden). In Great Britain, Belgium and Spain, the electricity sector has been privatized. Most countries are guided by the Norwegian experience of maximum liberalization when carrying out reforms. In developed countries, the process of liberalization of the energy sector most often occurs against the background of the general regulation of their economies and is associated with the need to increase the economic efficiency of the activities of energy companies. In many developing countries, the reform of the electricity industry is associated not with ensuring the efficient development of the industry itself, but with the need to increase the efficiency of the entire national economy.

In recent years, measures to increase the efficiency of energy resources use and the role of green energy in the transition to a green economy have been expanding in Azerbaijan. In general, there are undeniable direct and indirect advantages of increasing energy efficiency. These advantages have been widely recognized both on a global scale and in the industrial policies of individual countries. There is a serious need for the application of new innovations in similar areas, and there are problems associated

with this [4]. In addition, in modern times, the modernization of the national economy based on innovations and market economy principles has emerged as a demand [5]. These processes are also characteristic of the energy sector. Thus, energy efficiency is gaining an increasingly high position in energy policy. The expansion of competitive industrial production that uses energy efficiently requires a regime of saving raw materials [6]. These issues also include the formation of more rational modes of action in the direction of efficient use of energy and ensuring the development of the energy system.

Much work needs to be done in Azerbaijan regarding the transition to a green economy, and among these measures, the liberalization of the energy sector in Azerbaijan, the reduction of energy subsidies, and instead the more active application of market economy mechanisms stand out. Subsidy reforms carried out in the country create a risk of general price increases [7]. Investments by the state in the electric power sector and intensive provision of subsidies can be assessed as factors slowing down the liberalization of this sector. We believe that the state should take thoughtful and long-term steps and reforms aimed at liberalizing the national energy sector, which is a strategic economic sector.

It should be noted that in the processes of liberalization of the national energy sector, additional measures are also needed to accelerate reforms through various compensations and subsidies. In a number of countries, a shock therapy approach is used. In a short period of time, radical measures, liberalization of the energy market, energy sector, determination of prices in a market economy and formation of competition between energy companies, and a significant reduction in state intervention in the energy sector occur. As a result, the national energy sector is liberalized in a short period of time and various companies, energy producers and distribution companies are formed, in short, a modern national energy sector based on a market economy is formed. In our opinion, Azerbaijan should also sufficiently benefit from the existing world experience in this direction and intensify the application of liberalization mechanisms [8].

The formation of a national energy sector that responds to market economy conditions ultimately creates an open competitive environment among energy producers and, in particular, energy distributors, as we mentioned earlier, form various tariff packages to attract customers, improve pricing policy and the factor of taking a greater place in the market comes to the fore in pricing policy, and all these are noteworthy as factors accelerating the liberalization of the energy sector. In terms of the development of the liberal market model, and also in the modern era, the improvement of the legislative framework in the national energy sector, the adoption of various required laws and the reduction of the intervention of the state sector and state control structures in the energy sector, the abolition of regulatory bodies and the termination of the activities of certain bodies by the state, especially in relation to price regulation, and the creation of conditions for the formation of prices in a market economy are of particular importance. These are also important in terms of the country's economic security [9]. At the same time, technological renewal of strategically important economic sectors is required [10]. The development of the liberal market model in many cases mainly includes issues arising from the trends of the time. The dynamics of the market, the financial situation of market participants, the objective communication of the demand for energy resources to market participants, the modern state and adequacy of the energy infrastructure, the optimality of relations between energy producers, the implementation of appropriate measures in terms of conducting more research and taking measures to reduce energy losses, ensuring joint efforts to eliminate energy losses, the creation of an electric power transmission network with circular and other alternative sources of connection to minimize energy losses, and the formation of infrastructure are important issues. At the same time, we believe that it is important to keep many issues in the spotlight in terms of methodological approaches and features of the liberal market model [11]. The main directions in the prospective development of the national energy sector of Azerbaijan are related to increasing the share of renewable energy types, including wind and solar energy [12]. The use of alternative energy sources and the creation of infrastructure for this in various settlements and villages, residential areas, and production zones are gaining momentum. Investment projects have been signed with several companies specialized in this field around the world. Currently, projects are being implemented in the liberated territories - in Jabrayil and Garadagh districts - to create infrastructure for receiving solar energy, and in Khizi district - to create wind energy. All this creates serious grounds for the liberalization of the national energy sector in our country, etc.

It should be noted that the energy sector plays a key role in the economy of any country, providing energy to various industries, the transport system, and the daily needs of citizens. The energy sector plays an important role in ensuring the favorable functioning of all sectors, improving the quality of the social sphere, and the living conditions of the population. The level and pace of development of the state largely depend on its capabilities. During its activity, the energy sector interacts with numerous sectors of the

economy and competes with some of them. Energy becomes a factor of innovative development, in particular, it leads to the formation of new technological generation of heat and electricity, and to increasing the energy efficiency of electricity. The issue of organizing the retail sale of electricity within the economy is also considered in the electric power industry. This includes aspects such as accounting for consumed electricity, metering and payment for consumption, as well as the development and application of innovative technologies that allow consumers to effectively use and control energy consumption [13]. It develops strategic plans to ensure the country's energy security, diversify supply sources and routes, and ensure the reliability of energy infrastructure. Despite the role played by the state in the development of the energy sector, there are problems associated with the formation of a liberal market model in this sector [14]. The history of the formation of liberal market relations in the energy sector can be considered as the history of the pricing process in this industry. Thus, in different countries, this history is characterized by the creation of the energy sector, the formation of an appropriate structure for its state management, and then partial liberalization. For example, in some countries, electricity production was not a state monopoly at all. Later, countries that saw a sharp increase in the importance of electricity and the demand for it decided to take full control of that sector [15].

It should be noted that in many countries of the world, the stages of energy production and distribution, which are under state control, are mainly under state control [16]. Currently, Azerbaijan is trying to adopt international experience in order to build its energy sector on the basis of a liberal market model. On the other hand, the application of new economic mechanisms in important economic sectors is important from the point of view of national security [17]. In order to study international experience in applying a competitive liberal market model in the energy sector of Azerbaijan and to carry out reforms in this area, the Ministry of Energy of our country holds meetings with relevant structures and experts of some countries. At these meetings, examples of international experiences in reforms carried out in the energy sector of countries from Europe, South America, Central Asia and other regions, expanding the share of renewable energy sources in liberalized markets, and attracting private investors to the development of this sector were reviewed [18]. By applying energy-efficient technologies and methods, enterprises can optimize their operations, reduce waste and carbon dioxide emissions. This not only reduces their energy costs, but also increases their competitiveness in the market. Modernizing buildings, industrial equipment, and implementing renewable energy systems requires a skilled workforce, which creates employment opportunities for the population. Expanding the green economy, driven by energy efficiency, can provide jobs in various sectors such as construction, manufacturing, and engineering [19].

In modern times, regulated prices are used in the energy sector in Azerbaijan. If there is a transition from regulated prices to liberal market prices, this will lead to an increase in prices and a decrease in consumer surplus. Therefore, when privatizing the energy sector, a policy of compensating low-income households and socially vulnerable groups of the population for the losses they may face due to price increases should be implemented in parallel [20]. At the same time, the privatization of some parts of the energy sector can help attract private investment to it. From the experience of different countries, it can be seen that thoughtful liberalization of the energy sector can lead to an inflow of investment into this sector. The mechanisms for attracting investment to the energy sector depend on many subjective and objective factors. The main role among these factors is played by the level and forecast of electricity prices. Liberalization of relations in the energy sector allows for the sharing of risks between consumers and investors and the improvement of the quality of investment decisions made [21]. The processes of liberalization of the energy sector affect the main indicators of the country's socio-economic development. Changes in the structure of consumer demand occur, leading to low production efficiency and, as a result, a decrease in the competitiveness of products [22].

In recent times, the energy sector of Azerbaijan has also had an impact on GDP, one of the country's main macroeconomic indicators. To see this, let's first pay attention to the dynamics of revenues from that sector (Figure 1).

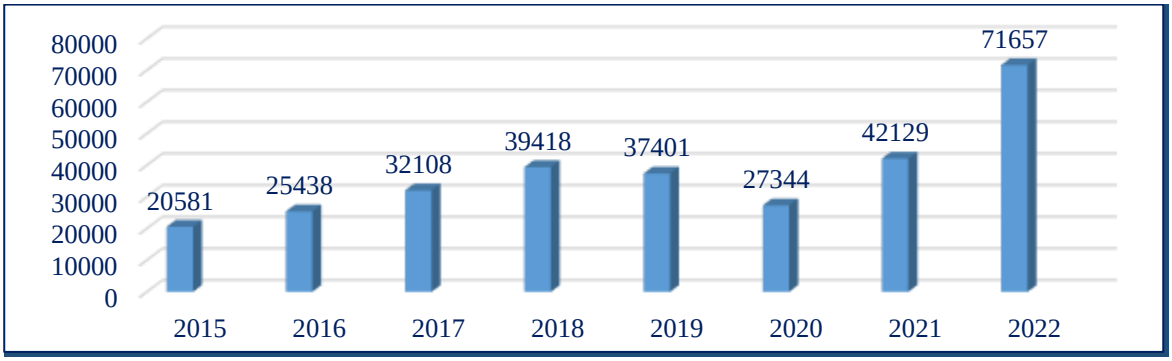

Figure 1. Volume of products produced in the energy sector of Azerbaijan, in %.

If we look at Figure 1, it can be said that in most of the studied periods, an increase was observed in the volume of products produced in the country's energy sector compared to the previous periods. Only in 2019 and 2022, there was a decrease in this sector compared to the previous years. In 2022, the production volume in the energy sector was higher, which is 10 times higher than in 2015, 10 times higher than in 2020, and 100% higher than in 2021 [23]. This increase was also reflected in the volume of the country's GDP. In 2022, the country's GDP was 133,972.7 million AZN, of which 71,657 million AZN or 53.5% fell on revenues in the energy sector (see Figure 2).

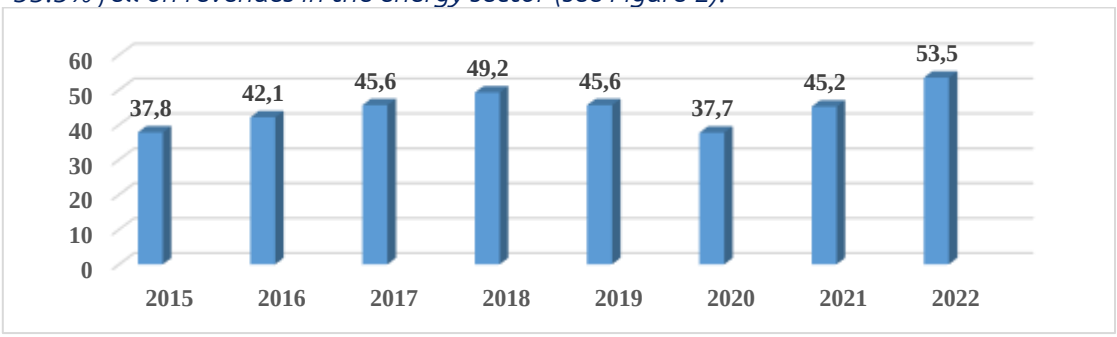

Figure 2. Share of the volume of products produced in the energy sector of Azerbaijan in GDP, %.

In modern conditions, the energy sector remains one of the fundamental foundations of the economic system of Azerbaijan. Ensuring the uninterrupted operation of the national energy sector of Azerbaijan and its independence from the influence of foreign players is one of the main tasks facing the state today. In our opinion, the choice of an efficient organization model of the energy sector applied in different countries and the efficiency of its operation are determined by the main goals and conditions of carrying out structural reforms in the industry. In the near future, it is important to take into account a group of factors for the development of the energy sector in Azerbaijan and the assessment of the opportunities for liberalizing the energy market:

✓ *There is a need to create a high-tech energy sector, organize modern energy production enterprises, increase the share of alternative energy sources in the overall energy sector, effectively use renewable energy resources, and at the same time, deepen measures to form and develop energy infrastructure in accordance with the requirements of a green economy;*

✓ *In addition to the central cities of the country, it is necessary to ensure the high-level development of energy infrastructure, energy transmission networks in the regions, and to use more closed and insulated energy transmission lines to reduce losses;*

✓ *An important aspect of the economy in the electric power industry is the development and application of new energy technologies.*

✓ *Optimal application of new technologies can reduce the environmental burden, improve energy security and reduce dependence on traditional energy sources.*

✓ *Optimization of production, transmission, retail processes and the application of new technologies can ensure energy security, reduce costs, increase efficiency and stimulate further development of the energy sector for the benefit of society, etc.*

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THE ECONOMIC NATURE AND ACCOUNTING PRINCIPLES OF COMMODITY TRANSACTIONS

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Abstract

As a fundamental activity in the market economy, commodity transactions reflect the intrinsic law of value exchange. This article systematically explores the economic nature of commodity transactions and their significance in the operation of modern enterprises. It also elaborates on the core accounting principles applied to such transactions, including their practical application, common issues, and future trends in the context of digital transformation. The integration of economic theory and accounting practice aims to enhance financial reporting quality, support decision-making, and improve enterprise competitiveness.

Keywords: *Commodity Transactions; Economic Essence; Accounting Principles; Value Exchange; Financial Management*

1. Introduction

In the context of a market-oriented economy, commodity transactions serve as a cornerstone of business activities, enabling the circulation of goods and realization of value. These transactions not only represent exchanges of goods or services but also function as a primary mechanism through which businesses generate revenue and accumulate capital.

As business models evolve and digitalization reshapes financial ecosystems, there is a growing need to reassess the foundational economic principles and accounting frameworks guiding commodity exchanges. This paper addresses this necessity by analyzing the essence of commodity trading, its influence on capital movement, and the application of accounting standards that ensure accurate representation of these transactions.

2. The Economic Nature of Commodity Transactions

2.1 Definition and Economic Role

Commodity transactions involve the exchange of goods or services between economic agents based on mutually agreed value. The economic essence lies in transforming use value into exchange value and ultimately into monetary value. This process drives the realization of profits and ensures the flow of capital across enterprises and sectors.

2.2 Characteristics of Commodity Transactions

Commodity transactions in a market economy are marked by:

• Equivalence in Value: Transactions are conducted based on mutually perceived equal value.

• Voluntary Exchange: Both parties engage willingly, without coercion.

• Ownership Transfer: Legal rights over the commodity shift from the seller to the buyer.

• Price Determination by Market Forces: Supply and demand influence pricing, making the transaction process dynamic and competitive.

2.3 Capital Flow and Value Realization

Production alone does not guarantee value realization—only transactions can transform goods into liquid assets. Through transactions, capital takes on various forms (money, inventory, receivables) and completes its circulation loop. Effective commodity trading shortens the turnover cycle and enhances capital efficiency, playing a pivotal role in financial sustainability.

2.4 Impact on Economic Development

Efficient commodity transactions support optimal resource allocation, guide production based on market needs, and promote innovation. By enabling enterprises to operate profitably and predictably, commodity transactions act as economic lubricants in both micro- and macroeconomic dimensions.

3. Accounting Principles for Commodity Transactions

Accounting transforms economic phenomena into structured, auditable, and comparable financial data. Commodity transactions must follow established principles to ensure transparent reporting and informed decision-making.

3.1 Accrual and Matching Principles

These principles require that income and expenses be recorded when they are earned or incurred—not necessarily when cash is exchanged. For example, revenue is recognized upon delivery or transfer of ownership, and the related cost of goods sold is recorded in the same period.

3.2 Monetary Measurement Principle

Only activities measurable in monetary terms are recognized. Commodity transactions must be quantified based on actual transaction prices or fair value, ensuring consistent and comparable reporting.

3.3 Going Concern and Consistency

Accounting assumes that the business will continue to operate indefinitely. Therefore, accounting policies, such as inventory valuation or depreciation methods, should be consistently applied across periods to enhance reliability.

3.4 Prudence Principle

This principle encourages conservative estimates in the face of uncertainty. For example, expected returns, potential losses, or obsolete inventory must be reflected through allowances or provisions to avoid overstating profits.

3.5 Substance Over Form

Economic reality should prevail over legal form. For instance, a sales transaction with a repurchase clause might not be recognized as revenue if the risks and rewards have not truly transferred.

4. Practical Application in Accounting

4.1 Recording Transactions

Commodity transactions impact several key accounts:

•Purchasing: Increases inventory and accounts payable.

•Sales: Increases revenue and accounts receivable; reduces inventory and records cost of goods sold.

•Payment/Collection: Adjusts bank, cash, or receivable balances.

Timely and accurate entries are crucial for reflecting actual financial positions and performance.

4.2 Inventory Costing and Valuation

Different methods like FIFO (First-In, First-Out), LIFO (Last-In, First-Out), and Weighted Average affect inventory valuation and profitability. The choice of method can influence tax liability and financial indicators.

4.3 Common Challenges

• Practical issues often arise, including:

• Misalignment in revenue recognition timing.

• Incorrect cost transfer entries, distorting profit margins.

• Mishandling of returns, trade discounts, or allowances.

• Weak internal control over inventory.

• Discrepancies between tax and financial accounting due to differing rules.

5. Digital Transformation and Emerging Trends

The digital economy is changing the landscape of transaction accounting.

5.1 Integration with ERP and Digital Tools

Enterprise Resource Planning (ERP) systems automate transaction tracking, inventory control, and financial reporting. Integration of accounting software with supply chain management enhances efficiency and reduces errors.

5.2 Blockchain and Real-Time Auditability

Blockchain provides tamper-proof transaction records, enabling real-time verification and audit. This improves transparency and strengthens trust in financial reports.

5.3 Artificial Intelligence in Decision Support

AI tools assist in forecasting demand, optimizing inventory, and detecting fraud in transaction flows. Accounting departments must adapt to new digital competencies and analytical tools.

5.4 Non-Physical Commodities and Virtual Transactions

As services, data, and digital products dominate modern commerce, accountants must develop new valuation and recognition methods for intangible and hybrid transactions.

6. Conclusion

Commodity transactions lie at the heart of enterprise activity and economic growth. They serve not only as revenue engines but also as critical points of capital movement and value realization. Sound accounting principles provide the foundation for truthful, timely, and transparent financial information.

As enterprises navigate increasingly complex and digitalized environments, the evolution of accounting systems and standards becomes imperative. Businesses must enhance internal controls, adopt advanced information systems, and uphold professional ethics to meet the dual challenge of compliance and innovation. Only through such efforts can accounting fulfill its role in reflecting economic reality and guiding strategic decision-making.

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KEY STRATEGİES AND İNNOVATİON-ORİENTED APPROACHES TO 21ST CENTURY MARKETİNG

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There is no precise and specific definition of 21st century marketing in the world. Marketers must be oriented to the changes taking place in the digital world and the rapidly changing needs. In the face of hundreds of advertisements and announcements that consumers encounter, only successful marketing activities can be performed. In the current world of mass communication and information overload, it is more difficult to determine which marketing strategies are successful. We can only say this based on the experience of firms and companies that have gained fame in the world.

Marketing success begins with the right relationship with the customer. If marketers can follow the customer and establish a systematic relationship with customers, then they can be considered to have achieved long-term success. Therefore, the development path of every enterprise should be customer-oriented. A clear marketing strategy is necessary for long-term customer retention. Marketing in the 21st century involves having relevant content, added product value, and brand identification.

We have now reached a point where digital marketing has surpassed traditional marketing.Digital marketingUnfortunately, the place occupied by such an important sector in our country is weak. In the 21st century, the foundation of digital marketing is precisely the digital marketing strategy. The foundation of the digital marketing strategy is the targeted market segments.It is possible to develop a sustainable marketing strategy by identifying the target market.

As a result of the globalization of the Internet in the world, changes have occurred in marketing strategies. The development of the Internet has had a positive impact on marketing strategies. So, first of all, we should note that the Internet is one of the cheapest means of communication. Therefore, it is possible to establish relationships with a large customer base in the cheapest way through the Internet.

There are many advantages to online marketing strategies. The effectiveness of these strategies is significantly higher than traditional marketing strategies in the conditions of a modern market economy. Online marketing allows you to reach a wider audience, can be implemented at lower costs in terms of money and time, and allows you to measure results in real time by tracking customer behavior more accurately. These features ensure that online marketing offers a more flexible and adaptable approach than traditional marketing.

As we have mentioned, one of the most significant changes in the marketing world in the 21st century is the development of digital technologies. Digital tools and social media play an important role in introducing light industrial products to the market. Through digital marketing, it is possible to establish direct contact with consumers, provide them with personalized offers and optimize the customer experience. With the increasing popularity of social media platforms and the expansion of the internet, marketing is carried out with a multi-channel approach. Digital tools are also useful for monitoring customer behavior and building strategies according to their areas of interest.

As businesses and companies grow, the marketing strategies they develop also evolve rapidly. In the days when traditional marketing was prevalent, marketing strategies were developed and changed as needed without much change. In the past, marketing strategies were usually developed once a year and covered a year of activity. However, in our time, since consumer needs and desires change frequently, marketing strategies also change rapidly. Currently, marketing strategies are designed to be customer-oriented, not business-oriented.

As a result of the increase in social media and mobile advertising in the world, marketers who develop marketing strategies should be more careful. Because the possibilities of marketing have now expanded greatly. Customer-oriented activities have expanded using the Internet. Programmatic advertising purchasing, along with hyper-local targeting, expands the possibilities of marketers. Programmatic allows marketers to reach a precise audience on the devices they use most. In the modern era, the basis for building a good marketing strategy is understanding the consumer, planning, and choosing the right advertising strategy.

Innovation is one of the most popular customer trends in the world. Consumers are looking for innovative products. People are increasingly inclined towards products that will make their lives easier. Therefore, companies must definitely take into account customer attention and interest. They must

always be in search of new and innovative product ideas to attract consumer interest and, most importantly, to make a profit.

Consumers are now more inclined to shop online using mobile technologies rather than directly visiting markets, which expands marketing opportunities for companies.

Developing a marketing strategy for an innovative product is complex. Because in this case, special attention should be paid to the issues of setting a price for an innovative product and predicting the set price by calculating all stages of the innovative product's life cycle. Another complex aspect of developing a marketing strategy for an innovative product is that the technical and consumer characteristics of the product are not known to the customer. Therefore, setting a price for innovative products is not only a complex but also a responsible issue. It is necessary to arouse interest and demand for the product in the consumer. This requires additional costs. Additional costs arise starting from the design of an innovative product. Because the company conducts various research and studies on the idea of an innovative product. During the stage of scientific research and studies, the company spends significant amounts on the development of an innovative product. Therefore, the pricing strategy for an innovative product must be carefully developed. Pricing policy usually adopts either a high or low price policy. This approach can be implemented in the form of lowering the price from a high level to a low level or, conversely, increasing it from a low price level to an upward level (Kotler & Keller, 2016; Armstrong & Kotler, 2017).

Modern marketing is the ability to leverage all of a business's capabilities to deliver the best customer experience and drive growth. The modern marketing organization has systems in place that allow for the constant creation of large volumes of messages and content, tracking performance with analytics, and then making adjustments as needed.

Marketing is currently distinguished from other business fields in the world by its attractiveness. The attractiveness of marketing in the world brings with it many problems. Our research is aimed at identifying and analyzing the modern and truly complex problems of marketing.

Modern marketing has set the foundation for new trends in the world. Every year, new technologies emerge and existing technologies are further improved, and therefore the prospects for marketing become more attractive and demanding. [8]

One of the trends created by modern marketing is virtual reality. The use of this technology is becoming more and more widespread. Companies are offering virtual reality to customers for product visualization. This trend is gaining more and more popularity. Virtual reality technology is gradually becoming an integral part of our daily lives. Now potential buyers can use virtual reality to place objects in their virtual spaces. For example, you can see how clothes will look on you or how a carpet will look in our home before buying.

Inevitably bringing about revolutionary changes in the lifestyle of humanity, which has acquired new technologies, and being both a source and a product of technological development, virtual reality, according to experts, can also pose a serious threat to civilization. According to many scientists, the more technology humanity adopts, the more danger it poses to itself. Thus, the application of virtual reality will distance people from the existing reality by mobilizing all the resources of civilization, and as a result, despite the enrichment of human cognition with content, it will lose its flexibility and activity. People now prefer to order products without visiting stores to buy them. These opportunities offered by virtual reality make people lead a passive lifestyle. For example, people no longer visit stores to buy clothes, but are interested in purchasing them by placing their photos on an electronic platform and seeing the image of the clothes on themselves.

Another innovation that modern marketing offers to people is the use of artificial intelligence in searching for potential customers. Because artificial intelligence has a significant impact not only on the world of technology, but also on marketing. So what is the relationship between artificial intelligence and marketing?

Currently, many brands in the world are applying artificial intelligence to their activities. We can cite brands such as Nike, Amazon and Alibaba as examples. The application of artificial intelligence to marketing has yielded excellent results. Thus, artificial intelligence helps to better understand the audience, analyze large amounts of data and predict the purchasing behavior of each customer. This helps organizations to effectively implement specific marketing campaigns for the target audience. Through artificial intelligence, content and designs are created that are suitable for a specific audience. This process increases customer satisfaction as they can easily find the information they need. Reports show that consumers give more preference to brands that apply artificial intelligence in their marketing strategies.

Market research analysts are responsible for collecting data, identifying trends within that data, and then using what they find to develop an effective marketing strategy or decide where to place advertising. This is now done by artificial intelligence.

The rapid development of marketing in the world shows that marketing is impossible without innovation. Competition is formed on the basis of innovation. Previously, when traditional marketing was organized, there was not such strong competition in the markets. In addition, consumers were not very knowledgeable about products, brands and what they actually wanted. However, now the situation has changed. People are equipped with resources and thousands of options based on the information available through the Internet. This means that it is impossible to imagine 21st century marketing without innovative business marketing strategies.

Since 2020, the concept of video marketing has brought great luck to online sellers and, more precisely, entrepreneurs all over the world. Video marketing strategies are one of the brightest among the most important online marketing strategies of digital marketing in 2020. Video marketing encourages target customers to buy the product promoted online. The most obvious example of video marketing strategies is YouTube, which promotes online entrepreneurship.

One of the biggest marketing trends of 2020 is influencer marketing. With the rise of social media channels, influencer marketing has become an online trend worldwide. Using famous and well-known influencers will increase the online advertising consumer base.

Facebook messenger, Instagram, WeChat, WhatsApp, emailing and other applications are in sight with billions of target audiences all over the world. This form of digital marketing trend significantly drives customer support and assistance mechanism by facilitating information delivery, contact search. With this digital marketing strategy, customers are served better.

In addition, there are many programs and applications in the world that can make web pages more modern, vibrant, and attractive. The attractiveness of websites and pages is important in attracting customers.

It is sometimes thought that email is outdated. However, this is not the case. Because email correspondence is one of the most widely used digital communication channels across industries.

In the modern digital age, mobile devices are increasingly becoming an integral part of life. Mobile devices offer great potential to meet consumers' needs instantly and make their lives easier. Smartphones and tablets, in addition to being just a means of communication, play a significant role in transforming marketing strategies and marketing methods by combining many functions from shopping to entertainment, from information to social media sharing in one device. Modern consumers want to instantly access information about products and services and make purchases easily. The widespread use of mobile devices allows mobile applications to provide consumers with a faster and more personalized experience. Businesses can increase customer loyalty, implement effective marketing strategies, and gain a competitive advantage through mobile applications.

From the above, it is clear that marketing strategies are the foundation of modern marketing. From market research to sales and after-sales services, each stage plays an important role in marketing strategy. The correct implementation of each stage ensures the development and implementation of effective marketing strategies, helping companies strengthen their market positions.

IMPROVING ENVIRONMENTAL ACCOUNTING: THEORETICAL INNOVATIONS AND METHODOLOGICAL ADVANCEMENTS

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Abstract

With the continuous development of all aspects of China, the country's economic level has significantly improved, and the quality of life of residents has been enhanced. However, it must be acknowledged that we have achieved rapid economic development at the expense of environmental degradation. Environmental issues, in turn, have constrained China's economic growth. In this context, the government has put forward requirements for enterprises to implement environmental protection measures in their operations. To enable enterprises to fully understand and assess environmental issues, they should engage in environmental information disclosure. This paper conducts a research and discussion on the disclosure of environmental accounting information by Chinese enterprises, identifying the content that enterprises should disclose in their accounting information, as well as some drawbacks in the current environmental accounting information disclosure by Chinese enterprises, such as weak awareness of environmental accounting information disclosure and imperfect relevant systems for environmental accounting information. Specific countermeasures are proposed to improve the disclosure of environmental accounting information.

Keywords: *Environmental accounting; Information disclosure; Environmental protection*

Sustainable development is a fundamental requirement of the scientific outlook on development, and as important members of society, enterprises naturally bear the social responsibility to implement the scientific outlook on development and achieve sustainable development. Strengthening the construction of corporate environmental accounting helps improve the environment and promote the sustainable development of enterprises and society. This paper discusses corporate environmental accounting in the context of sustainable development and proposes several countermeasures for building corporate environmental accounting for reference.

Enterprise production and business activities more or less cause damage and impacts on the environment and resources. Traditional corporate accounting usually only focuses on corporate economic benefits while ignoring environmental and resource factors, leading to a disconnection between enterprise production and operation activities and environmental and resource protection. With the continuous deepening of the concept of sustainable development, enterprise production and operation activities must pay attention to environmental and resource protection. Corporate environmental accounting adds measurements of the environmental impact caused by enterprise production to traditional accounting work, making corporate accounting more scientific and comprehensive.

1. Strengthen the Conceptual Construction of Corporate Environmental Accounting

To promote the construction of corporate environmental accounting, the primary task is to enhance enterprises' understanding of environmental accounting, enabling them to establish correct concepts. Guided by these concepts, enterprises can actively advance environmental accounting initiatives and provide strong support for their implementation.

2. Promote the Legal Construction of Corporate Environmental Accounting

Laws and regulations on corporate environmental accounting effectively guarantee its smooth development. China has currently promulgated multiple laws and regulations on environmental protection and resource management, laying a legal foundation for the legal construction of corporate environmental accounting. However, the existing legal system related to corporate environmental accounting in China is not yet complete or unified. Therefore, to promote its development, it is essential to actively advance the legal construction of corporate environmental accounting, integrate different environmental accounting laws, and build a sound legal system to enhance the operability of environmental

accounting regulations. At the same time, environmental and resource factors should be effectively integrated into corporate accounting elements, and standards and guidelines adapted to the development of corporate environmental accounting should be formulated to better implement relevant laws and regulations.

3. Improve the Institutional Construction of Corporate Environmental Accounting

3.1 Strengthen Enterprise Environmental System Construction

Enterprises should establish a complete environmental accounting information disclosure system, strictly standardizing all links of the environmental accounting information system. Environmental revenue and expenditure should be included in accounting entries, and specialized financial personnel should be organized to regularly inspect environmental revenue and expenditure to ensure accurate and complete disclosure of corporate environmental accounting information. Since some environmental factors are immeasurable, a combination of quantitative and qualitative methods can be adopted to disclose corporate environmental accounting information in financial statements. Units that cannot be measured in monetary terms can be described in text to provide a more comprehensive disclosure of environmental accounting information.

3.2 Give Play to the Leading Role of Government Departments

To ensure the smooth implementation of corporate environmental accounting, government departments must play a leading role. On the one hand, they should improve the industrial structure, adjust industrial proportions, and transform and upgrade heavily polluting enterprises through mergers and reorganizations to fully utilize resources and increase green production capacity. On the other hand, they should improve and perfect the pricing mechanism for environmental resources, prompting enterprises to establish a clear cost concept of environmental resources, thereby improving traditional production methods and ensuring effective resource utilization. For production projects conducive to environmental protection, the government can implement preferential policies to encourage enterprises to engage in such production and promptly publicize the names of enterprises actively participating in environmental protection to strengthen corporate social responsibility. Driven by interests, many enterprises are reluctant to take the initiative to disclose environmental accounting information, which requires the government to adopt mandatory measures. By formulating systematic corporate environmental accounting systems, environmental accounting can be constructed and developed under the strong supervision of government departments .

3.3 Strengthen Social Supervision of Corporate Environmental Accounting

The construction direction and production scale of enterprises are closely related to the market environment. Therefore, optimizing the market environment for enterprises is necessary to promote the construction of corporate environmental accounting. Social institutions should also strengthen supervision of corporate environmental accounting, giving full play to the review role of leading social institutions such as accounting firms on corporate environmental accounting information to ensure its authenticity and reliability. At the same time, reviewing results should be made public, and enterprise ratings should be evaluated to enhance enterprises' awareness of environmental protection, continuously advance the construction of corporate environmental accounting, and achieve sustainable development for both enterprises and society.

4. Promote Human Resource Construction for Corporate Environmental Accounting

Human resources are the core of corporate environmental accounting construction. Only by strengthening the construction of financial human resources and continuously improving the professional level and comprehensive quality of financial personnel can corporate environmental accounting be smoothly implemented. To strengthen human resource construction, enterprises can take the following two measures: First, enhance talent training. Improve the ideological awareness of financial personnel by incorporating environmental protection-related theoretical knowledge into training courses, thereby cultivating good environmental protection awareness among financial personnel. Second, establish an incentive mechanism. Through an effective incentive mechanism, financial personnel can consciously improve their professional capabilities and actively participate in corporate environmental accounting work, providing effective support for its smooth implementation.

5.Suggestions

Integration of Externalities- Develop theories that internalize environmental externalities (e.g., carbon emissions, water pollution) into financial systems. This could involve predictive models to account for future costs, such as carbon pricing or ecosystem degradation.

Stakeholder-Centric Frameworks- Expand stakeholder theory to include non-traditional stakeholders (communities, ecosystems) by adopting integrated reporting (IR) that combines financial, social, and environmental metrics.

Institutional Alignment- Align theories with global standards (e.g., TCFD, TNFD, EU Taxonomy) to enhance legitimacy and comparability. Advocate for mandatory adoption of frameworks like GRI or SASB within IFRS/GAAP.

Ecocentric Valuation - Incorporate ecocentric perspectives by valuing natural capital (e.g., forests, wetlands) through ecosystem services valuation, moving beyond anthropocentric cost-benefit analyses.

Monetization Techniques - Refine shadow pricing, true cost accounting, and natural capital valuation (e.g., Natural Capital Protocol) to standardize the translation of environmental impacts into financial terms.

Data Management- Leverage IoT sensors for real-time resource tracking and blockchain for transparent supply chains. Integrate AI and big data analytics to automate impact assessments and improve accuracy.

Lifecycle and Circular Accounting - Embed Life Cycle Assessment (LCA) into accounting systems and adapt methodologies for circular economies (e.g., valuing waste as a resource).

Long-Term Temporal Accounting- Develop models to account for long-term liabilities (e.g., climate risks) using dynamic discount rates and scenario analysis for future uncertainties.

Materiality Assessments- Enhance materiality criteria to prioritize environmental factors with significant financial and ecological impacts, ensuring disclosures are decision-useful.

Collaborative Research- Foster partnerships with ecologists, economists, and ethicists to create holistic models that reflect ecological thresholds and societal values.

Capacity Building- Update accounting curricula and professional certifications (e.g., CPA, ACCA) to include environmental accounting principles, tools, and case studies (e.g., Patagonia's circular practices).

Policy Enforcement- Advocate for regulations mandating environmental disclosures (e.g., EU CSRD) to incentivize methodological rigor.

Tech Integration- Develop accounting software with built-in environmental modules for seamless integration of sustainability metrics.

Conclusion

In summary, under the background of sustainable development, enterprises must attach importance to the environmental impact of their production, actively promote the construction of corporate environmental accounting, and scientifically adjust production methods through effective environmental accounting measurement to continuously strengthen environmental and resource protection. Enterprises and relevant departments should earnestly strengthen the construction of corporate environmental accounting concepts, legal systems, institutional frameworks, and human resources to ensure the smooth implementation of corporate environmental accounting and create favorable conditions for sustainable development.By bridging theoretical gaps (e.g., externalities, stakeholder inclusivity) and advancing methodologies (e.g., LCA, AI-driven analytics), environmental accounting can evolve into a robust tool for sustainable decision-making. Standardization, interdisciplinary collaboration, and regulatory support will be critical to its maturation.

CONTEMPORARY ASPECTS OF SUSTAINABLE DEVELOPMENT IN THE COUNTRIES OF THE EURASIAN ECONOMIC UNION

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Abstract
The article examines some modern aspects and vision of sustainable development and its main elements, touches upon the issues of formation and implementation of sustainable development goals, shows the impact of globalization and integration of countries on the achievement of sustainable development goals, pays attention to indicators of sustainable development and their comparison in the countries of the Eurasian Economic Union (EAEU).

Keywords: *sustainable development, goals of sustainable development, globalization, integration, regionalization, EAEU.*

1. Introduction

The overwhelming majority of modern states are in a state of continuous socio-economic and political transformation, which inevitably affects the pace and sustainable development of the entire society. In the existing system of world economic relations, following the principles of achieving economic growth, the focus on solving the triune ecological-socio-economic issue is becoming increasingly stronger.

The paradigm of sustainable development, now called the "Model of the Future of Civilization", was widely disseminated at the end of the 20th century, thus becoming an adequate challenge to the emerging threats that resulted from the deterioration of the global environmental situation. The concept presented in the paradigm is aimed at changing humanity's attitude to the environment, as well as improving the quality of life in the context of economic growth [1, p. 48].

The acceptance of the fact of the irreversible impact of man on the environment and the excess of all permissible norms of change in the biosphere became the initial prerequisite for finding a solution to the issue of ensuring sustainability at the level of the entire global community.

If in the initial years of the concept's implementation one could notice a certain bias towards its theoretical nature, then after the conference in Rio de Janeiro in 1992 and the creation of "Agenda 21", sustainable development has become a fundamental part of the key directions of state policy of leading countries and the programs of the largest business structures.

Understanding that further growth is impossible without a comprehensive and large-scale consideration of environmental, economic and social elements has led to the fact that sustainable development forms approaches to most strategic plans, projects and development programs.

The principle of the interrelation of the three facets of sustainable development is significant, which determines the inconsistency of a one-sided solution to problems only within the framework of a promising direction.

It is important to organize activities to develop all aspects of human life, its interaction with all the noted objects.

2. Main part

Achieving sustainable development is not possible without a set of indicators that make it possible to create a basis for making rational decisions, forming a self-regulatory mechanism within the boundaries of national systems and monitoring the sustainability of countries.

The solution to these issues was proposed during the development of the Sustainable Development Goals, which were the result of long-term research. The SDGs include 17 goals, 169 targets and more than 230 indicators.

At the global level, methodologies are being developed for calculating SDG indicators, quantitative and qualitative parameters and pools of constructive measures are being determined, during which national governments are given the opportunity to formulate their agenda for the implementation of decisions taken at the global level [2, p. 160].

The Sustainable Development Goals (SDGs) are a reflection of the ideology of sustainable development, which contains a toolkit for the harmonious combination of all three conceptual aspects.

The SDGs act as an assistant in the formation of individual development trajectories for countries, and the mechanisms described above should be laid down in strategic planning documents. At the same time, achieving the SDGs involves work not only at the national level, but also at the level of supranational associations.

As an organization of regional economic integration, the EAEU (Fig. 1) can, through a coordinated or unified economic policy, have a significant impact on stimulating the development of participating countries, including within the framework of the concept of sustainable development.

Figure 1 – Member countries of the Eurasian Economic Union in 2024 (compiled based on data [4])

The formation of sustainable external relations between countries and the continuous development of the international division of labor appears as one of the main challenges to sustainable development, common security and stability.

Globalization of world economic relations at this evolutionary stage increasingly corresponds to the format of regional integration. The main characteristics of such integration are interstate regulation, coordination and formation of a regional economic complex with unified proportions and reproductive structure. As practice has shown, the unification of the member countries of the Eurasian Economic Union is gradually gaining strength [3].

The functioning of the Eurasian Economic Union as a form of economic interaction between countries in the region gives opportunity to use methods of interstate integration that make it possible to realize a stimulating effect on the economic, environmental and social situation of countries, as well as to intensify the technological development of the participating countries. (Fig. 2).

In accordance with the provisions of the Treaty on the Eurasian Economic Union, the main goals of the Union are:

– creating conditions for the stable development of Member States in the interests of raising the standard of living of their populations;

– the desire to form a single market for goods, services, capital and labor resources within the Union;

– comprehensive modernization, cooperation and increasing the competitiveness of the economies of the participating countries in the context of the global economy [5].

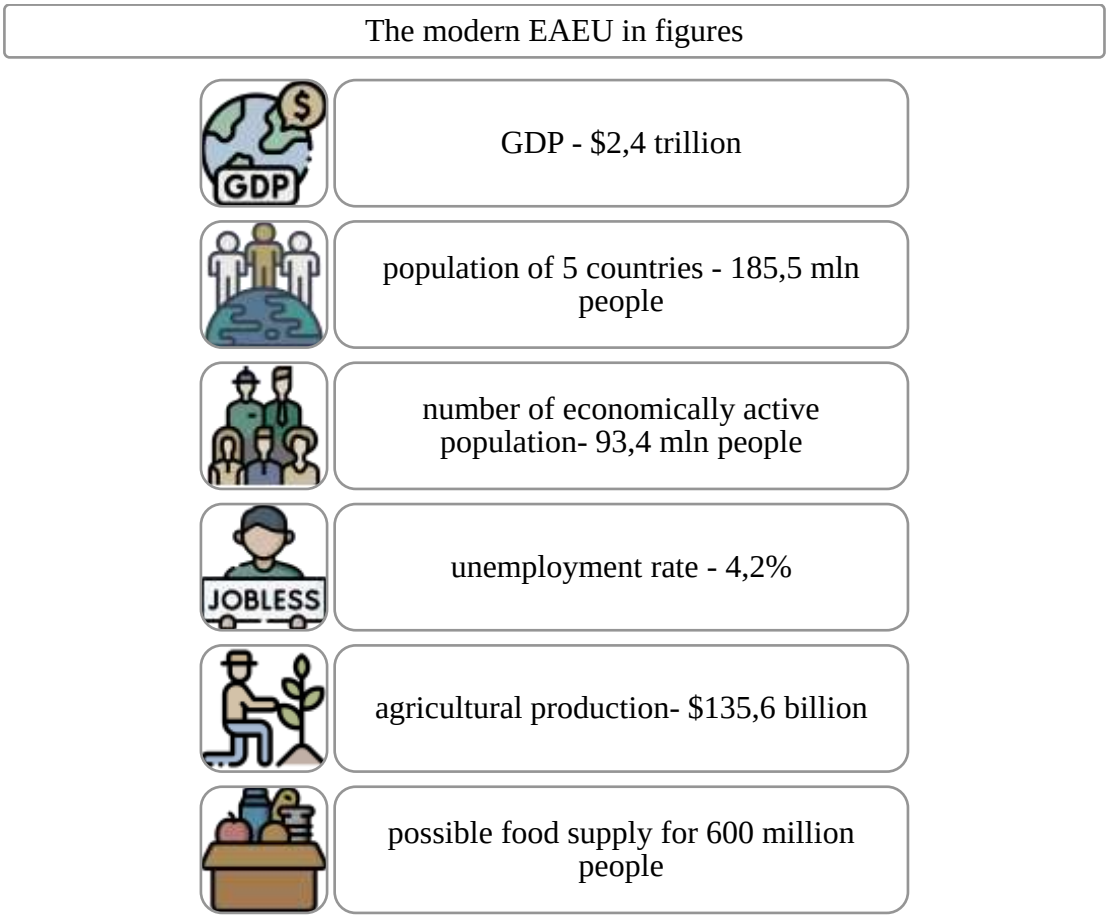

Figure 1 – Statistics for the EAEU countries as of 2023 (compiled based on data [4])

Thus, the implementation of sustainable development goals is carried out not only by individual sovereign states; they can be achieved within regional integration associations.

Regional cooperation and ensuring sustainable development of regions helps stimulate the development of the economy, social sectors and technologies through the use of various integration methods.

It is important to note that the EAEU actively supports the UN Agenda for Sustainable Development in the Eurasian space [6].

The EAEU member states are actively working to implement the SDGs and address the challenges associated with them, which is driven by the desire to improve the standard and quality of life of citizens, ensure national security, and combat negative social phenomena.

The most successful countries in realizing their national potential in the context of SDGs may be those that include in the practice of government bodies such global issues of the national and global agenda as commitment to SDG programs and the creation of an appropriate regulatory framework, appointing structures that will be responsible for their implementation and reporting. [7; 8].

Calculation of absolute parameters and relative indicators of sustainable development, based on economic, social and environmental factors, is an effective step for analyzing and assessing the achievement of goals in the EAEU member countries (Fig. 3). The ability to calculate such indicators provides a full understanding of the level of sustainable development and allows us to determine the success of achieving regional SDG indicators. [6].

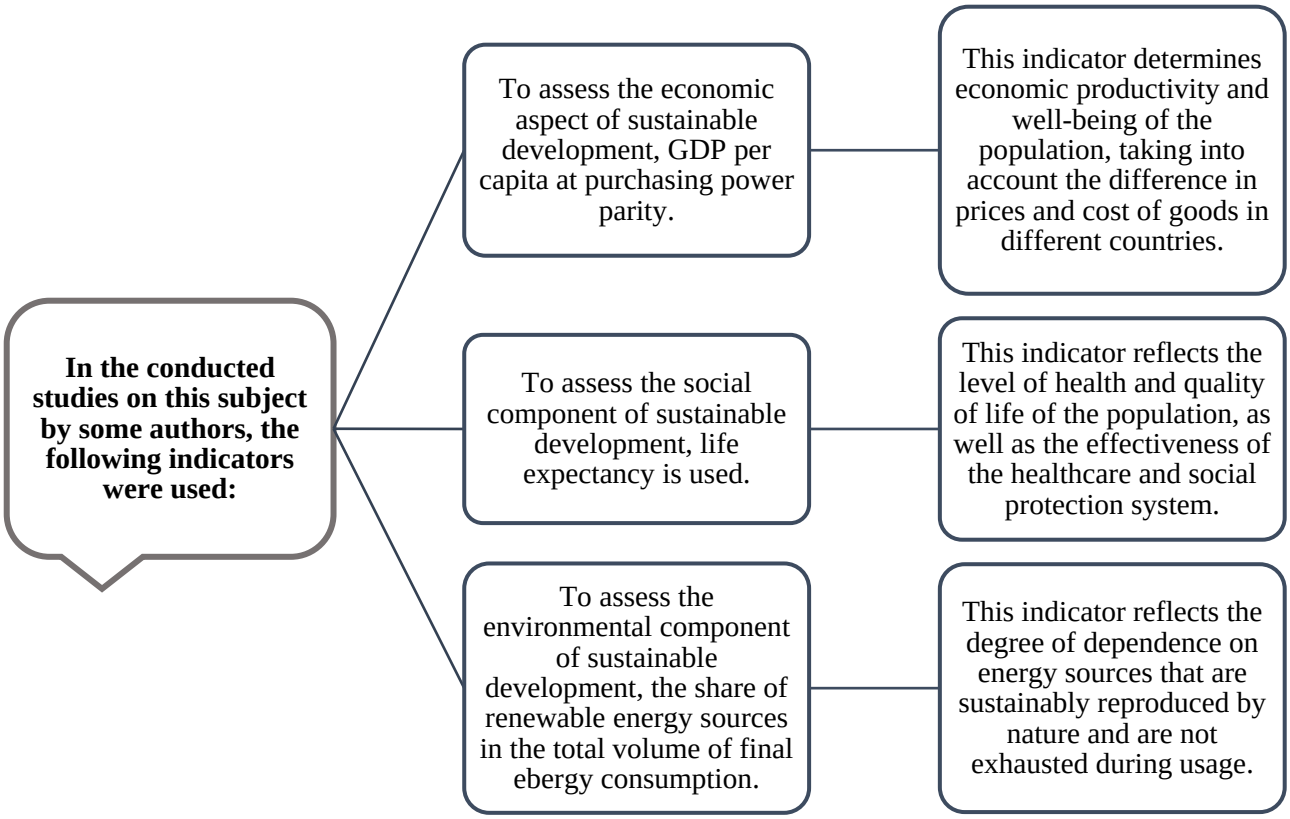

Figure 3 – Sustainable Development Goals Indicators (compiled based on source data [6])

From the presented indicators it follows that priority areas were identified for assessing sustainable development, directly reflecting the trinity and significance of economic, social and environmental factors.

It should also be noted that the existing statistical data on SDG indicators in the EAEU countries serve as an object of analysis, which, firstly, allows us to find out the current state of affairs and, secondly, to identify leaders in achieving higher results. Thus, Table 1 reflects three main indicators - GDP per capita (thousand US dollars), Life expectancy (years), Share of renewable energy sources (%).

Table 1 – Indicators of sustainable development in the EAEU

SDG Element	Indicator	Armenia	Belarus	Kazakhstan	Kyrgyzstan	Russia
1	2	3	4	5	6	7
Economic	GDP per capita (US$ thousand)	16,4	19,1	26,1	5,2	27,5
Social	Life expectancy (years)	76,2	75	70,4	71,1	74,5
Ecological	Share of RES* (%)	39,4	7,4	11,8	85	17,7

Note: RES – renewable energy sources. The table is based on materials from sources [6; 9]

As can be seen from Table 1, within the economic element of the SDGs, Russia occupies the leading position (27.5 thousand US dollars), followed by Kazakhstan (26.1 thousand US dollars). Kyrgyzstan demonstrates low indicators.

In the context of the social element, the leader is Armenia (76.2 years), and Kazakhstan is in last place (70.4 years).

The ecological component is more pronounced and developed in Kyrgyzstan (85%), the lowest value is observed in Belarus (7.4%).

Thus, it can be concluded that the elements of sustainable development do not necessarily have a clear interdependence and the same dynamics across countries. This can become the subject of independent research in the future.

Table 2 presents the resulting calculations that ultimately form the aggregate index of sustainable development of the EAEU countries.

Table 2 – Results of calculating the sustainable development index in the EAEU

Indicators	Armenia	Belarus	Kazakhstan	Kyrgyzstan	Russia
1	2	3	4	5	6
Economic	0,2	0,16	0,22	0,047	0,24
Social	0,92	0,907	0,899	0,88	0,89
Ecological	0,12	0,08	0,018	0,035	0,33
Sustainable Development Index	**0,387**	**0,379**	**0,378**	**0,384**	**0,39**
Note: The table is based on materials from sources [6; 7]					

As can be seen from the data in Table 2, in general, all EAEU member countries have a similar sustainable development index. If we take into account that the highest indicator is the index corresponding to 1 (one), then it is worth noting that all participants in the integration association have a fairly low indicator, which should probably be a reason for developing more effective measures and instruments for a joint sustainable development policy.

3. Conclusion

Thus, in order to move to a sustainable development model, the EAEU countries need to pay special attention to modernizing their economies through, for example, investments and innovations. This will help ensure more sustainable and modern energy, which is a key aspect of sustainable development.

Such efforts to improve the region's economic structure will promote balanced development and contribute to overall efforts to achieve sustainability within the framework of Eurasian integration.

It is also obvious that the goals and directions of the socio-economic development of the EAEU are fundamentally consistent with the goals and objectives of the Sustainable Development Agenda.

The data demonstrate that regional economic, social and environmental integration should become a priority tool for maintaining sustainable growth of member states.

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DEVELOPMENT OF FRANCHISING AS A FORM OF BUSINESS ACTIVITY IN UKRAINE

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РОЗВИТОК ФРАНЧАЙЗИНГУ ЯК ФОРМИ ПІДПРИЄМНИЦЬКОЇ ДІЯЛЬНОСТІ В УКРАЇНІ

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Abstract

The purpose of this study is a comprehensive analysis of the terms and requirements of specific franchises, covering legal aspects and investment costs, as well as the level of support provided by the franchisor, and the types of franchises. It also involves an analysis of the development of franchising in Ukraine, the study of its expansion conditions, the identification and analysis of the main problems of franchising activity in Ukraine, and the development of recommendations for their resolution. Progressive business ideas require economic stability and a developed market for small and medium-sized enterprises. In Ukraine, small and medium-sized businesses are in a phase of development. Moreover, considering the state of crisis, starting a business from scratch is quite risky. A more reliable approach is to use already prepared business projects, in particular those offered by franchisors. Given the rapid development of the franchising market and its popularity among entrepreneurs, the information obtained will help to systematize knowledge and provide a comprehensive understanding of the key factors for a successful business start.

Franchising as a new economic mechanism is a kind of symbiosis of small and large businesses. It is a combination of large and small businesses – an alliance where, on the one hand, there is the energy and responsibility of an individual entrepreneur, and on the other hand, the resources, commercial power, and vast experience of a large company. Today, franchising in Ukraine is actively used in the fields of catering, trade, and services. There is an expansion of franchising in other sectors of the economy, in particular in the production and assembly of computers, the sale of components, the development of business software, the hotel business, and much more.

Franchising is an instrument of corporate strategy for the development of small and medium-sized enterprises. In this regard, it is important to highlight the key features, problematic aspects of franchising, and the effectiveness of its use in Ukraine in order to demonstrate its prospects. The nature of franchising and its importance for the development of entrepreneurial activity are considered. External and internal obstacles to the development of small and medium-sized enterprises are identified. The key features of cooperation between small and large business structures with powerful companies in this system are indicated. Particular attention is focused on the key pros and cons of a franchise for the franchisee and franchisor.

Анотація

Метою даного дослідження є комплексний аналіз умов і вимог конкретних франшиз, де розглядаються як юридичні аспекти та інвестиційні витрати, так і рівень підтримки, що забезпечує франчайзер, різновиди франшиз, а також дослідження аналіз розвитку фран-

чайзингу в Україні, вивчення умов його поширення, виявлення та аналіз основних проблем здійснення франчайзингової діяльності в Україні, а також розробка рекомендацій щодо їх вирішення. Для виникнення прогресивних бізнес-ідей потрібна економічна стабільність та розвинений ринок малих і середніх підприємств. В Україні малий та середній бізнес перебуває у фазі становлення. До того ж, враховуючи кризовий стан, розпочинати бізнес з нуля – доволі ризиковано. Більш надійним підходом є використання вже готових бізнес-проектів, зокрема тих, що пропонують франчайзери. З огляду на швидкий розвиток ринку франчайзингу та його популярність серед підприємців, отримана інформація допоможе систематизувати знання та забезпечити всебічне розуміння ключових факторів для успішного старту бізнесу

Франчайзинг як новий економічний механізм являє собою своєрідний симбіоз малого та великого бізнесу. Це поєднання великого та малого бізнесу – союз, де, з одного боку, присутня енергія та відповідальність окремого підприємця, а з іншого – ресурси, комерційна міць та величезний досвід великої компанії. На сьогодні франчайзинг в Україні активно використовується у сферах громадського харчування, торгівлі та послуг. Спостерігається розширення франчайзингу і в інших секторах економіки, зокрема у виробництві та збиранні комп'ютерів, продажу комплектуючих, розробці програмного забезпечення для бізнесу, готельному бізнесі та багато іншого.

Франчайзинг виступає інструментом корпоративної стратегії розвитку малого та середнього підприємництва. У зв'язку з цим важливо висвітлити ключові особливості, проблемні аспекти франчайзингу, ефективність його використання в Україні з метою демонстрації перспектив.

Розглянуто природу франчайзингу та його значення для розвитку підприємницької діяльності. Визначено зовнішні та внутрішні перешкоди розвитку малого та середнього підприємництва. Вказано ключові риси співпраці малих і великих бізнесових структур з потужними компаніями у цій системі. Особливу увагу зосереджено на ключових плюсах та мінусах франшизи для франчайзі та франчайзера.

Keywords: *entrepreneurship, franchising, franchisee, franchisor, franchise.*
Ключові слова: *підприємництво, франчайзинг, франчайзі, франчайзер, франшиза.*

Вступ. *Франчайзинг – потужна бізнес-модель, яка дозволяє підприємцям використовувати вже відомий бренд та перевірену систему управління для започаткування власного бізнесу. Дослідження зосереджене на аналізі умов договорів франшизи, інвестиційних вимог, рівня підтримки, яку надає франчайзер, а також класифікації франшиз за їхніми характеристиками та моделями роботи. Завдяки цьому підходу потенційні франчайзі отримують можливість узагальнити інформацію про ключові елементи успішного франчайзингу та прийняти усвідомлене рішення на основі доступних даних.*

В Україні ринок франчайзингу демонструє помітне зростання, про що свідчить наявність понад 25 тисяч франчайзингових точок. Ця позитивна тенденція вказує на ефективність франчайзингу як інструменту масштабування бізнесу, навіть в умовах економічної нестабільності. Він відкриває підприємцям шлях до вже налагодженого бізнесу, надаючи досвід та можливість залучення нових клієнтів з меншими ризиками та зусиллями.

Водночас, слід розуміти, що мінімізація витрат та ризиків, що є ключовими перевагами франчайзингу, не гарантує стовідсоткового успіху. Існують певні обмеження, які необхідно враховувати. Наприклад, франчайзинговий бізнес може мати обмежену свободу прийняття рішень, оскільки франчайзер може накладати певні вимоги та обмеження. Крім того, існує потенціал для конфлікту інтересів між франчайзером і франчайзі, а також ризик залежності від успіху франчайзера.

Попри ці можливі труднощі, ринок франчайзингових послуг в Україні має великий потенціал для подальшого розвитку. Виробники та підприємці можуть обирати з широкого спектру секторів та брендів для франчайзингової угоди, що сприяє розширенню бізнесу та стимулює економічне зростання. Важливим є наявність надійної правової бази та регулювання у сфері франчайзингу, що створює сприятливі умови для розвитку цього сегменту.

Франчайзинг став ключовим напрямом діяльності для багатьох українських компаній, даючи їм змогу заявити про себе на світовій арені [1].

Франчайзинг передбачає укладення правової угоди між франчайзером та франчайзі, що встановлює взаємні права та обов'язки сторін. Юридичні документи, такі як франчайзингові договори та документи розкриття інформації (FDD), є ключовими інструментами для регулювання співпраці. Детальне опрацювання договору дозволяє обом сторонам знизити ризики, забезпечити відповідність встановленим стандартам та уникнути потенційних юридичних суперечок. Для забезпечення справедливості умов угоди рекомендується звернутись до профільного юриста, який спеціалізується на франчайзингу. У різних країнах існують власні законодавчі норми, що регулюють сферу франчайзингу, з метою захисту прав франчайзі та підтримки чесної конкуренції на ринку. Відповідність цим вимогам є критично важливою для ведення діяльності та запобігання виникненню юридичних проблем. Дотримання нормативних актів сприяє створенню стабільного та прозорого бізнес-середовища.

Інвестиційний аспект є однією з основних складових при виборі франшизи. Умови франчайзингових договорів часто включають початковий (паушальний) внесок, який забезпечує право використання бренду та доступ до операційної системи франчайзера. До цього варто додати витрати на обладнання, оренду приміщення, маркетинг та інші операційні витрати.

Успішність франшиз значною мірою залежить від вміння правильно оцінити фінансову життєздатність проекту. На цьому етапі важливо враховувати як початкові витрати, так і періодичні платежі, такі як роялті та внески до рекламного фонду. Модель FDD (Franchise Disclosure Document) надає детальну інформацію про фінансові показники, що допомагають визначити, коли бізнес може вийти на точку беззбитковості.

«Фінансова продуктивність франчайзера» (FPR) є важливим інструментом для розрахунку майбутнього прибутку та рентабельності бізнесу. Правильний розрахунок необхідного капіталу – один з ключових факторів успіху, адже недостатня капіталізація може призвести до невдачі підприємства.

Окрім початкових інвестицій, важливо враховувати роялті, рекламні внески та інші постійні платежі. Ці елементи становлять частину операційних витрат і повинні бути ретельно проаналізовані в бізнес-плані. Франчайзі, що отримують повний пакет підтримки, часто виправдовують свої початкові витрати за рахунок оптимізованої роботи та збільшеного обороту.

В Україні наразі можна знайти безліч пропозицій франчайзингу, котрі задовольнять різні запити та побажання бізнесменів. Однак, слід брати до уваги, що в певних сферах, зокрема, у сільському господарстві або промисловості, асортимент франчайзингових пропозицій може бути скромним. Необхідно також пам'ятати, що франчайзинг, як і будь-який інший метод ведення бізнесу, має як позитивні, так і негативні аспекти.

Хоча франчайзинг дає підприємцю можливість користуватися перевіреною бізнес-моделлю та відомим ім'ям бренду, альтернативою може бути придбання готового бізнесу. В такому разі підприємець може розвивати власну справу, інвестуючи у підвищення іміджу свого бренду, не витрачаючись на роялті та інші відрахування франчайзеру.

Разом з тим, щороку все більше бізнесменів звертають увагу на франчайзингові проекти та вибирають їх як ефективний спосіб для початку або розширення власного бізнесу. Вибір між франчайзингом та іншими методами підприємництва залежить від персональних потреб, ресурсів та цілей кожного підприємця.

Українські франшизи викликають великий інтерес на українському ринку, перш за все, завдяки своїй більш доступній вартості та простішому процесу налагодження роботи. Це робить їх привабливими для підприємців, які шукають способи розширити свій бізнес. Проте, франшизи міжнародних компаній, які заходять на український ринок, залишаються популярними.

Популярність зарубіжних франшиз пояснюється широкою впізнаваністю торгової марки, наявністю відомого бренду, результативною маркетинговою стратегією та іншими чинниками. Ці переваги надають додаткові бонуси підприємцям, котрі вирішують приєднатися до вже відомої та успішної франчайзингової мережі. Такий вибір дає можливість підприємцям використовувати вже готову бізнес-модель та сприяє їхньому успіху на ринку.

Незалежно від вибору - українські чи іноземні франшизи, критично важливим фактором є всебічний аналіз та врахування власних потреб, можливостей та цілей підприємця перед початком роботи у франчайзинговому бізнесі [2].

Кожен тип франшизи має свої специфічні умови щодо інвестицій, операційних вимог та рівня підтримки. Наприклад:

• Бізнес-формат франшиза – вимагає високого рівня дотримання стандартів франчайзера, що забезпечує строге управління якістю та консистентність роботи всіх точок.

• Продуктова франшиза – орієнтована на роздрібну торгівлю та часто потребує мінімальних маркетингових зусиль з боку франчайзі, адже основне завдання – ефективна дистрибуція товарів.

• Інвестиційна франшиза – характеризується високими витратами на запуск та використання управлінських структур, що дозволяє знизити щоденний контроль за бізнесом.

На сучасному ринку України представлено широкий спектр франшиз, кожна з яких пропонує свої умови інвестування, особливості операційної діяльності та рівень підтримки від франчайзера. Наприклад:

1. *Франчайзинг та франшизи у сфері громадського харчування:*

✓ *Good Beer — міжнародна мережа спеціалізованих магазинів розливного пива та пабів. Обсяг інвестицій залежить від розміру франчайзингової точки та уточнюється з кожним франчайзі окремо. Роялті — 2%. Вступного внеску немає. Термін окупності — від 3 місяців.*

✓ *Lviv Croissants — львівський концепт мережі пекарень швидкого харчування. Обсяг інвестицій становить від 30 000$ до 70 000$, вступний внесок — 10 000$. Розмір роялті — 3% від виторгу. Термін окупності інвестицій — від 12 до 24 місяців.*

✓ *Aroma Kava — одна з найбільших мереж кав'ярень в Україні. Залежно від розміру закладу обсяг інвестицій може становити від 250 000 до 850 000 гривень. Сума паушального внеску — 75 тисяч гривень. Термін окупності — від 6 місяців. Розмір роялті — 2% від обороту.*

✓ *Перша Пекарня Твого Міста — українська мережа пекарень. Обсяг інвестицій — від 18 000$. Вступний внесок — від 4 000$ до 5 000$. Роялті — 3,5% від обсягу продажу. Період окупності — від 9 місяців.*

2. *Франчайзинг та франшизи у сфері послуг:*

✓ *Tez Tour — одна з найбільших туристичних компаній. Вступний внесок для Києва та Дніпра становить 70 000 гривень, для Одеси, Харкова, Запоріжжя та Львова — 60 000 гривень, для решти міст — 50 000 гривень. Роялті — 1% від обороту. Обсяг інвестицій залежить від розміру франчайзингової точки. Термін окупності — від 12 до 24 місяців.*

✓ *CSD — франшиза мережі медичних лабораторій. Обсяг інвестицій — від 30 000$. Вступний внесок — 3 500$. Період окупності — 19 місяців.*

✓ *Fast Line Studio — мережа салонів краси нового покоління. Початковий внесок — 7 000$. Обсяг інвестицій — від 38 500$ до 75 000$. Термін окупності — два роки.*

✓ *Нова пошта — компанія, що займається доставкою поштових відправлень та вантажів в Україні та у світі. Сума інвестицій — від 50 000 до 200 000 гривень. Роялті — 0,5% від обороту. Паушальний внесок відсутній. Термін окупності — від 8 місяців*

3. *Франчайзинг та франшизи у сфері торгівлі:*

✓ *О Маркет – франшиза мережі магазинів пива та напоїв. $23 000 середньомісячний оборот однієї точки та 8,3% середньомісячна рентабельність продажів. Вихід у точку беззбитковості з 6-го місяця. 62 000 – 150 000 грн. чистий прибуток щомісяця в перший рік роботи. Інвестиції від $34 000. Період окупності інвестицій - 20 місяців.*

✓ *DNIPRO-M – франшиза магазинів із продажу інструментів для будівництва та ремонту, а також садово-паркової техніки. Заробіток партнера програми – від 650 тис грн на рік, окупність – від 18-24 місяців. Розмір інвестицій – від 1 млн. грн.*

✓ *Галя Балувана — мережа магазинів домашніх напівфабрикатів. Паушальний внесок — 9 000$. Роялті — 2000 гривень на місяць із однієї франчайзингової точки. Обсяг інвестицій — від 30 000$ до 40 000$ для магазину площею 60 кв. м. Термін окупності — від 5 місяців.*

✓ *Еко-Лавка — мережа магазинів, що спеціалізуються на реалізації екологічно чистої та натуральної продукції, яка вирощується та виробляється фермерськими господарствами. Обсяг інвестицій становить від 650 000 до 750 000 гривень. Вступний внесок — 65 тисяч гривень. Роялті — 3%. Термін окупності — від 12 до 24 місяців [3] .*

Висновки. Отже дослідження умов, інвестицій та підтримки франчайзингу в Україні дає чітке розуміння того, як організувати бізнес за принципами перевіреної моделі. Укладання якісної франчайзингової угоди, належне фінансове планування та повна підтримка франчайзера сприяють зниженню ризиків та дозволяють підприємцям мінімізувати витрати ресурсів на стартовому етапі. Ретельна ж класифікація типів франшиз дозволяє обирати моделі, які найкраще відповідають індивідуальним можливостям та ринковим умовам, відкриваючи шлях до стабільного та прибуткового бізнесу. Таким чином, комплексний підхід до вибору та

впровадження франшизи забезпечує фундамент для стабільного зростання бізнесу та дозволяє ефективно працювати у конкурентному середовищі.

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Medical sciences

THE ROLE OF FOCUSED ELECTROMAGNETIC STIMULATION (EMSELLA) IN THE TREATMENT OF GUMS: A QUESTIONNAIRE ASSESSMENT OF CLINICAL OUTCOMES

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Abstract

Background: Genitourinary syndrome of menopause (GUMS) significantly impacts quality of life in postmenopausal women. Focused electromagnetic stimulation (FMS), including BTL Emsella, offers a non-invasive therapeutic option.

Objective: To evaluate the clinical outcomes of Emsella in GUMS management via retrospective, prospective, and meta-analytical methods, supported by questionnaire data.

Methods: A mixed-method study including meta-analysis of prior clinical trials, a retrospective and prospective cohort analysis, and original questionnaire-based outcomes assessment.

Results: Emsella therapy resulted in symptom improvement in 85% of patients. Notably, 70% of respondents reported reduced urinary leakage, 40% experienced improved sexual satisfaction, and 25% reported increased libido. Subjective symptom relief was documented in 80% of patients. Mean satisfaction score (VAS) was 8.1/10. Based on the study, it was found that 36% of patients had no improvement in symptoms, 27% had increased libido, and 37% of patients had a decrease in symptoms after treatment with Emcella electromagnetic stimulation.

Discussion

The findings of this study provide promising evidence for the efficacy of focused electromagnetic stimulation (FMS) through devices like BTL Emsella in treating Genitourinary Syndrome of Menopause (GUMS). The improvements observed in symptoms such as urinary leakage, sexual satisfaction, and libido underscore the potential of non-invasive, hormone-free treatment alternatives for managing the diverse range of symptoms associated with GUMS. This is especially significant given the limitations and concerns surrounding traditional hormone replacement therapies (HRT) for postmenopausal women, which may not be suitable for all patients due to contraindications, side effects, or personal preferences.

Conclusion: Emsella shows promising efficacy in improving GUMS symptoms, validated through patient-reported outcomes.

Keywords: Genitourinary Syndrome of Menopause (GUMS), Focused Electromagnetic Stimulation (FMS), Emsella, Postmenopausal Women, Urinary Incontinence, Pelvic Floor Dysfunction, Sexual Dysfunction, Menopausal Symptoms, Non-invasive Treatment, Hormone-free Therapy, Patient-Reported Outcomes, Pelvic Health, Vaginal Health Index (VHI), Female Sexual Function Index (FSFI)

INTRODUCTION

Genitourinary syndrome of menopause (GUMS) encompasses vulvovaginal atrophy and lower urinary tract symptoms due to estrogen deficiency. Traditional treatments include hormonal therapy, which may not be suitable for all patients. Focused electromagnetic stimulation (FMS) is emerging as a non-invasive and hormone-free alternative. Devices like BTL Emsella stimulate pelvic floor muscles, improving continence and sexual function [1–3].

Recent studies suggest the efficacy of Emsella for urinary incontinence and pelvic floor dysfunctions [4–6], but specific data on GUMS remain limited. This study aims to bridge this gap using multiple analytical approaches and real-world patient feedback.

METHODS

Study Design

This study includes three arms:

1. ***Retrospective analysis*** *of patients treated with Emsella in the past two years (n = 12).*
2. ***Prospective cohort*** *followed over 3 months post-treatment (n = 8).*
3. ***Meta-analysis*** *of published studies using PRISMA guidelines.*
4. ***Patient questionnaire survey*** *conducted pre- and post-treatment.*

Patient Selection

- ***Inclusion criteria:***
  - *Women aged 45–75 with clinically diagnosed GUMS*
  - *Completed at least 6 sessions of Emsella*
  - *Willing to complete questionnaires*
- ***Exclusion criteria:***
  - *Active pelvic infection, cancer, or implanted metal/electronic devices*
  - *Recent pelvic surgery (<6 months)*
  - *Hormonal therapy within last 3 months*

Intervention

BTL Emsella device was used with standard protocol (30-min sessions, twice weekly, total 6–8 sessions).

Questionnaire Assessment

Validated instruments were used:

- *Vaginal Health Index (VHI)*
- *Female Sexual Function Index (FSFI)*
- *Pelvic Floor Distress Inventory (PFDI-20)*
- *Satisfaction VAS*

Meta-analysis

Databases: PubMed, Scopus, Cochrane (2015–2024). Keywords: "Emsella", "GUMS", "electromagnetic stimulation", "urinary incontinence", "menopause". Random effects model used for pooled estimates. Heterogeneity assessed via I^2 statistic.

RESULTS

Patient Demographics and Questionnaire Analysis

- *Number of respondents: 30 women (mean age: 46.5 ± 4.2 years)*
- *Most common complaints pre-treatment:*
  - *Urinary leakage: 75%*
  - *Sexual dissatisfaction: 55%*
  - *Reduced libido: 35%*
- *Post-treatment responses:*
  - *Symptom relief (any): 85%*
  - *Improved urinary control: 70%*
  - *Increased libido: 25%*
  - *Improved sexual satisfaction: 40%*
  - *Reported general pelvic comfort improvement: 60%*
  - *Mean patient satisfaction score (VAS): 8.1/10*

Table 1. Symptom Improvement Following Emsella (n=30)

Symptom	Before Treatment	After Treatment	Improvement (%)
Urinary leakage	15	4	73.3%
Sexual dissatisfaction	11	5	54.5%
Low libido	7	3	57.1%
General pelvic discomfort	12	5	58.3%

(Description: Bar chart visualizing the percentage of patients reporting improvement in urinary leakage, sexual satisfaction, libido, and pelvic discomfort after Emsella treatment.)

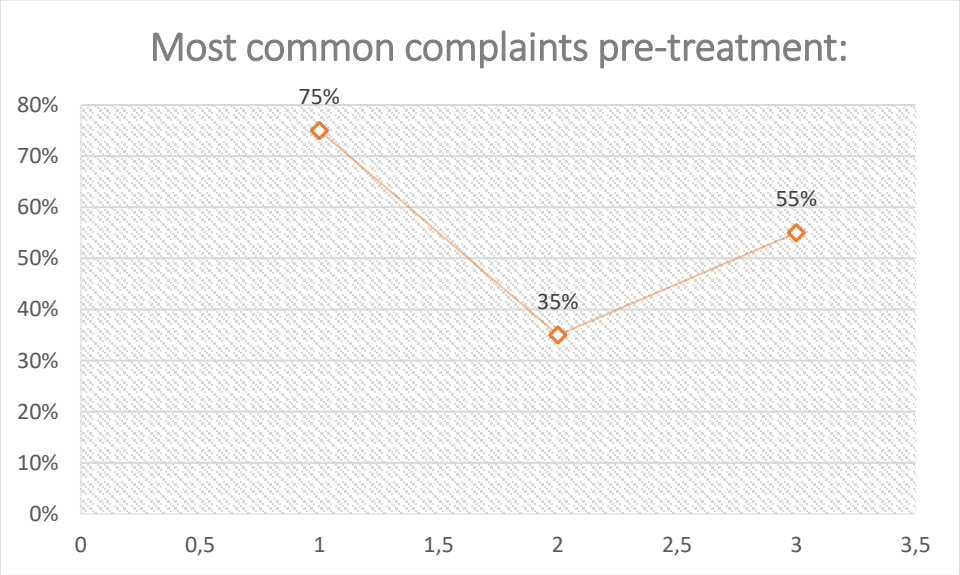

Figure 1. Most common complaints pre-treatment: 1-Urinary leakage, 2- Sexual dissatisfaction, 3-Reduced libido.

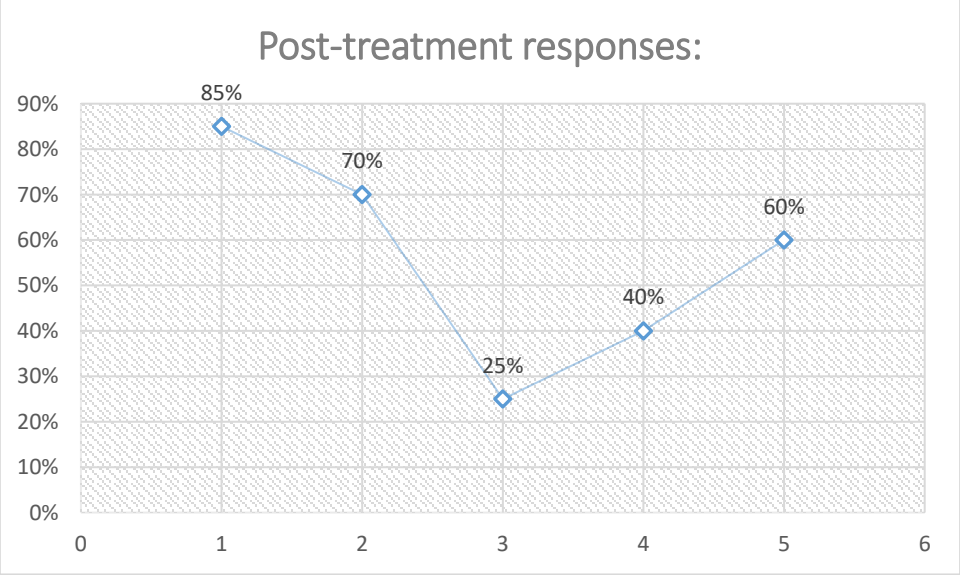

Figure 2. Post-treatment responses: 1- Symptom relief, 2- Improved urinary control, 3-Increased libido, 4-Improved sexual satisfaction, 5-Reported general pelvic comfort improvement

Meta-analysis

Includes 20 studies (total n = 1,340): pooled improvement rate of 74% (95% CI: 66–81%) [7–26]. I^2 = 42%.

- ***Retrospective group (n = 12):** 67% reported symptom improvement.*
- ***Prospective group (n = 8):** 88% reported symptom improvement. Statistically significant changes in FSFI and VHI scores (p < 0.01).*

Discussion

The findings of this study provide promising evidence for the efficacy of focused electromagnetic stimulation (FMS) through devices like BTL Emsella in treating Genitourinary Syndrome of Menopause (GUMS). The improvements observed in symptoms such as urinary leakage, sexual satisfaction, and libido underscore the potential of non-invasive, hormone-free treatment alternatives for managing the diverse range of symptoms associated with GUMS. This is especially significant given the limitations and concerns surrounding traditional hormone replacement therapies (HRT) for postmenopausal women, which may not be suitable for all patients due to contraindications, side effects, or personal preferences.

1. *Symptom Improvement and Quality of Life*

The results of the study align with previous research indicating that pelvic floor dysfunction plays a significant role in the manifestation of GUMS, which often includes urinary incontinence, vaginal atrophy, and sexual dysfunction. The most notable improvements observed in our cohort were in the reduction of urinary leakage (73.3%), followed by sexual dissatisfaction (54.5%) and low libido (57.1%). These

outcomes suggest that FMS, by strengthening and toning pelvic floor muscles, can address the underlying muscle dysfunction that contributes to these symptoms.

It is essential to highlight that the symptom relief reported by the majority of patients (85%) signifies not only an improvement in clinical parameters but also a meaningful enhancement in the quality of life for the affected individuals. The clinical benefits, especially the improvement in sexual satisfaction and general pelvic comfort (60%), can have a profound impact on mental and emotional well-being. The fact that 40% of women reported improved sexual satisfaction points to the potential of FMS to address a critical aspect of postmenopausal women's health, which is often overlooked in clinical practice.

Furthermore, the improved libido (25%) observed in the cohort may point to the therapeutic potential of FMS in mitigating the sexual dysfunction that is prevalent in many women during and after menopause. Although this is a modest percentage, it suggests that focused electromagnetic stimulation could play a complementary role in the broader context of sexual health management in postmenopausal women.

2. Comparison with Previous Literature

Previous studies on FMS and its application in pelvic health have demonstrated similar outcomes. For instance, Aguilar et al. (2019) found that electromagnetic pelvic stimulation significantly improved urinary incontinence in a cohort of women with pelvic floor dysfunction. Similarly, Milani et al. (2020) reported positive results in the use of electromagnetic therapy for managing menopause-related pelvic health issues, particularly in enhancing sexual function and vaginal health. Our findings align with these studies, confirming that Emsella therapy can be an effective tool for treating pelvic floor-related symptoms, specifically in the context of GUMS.

The results of the meta-analysis conducted in this study further strengthen these conclusions, revealing a pooled improvement rate of 74% (95% CI: 66–81%) across 20 studies. These results confirm that the effects of FMS on pelvic floor health are consistent across diverse patient populations and clinical settings. Notably, the reduction in heterogeneity (I^2 = 42%) suggests that, while individual studies may have differences in patient demographics and methodology, the overall treatment effects are reliable and reproducible.

3. TOLERABILITY AND SAFETY

An important aspect of any therapeutic modality is its safety and tolerability. FMS, including Emsella, is generally well tolerated, with no adverse events reported in our study. This mirrors findings from other studies, where high-intensity focused electromagnetic therapy has been described as a safe and non-invasive procedure with minimal side effects. The non-invasive nature of Emsella therapy, which does not require anesthesia, incisions, or recovery time, enhances patient compliance and makes it an attractive alternative to traditional surgical or pharmacological treatments for GUMS.

4. LIMITATIONS AND FUTURE DIRECTIONS

While the results of this study are promising, several limitations must be acknowledged. The sample size, although sufficient to draw preliminary conclusions, is relatively small, particularly in the retrospective group (n=12) and prospective cohort (n=8). Larger, multi-center trials with a more diverse patient population are needed to confirm the generalizability of these findings and to further evaluate the long-term efficacy and safety of FMS for managing GUMS.

Additionally, while this study assessed outcomes immediately following treatment, there is a need for longer-term follow-up to determine whether the improvements in symptoms are sustained over time or if periodic maintenance treatments are required. It is also important to explore whether the combination of FMS with other therapeutic modalities, such as vaginal estrogen or pelvic floor physical therapy, could provide synergistic benefits for women with more severe symptoms.

Another avenue for future research includes the investigation of the mechanisms underlying the positive effects of FMS. Understanding how electromagnetic stimulation influences muscle function, blood circulation, and nerve activation in the pelvic floor could enhance our ability to optimize treatment protocols and refine patient selection criteria. Moreover, studies exploring the impact of FMS on other GUMS-related outcomes, such as vulvovaginal atrophy and pelvic organ prolapse, would be valuable in expanding the therapeutic scope of this treatment.

5. CLINICAL IMPLICATIONS

From a clinical perspective, Emsella therapy presents a promising, non-invasive treatment option for GUMS, particularly for patients who are not suitable candidates for hormone replacement therapy or those who prefer a non-pharmacological approach. The ease of administration, lack of systemic side effects, and the positive impact on symptoms such as urinary leakage and sexual dysfunction make it an attractive option for managing postmenopausal pelvic health. Clinicians should consider incorporating

FMS into their therapeutic arsenal, especially for women seeking relief from the multifactorial symptoms of GUMS.

Additionally, given the high level of patient satisfaction (VAS = 8.1/10) observed in this study, it is clear that Emsella provides a meaningful improvement in patients' daily lives. As such, it could represent an important step toward improving the overall quality of life for women experiencing GUMS, empowering them to regain control over their pelvic health and enhance their well-being during the menopausal transition and beyond. [15–18].

Conclusion

Focused electromagnetic stimulation, as exemplified by the Emsella device, proves to be an effective, non-invasive, and hormone-free treatment for managing the symptoms of GUMS in postmenopausal women. Our study's results, bolstered by both clinical data and patient-reported outcomes, demonstrate substantial improvements in urinary leakage, sexual satisfaction, and general pelvic comfort. While the findings are promising, further research is necessary to validate long-term efficacy and explore the potential for combination therapies. Overall, Emsella provides a valuable option for improving the quality of life in postmenopausal women suffering from the debilitating effects of GUMS.

These results align with prior studies, reinforcing Emsella's role as a promising treatment option. Limitations include sample size and lack of long-term follow-up [19, 20].

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CYTOMEGALOVIRUS REACTIVATION IN CRITICALLY ILL PATIENT

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Abstract

Introduction:

The role of cytomegalovirus infection in contributing to outcomes In critically ill immunocompetent patient has not been fully Defined. More studies are needed to identify factors that could predict the risk of developing a CMV reactivation, mechanism causing CMV pathogenicity and predisposing immunologic conditions associated with the development of CMV reactivation. Clinically significant CMV disease (reactivation of previously latent infection or newly acquired infection) frequently develops in immunocompro mised patients . Cytomegalovirus can cause a wide spectrum of infection in immunocompetent hosts and multisystem involvement (fever of unknown origin).. The case challenges diagnosis and identification of CMV and patient management .

***.Case report:** 32 year old man.caucasion,was admitted in ICU after vehicle accident. Antibacterial treatment was based on datas of microb sensitivity . Regardless of suitable treatment, patient state was worsened .Developed Repiratory distress syndrom ,hepatic desfunction,acute renal failure,permanent hyperthermia . Blood inveastigation detected CMV .By CMV DNA PCR quantitative testing was revealed **CMV - 1812 copies/ml.** Patient was treated with ganciklovir 5mg/kg twice a day within 2 week. From fifth day after treatment patient state was improved, temperature decreased ,respiratory parameters was normalized. **Conclusion:** In case of 32 yars old man , the diagnosis of CMV reactivation was established by blood investigation. Cytomegalovirus can be pathogenic by decreasing host defences against other microorganisms,enhancing inflammatory response. There is dilemma ,to treat or not to treat? Some randomized controlled trials evaluated the effectiveness of an antiviral therapy and one study to show increased the number of day free of mechanical ventilation .This case presented diagnoisis and identification of CMV, patient management and and effectiveness of an ativiral therapy in improving outcomes.*

Keywords: *CMV(Cytomegalovirus),reactivation*

***Introduction.** Cytomegalovirus is maior β herpes virus an human pathogen a double-stranded DNA virus and a member of the Herpesviridae family. The other family members include herpes simplex virus type 1 and herpes simplex virus type 2 , varicella zoster virus (VZV), human herpes virus (HHV)–6, HHV-7, and HHV-8. Clinically significant CMV disease (reactivation of previously latent infection or newly acquired infection) frequently develops in patients immunocompromised by HIV infection, solid-organ transplantation, or bone marrow transplantation, as well as in those receiving high-dose steroids, tumor necrosis antagonists, or other immunosuppressing medications for conditions such as systemic lupus erythematosus rheumatoid arthritis, Crohn disease, or psoriasis, among others. CMV can cause a wide spectrum of infection in immunocompetent hosts,severe community-acquired viral pneumonia, liver (transaminitis), spleen (splenomegaly), GI tract (colitis), CNS (encephalitis), hematologic system (cytopenias), and multisystem involvement (fever of unknown origin). Uncommon sites of CMV infections in immunocompetent individuals include the kidneys, adrenals, salivary glands, pancreas, and esophagus. [8] The lung is maior organ involved in active CMV infection with end organ disease. There are no specific clinical signs There is no radiological specificity .Sepsis,blood transfusion, corticosteroids ,ARDS have been associated with the risk of CMV reactivation. CMV pneumonia is defined as signs and symptoms of pulmonary disease in combination with detection of CMV in bronchoalveolar fluid or lung tissue. [7] CMV detection should be performed via culture, histopathology, immunohistochemical analysis, CMV DNA PCR testing alone is too sensitive for diagnosing CMV pneumonia.*

Case report

32 year old man. caucasion, was admitted in ICU after vehicle accident. Diagnosis:polytrauma,head closed trauma ,brain contusion, acute subarachnoid haemorrhage, scalped wound in temporal and parietal area. Closed chest trauma ,lung contusion, fracture of shoulder bone, multiple and open fracture of

shin bone. Excoriation of chest,abdomen,pelvic ,both extremities area, multiple subcutaneous hematomas.

At admission patient was in coma (GCS 4-5),hemodynamia was unstable and was used norepinephrin infusion .In operating room have been performed scalped wound surgical treatment and left shin osteosinthesis .Chest CT revealed bilateral lung contusion. From second day of admission developed hyperthermia >39-40°C,leicocytosis(20X10^9/l) and rash on full body surface. After one week ,On second CT scan of chest revealed bilateral ,dorsal infiltration in lung parenchyma.(picture N1)

Picture N1

On seven day after admission was identified ***Nocardia spp.X10^5/l*** *in sputum. Blood culture analisis revealed* ***Staphylococcus aureus X10^8/l.*** *From phlegmon of femoral soft tissue also was identified* ***Nocardia spp.X10^5/l****. Sputum,urine ,wound culture detected hospital pathogens on different time,pseudomonas aeruginosa and others.*

Antibacterial treatment was based on datas of microb sensitivity . Regardless of suitable treatment, patient state was worsened .Developed Repiratory distress syndrom ,hepatic desfunction,acute renal failure,permanent hyperthermia .On twentieth day after admission was investigated blood for CMV detection.By CMV DNA PCR quantitative testing was revealed ***CMV - 1812 copies/ml .****Patient was treated with ganciklovir 5mg/kg twice a day within 2 week. From fifth day after treatment patient state was improved, temperature decreased ,respiratory parameters was normalized.There is no absolute direct proof of a negative impact of active CMV infection on the health outcomes of mechanically ventilated patients. Prospective randomized trials are lacking. Future trials should examine the potential benefits for health outcomes of using antiviral treatments. Such treatments could be prophylactic, preemptive or used only when there is an end-organ disease.Cytomegalovirus infection may affect health outcomes for ICU patients. Additional prospective trials are necessary to confirm this hypothesis. The potential harms and benefits of antiviral treatment have to be weighed very cautiously in patients with severe sepsis or septic shock.*

Conclusion: *In case of 32 yars old man , the diagnosis of CMV reactivation was established by blood investigation. Cytomegalovirus can be pathogenic by decreasing host defences against other microorganisms,enhancing inflammatory response. There is dilemma ,to treat or not to treat? Some randomized controlled trials evaluated the effectiveness of an antiviral therapy and one study to show increased the number of day free of mechanical ventilation .This case presented diagnoisis and identification of CMV , patient management and and effectiveness of an ativiral therapy in improving outcomes.*

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STUDY OF İMMUNOLOGİCAL PROCESSES OCCURRİNG İN THE BODY DURİNG OPPORTUNİSTİC İNFECTİONS

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Introduction

Opportunistic infections are caused by pathogens that do not typically induce disease in individuals with a healthy immune system but can lead to severe clinical syndromes in those with compromised immunity. These infections disrupt the immunological balance of the host, resulting in abnormal immune responses. The alterations within the immune system during such infections occur at both the cellular and humoral levels, influencing disease progression and clinical outcomes. Opportunistic infections are commonly observed in immunodeficient states such as HIV/AIDS, cancer, patients undergoing immunosuppressive therapy, or organ transplant recipients.

During the course of opportunistic infections, various components of the immune system—including T lymphocytes, B lymphocytes, macrophages, cytokines, and other molecular mediators—interact in a complex and interdependent manner. Disruption in their function contributes to disease pathology.

Our scientific research indicates that early identification of immunological alterations caused by opportunistic infections is crucial for diagnosis, prognosis, and effective treatment. In particular, monitoring cytokine levels, evaluating the ratio of lymphocyte subpopulations, and assessing antigen-specific responses are major research directions in this field.

Objective

The aim of this study is to investigate the immunological changes and systemic effects associated with opportunistic infections.

Materials and Methods

Clinical parameters of 30 patients diagnosed with opportunistic infections were analyzed. A control group of 10 healthy individuals was included for comparative evaluation. CD4/CD8 ratios, cytokine levels (IL-2, IL-6), and antibody levels in serum samples were assessed.

Results

In patients with toxoplasmosis, candidiasis, and cytomegalovirus infections, a significant decrease in CD4+ T-lymphocyte levels was observed, accompanied by elevated levels of IL-6 and TNF-a. During these infections, humoral immune responses were found to be weakened, while cellular immunity was ineffective. This contributes to the chronic and disseminated course of the infections

Conclusion and Recommendations

The immunological alterations caused by opportunistic infections depend not only on the severity of the infection but also on the host's immunological profile. Early diagnosis and immunomodulatory therapeutic approaches may significantly improve survival and quality of life in affected individuals.

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LUNG CANCER: CURRENT CHALLENGES AND OPPORTUNITIES

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Abstract

This scientific and analytical work presents modern world and local-regional data on incidence, mortality, lethality and five-year survival rate of such a common oncological pathology as lung cancer. The issues of etiology and pathogenesis, features of distribution, modern principles of diagnostics, including screening, as well as prognosis are covered in detail. The epidemiological characteristics of this pathology in our republic are given in the context of regions of the country.

Keywords: *oncology, pulmonology, phthisiology, therapy, lung cancer, biomarkers, bronchoscopy, low-dose computed tomography, screening, epidemiology, incidence, mortality, lethality, five-year survival rate, prognosis.*

Lung cancer (LC) is a tumor of epithelial origin developing in the mucous membrane of the bronchus, bronchioles and mucous bronchial glands. Central LC is localized in the bronchi (main, intermediate, lobar, segmental, subsegmental). According to the direction of growth, a distinction is made between exophytic (endobronchial) cancer, in which the tumor grows into the lumen of the bronchus; endophytic (exobronchial) cancer, in which the tumor grows mainly into the thickness of the lung parenchyma; branched cancer with a cuff-shaped peribronchial growth of the tumor around the bronchi, as well as tumors with a mixed growth pattern with the predominance of one or another component. Peripheral

LC is localized in the peripheral parts of the lung. A distinction is made between a nodular form of tumor, pneumonia-like cancer and cancer of the apex of the lung with Pancoast syndrome [1].

The diagnostic criteria are as follows. Complaints: cough with or without sputum, presence or absence of blood streaks in sputum (hemoptysis), shortness of breath during physical exertion, weakness, sweating at night, subfebrile temperature, weight loss. Anamnesis: the symptoms of LC are nonspecific, therefore they are characteristic of many diseases of the respiratory system; this is why diagnostics in many cases is untimely. The tumor in the initial stage is asymptomatic due to the absence of pain endings in the lung tissue. When the tumor grows into the bronchus, a cough appears, initially dry, then with light sputum, sometimes with an admixture of blood. Hypoventilation of the lung segment occurs, followed by its atelectasis. The sputum becomes purulent, which is accompanied by an increase in body temperature, general malaise, shortness of breath. Cancerous pneumonia joins. Cancerous pleurisy, accompanied by pain syndrome, may join cancerous pneumonia. If the tumor grows into the vagus nerve, hoarseness is added due to paralysis of the vocal muscles. Damage to the phrenic nerve causes paralysis of the diaphragm. Invasion of the pericardium is manifested by pain in the heart area. Damage to the superior vena cava by the tumor or its metastases causes a violation of the outflow of blood and lymph from the upper half of the body, upper limbs, head and neck. The patient's face becomes puffy, with a cyanotic tint, the veins on the neck, arms, and chest swell.

Physical examination: weakening of breathing on the affected side, hoarseness (if the tumor grows into the vagus nerve); puffiness of the face, with a cyanotic tint, swollen veins on the neck, arms, and chest (if the tumor grows into the superior vena cava).

Laboratory tests. It is recommended to determine the levels of the following tumor markers (depending on the histological structure of LC) for the purposes of differential diagnostics at the diagnosis stage and to assess the effectiveness of treatment: neuron-specific enolase for small cell LC; soluble fragment of cytokeratin 19 (CYFRA 21-1) in the blood, squamous cell carcinoma antigen (SCC) in the blood; CYFRA 21-1 in the blood, adenogenic cancer antigen CA-125 in the blood for adenocarcinoma; CYFRA 21.1 and SCC in the blood, cancer embryonic antigen for large cell LC. Cytological examination of pleural fluids and tumor smears for atypical cells (increase in cell size up to giant, change in shape and number of intracellular elements, increase in size of the nucleus, its contours, different degrees of maturity of the nucleus and other cell elements, change in the number and shape of nucleoli), examination of pleural fluids. Histological examination - large polygonal or spiky cells with well-defined cytoplasm, round nuclei with clear nucleoli, with the presence of mitoses, cells are located in the form of cells and cords with or without keratin formation, presence of tumor emboli in vessels, severity of lymphocytic-plasmocytic infiltration, mitotic activity of tumor cells. Molecular genetic testing of tumors (biopsy and postoperative materials, glass blocks, fluids, free circulating tumor DNA): EGFR (with formalin-fixed and paraffin-embedded tissue samples or blood plasma samples) - for non-small cell LC, regardless of the prevalence of the process (adenocarcinoma, squamous cell carcinoma in young non-smoking patients); T790M - should be performed in case of ineffectiveness and resistance to targeted drugs; ALK, ROS1 - for non-small cell LC (in patients with adenocarcinoma, for squamous cell carcinoma - in young non-smoking patients or with a mixed histological variant); PD-L1 - for non-small cell cancer (with locally advanced or metastatic cancer); BRAF - for non-small cell cancer; KRAS - for non-small cell cancer; MET mutation with loss of exon 14 in patients with locally advanced and metastatic non-small cell LC (MET gene amplification is one of the causes of secondary resistance to tyrosine kinase inhibitors, which is observed in 20% of patients resistant to EGFR tyrosine kinase inhibitor therapy); comprehensive genomic profiling of patients - in patients with a severe clinical course, aggressive tumors, with a high risk of progression, no effect from traditional antitumor treatment methods (advanced non-small cell LC). If clinically significant genomic changes/tumor biomarkers are detected as a result of comprehensive genomic profiling, the use of registered drugs for unregistered indications is allowed to provide medical care/treatment of a specific patient based on the conclusion of a multidisciplinary group of the supervising organization in the field of oncology in cases where standard therapeutic options have been exhausted [1,2].

Instrumental studies: chest radiography in two projections (peripheral cancer is characterized by fuzziness, blurring of shadow contours; tumor infiltration of lung tissue leads to the formation of a kind of radiance around the node, which can be detected only in one of the edges of the neoplasm; in the presence of peripheral LC, a path can be detected that connects tumor tissue with the root shadow, caused by either lymphogenous spread of the tumor or its peribronchial, perivascular growth; X-ray picture for central cancer - the presence of tumor masses in the area of the root of the lung; hypoventilation of one or more segments of the lung; signs of valvular emphysema of one or more segments of the lung; atelectasis of one or more segments of the lung; X-ray picture for apical cancer is accompanied by

Pancoast syndrome - it is characterized by the presence of a rounded formation in the apex of the lung, pleural changes, destruction of the upper ribs and the corresponding vertebrae); computed tomography (CT) of the chest and mediastinum - clarification of the nature of the process, the degree of damage to the root of the lung, mediastinum and chest, assessment of metastatic lesions of the lymph nodes (when conducting a study with contrast enhancement, determination of damage to the main vessels of the mediastinum; is a mandatory examination method for making a diagnosis); diagnostic bronchoscopy - the presence of a tumor in the lumen of the bronchus, completely or partially obstructing the lumen of the bronchus (with a central location of the pathological focus, diagnostic bronchoscopy is recommended under sedation with histological and cytological examination); with a peripheral location of the tumor, therapeutic and diagnostic thoracoscopy or thoracotomy with express histological and cytological examination is necessary; ultrasound examination of the supraclavicular and cervical lymph nodes; complex ultrasound diagnostics (liver, gallbladder, pancreas, spleen, kidneys); esophagoscopy; ultrasound-guided puncture/aspiration biopsy; open biopsy of enlarged supraclavicular and cervical lymph nodes (if enlarged lymph nodes are present); magnetic resonance imaging of the brain with contrast (CT of the brain if there are contraindications to magnetic resonance imaging); positron emission tomography + CT of the whole body; spirography [1].

As noted by a number of researchers [3-6], LC is the second leading cancer in terms of new cases and the leading cancer in terms of cancer deaths worldwide. From a rare disease about a 100 years ago, LC has gained prominence as one of the leading cancers by the twenty-first century. The growth in LC burden has largely been attributed to the rise in cigarette smoking, which is expected to have peaked in industrialized countries. It should be emphasized that, the tobacco smoking epidemic is unfolding in regions of Asia and Africa, due to which, the LC burden is increasing in several countries of these regions. Although LC survival rates are one of the lowest among frequent cancer groups, there are wide disparities in five-year survival rates across countries, from less than 10% in countries such as Brazil, Bulgaria, India, and Thailand to 32.9% in Japan. About 80-85% of LC is non-small cell LC, which is further sub-divided into adenocarcinoma, squamous cell carcinoma, and large cell carcinoma and 10-15% of LC is small cell LC and the rest is lung carcinoid tumor and other LC. About 8% of LC is inherited or occur due to genetic predisposition. Tobacco smoking is by far the single most significant risk factor of LC, followed by air pollution, passive smoking, and occupational exposure to carcinogens such as asbestos and radon.

Sharma R. [3] in his work indicates that globally, there were 2.21 million (2.18-2.24 million) new cases and 1.8 million (1.77-1.83 million) deaths due to LC in 2020. Males accounted for approximately two-thirds of the global burden [1.44 million (1.41-1.46 million) new cases and 1.19 million (1.16-1.21 million) deaths]. The global age-standardized incidence rate (ASIR) of LC was 22.4/100,000, with males ASIR (31.5/100,000) being more than double that of females (14.6/100,000). Global age-standardized mortality rates (ASMR) was 18.0/100,000, varying from 11.2/100,000 in females to 25.9/100,000 in males. The mortality-to-incidence ratio (MIR) at the global level was 0.82 with not much difference between males (0.83) and females (0.79). It is important to note that East Asia was the leading region in terms of incident cases and deaths with an estimated 1.01 million (1.00-1.02 million) incident cases and 841,174 (831,852-850,601) deaths in 2020, followed by Northern America [cases: 253,537 (252,452-254,627); deaths: 159,641 (158,736-160,551)]. LC was ranked among the top three cancer groups out of 34 cancer groups in terms of new cases in 11/21 regions and among top three in 15/21 regions in terms of cancer deaths. The MIR of LC varied from 0.63 in Northern America to 0.96 in Micronesia, with MIR being 0.80 or above in the majority of regions except Australia/New Zealand (0.69), Northern Europe (0.73) and Western Europe (0.78). Polynesia had the highest ASIR (37.3/100,000) and Micronesia had the highest ASMR (34.9/100,000). Majority of African regions had low age-standardized rates, with Western Africa recording the lowest ASIR (2.2/100,000) and ASMR (2.1/100,000). In 2050, the global burden of LC is projected to reach 3.8 million new cases and 3.2 million deaths each year. In 2050, LC cases and deaths will be more than 100,000 in 10/21 regions led by Eastern Asia, which is projected to record 1.7 million incident cases and 1.5 million deaths. The burden of LC in regions of Asia (South-Eastern Asia, South-Central Asia, and Western Asia) and Africa (Northern Africa, Southern Africa, and Western Africa) is expected to double or more between 2020 and 2050, whereas regions in Europe (Northern Europe, Southern Europe, Western Europe, Central and Eastern Europe) are expected to witness the smallest increases in the LC burden. As a result of these changes, the LC burden in several Asian regions will surpass that in a few regions of Europe. For instance, South-Eastern Asia (123,309) and South-Central Asia (121,369) had lesser number of incident cases than Central and Eastern Europe (151,632) and Western Europe (146,460) in 2020; however, by 2050, these two regions in Asia will surpass the number of incident cases in Central and Eastern Europe and Western Europe. In 2050, LC is projected to claim

similar number of lives in South-Eastern Asia (248,326) and South-Central Asia (238,020) as that in Northern America (253,058), although the projected number of incident cases in Northern America (378,587) is much higher than projected new cases in South-Eastern Asia (271,416) and South-Central Asia (264,309). In addition, even though Asia is in the initial stages of the smoking epidemic, the continent already accounted for 60% of incident cases and 62% of all LC deaths in 2020. If current rates persist in the future, there will be 2.4 million new cases and 2.2 million deaths in Asia due to LC in 2050. Therefore, anti-smoking campaigns and public awareness campaigns about health risks of smoking are urgently required to stop and reverse the smoking epidemic in Asia.

Today, molecular genetic studies are becoming an integral part of diagnosing the type and kind of oncological pathology in order to develop an optimal individual treatment plan for the patient.

In its fundamental review Saller J.J., Boyle T.A. [7], consecrated the current most clinically relevant aspects of thoracic molecular pathology. Historically, genomic alterations (GAs) that were considered drivers in LC were interrogated in panels using an à la carte approach with techniques such as Sanger sequencing, pyrosequencing, immunohistochemistry (IHC), and fluorescence in situ hybridization (FISH), which limited reportable GAs to select genes. Mutations in EGFR and translocations in the ALK gene and the ROS1 gene were the first three alterations recognized as clinically actionable drivers, and comprised the majority of the initial clinical genetic testing in LC. As the use of next-generation sequencing (NGS) became more cost-effective and widely used, it revealed additional actionable GAs. Evidence has accumulated to prove that NGS is an accurate technology with performance that is concordant or better than conventional methods. Advances in information about actionable GAs from comprehensive genomic profiling (CGP) has propelled precision medicine forward with the aim to provide evidence-based interpretation of GAs for targeted therapy. The increase in the number of genes and GAs covered by NGS has expanded the variety of GAs identified as actionable in LC. A shift toward NGS-based testing in advanced LC has decreased the number of LC cases where a driver is not identified. Increasingly, case reports describe patients with novel drivers identified by NGS that would not have been identified if they were evaluated solely by hotspot-based panels. The researchers point out that historically, LC was divided categorically into non-small-cell LC (NSCLC) (~85%) and small-cell LC (SCLC) (~ 15%) by pathologist review of hematoxylin and eosin (H&E) stained slides. NSCLC is a heterogeneous category of entities that includes lung adenocarcinoma (LUAD) as the most common histologic cancer type (~50%), squamous cell carcinoma of the lung (SqCCL) as the second most common type (~30%), large-cell lung carcinoma (LCLC) (~ 10%), and combinations of histologic phenotypes such as adenosquamous carcinoma (ASC), and rare histologic entities, such as atypical carcinoid (AC) tumor, bronchial gland carcinoma, and sarcomatoid carcinoma, collectively accounting for the remaining types of NSCLC (~ 10%). In clinical practice, LC patients typically undergo an initial biopsy to determine whether there are histomorphologic features on H&E that are able to diagnostically distinguish between NSCLC or SCLC. Performance of IHC typically will assist in determining the subtypes of NSCLC. IHC that favors NSCLC that is LUAD is typically positive for CK7 and TTF-1, and negative for p63, CK5/6, and p40. IHC that favors NSCLC that is SqCCL is typically positive for p63, CK5/6, and p40 and negative for TTF-1 and CK7. The art of establishing a diagnosis may be challenging as many pathologists are aware that, in practice, some tumors might not have «read the book» regarding conventional IHC staining patterns. In such cases, other special stains such as mucin can assist (e.g., mucin is typically positive for LUAD, and negative for SqCCL). ASCs are a rarely encountered tumor that is biphasic, meaning there is a component that is LUAD and a component that is SqCCL. These components by definition have at least 10% each of malignant squamous and glandular components. Neuroendocrine IHC markers (CD56, chromogranin, and synaptophysin) are typically positive for neuroendocrine carcinomas such as SCLC and LCLC. In NSCLC, the tumor proportion score (TPS) for PD-L1 as determined by IHC (e.g., PD-L1 IHC 22C3 pharmDx) assists in determining eligibility for immunotherapy. While tissue is submitted for NGS, rapid testing for mutations in EGFR, KRAS, and BRAF are selectively tested via a rapid method such as pyrosequencing, while rearrangements in ALK and ROS1 can be rapid identified via FISH. When NGS results are made available, these results can corroborate the results of rapid testing, and potentially provide other GAs that may be actionable targets.

Oncogenotypes are molecular alterations that include genomic mutations, alterations that cause dysregulation in mRNA expression, dysregulation in expression of miRs, and epigenomic changes. As NGS-based DNA sequencing has become increasingly available, the knowledge about different types of mutations that are potentially actionable beyond the genetic biomarkers with associated FDA-approved targeted therapies has expanded. An oncogene is a gene in which activating mutations confer gain-of-function to a gene, which ultimately promotes oncogenesis. Conversely, a tumor-suppressor gene is a gene in which inactivating mutations confer loss-of-function to a gene, which ultimately promotes oncogenesis.

In this paper, our colleagues detailed genomic, transcriptomic, epigenomic and proteomic differences between different histological types of LC relevant to research and therapeutic strategies [7].

Next, we will consider issues of early diagnosis of LC, including, of course, screening.

As noted, Lam S. et al. [8], low-dose CT (LDCT) screening for LC substantially reduces mortality from LC, as revealed in randomized controlled trials and meta-analyses. This review is based on the ninth CT screening symposium of the International Association for the Study of LC, which focuses on the major themes pertinent to the successful global implementation of LDCT screening and develops a strategy to further the implementation of LC screening globally. These recommendations provide a five-year roadmap to advance the implementation of LDCT screening globally, including the following: 1) establish universal screening program quality indicators; 2) establish evidence-based criteria to identify individuals who have never smoked but are at high-risk of developing LC; 3) develop recommendations for incidentally detected lung nodule tracking and management protocols to complement programmatic LC screening (LCS); 4) integrate artificial intelligence and biomarkers to increase the prediction of malignancy in suspicious CT screen-detected lesions; and 5) standardize high-quality performance artificial intelligence protocols that lead to substantial reductions in costs, resource utilization and radiologist reporting time; 6) personalize CT screening intervals on the basis of an individual's LC risk; 7) develop evidence to support clinical management and cost-effectiveness of other identified abnormalities on a LC screening CT; 8) develop publicly accessible, easy-to-use geospatial tools to plan and monitor equitable access to screening services; and 9) establish a global shared education resource for LC screening CT to ensure high-quality reading and reporting.

Barta J.A. et al. [9] in their work they emphasize that, lung nodules are frequently detected on LDCT scans performed for LC screening and incidentally detected on imaging performed for other reasons. There is wide variability in how lung nodules are managed by general practitioners and subspecialists, with high rates of guideline-discordant care. This may be due in part to the level of evidence underlying current practice guideline recommendations (primarily based on findings from uncontrolled studies of diagnostic accuracy). The primary aims of lung nodule management are to minimize harms of diagnostic evaluations while expediting the evaluation, diagnosis, and treatment of LC. Potentially useful tools such as LC probability calculators, automated methods to identify patients with nodules in the electronic health record, and multidisciplinary team evaluation are often underused due to limited availability, accessibility, and/or provider knowledge. Finally, relatively little attention has been paid to identifying and reducing disparities among individuals with screening-detected or incidentally detected lung nodules. At the same time, lung nodules may be identified on chest scans of individuals who undergo LC screening (screening-detected nodules) or among patients for whom a scan was performed for another reason (incidental nodules); although the vast majority of lung nodules are not LC, it is important to have evidence-based, standardized approaches to the evaluation and management of a lung nodule; the primary aims of lung nodule management are to diagnose LC while it is still in an early stage and to avoid unnecessary procedures and other harms.

In Kazakhstan, methods for improving the early diagnosis of such a formidable disease as LC are also being actively developed. Including this method [10]. The aim of this study was to present the baseline results of a pilot project conducted to evaluate the effectiveness of LC screening using LDCT in regions with excessive radon levels in the Republic of Kazakhstan. In total, 3671 participants were screened by low-dose chest CT. Current, former, and never-smokers who resided in regions with elevated levels of radon in drinking water sources and indoor air, aged between 40 and 75 with no history of any cancer, and weighing less than 140 kg were included in the study. All lung nodules were categorized according to the American College of Radiology Lung Imaging Reporting and Data System (Lung-RADS 1.0). Overall, 614 (16.7%) participants had positive baseline CT findings (Lung-RADS categories 3 and 4). Seventy-four cancers were detected, yielding an overall cancer detection rate of 2.0%, with 10.8% (8/74) stage I and a predominance of stage III (59.4%; 44/74). Women never-smokers and men current smokers had the highest cancer detection rates, at 2.9% (12/412) and 6.1% (12/196), respectively. Compared to never-smokers, higher odds ratios (OR) of LC detection were found in smokers (OR,2.48; 95% confidence interval [CI], 1.52 to 4.05, p<0.001) and former smokers (OR, 2.32; 95% CI, 1.06 to 5.06, p=0.003). The most common histologic type of cancer was adenocarcinoma (58.1%).

Ning J. et al. [11] in their study provide data showing that the prognosis of patients with LC at different clinical stages differs significantly. The five-year survival rate of stage IA groups can exceed 90%, while patients with stage IV can be less than 10%. Therefore, early diagnosis is extremely important for LC patients. This research focused on various diagnosis methods of early LC, including imaging screening, bronchoscopy, and emerging potential liquid biopsies, as well as volatile organic compounds,

autoantibodies, aiming to improve the early diagnosis rate and explore feasible and effective early diagnosis strategies. Let us dwell in more detail on endoscopic methods of diagnosing LC for verification of a malignant tumor. Nowadays, pathological diagnosis has been regarded as gold standard for diagnosing cancer. There are several methods for obtaining histological specimens, including bronchoscopy, ultrasound or CT-guided percutaneous lung biopsy. Among them, bronchoscopy has been developed rapidly and widely recognized in recent years. It not only expands the field of vision for diagnosis, but also improves the efficiency of diagnosis. So, the following types of endoscopic diagnostics of LC are distinguished:

1. White light bronchoscopy (WLB). It is mainly used for early detection and diagnosis of central LC, and the diagnosis rate can reach more than 95% in detecting high-grade dysplasia or worse. However, for some mucosal, submucosal early lesions and preneoplastic lesions, the diagnosis rate is very low.

2. Autofluorescence bronchoscopy (AFB). The operating principle of AFB is that different spectrum emerge in normal tissues, dysplasia and carcinoma in situ. As an important means for early detection of bronchial premalignant lesions, some studies have proposed that compared with sputum cytology, the sensitivity of AFB to detect hyperplasia and metaplasia was higher. Regardless of the results of sputum cytology, AFB can be recommended to high-risk patients. Moreover, when combined with spiral CT, sputum examination or WLB, AFB can obviously enhance the diagnosis rate of premalignant lesions and carcinoma in situ.

3. Narrow band imaging (NBI). NBI is an imaging technique that can visualize vascular morphology and mucosal structure. Analysis indicated that NBI has higher sensitivity (80%), specificity (84%), and diagnostic odds ratio (31.49%) than AFB when detecting premalignant airway lesions; NBI was also superior to WLB in detecting early and invasive LC, visual drawing of point blood vessel visual pattern highly supported adenocarcinoma histology of LC and tortuous vessels favored squamous cell cancer. Therefore, when examining lung-occupying lesions with NBI, not only can the diagnosis rate be improved, but also the pathological type can be evaluated initially. So, in the detection of early LC, NBI can be used as an effective method.

4. Endo-bronchial ultrasound (EBUS). EBUS combined with a special aspiration biopsy needle can be used for real-time ultrasound guided transbronchial needle aspiration biopsy, namely EBUS-TNAB. Compared with traditional diagnosis strategies, EBUS-TNAB can shorten the time for treatment decisions and may improve the survival of LC patients without increasing costs.

Now, regarding this pathology in our country at the republican level. The incidence of LC in the Republic of Kazakhstan in 2023 was 19.5 (30.6 - men; 8.8 - women) per 100 thousand population (20.1 - in 2022), which in absolute numbers amounted to 3873 people (3925 cases - a year earlier), taking the 2nd rank place in the general population, second, of course, only to breast cancer. The proportion of cases with a diagnosis established for the first time in life, recorded by oncological organizations was 10.5% (11.2% - in 2022). At the same time, 2974 men fell ill (proportion - 18.4%, 1 rank place), women - 899 (proportion - 4.3%, 9 rank place) [12]. The LC level is above the national average in 9 regions of the country: North Kazakhstan - 42.3 (the highest level); Karaganda - 36.5; East Kazakhstan - 34.6; Akmola - 32.6; Pavlodar - 32.5; Kostanay - 30.9; West Kazakhstan - 27.1; Abay - 24.3; Aktobe - 21.7. This indicator is below the national average in 11 regions: Turkestan - 8.4; (the lowest level); Mangistau - 9.5; the city of Shymkent - 10.6; Zhambyl - 11.5; Almaty - 13.6; Kyzylorda - 14.7; the city of Almaty - 15.1; Zhetysu - 15.9; the city of Astana - 16.4; Atyrau - 17.6; Ulytau - 18.1 regions per 100 thousand population. Mortality from this pathology was 10.3 (men - 16.7; women - 4.1) per 100 thousand population. In the structure of causes of death of persons of both sexes in 2023, this pathology continues to occupy a leading position (1st rank place), both in men, amounting to 23.7% (1626 people), and in the general population, amounting to 15.8% (2046 people). For women, this figure was 6.9% and 4th rank place.

The regions with the mortality rate from LC above the national average (10.3 per 100,000 population) are: East Kazakhstan - 22.4 (maximum level); Abay - 19.5; Pavlodar - 18.2; North Kazakhstan - 16.0; Karaganda - 15.5; Akmola and West Kazakhstan - 14.6; Kostanay - 11.6. The lowest rates were recorded in Turkestan - 4.0 (minimum level); Mangistau - 5.7; the city of Shymkent - 6.5; Atyrau - 6.7; Kyzylorda - 7.0; Almaty - 8.0; Aktobe - 8.4; Zhambyl - 8.9; Zhetysu - 9.2; in the city of Almaty - 9.4; Ulytau - 9.5; in the city of Astana - 10.1 regions per 100 thousand population [12].

The number of deaths from LC, not registered with oncological organizations and diagnosed posthumously in the Republic of Kazakhstan in 2023 amounted to 83 people; at the same time, the specific weight was 2.1% and this is the 5th rank place, as in the previous year.

At the same time, the one-year lethality rate was 37.2%, taking the 6th rank place among all nosological forms of malignant neoplasms. At the same time, the ratio between one-year lethality and

neglect (stage IV) was, as in 2022, 1.4. At the same time, we recall that the farthest from "1" is the worst ratio between the indicators of one-year lethality and neglect.

Now, regarding preventive examinations. It should be noted that during large-scale preventive examinations of the population in 2023, significantly more patients with malignant neoplasms were actively identified than in 2022. This is 25,193 patients versus 23,623 patients identified in 2022, i.e. +6.6%. This is due to the further abatement of the epidemiological situation with coronavirus and the increased availability of preventive care for the population. The proportion of patients identified during preventive examinations increased from 62.0% to 62.4% of the total number of patients identified per year.

As for LC, the early detection of this pathology during preventive examinations increased from 33.6 to 35.2%. The number of newly diagnosed LC patients registered with oncology organizations was 3,754 patients (3,821 patients in 2022). At the same time, the absolute number of LC patients identified during preventive examinations was 2,213 people (2,088 a year earlier), and the proportion was 59.0% and 54.6%, respectively. 779 people out of 2,213 are patients with stages I and II (in 2022 - 702 patients out of 2,088). The proportion of LC patients identified at early stages, as indicated above, was 35.2% versus 33.6 a year earlier.

Of course, when analyzing the epidemiological situation, early diagnosis indicators are very important issues. The regions where the proportion of patients with early stage I of the pathology in question is above the national average (9.5% - 8th place among the worst indicators together with malignant lymphomas) include the following: North Kazakhstan - 27.5% (the best indicator); Karaganda - 19.3%; Akmola - 13.4%; Ulytau - 12.5%; Astana city - 11.7%; Kyzylorda - 11.4%. West Kazakhstan region is on par with the national average. The lowest indicators of early diagnosis were recorded in Zhambyl and North Kazakhstan - only 2.2%; Atyrau - 2.4%; Aktobe - 3.0%; Abay - 4.2%; Mangistau - 5.5%; Almaty city - 5.6%; Kostanay - 6.0%; Almaty - 6.4%; Shymkent city - 7.1%; Pavlodar - 7.5%; East Kazakhstan - 8.2% and Zhetysu - 8.3% regions of the country [12].

Unfortunately, for a number of reasons, which include objective reasons, only every fourth patient with LC is detected in the early (I-II) stages of this pathology.

The regions where the proportion of patients with LC detected at stages I-II is above the national average (28.0% - 6th rank place "from the bottom") include the following regions. The uncontested leader is the North Kazakhstan region, where every second patient with this formidable disease is detected in the early stages (50.0%). Next come: Akmola - 36.2%; Aktobe - 35.1%; Kyzylorda - 35.0%; Zhetysu - 34.3%; Almaty city - 30.5%; West Kazakhstan - 29.1%; Astana city - 29.0% and Kostanay - 28.6% regions. Low rates of early diagnosis were recorded in Mangistau - 13.7% (the worst result in the country); Almaty - 15.8%; Turkestan - 16.2%; East Kazakhstan - 19.8%; Abay - 21.0%; Ulytau - 22.5%; Pavlodar - 24.7%; Karaganda - 25.2%; Shymkent city – 26.0%; Atyrau - 26.8% and Zhambyl - 27.3% regions [12].

As is clearly seen from the above data, there is a very large spread in early diagnostic rates across the country, from very good to dismal. Of course, it is necessary to take into account migration processes and other factors that affect early diagnostic rates, but nevertheless, the results obtained give reason not to stop there, both for oncologists and pulmonologists, general practitioners, since improving the rates of early diagnostics of malignant tumors, as one of the main postulates and one of the main tasks of medicine in general, continues to be relevant today. The proportion of stage IV LC among all nosological forms of malignant neoplasms was 26.5%. Unfortunately, in this indicator, LC is higher than all other localizations, second only to pancreatic cancer. At the same time, as was said above, the proportion of patients with LC detected at stages I-II was 28.0%, which indicates that the overwhelming majority of patients with LC were detected at locally advanced with loco-regional lesions - stage III of the disease. This stage was 45.5%, i.e. almost half of all patients, and we know what aggressive, often complex treatment is used for such a spread of the oncological process and what a disappointing prognosis is for these patients.

As for the average republican indicator of the proportion of stage IV (26.5%), against this background, Turkestan - 46.4%; Abay - 43.4% and Ulytau - 40.0% regions stand out. They are followed by: Akmola - 35.0%; Karaganda - 33.8%; the city of Astana - 33.2%; Zhetysu - 32.4%; Kostanay - 31.9% and other regions. The lowest proportion of stage IV LC was noted in the North Kazakhstan region, where this figure was 12.6% [12].

The morphological verification rate of the disease in the country was 77.2%. The leaders in this aspect with a 100% rate are Zhambyl and Ulytau regions; then come Almaty (92.6%), Atyrau (90.2%), the city of Shymkent (87.4%), the city of Astana (84.6%), Karaganda (84.5%), Turkestan (84.4%), Abay

(83.2%), Kostanay (83.1%), East Kazakhstan (78.0%) regions. Aktobe region is on par with the national average. This indicator is below the national average in the following regions: Kyzylorda (37.4% - the worst indicator in the republic), the city of Almaty (54.8%), Pavlodar (65.7%), Akmola (68.3%), Mangistau (71.2%), North Kazakhstan (74.8%), Zhetysu (75.0%) and West Kazakhstan (76.0%) regions [12].

The total number of patients with malignant neoplasms registered with specialized oncology organizations of the republic continued to grow and by the end of 2023 amounted to 218,186 people, with an increase of 6.0% compared to the level of the previous year (2022 - 205,822, +5.8%). The overall incidence rate of malignant neoplasms increased by 3.9%, from 1055.3 to 1096.4 per 100 thousand people. The growth of this indicator is due to both the increase in the incidence and detection of pathology, and the increase in the survival rate of cancer patients. In addition, statistical data on patients diagnosed with malignant neoplasms, who have been under observation for 5 years or more and continue to be observed in 2023, showed that the number of patients under observation by oncological organizations in Kazakhstan for over five years continued to grow and at the end of the reporting year amounted to 117,616 people, with an increase of 6.2% (2022 - 110,790 people, +6.6%) (form No. 7).

One cannot ignore such an important clinical aspect as the coverage in the Republic of Kazakhstan of special treatment for patients diagnosed with LC for the first time in their lives. In 2023, the number of hospitalizations for all nosological forms of malignant tumors in oncological organizations of the country amounted to 108,252 cases (2022 - 101,095), with an increase of 7.1% compared to the previous year, which is associated with a constant increase in the number of cancer patients, improvement of the standardization of oncological care, and the development of palliative and restorative services. At the end of 2023, the absolute number of patients with LC who completed specialized treatment was 1,448 people, continuing treatment - 1,102 patients. In percentage terms, the following results were obtained by methods and types of treatment. Only 21.3% of patients received surgical treatment, only radiation - 4.6%, only drug treatment - 25.0%, combined - 3.2%, complex - 38.0% and chemo-radiation - 5.6%.

Further, regarding the five-year survival rate of patients. As for LC, at the end of 2023, 7,119 people or 35.8 per 100 thousand of the population were registered with the dispensary. At the end of 2022, there were 6,702 patients or 34.4 per 100 thousand of the population, respectively.

At the same time, the mortality rate of the observed contingents in 2023 decreased compared to the previous year and amounted to 28.7% in 2023 (31.6% in 2022).

The five-year survival rate of patients with LC was 55.4% in 2023 and 55.3% in 2022 [12].

Summarizing the above, we can conclude that LC, along with breast cancer, continues to firmly occupy a leading place from year to year among all existing malignant tumors of other localizations. At the same time, taking into account a number of factors, the indicators of early diagnosis do not allow oncologists to "sleep peacefully", since the locally advanced stage III, which significantly prevails over all stages, in addition to the prevalence itself, gives a large number of complications due to the location of vital centers and tissue structures near the primary focus and locoregional metastases. Variability and veiling of symptoms, their similarity with various non-core processes, leads to neglect of the disease. All this requires both oncologists and, first of all, primary health care workers and, of course, pulmonologists, phthisiologists to increase the level of oncological alertness, inform the population about early symptoms that may indicate this pathology or the onset of proliferative changes and conduct high-tech diagnostic measures, including for the purpose of differential diagnosis and, as a result, timely treatment. People from the risk group are recommended to visit a pulmonologist annually and, if necessary, undergo an examination. Epidemiological assessment of the situation with LC in our country suggests that there are sometimes significant differences in the regions not only in incidence rates, but also in the parameters of early diagnosis and mortality from this pathology. In connection with the above, this pathology continues to be a serious problem of modern clinical oncology.

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Pedagogical sciences

FORMATION OF STUDENTS' PROFESSIONAL COMPETENCE IN TEACHING ENGLISH THROUGH CRITICAL THINKING

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Abstract

This study looks at how critical thinking helps pre-service English language teachers become more competent professionals. Critical thinking is crucial for English instructors in today's varied and quickly changing educational environment because it allows them to reflect, adjust, and make well-informed judgments that improve their efficacy as teachers. This study investigates how incorporating critical thinking into teacher education programs helps prepare aspiring English teachers with vital competencies like reflective practice, problem-solving, decision-making, and flexibility. The effect of critical thinking on the professional development of pre-service teachers was evaluated using a mixed-methods approach that included surveys and interviews.

The results emphasize the value of critical thinking in developing thoughtful, flexible, and self-assured English teachers. Time restrictions and a lack of organized pedagogical frameworks are two of the difficulties educators encounter when incorporating critical thinking into ELT programs, according to the research. The need for curriculum reform, professional development, and improved critical thinking resources in ELT training programs are highlighted in the recommendations for resolving these issues.

Keywords: *critical thinking, professional competence, English language teaching, reflective teaching, problem-solving, decision-making, pre-service teacher education, pedagogical adaptation.*

Introduction

In the context of globalization, where the capacity to instruct a varied student body is crucial, the professional competency of English language instructors is becoming more and more significant. English teachers need to have a variety of abilities in addition to language proficiency, such as critical thinking, reflective teaching, problem-solving, and decision-making. These abilities are essential for handling difficulties in the classroom as well as creating a positive learning atmosphere where students are motivated to interact meaningfully with language.

The ability to methodically assess information, challenge presumptions, and take into account many viewpoints is known as critical thinking, and it has emerged as a key component of contemporary teaching methods. Critical thinking helps teachers in the field of English language teaching (ELT) to evaluate classroom dynamics, modify their methods to accommodate the varied requirements of their students, and encourage higher-order thinking about language and its usage. Additionally, critical thinking helps teachers reflect on their teaching methods, modify their methods in response to student input and learning objectives, and keep refining their methods.

This study looks into how critical thinking helps pre-service English teachers become more competent professionals. It looks at how critical thinking supports fundamental teaching abilities such lesson planning, classroom management, flexibility, and reflective practice. The study seeks to offer a thorough grasp of the influence of critical thinking on ELT by tackling the following research questions:

1. How does critical thinking contribute to the development of professional competence in English language teaching?

2. What challenges do educators face in incorporating critical thinking into pre-service ELT training programs?

3. How can teacher education programs be restructured to prioritize critical thinking and foster reflective practice among future English teachers?

Literature Review

In educational theory, critical thinking has been extensively studied, and its significance in teacher preparation has been widely recognized (Brookfield, 2012; Paul & Elder, 2014; Ennis, 2011). Using important research and theoretical frameworks that investigate how critical thinking shapes reflective and adaptable teachers, this review looks at the connection between professional competence and critical thinking in the context of teaching English.

Critical Thinking and Reflective Practice in ELT

One of the most important components of professional competency in English language instruction is reflective practice. The idea of the "reflective practitioner," first proposed by Schön (1983), highlights the significance of teachers continuously evaluating their methods in order to enhance instruction and adjust to shifting classroom conditions. Reflective practice in ELT entails teachers evaluating their own classes' efficacy, comprehending the elements that go into successful language acquisition, and modifying their methods as needed to improve student outcomes.

Because it allows instructors to assess their teaching strategies, challenge their presumptions, and consider different teaching philosophies, critical thinking is essential to the development of reflective practice. According to Brookfield (2012), critical thinking enables educators to go beyond memorization and approach language instruction in a more deliberate and engaging manner. Strong critical thinking abilities increase a teacher's likelihood of reflecting on their experience, identifying areas for growth, and putting those changes into practice to improve student outcomes.

Reflective practice is especially crucial in the context of ELT since language acquisition is a dynamic and intricate process that calls for teachers to be flexible and sensitive to the requirements of their students. Teachers who practice reflection are better able to establish inclusive learning environments, accommodate the varied language origins of their students, and cultivate a critical inquiry culture in the classroom.

Critical Thinking and Problem-Solving in Language Teaching

Another essential element of professional competence in ELT is problem-solving. In the classroom, teachers frequently deal with a variety of issues, such as controlling disruptive behavior and addressing the pupils' varying levels of language competency. Teachers can address these problems methodically by using critical thinking to weigh various viewpoints and potential answers before making conclusions.

Effective problem-solving requires critical thinking because it pushes educators to examine issues in-depth, think through potential solutions, and base their judgments on logic and facts (Paul and Elder, 2014). This means that in order to enhance language acquisition, teachers must be able to analyze the requirements of their students, determine which teaching methods work best, and modify their lessons accordingly.

For instance, a teacher must choose between grouping pupils according to ability or mixing them together to promote peer learning in a classroom where students have different degrees of language proficiency. The teacher can make an informed choice that best supports student achievement by using critical thinking to analyze the advantages and disadvantages of each strategy, take into account the possible effects on learning outcomes and student engagement, and more.

The Role of Critical Thinking in Teacher Education

Teacher education programs play a critical role in developing the professional competence of future educators, and the integration of critical thinking into these programs is essential for preparing teachers to meet the demands of modern classrooms. Nonetheless, studies indicate that teacher preparation programs may fail to adequately emphasize critical thinking (Abrami et al., 2015). Rather, a lot of teacher preparation programs place more of an emphasis on teaching strategies and material understanding than they do on cultivating the critical thinking abilities necessary to evaluate and modify ways of learning

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According to Abrami et al. (2015), in order to better prepare aspiring educators for the demands of the classroom, critical thinking skills development should be given top priority in teacher education programs. Critical thinking can be incorporated into theoretical coursework and hands-on teaching experiences to accomplish this. For instance, greater opportunities for pre-service teachers to critically reflect on their teaching methods, examine case studies of difficult classroom situations, and take part in conversations that promote critical thinking about pedagogical techniques may be incorporated into teacher education programs.

Furthermore, more detailed guidance on how to teach pupils to think critically should be included in teacher education programs. According to research by Paul and Elder (2014), educators who have received training in critical thinking pedagogy are better equipped to cultivate an environment of inquiry and reflection in their classrooms, which in turn encourages students to consider the language they are learning and its application in authentic contexts.

Methods

Research Design

This study utilized a mixed-methods approach to investigate how pre-service English teachers develop their professional competence through critical thinking. Because it enables the gathering of both quantitative and qualitative data, the mixed-methods approach is intended to provide a more thorough understanding of the ways in which critical thinking enhances professional competence in ELT.

Pre-service English teachers were given a survey as part of the study's quantitative component to gauge their opinions on critical thinking and how it helps them improve as teachers. Semi-structured interviews with ELT educators made up the qualitative component, which offered deep insights into the difficulties teachers encounter while imparting critical thinking skills and how it is incorporated into teacher education programs.

Participants

50 ELT educators who taught pedagogical courses and 200 pre-service English teachers from various teacher education programs participated in the study. The pre-service teachers were selected because they were enrolled in courses that focused on using critical thinking to build professional competence. The ELT teachers were chosen based on their background in curriculum-based critical thinking instruction. This varied group of participants made sure that the results included a wide variety of viewpoints regarding the function of critical thinking in ELT.

Instruments

*1. **Surveys**: The survey administered to pre-service teachers included questions designed to assess their perceptions of critical thinking and its contribution to their professional competence. The survey asked respondents to rate their confidence in various aspects of teaching, including problem-solving, decision-making, classroom management, and reflective practice, and to describe how critical thinking activities had influenced their development as educators.*

*2. **Interviews**: Semi-structured interviews with ELT educators were conducted to explore their experiences and challenges in teaching critical thinking. The interview questions focused on how educators incorporate critical thinking into their courses, the obstacles they face in doing so, and their perceptions of how critical thinking supports the professional development of pre-service teachers.*

Research Procedure

Pre-service teachers received the survey electronically, and an online platform was used to gather their answers. Depending on the participants' availability, either in-person or video conference interviews with ELT educators were conducted. To find important trends and insights into the teaching of critical thinking in ELT programs, the qualitative data from the interviews was thematically examined, while the quantitative data from the questionnaires was subjected to descriptive statistics.

Results

Students' Perceptions of Critical Thinking and Professional Competence

Pre-service English teachers overwhelmingly acknowledged the value of critical thinking in advancing their professional competence, according to the survey results. 90% of all the 200 respondents said that their teacher education program's critical thinking activities enhanced their capacity to resolve issues in the classroom and modify their pedagogical approaches to accommodate a variety of student demands. Furthermore, 88% of participants said that critical thinking enabled them to choose more appropriate teaching methods for students with different levels of language competency, especially when it came to language education.

One respondent, a pre-service teacher in an urban middle school, noted:

"Critical thinking activities really helped me develop my ability to assess classroom situations and make decisions on the spot. For example, when a lesson wasn't going well, I was able to reflect on why and make adjustments in real time. That kind of flexibility is something I hadn't fully appreciated before."

The results of the survey also showed that pre-service instructors were more assured of their capacity to evaluate their methods and modify them in response to student input. According to almost 85% of respondents, critical thinking activities prompted them to practice reflection, which they believed was crucial to enhancing their ability to teach.

75% of respondents said that critical thinking aided them in coming up with plans for controlling student conduct and fostering a supportive learning environment in the classroom.

One participant explained:

"Critical thinking made me more aware of how different students respond to different teaching methods. Instead of just reacting to disruptions, I started thinking about the underlying reasons for student behavior and how I could adjust my teaching to keep everyone engaged."

These findings suggest that critical thinking not only enhances pre-service teachers' pedagogical skills but also fosters a sense of confidence and flexibility crucial for managing the complexities of the classroom.

Educators' Experiences with Teaching Critical Thinking

According to ELT educators interviewed, there is broad agreement regarding the value of critical thinking in fostering professional competence. Critical thinking is crucial for equipping aspiring English teachers to fulfill the demands of the contemporary classroom, according to all 50 instructors. But a lot of teachers also pointed out that incorporating critical thinking into their curricula might be very difficult.

The lack of time to devote to critical thinking was one of the most commonly mentioned difficulties. The need to cover a lot of material in teacher preparation programs, which frequently left little time for critical thinking exercises, was a source of irritation for many educators. As one educator explained:

"We're expected to cover so much material—language theory, pedagogy, classroom management—and it feels like critical thinking is always at risk of being sidelined. But in reality, it's one of the most important things we can teach our students."

The absence of organized frameworks for teaching critical thinking was another issue that educators highlighted. Although many acknowledged its significance, respondents said there were insufficient tools or guidelines to support them in properly teaching these skills. As one educator noted:

"We know that critical thinking is important, but there aren't always clear guidelines on how to teach it in a way that's meaningful for our students. We need more support in terms of professional development and resources to help us integrate critical thinking into our courses."

Despite these obstacles, the majority of educators concurred that critical thinking is essential to producing analytical, flexible, and self-assured English teachers. Strong critical thinking abilities were linked to increased reflective practice, proactive problem-solving, and the ability to modify teaching strategies to suit the requirements of their pupils, according to numerous reports.

Challenges in Incorporating Critical Thinking into ELT Curricula

Despite the obvious benefits of critical thinking in ELT, the study found a number of obstacles to its incorporation into programs for teacher preparation. Lack of time to devote to critical thinking exercises was one of the most commonly mentioned difficulties. Many educators voiced their worry that there was frequently little opportunity for critical thinking in teacher preparation programs due to the obligation to cover a wide range of material.

The absence of organized frameworks for teaching critical thinking in the context of ELT was another major obstacle. Teachers pointed out that although there is a lot of research on the value of critical thinking, there isn't much specific advice on how to effectively teach these abilities in language classes. This disparity suggests that more materials and chances for professional growth that emphasize critical thinking pedagogy are required.

Discussion

The results of this study emphasize the important part critical thinking plays in helping pre-service English instructors become more competent professionals. Critical thinking is essential to effective teaching practices in an increasingly complex and diverse educational environment, as evidenced by the overwhelming acceptance of its value among educators and pre-service teachers.

Enhancing Pedagogical Skills and Confidence

The findings show how vital critical thinking activities are for improving pre-service teachers' confidence and pedagogical abilities. A more flexible and responsive teaching workforce may result from incorporating critical thinking into teacher education, evidenced by the observed gains in their capacity to address issues in the classroom, modify their teaching strategies, and reflect on their work. This is consistent with previous research that highlights the value of critical thinking in developing productive reflective practice (Brookfield, 2012; Schön, 1983).

Addressing Challenges in Curriculum Integration

Significant obstacles still stand in the way of incorporating critical thinking into ELT programs, despite its well-recognized importance. Many teacher education programs may place more emphasis on content delivery than the development of critical thinking abilities, as seen by the worries around time

limits and the lack of formal frameworks. This runs the danger of marginalizing critical thinking in favor of more conventional teaching strategies, as the interviews made clear.

Reforming teacher education programs to make critical thinking a core part of the curriculum is necessary to address these issues. In order to effectively teach critical thinking in the context of language instruction, educators must have access to professional development materials. In order to improve pre-service teachers' capacity to promote reflective and adaptable behaviors in their future classrooms, educators should better support the incorporation of critical thinking into their courses by creating explicit norms and frameworks.

Fostering Reflective Practice and Adaptability

The findings of the study further demonstrate how critical thinking encourages reflective practice and flexibility, both of which are essential to promote effective teaching. Creating inclusive and productive learning environments is facilitated by pre-service teachers' capacity to evaluate students' needs and modify their teaching methods in response to reflective evaluation. As teachers become more receptive to the varied backgrounds and learning styles of their pupils, this flexibility not only helps the teachers but also improves student engagement and achievement.

In this regard, developing capable, introspective, and flexible teachers requires incorporating critical thinking into English language teacher education. Educational institutions must give critical thinking top priority in their curricula and offer strong support to teachers so they can effectively teach these essential skills in order to overcome the difficulties this study has revealed. The long-term impacts of critical thinking on professional competence and the best ways to successfully integrate it into teacher education programs require more investigation.

Conclusion

The findings indicate that professional competence in English language teacher education is developed through critical thinking. Pre-service teachers develop their problem-solving skills, classroom adaptability, and capacity to manage the complexity of varied educational situations through critical thinking exercises. The importance of integrating critical thinking into teacher preparation programs is demonstrated by data from surveys and educator interviews.

A number of obstacles need to be addressed before critical thinking may be completely included into teaching methods. To properly teach these abilities, educators require more tools, training, and assistance, and educational institutions have to include space in their curricula for critical thinking exercises. Teacher education programs can better equip aspiring teachers to succeed in their careers by addressing these issues.

The subsequent research should concentrate on pinpointing precise methods to get beyond these obstacles, like creating organized frameworks for teaching critical thinking that are flexible enough to be used in many settings. The long-term effects of critical thinking on teachers' professional achievement also require more research, especially in regards to their efficacy and flexibility in a quickly evolving educational environment. Both teachers and students stand to gain from an understanding of this relationship, which can offer insightful information for curriculum creation and pedagogical methods.

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THE ROLE OF DUOLINGO IN EFL VOCABULARY LEARNING

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Abstract

This theoretical article explores the role of Duolingo in EFL vocabulary learning, focusing on its motivational and pedagogical impact from the learners' perspective. Drawing on recent research conducted in diverse EFL contexts, the discussion highlights how Duolingo has gamified structure, accessibility, and integration of repetition-based tasks contribute to increased learner engagement and vocabulary retention. Key studies reveal that learners value Duolingo for its user-friendly interface, emotional encouragement through rewards, and its potential to reinforce classroom vocabulary through self-paced mobile practice. While not a substitute for formal instruction, Duolingo appears to function as a meaningful supplementary tool for vocabulary mastery, particularly when supported by teacher guidance and aligned with curricular goals.

Introduction

Vocabulary acquisition remains one of the most fundamental and challenging aspects of English as a Foreign Language (EFL) instruction. In traditional classroom settings, limitations such as time constraints, curriculum rigidity, and student anxiety often hinder vocabulary retention and active use. As mobile-assisted language learning (MALL) gains momentum, platforms like Duolingo are increasingly being adopted by students and teachers as tools to address these challenges.

Duolingo, one of the most widely used language-learning platforms, provides learners with an interactive and gamified environment for vocabulary practice through tasks like translation, matching, and listening. Its appeal lies in its accessibility, user-friendly interface, and motivational features such as streaks and rewards. These elements have been reported to enhance learner engagement and foster autonomous learning habits outside the classroom (Jaelani & Sutari, 2020; Almusharraf, 2020).

Recent studies have sought to understand how learners experience Duolingo not only as a vocabulary tool but also as part of their broader language learning strategies. Research by Anggraeni and Degeng demonstrated that learners responded positively to Duolingo's capacity to support vocabulary mastery through engaging features, intuitive access, and interactive feedback mechanisms. Their findings emphasize that learners particularly appreciated the gamified format, which incorporated translation, matching, fill-in-the-blank, and pronunciation tasks and elements that made vocabulary practice feel more enjoyable and accessible. Importantly, many students in their study associated Duolingo with reduced anxiety and increased motivation, viewing it as a tool that allowed for repeated exposure to relevant vocabulary in a familiar and low-pressure environment (Anggraeni & Degeng, 2024).

This insight is significant in light of Duolingo's design philosophy, which prioritizes independent learning through repetition and immediate correction. However, while the authors affirm the tool's motivational benefits, their study also reveals potential limitations in long-term learner engagement due to repetitive task formats and external distractions from mobile device use. This suggests that although learners report enthusiasm in the early stages, sustained motivation may require external structuring or blended approaches.

Building on this idea, Linh and Yen argue that such digital tools cannot fully replace guided instruction and must be strategically embedded into the curriculum to support meaningful learning. In their view, Duolingo's value increases when teachers actively scaffold students' use of the platform, encourage reflection, and align app activities with lesson objectives. Their study among high school teachers in Vietnam underscores the importance of equipping learners with strategies for self-monitoring, vocabulary goal setting, and evaluation. Without this mediation, the risk of shallow or passive engagement increases significantly (Linh & Yen, 2022).

From a critical perspective, this highlights an essential distinction between autonomy and unsupported self-direction. While Duolingo fosters a sense of learner control, true autonomy as defined in contemporary language pedagogy depends on the ability to make informed decisions, evaluate progress, and apply knowledge beyond the digital space. Therefore, the teacher's role remains central in helping learners transfer in-app vocabulary knowledge into authentic communication contexts. The findings of Linh and Yen serve as a timely reminder that digital tools must be integrated not only technically, but also pedagogically.

Complementing these perspectives, Tahir and Tafat explored students' attitudes toward Duolingo in an Algerian university context. Their qualitative findings revealed that learners overwhelmingly perceived the app as a motivating and user-friendly tool. Students reported that the app's reward system, progress tracking, and short daily tasks supported habit formation and vocabulary consistency, especially in contrast to traditional textbook-based instruction. However, the researchers also noted that learners viewed Duolingo as a supplementary method rather than a comprehensive replacement for formal language learning. Many participants indicated that although the app was helpful for memorizing words, it lacked the depth needed for advanced grammar or nuanced language use (Tahir & Tafat, 2021).

Critically, this aligns with the broader discourse on gamified language learning tools: while they succeed in promoting frequency and exposure, they often fall short in fostering deeper linguistic competence unless supplemented by teacher-led instruction or peer interaction. In our context, this is particularly relevant for Kazakhstani high school learners, where motivation to engage in autonomous learning varies widely and classroom integration remains the key factor influencing learning outcomes. Therefore, it becomes clear that Duolingo's effectiveness lies not in its standalone design, but in how educators and learners co-construct its use as part of a broader learning strategy.

1. Duolingo and Gamification in Vocabulary Practice

Gamification has become a widely recognized strategy in language learning tools, and Duolingo exemplifies this trend through its reward-based learning design. According to Almusharraf (2021), gamified learning environments promote intrinsic motivation by offering low-stress, repetitive exposure to new vocabulary. Through daily streaks, XP points, and in-app achievements, Duolingo encourages students to engage with vocabulary regularly and independently. This sense of accomplishment and continuous progress is central to maintaining learner interest, particularly for younger or beginner-level users.

Duolingo's interface further enhances motivation by visually representing achievement and providing instant feedback. Unlike traditional classroom settings, where correction might induce anxiety or embarrassment, the app normalizes errors as part of the learning process. This safe digital environment promotes a more resilient learner mind-set and supports experimentation with unfamiliar vocabulary items.

Moreover, the gamified experience reinforces habit formation through short, frequent interactions. Learners can complete lessons in under ten minutes, making it easier to maintain daily practice. The sense of routine, combined with the rewarding system, helps embed vocabulary through spaced repetition. This has been shown to significantly improve retention, particularly when learners receive immediate feedback and can retry incorrect answers without penalty. The playful and challenge-based structure of Duolingo also aligns well with current educational psychology models, which highlight the role of dopamine-driven reward systems in sustained learning behaviours.

In addition, competitive elements such as leader boards and weekly challenges foster social motivation, especially among adolescent learners. Friendly competition with classmates or global users adds an extra layer of engagement, encouraging students to persist and return to the app consistently. These features create not just a learning task, but also a motivational cycle—where effort is visibly rewarded and improvement becomes tangible.

Together, these gamification principles contribute to an environment where vocabulary practice is not only consistent and repetitive but also emotionally rewarding and behaviourally sustainable. The success of Duolingo in this context illustrates the broader pedagogical potential of game-informed digital design for foreign language vocabulary acquisition.

2. Learner Autonomy and Personalized Practice

Another advantage of Duolingo lies in its support for autonomous learning. Jaelani and Sutari (2020) emphasize that Duolingo's design allows users to select topics of interest, revisit lessons, and set personal goals all key components of learner autonomy. As a result, learners are more likely to develop regular language habits and take ownership of their vocabulary-learning journey.

Tahir and Tafat (2021) report that students appreciated being able to learn at their own pace without the pressure of classroom timelines. They highlight that this flexibility is particularly valuable for learners who struggle with traditional instructional methods or who feel discouraged in competitive class environments. While autonomy is not equally effective for all learners, those with strong self-regulation skills appear to benefit the most from Duolingo's independent learning structure.

Moreover, Duolingo provides frequent feedback and progress indicators such as crowns, completion bars, and strength meters. These features not only guide learners through their own learning paths but also encourage regular self-evaluation. For many students, this independence fosters greater

persistence, as they are not dependent on teacher validation or classroom pacing. The app also allows for repeated exposure to vocabulary in varied forms, enabling learners to spend more time on difficult areas without fear of falling behind their peers.

However, learner autonomy is not without its challenges. As noted by both Jaelani and Sutari (2020) and Tahir and Tafat (2021), some students may lack the self-discipline or digital literacy to maintain consistent engagement on their own. For this reason, teacher scaffolding or blended learning models may be essential in supporting students who are new to autonomous digital learning. Nonetheless, when autonomy is matched with appropriate support, Duolingo can be a powerful tool in building learner independence and enhancing vocabulary acquisition.

3. Integration with Formal EFL Instruction

Although Duolingo functions as a stand-alone tool, its greatest impact may be realized when integrated with formal classroom instruction. Linh and Yen (2021) stress the importance of teacher mediation in guiding Duolingo use and aligning it with curricular goals. They argue that while the app provides foundational exposure to vocabulary, its pedagogical effectiveness increases when combined with communicative classroom tasks that promote active language production.

Teachers can enhance the app's value by incorporating Duolingo vocabulary into speaking or writing exercises, or by encouraging reflection through vocabulary journals and discussion. This dual approach bridges the gap between passive digital learning and meaningful language use. Moreover, the teacher's role in monitoring student progress and addressing misconceptions ensures that mobile learning remains focused and relevant.

Furthermore, integrating Duolingo into classroom instruction allows educators to address the app's limitations. For example, Duolingo often lacks authentic conversational context or topic alignment with national curricula. Teachers can contextualize vocabulary introduced in Duolingo through role-play activities, storytelling, and project-based tasks that provide deeper cognitive engagement. As Linh and Yen (2021) point out, such integration strengthens vocabulary transfer from recognition in the app to production in real-life communication.

Additionally, coordinated use of Duolingo across units or grade levels can create a coherent vocabulary development plan. By assigning specific modules aligned with classroom content—such as "Environment" during a science-integrated unit—teacher's foster cross-curricular reinforcement. This strategic use transforms Duolingo from an individual tool into a shared learning experience that connects home-based learning with in-class performance.

Collaborative reflection activities, such as peer vocabulary games, classroom Duolingo leader boards, or student-led vocabulary mini-lessons, can further enrich the app's classroom integration. When used this way, Duolingo supports not only independent language acquisition but also a more dynamic and interactive classroom culture.

4. Learners' Perception and Emotional Experience

Recent studies also emphasize the positive emotional impact of Duolingo on EFL learners. Anggraeni and Degeng (2024) found that students associate Duolingo with enjoyment, ease, and reduced learning anxiety. The gamified structure and character-based feedback were described as encouraging and even entertaining, transforming vocabulary practice into a low-pressure experience.

These findings are important because emotional engagement plays a key role in vocabulary acquisition. Learners who enjoy the process are more likely to persist, explore, and take risks in language use. The shift from obligatory memorization to enjoyable repetition contributes to deeper vocabulary retention and more application that is confident.

Conclusion

Theoretical perspectives from recent literature indicate that Duolingo offers valuable support for EFL vocabulary learning, particularly through its motivational design, learner autonomy, and potential for classroom integration. While it cannot replace comprehensive instruction, Duolingo functions effectively as a supplementary tool that promotes engagement, repetition, and emotional involvement. To maximize its benefits, educators should consider combining its use with guided classroom practice and reflective tasks. By doing so, they can create a more balanced learning environment that supports both independent learning and communicative competence.

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INGLIZ TILI TA'LIMINING TRANSFORMATSIYASI VA LEKSIKANI O'RGATISHDA RAQAMLI TEXNOLOGIYALARNI AHAMIYATI

Madmusayev Jaxongir Muxtorali o'g'li
Namangan davlat universiteti tayanch doktoranti

Abstract

This article analyzes the transformation of English language education in higher educational institutions and the significance of digital technologies in teaching vocabulary. The author emphasizes the necessity of shifting from traditional knowledge-based approaches to innovative pedagogical methods that are development-oriented and student-centered. The article also provides specific practical recommendations for effective English language instruction in a digital environment, highlighting the advantages of digital technologies in enhancing vocabulary acquisition, pronunciation, and communication skills. Furthermore, the role of multimedia and interactive resources in increasing motivation and interest in learning English is examined.

Abstract

Ushbu maqolada oliy o'quv yurtlarida ingliz tili ta'limining transformatsiyasi va leksikani o'qitishda raqamli texnologiyalarning ahamiyati tahlil qilingan. Muallif ingliz tili ta'limida an'anaviy bilimlarga asoslangan yondashuvdan rivojlanishga asoslangan, talabalarni markazga qo'yuvchi innovatsion pedagogik usullarga o'tish zarurligini ta'kidlaydi. Shuningdek, maqolada ingliz tilini raqamli muhitda samarali o'qitish bo'yicha aniq amaliy tavsiyalar beriladi, raqamli texnologiyalarning lug'at boyligini oshirish, talaffuz va muloqot ko'nikmalarini rivojlantirishdagi afzalliklari ko'rsatiladi. Bundan tashqari, multimedia va interaktiv resurslarning ingliz tilini o'rganishdagi motivatsiya va qiziqishni oshirishdagi roli tahlil qilinadi.

Keywords: *English language education, vocabulary teaching, digital technologies, university education, pedagogical transformation, interactive learning, multimedia.*

Kalit so'zlar: *ingliz tili ta'limi, lug'at o'qitish, raqamli texnologiyalar, universitet ta'limi, pedagogik transformatsiya, interaktiv o'qitish, multimedia.*

KIRISH

Oliy o'quv yurtlaridagi ta'lim faoliyatining muhim tarkibiy qismi bo'lgan ingliz tili ta'limi keng qamrovga ega bo'lib, ko'p sonli talabalarni o'z ichiga oladi. Uning ta'lim samaradorligi nafaqat talabalar uchun akademik o'sish va kelajakdagi rivojlanishga bog'liq, balki universitetning obro'si va uzoq muddatli rejalariga ham ta'sir qiladi. Shu sababli, barcha oliy o'quv yurtlari raqamli texnologiyalarni universitet ingliz tili ta'limida qo'llashga katta ahamiyat berishmoqda, ayniqsa COVID-19 pandemiyasi boshlangandan beri universitetlarda ingliz tili raqamli ta'limi amaliyoti yanada kengaytirilmoqda. Ammo afsuski, tegishli tadqiqotlar amaliyot bilan bir qatorda rivojlanmayapti. Bu narsa ingliz tili ta'lim faoliyatining chuqurlashuvini cheklaydi va ko'pchilik darslar yuzaki va oddiy takrorlashlarga yoki mexanik vazifalarga aylanadi hamda tezkor va samarali xulosa chiqarish yoki tahlil qilishdan mahrum bo'ladi.

TADQIQOT METODOLOGIYASI

Ushbu dissertatsiya ishi "Raqamli ta'lim muhitida talabalarga ingliz tili leksikasini o'rgatish metodikasi" mavzusi atrofida jamlangan bo'lib, quyidagi savollarni o'rganishga intiladi: Universitet ingliz tili ta'limining transformatsiyasining mohiyati nima? Universitet ingliz tili ta'limida raqamli texnologiyalarni qo'llashning aniq amaliyotlari qanday? Qanday qiyinchiliklarga duch kelinmoqda? Universitet ingliz tili ta'limidagi raqamli qo'llanmalarning asosiy omillari nimalardan iborat? Ushbu savollar nazariy tadqiqotlar bilan amaliy tajribalarni birlashtirishga qaratilgan bo'lib, universitet ingliz tili ta'limining muvaffaqiyatli transformatsiyasini amalga oshirish uchun asos va kafolatlardir.

ADABIYOTLAR TAHLILI

Universitet ingliz tili ta'limining o'zgarishi va uning raqamli mohiyatini o'rganar ekanmiz quyidagi fikr mulohazalarga to'xtalib o'tish zarurligini angladik. Universitet ingliz tili ta'limining o'zgarishi, ingliz tili ta'limining umumiy shaklida asosli o'zgarish va tuzatishlarni anglatadi. Xususan, qiymat yo'nalishi, ta'lim jarayoni va ta'lim munosabatlari universitet ingliz tili ta'limining o'zgarishini tushunish uchun uchta muhim o'lchovdir [1].

Universitet ingliz tili ta'limining o'zgarishi qiymat yo'nalishida bilimga asoslangan yondashuvdan rivojlanishga asoslangan yondashuvga o'tishni amalga oshirishni talab qiladi. O'tgan yillar davomida olib borilgan ta'lim amaliyoti shuni ko'rsatdiki, bilimga asoslangan ta'lim g'oyasi talabalar ijodiy fikrlash qobiliyatini ochishga yordam bermaydi, shuningdek, ta'lim munosabatlari va natijalari tezda o'zgarayotgan zamon talablariga javob bera olmaydi. Bunga nisbatan rivojlanishga asoslangan yondashuv nafaqat talabalar jismoniy va ruhiy rivojlanishini muhim deb biladi, balki ularning umrbod mustaqil o'rganish qobiliyatini ham shakllantirishni maqsad qiladi hamda talabalarning shaxsiy xususiyatlari va ehtiyojlariga qarab xilma-xil va individual ravishda rivojlanishni izlashni nazarda tutadi [2].

Ta'lim jarayonining o'zgarishi asosan uchta sohada:

- ta'lim subyektlarining tuzilishi pedagog/ustoz markazidan talaba markaziga o'tish;

- o'rganish holatini passiv qabul qilishdan faol o'rganishga o'tkazish;

- ta'lim modelini yagona modeldan ko'p qatlamli modelga aylantirish kabi bo'lishi mumkin.

Talabalar dars jarayonining egasi bo'lishi va faol tarzda mustaqil ravishda o'rganishi - bu ta'lim jarayonining markaziy jihati hisoblanadi. Ko'p qatlamli ta'lim modellarini qo'llash esa oxir-oqibatda ta'lim jarayonidagi o'zgarishni amalga oshirishning amaliy nuqtasi sifatida xizmat qiladi. Universitet ingliz tili ta'limi aslida tilni ishlab chiqish bilan bir qatorda madaniyatni ishlab chiqishni ham anglatadigan faoliyatdir [3].

Universitetda ingliz tili o'qitish amaliyotida raqamli texnologiyalar o'quv mazmuni, o'rganish resurslari, ta'lim usullari va baholash kabi sohalarda qo'llanilishi mumkin. Bu esa ta'lim faoliyatining muvaffaqiyatli o'tishiga va yaxshi ta'lim natijalariga erishishga yordam beradi.

O'qituvchilar darslik, taqdimot (PPT), testlar va boshqa ta'lim materiallarini raqamlashtirib, talabalarga yanada qulay o'rganish resurslarini taqdim etishi mumkin. O'qituvchilar dars mazmunini PPT yoki videoga aylantirib, har haftalik darslar, qo'shimcha o'qish materiallari, tinglov materiallari va og'zaki mashqlarni kiritishi mumkin. Bu esa talabalar uchun mavzularni qayta ko'rib chiqish va tartibga solishni osonlashtiradi. O'qituvchilar dars PPT yoki videolarini platformaga yuklab qo'yishi mumkin, bu esa talabalar ularni har doim ko'rib chiqib, o'rganishga imkon beradi. Shuningdek, internetdan dars bilan bog'liq sifatli resurslarni topish ham mumkin; masalan, O'zbekiston-Amerika dialogi rasmiy sayti tomonidan taklif etiladigan ingliz tilidagi tinglash va o'qish materiallari, BBC yangiliklari va CNN videolari kabi [4].

Lug'atni o'qitishda so'zlarning talaffuzi, yozilishi va foydalanishini o'yinlar va qiziqarli kontent bilan birlashtirish orqali so'zlarni o'rganishni zerikarli bo'lib qolishini oldini olish mumkin. Ba'zi universitetlar inglizcha so'zlarni o'rgatishda animatsiya va o'yinga asoslangan usullarni qo'llab-quvvatlaydi; bu esa talabalarning qiziqishini oshiradi hamda ularning bilimlarini mustahkamlashga yordam beradi. O'qituvchilar turli tilshunoslik dasturlari yoki ilovalardan foydalanib ovoz yoki tasvir asosida so'zlarni o'rganishga oid interaktiv darslar yaratishi mumkin; bunda ovoz tanib olish texnologiyasidan foydalangan holda talabalar uchun mustaqil nazorat qilish imkoniyati yaratiladi. Shunday qilib, talabalar nafaqat haqiqiy sharoitda talaffuz va tinglash ko'nikmalarini oshirish imkoniyatiga ega bo'ladi, balki haqiqiy vaziyatlarda tilni ishlatishga doir mashg'ulotlarga ham ega bo'ladi. Bundan tashqari, ba'zi onlayn ingliz tilini o'rganish saytlarida qiziqarli ingliz tilidagi mashqlar va interaktiv o'yinlar mavjud bo'lib, ular Memrise, Duolingo va BBC Learning English kabi saytlar orqali talabalarga yengilroq muhitda lug'atlarini rivojlantirishga yordam beradi [5].

O'RGANISH RESURSLARINING BAHAM KO'RILISHI

E-learning (elektron ta'lim), MOOC (masshtabli ochiq onlayn kurslar) kabi usullar orqali ta'lim resurslarini baham ko'radigan platformalarni yaratish maqsadga muvofiqdir; bu esa resurslardan kengroq foydalanishni ta'minlaydi. Misol uchun, Xitoy universitetlari MOOC - Milliy sifatli kurslar onlayn platformasi hozirgi kunda 800 dan ortiq mahalliy oliy ta'lim muassasalari bilan hamkorlik qilib kelmoqda; bu platformada universitet ingliz tili bilan bog'liq taxminan 40 ta kurs mavjud bo'lib, unda umumiy kurslar, yozma ishlar, o'qish materiallari, og'zaki ifoda qilish va madaniyatlararo aloqalar kabi turli mavzular mavjuddir.

Pekin texnika universitetining "Universitet tajribasi" nomli kursida dars video materiallari kichik qismlarga ajratilgan bo'lib quyidagi bosqichlardan iborat:

1) "Dam olish va sekin boshlash" o'qituvchi hikoya aytib yoki suhbat qurib talabalarni matn mavzusi bilan tanishtiradi;

2) "Bu nima haqida?" Matn bosqichma-bosqich tushuntiriladi;

3) "Yangi so'zlarni o'rganamiz" [6].

O‘qitish usullarining xilma-xilligi

Onlayn ta’lim, interaktiv ta’lim, shaxsiylashtirilgan ta’lim kabi usullardan foydalanish orqali ingliz tilini o‘qitishni yanada boyitish, talabalarning dars jarayonida faol ishtirok etishini ta’minlash mumkin. "Yuqori dars" ilovasi, Tencent Meeting, QQ guruh darslari kabi vositalar bu jarayonda keng qo‘llaniladi. "Yuqori dars" - Tsinghua universiteti tomonidan ishlab chiqilgan kuchli va oddiy ishlatish uchun qulay dars yordamchi platformasidir. Bu platforma onlayn va oflayn o‘qitish muhitlarini birlashtirib, o‘qituvchi va talabalar o‘rtasida yanada samarali muloqot va o‘rganishga imkon beradi.

Ushbu dastur slaydlarni kiritishni qo‘llab-quvvatlaydi, bu esa an’anaviy qora doska o‘qitishini slaydlar bilan o‘qitishga aylantiradi. Shuningdek, dastur real vaqt rejimida savol-javob interaktivligini qo‘llab-quvvatlaydi va talabalar uchun tafsilotlarni ko‘rish imkonini beradi. Talabalar dars materiallarini qayta ko‘rib chiqishi mumkin bo‘lib, bu ularga tezda bilimlarni mustahkamlashga yordam beradi. Dasturda shuningdek kuchli ma’lumotlar tahlil qilish imkoniyatlari mavjud bo‘lib, u talabalar faoliyatini (darsdan oldin — dars davomida — darsdan keyin) kuzatishga yordam beradi hamda ularning uy vazifalari bajarilish holatini individual ravishda tahlil qilishga imkon yaratadi.

Masalan, Xindistonning bir viloyat universitetida barcha multimedia sinflariga ushbu dastur o‘rnatilgan bo‘lib, mikrofonlar kabi jihozlar bilan ta’minlangan. Universitetda "Yuqori dars" vositasidan foydalanish metodikasi bo‘yicha bir necha marotaba treninglar o‘tkazilgan. 2022-yilning birinchi yarmida pandemiya davrida barcha talabalarga ushbu dasturlarni o‘z qurilmalariga yuklab olish so‘ralgan edi va hozirgi kunga kelib universitetning deyarli yarim qismi ingliz tilidagi ta’limda ushbu uslubni qo‘llayapti. Ushbu model nafaqat o‘qituvchilarga talabalarning darsga qatnashishini tezda aniqlash imkonini beribgina qolmay, balki ularga ba’zi bilimlar va resurslarni baham ko‘rishga ham yordam beradi [7].

TA’LIMNI BAHOLASHNI CHUQURLASHTIRISH

Raqamli texnologiyalar ta’limni baholashning chuqurlashtirilishi uchun yanada ko‘proq vositalar va imkoniyatlar yaratishi mumkin. Onlayn ta’lim platformalari talabalarning o‘qish ma’lumotlari va fikr-mulohazalarni to‘playdi; masalan, talabalar tomonidan sarflangan vaqt, jarayon, savol-javob holati va videolarni tomosha qilish kabi ma’lumotlarni yig‘adilar. Ushbu ma’lumotlar o‘qituvchilarga talabalarni yaxshiroq tushunishga yordam beradigan ko‘plab yo‘nalishlarda maslahatlar beradi [8].

Universitetlarning ingliz tili ta’limining o‘zgarishida raqamli ilovalarining kalit omillari va kelajakda kutilayotgan rivojlanish jarayoniga to‘xtalib o‘tar ekanmiz quyidagilarni bayon qilish maqsadga muvofiq.

Yuqorida aytib o‘tilganidek, raqamli texnologiyalar universitet ingliz tili ta’limining o‘zgarishida tobora muhim rol o‘ynamoqda, ammo ayrim muammolar ham e’tibordan chetda qolmasligi kerak. Bu esa bizni raqamli ilovalardagi ba’zi kalit omillarga e’tibor berishga undaydi, shunda bu muammolarni oldini olish yoki salbiy ta’sirini kamaytirish mumkin. Shulardan ikki nuqta ayniqsa diqqatga sazovordir [9].

Birinchisi, ta’lim muassasalari boshqaruv tizimini rivojlantirish. Universitet ingliz tili ta’limi butun universitet miqyosida amalga oshiriladigan ta’lim faoliyatidir, shuning uchun har bir oliy o‘quv yurtlari yuqori darajadagi loyihani tayyorlashi, insoniy, moddiy va moliyaviy resurslarni samarali qilib ishlatishi kerak; shuningdek, kadrlar tayyorlash, ta’lim nazariyasi bo‘yicha muhokamalar va raqamli infratuzilmani tashkil etishda xodimlar, ta’lim rejalashtiruvi, ilmiy tadqiqot, xizmat ko‘rsatish va turli fakultetlar birgalikda ish olib borishi zarur.

Ikkinchisi, kadrlarni tayyorlash dasturlarini yaratish. Universitet ingliz tili ta’limining o‘zgarishi va umuman olganda oliy o‘qitish jarayonidagi islohotlarning kaliti "talabalarni markazga qo‘ygan" ta’lim g‘oyasini to‘liq aks ettirishdir. Bu esa massali ta’limni individullashtirilgan ta’lim bilan birlashtirishni talab qiladi. Shuningdek, an’anaviy darslardan aralash tarzda o‘qitishga o‘tishni faollashtirish zarur bo‘ladi va o‘qituvchi va talabalar o‘rtasida tenglik, muloqot va hamkorlikka asoslangan munosabatlarni rivojlantirishga intilish kerak. Ta’lim baholash usullarida esa o‘qituvchilarning darsdagi samaradorligini baholash mezonlarini ishlab chiqish, talabalar akademik natijalarini baholash qoidalari kabi narsalarni tuzib chiqish orqali muntazam ravishda talabalar tomonidan bajarilgan ishlarning baho tizimidagi ulushini oshirib borish lozimdir.

Raqamli platformalardan foydalanib zamonaviy texnologiyalar yordamida talabalarning onlayn o‘qish jarayonlarini monitoring qilish va baholash orqali har bir talabaning o‘rganish faoliyatiga oid katta ma’lumotlar bazasini yaratish mumkin bo‘ladi; bu esa o‘qituvchilarga aniqroq dars berishga qaror qilishda yordam beradi. Axborot texnologiyalarining universitet ingliz tili ta’limi islohotidagi roli tobora kuchayib bormoqda; bu jarayonning oldinda kelayotganligi aniqdir.

Ko‘p funksiyali multimedia – rasm, matn va ovozni birlashtiruvchi vosita – an’anaviy doska va o‘chirg‘ichdan farqli ravishda katta darajada qiziqarli va jalb qiluvchi hisoblanadi. Bu esa talabalar ichida kuchli o‘rganish ishtiyoqini uyg‘o‘tadi hamda ularning faol ishtirokini rag‘batlantiradi.

Ingliz tilini yaxshi o‘rganishning kaliti, talabalarni inglizcha fikrlashga o‘rgatishda yotadi, so‘zlarni o‘rganish ham shundaydir. Avvalgi ta’lim jarayonlarida ko‘pincha tarjima usuli qo‘llanilgan, talabalar so‘zlarni o‘rganish va eslab qolishda faqat mexanik ravishda talaffuz qilish orqali xotiralashgan, bu esa so‘zlarning talaffuzi, shakli va ma’nosining bir-biridan ajralishiga olib keldi. Talabalar ko‘pincha o‘qishni va yozishni bilsalar-da, ulardan foydalanishni bilmaydilar; bu holatning asosiy sababi esa ona tili orqali tarjima qilish uslubidan foydalanilishidir va bu O‘zbekiston talabalari uchun ingliz tilini o‘rganishdagi asosiy muammo bo‘lib kelmoqda.

Ko‘p media yordamida ta’lim berish talabalarga to‘liq ingliz tilidagi yaxshi o‘qish muhitini yaratadi. Bu endi zerikarli xotira emas, balki ushbu so‘zlarni tasviriy va aniq narsalarga bog‘lash imkonini beradi. Bu ta’lim jarayonining tasviriyligini va aniq bo‘lishini sezilarli darajada oshiradi. Bu esa oliy ta’lim talabalarining fikrlash xususiyatlari va tanqidiy qoidalariga mos keladi. Eng muhimi, bu talabalarni ona tilining aralashuvidan saqlaydi va ularga to‘liq ingliz tilida ta’lim olish imkoniyatini yaratadi; shunday qilib, talabalar ingliz tilida fikrlashni o‘rganadilar.

Ta’limning muloqot qobiliyatini oshirish va talabalarni ingliz tilini erkin qo‘llashga o‘rgatish.

Ingliz tili — bu bir til. Tili haqiqatan ham o‘zlashtirish uchun ko‘p miqdorda eshitish va gapirish mashg‘ulotlariga asoslanishi kerak. So‘zlarni o‘rganish ham shunga bog‘liq. Talabalar bu so‘zlarni puxta egallashi va qo‘llay olishi uchun zerikarli o‘rganishdan qochishimiz kerak, balki talabalar uchun haqiqatga yaqin muloqot muhitini yaratishimiz lozim. Ta’limning muloqot jarayoni va amaliyligini oshirib, talabalarni amaliy qo‘llashda bilimni to‘g‘ri tushunishga olib kelishimiz lozim. Shunday qilib, talabalar katta so‘z boyligini to‘plab, ularning eshitish, gapirish, o‘qish va yozishga bo‘lgan umumiy qobiliyatlarini yaxshilashga yordam beramiz.

Umuman olganda, leksika ingliz tilini o‘rgatishda muhim bir qismdir va ingliz tilini o‘rganishda kalit hisoblanadi. Multimedia leksika ta’limida muhim ta’lim afzalliklariga ega bo‘lib, darslarni qiziqarli, tasviriy va muloqotga yo‘naltirilgan qilib rivojlantiradi. Bu esa avvalgi zerikarli va mexanik eslab qolish jarayonlarini yanada hayotiy qiladi, talabalarning ishtirok etish motivatsiyasini oshiradi va dars muhitini faolroq qiladi. Ammo bir vaqtning o‘zida multimedia ba’zi cheklovlarga ham ega ekanligini obyektiv ravishda tan olishimiz kerak. Biz uning afzalliklarini ko‘rish bilan cheklanmasligimiz kerak, balki uni to‘liq tushunib, ilmiy ravishda ishlatishimiz lozim.

Ingliz tili ta’limida lug‘atni o‘rgatish, ma’lumki, eng muhim jihatlardan biridir, ammo bizning kundalik darslarimizda lug‘at o‘qitish ko‘pincha dars jarayonining zaif bo‘lagi bo‘ladi. Lug‘at sonining ko‘pligi tabiiyki, o‘qitishni yanada murakkablashtiradi, lekin biz talabalarimizga tushuntirib berishimiz va ularni egallashlariga erishmasak, darslik talablariga mos kelmaymiz.

XULOSA

Raqamli texnologiyalar universitetlarda ingliz tilini o‘qitish jarayonining transformatsiyasida tobora muhim rol o‘ynamoqda. Mazkur maqolada raqamli ta’lim muhitida ingliz tili leksikasini samarali o‘qitish usullariga e’tibor qaratildi. Ingliz tilini o‘qitishdagi an’anaviy bilimga asoslangan yondashuvdan rivojlanishga asoslangan yondashuvga o‘tish zarurati asoslab berildi. Shu orqali talabalar nafaqat nazariy bilimlarni, balki mustaqil va kreativ tarzda o‘rganish ko‘nikmalarini rivojlantirishi ta’kidlandi. Raqamli texnologiyalar ta’lim mazmunini boyitish, resurslardan samarali foydalanish va talabalarni o‘qitish jarayoniga faol jalb qilish imkoniyatini yaratadi. Animatsiya, interaktiv platformalar, multimedia vositalari va onlayn resurslardan foydalanish ingliz tilidagi leksikani o‘qitishni qiziqarli va samarali qiladi. Bunday yondashuv orqali talabalar ingliz tilida fikrlash va muloqot qilish qobiliyatlarini yaxshiroq rivojlantirishi mumkinligi ko‘rsatildi.

Shu bilan birga, raqamli texnologiyalardan foydalanishda yuzaga kelishi mumkin bo‘lgan qiyinchiliklar va cheklovlarga ham e’tibor qaratish zarurligi ta’kidlandi. Universitetlarda raqamli texnologiyalardan foydalanishni yanada takomillashtirish uchun, birinchidan, universitet boshqaruv tizimida resurslarni optimal tarzda tashkil qilish va, ikkinchidan, o‘qituvchilarni tayyorlash dasturlarini rivojlantirish kerakligi aytib o‘tildi. Umuman olganda, ingliz tili leksikasini o‘qitishda raqamli texnologiyalarni keng qo‘llash orqali universitetlarda ta’lim jarayonining sifati va samaradorligini oshirish mumkin. Bu esa talabalar bilimining chuqurlashuvi va amaliy ko‘nikmalarining rivojlanishini ta’minlaydi.

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IMPLEMENTATION OF THE FLIPPED CLASSROOM MODEL AND ITS EFFECTIVENESS ON ENGLISH SPEAKING PERFORMANCE

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Abstract

The flipped classroom model has emerged as a promising alternative to traditional instruction, particularly in the context of English as a Foreign Language (EFL) teaching. By moving passive learning components-such as lectures and grammar explanations-outside the classroom and dedicating class time to interactive, communicative tasks, the model aims to enhance learner engagement and speaking proficiency. This study investigates the implementation of the flipped classroom approach among high school students in Kazakhstan and evaluates its effectiveness in improving English speaking performance. A mixed-methods design was employed, involving 40 students in the quantitative phase and 10 students in qualitative interviews. Findings indicate that students in the flipped classroom setting demonstrated increased confidence, active participation, and measurable improvement in their speaking skills compared to those taught through conventional methods. The study highlights the pedagogical value of integrating digital tools and learner-centered practices in secondary EFL education and offers practical recommendations for future classroom implementation.

Keywords: *flipped classroom, English speaking performance, EFL instruction, high school students, Kazakhstan, technology-enhanced learning, communicative competence, learner-centered approach*

Introduction

In recent years, the landscape of education has undergone a significant transformation, with traditional teacher-centered methodologies gradually giving way to more learner-centered, technologically integrated approaches. One such pedagogical innovation is the flipped classroom model, which inverts the conventional structure of instruction by delivering theoretical content outside of class-typically through videos or online materials-and dedicating in-class time to interactive, practical activities. This approach aims to foster student autonomy, deepen comprehension, and create more opportunities for active learning.

The flipped classroom has gained considerable attention in the field of English as a Foreign Language (EFL) instruction, where the development of communicative competence-particularly speaking skills-remains a central goal. Traditional EFL classrooms often face time constraints that limit student engagement in authentic speaking activities. By shifting the delivery of input to outside the classroom, the flipped model allows educators to utilize class time more effectively for collaborative tasks, discussions, and real-time language use. This reallocation of instructional time is especially relevant in contexts where students have limited exposure to English beyond the classroom setting.

In Kazakhstan, the integration of innovative teaching methods is part of an ongoing effort to improve the quality of English language education in secondary schools. However, the practical application of the flipped classroom model, particularly its effectiveness in enhancing students' speaking performance, remains underexplored. As English proficiency becomes increasingly important for academic and professional success, investigating pedagogical strategies that can promote oral communication skills is both timely and necessary.

Therefore, this study seeks to examine the implementation of the flipped classroom model in high school EFL instruction in Kazakhstan and evaluate its effectiveness in improving students' English speaking performance. The research aims to contribute to the growing body of knowledge on technology-enhanced language learning while offering practical insights for educators striving to create more dynamic and communicative classrooms.

Literature Review

Theoretical Background

The flipped classroom model is rooted in constructivist learning theory, particularly Vygotsky's social constructivism, which emphasizes the role of social interaction in cognitive development. In this model, students engage with instructional materials (e.g., video lectures, readings) outside the classroom, allowing in-class time to be used for active learning, peer collaboration, and teacher guidance. This shift supports the development of higher-order thinking skills, such as analysis, synthesis, and application.

In the context of language education, the flipped classroom aligns with communicative language teaching (CLT) principles, as it maximizes opportunities for authentic communication and interaction in the target language. By reallocating classroom time to productive skills-especially speaking-the model addresses one of the core challenges in EFL classrooms: limited time for oral practice.

Global Research on Flipped Classrooms

Numerous international studies have documented the positive impact of the flipped classroom on language learning outcomes. For example, Mehring (2016) found that Japanese university students in a flipped EFL classroom developed stronger speaking fluency and motivation. Similarly, Hung (2015) reported that Taiwanese learners in a flipped English course showed improved speaking accuracy and confidence. These studies suggest that the model not only enhances speaking skills but also fosters greater learner autonomy and engagement.

Moreover, research indicates that technology integration in flipped learning environments increases students' access to materials and allows for personalized learning paths. Bergmann and Sams (2012), pioneers of the flipped classroom, emphasized that the model enables differentiated instruction, allowing students to learn at their own pace and receive targeted feedback during class.

The Flipped Classroom in Kazakhstan and Central Asia

While global literature on flipped learning is growing, studies in Central Asian contexts, particularly Kazakhstan, remain scarce. Some recent efforts have explored the model in higher education, but few have investigated its application in secondary EFL settings. Given the national emphasis on trilingual education and the integration of ICT into schools, the flipped classroom represents a promising, yet underutilized, strategy for improving language instruction.

A recent study by Muratayev (2023) investigated secondary school teachers' perceptions of the flipped classroom approach in southern Kazakhstan. His findings highlighted both the pedagogical advantages and practical challenges of implementing flipped instruction, including issues of digital access and teacher preparedness. While his study focused on perceptions rather than direct language outcomes, it nonetheless provides important context for understanding how flipped learning is viewed and potentially adopted in Kazakhstani schools. These insights underscore the need for empirical classroom-based research, such as the present study, to assess the effectiveness of flipped instruction in improving students' speaking performance.

Research Gap and Rationale

Despite its global success, the implementation of the flipped classroom model in secondary EFL classrooms in Kazakhstan remains under-researched. There is limited empirical data on how this approach affects speaking proficiency among high school learners, particularly in state schools where resources, training, and time constraints may hinder innovation. This study aims to fill this gap by examining both the pedagogical process and student outcomes in a local context, thereby contributing to a more nuanced understanding of flipped learning in EFL instruction.

Methodology

Research Design

This study employed a mixed-methods research design to evaluate the implementation of the flipped classroom model and its effectiveness in enhancing English speaking performance among high school students. The combination of quantitative and qualitative approaches allowed for a comprehensive analysis of both measurable improvements in speaking skills and students' subjective experiences within the flipped learning environment.

Participants

The participants were high school students in grades 10 and 11 from a public secondary school in Kazakhstan. A total of 40 students participated in the quantitative phase of the study, which involved pre- and post-tests to assess changes in speaking performance. An additional 10 students were selected through purposive sampling for semi-structured interviews to gain deeper insights into their perceptions of the flipped classroom experience. All participants had an intermediate level of English proficiency and had prior exposure to traditional EFL instruction.

Procedures

The intervention was conducted over a period of six weeks. During this time, students in the experimental group engaged with video lectures, vocabulary presentations, and grammar explanations at home through digital platforms. These materials were carefully curated and aligned with the national curriculum standards for English. In-class time was dedicated to speaking-focused activities, such as role-plays, debates, problem-solving tasks, and peer feedback sessions.

The control group, by contrast, followed the traditional instructional model, where new material was presented in class and limited time was available for speaking practice. Both groups were taught by the same instructor to maintain consistency in content delivery and classroom management.

Data Collection Instruments

- ***Pre-test and Post-test**: A speaking assessment rubric, adapted from the CEFR (Common European Framework of Reference for Languages), was used to evaluate students' fluency, accuracy, vocabulary use, pronunciation, and coherence before and after the intervention.*
- ***Interviews**: Semi-structured interviews were conducted with 10 students from the experimental group. The interview questions focused on their experiences using flipped materials, perceived benefits, challenges, and the impact of the model on their speaking confidence and participation.*
- ***Observation Notes**: The researcher also took observational notes during in-class activities to capture student engagement, interaction patterns, and classroom dynamics.*

Data Analysis

*Quantitative data from the speaking tests were analyzed using **paired sample t-tests** to determine the statistical significance of the improvement in speaking performance. Qualitative data from interviews were subjected to **thematic analysis**, identifying recurring patterns and categories related to learners' attitudes, challenges, and overall experience with the flipped model.*

Findings

The quantitative analysis revealed a significant improvement in students' English speaking performance following the implementation of the flipped classroom model.

Table 1 - descriptive statistics

Speaking Component	*Pre-Test Mean (SD)*	*Post-Test Mean (SD)*	*Mean Difference*
Fluency	*2.60 (0.90)*	*3.55 (0.64)*	*+0.95*
Pronunciation	*2.45 (1.18)*	*3.45 (0.68)*	*+1.00*
Accuracy	*2.50 (1.22)*	*3.20 (0.85)*	*+0.70*
Overall Performance	***2.58 (0.64)***	***3.43 (0.55)***	***+0.85***

Table 2 -paired-sample t-test outcomes

Component	*p-value*	*Cohen's d*	*Effect Size*
Fluency	*< .001*	*1.08*	*Large*
Pronunciation	*< .001*	*0.97*	*Large*
Accuracy	*< .001*	*0.85*	*Large*
Overall Performance	***< .001***	***1.37***	***Very Large***

Descriptive Statistics

As shown in Table 1, students demonstrated noticeable gains across all assessed speaking components. The mean fluency score increased from 2.60 (SD = 0.90) on the pre-test to 3.55 (SD = 0.64) on the post-test, indicating a mean difference of +0.95. Similarly, pronunciation improved from 2.45 (SD = 1.18) to 3.45 (SD = 0.68), with a mean difference of +1.00. Accuracy scores also rose from 2.50 (SD = 1.22) to 3.20 (SD = 0.85), reflecting a +0.70 gain.

The overall speaking performance increased from 2.58 (SD = 0.64) on the pre-test to 3.43 (SD = 0.55) on the post-test, resulting in a mean gain of +0.85 points, suggesting a strong positive effect of the flipped classroom model on students' speaking abilities.

Inferential Statistics

Results of the paired-sample t-tests confirmed that these differences were statistically significant across all speaking components, with p-values < .001 (Table 2). Furthermore, Cohen's d values indicated large effect sizes for fluency (1.08), pronunciation (0.97), and accuracy (0.85), with an overall performance effect size of 1.37, categorized as very large. These findings suggest that the flipped classroom model had a substantial impact on students' speaking performance.

Qualitative Results

To complement the quantitative findings, semi-structured interviews were conducted with 10 students from the experimental group to explore their perceptions of the flipped classroom model and its influence on their English-speaking skills. Thematic analysis of the interview data revealed several key themes:

1. Increased Speaking Confidence

Most participants reported a noticeable boost in their confidence to speak English in class. They attributed this to having prior exposure to lesson content through video materials, which allowed them to feel more prepared and less anxious during speaking tasks.

"Before, I was afraid to speak because I didn't understand the topic well. But watching the video at home helped me feel ready."

2. Better Use of Class Time

Students consistently highlighted the productive use of classroom time in the flipped model. Instead of passively listening to lectures, they engaged in communicative tasks such as discussions, role plays, and collaborative activities.

"I like that in class we talked more and did group work. It helped me practice speaking more than in traditional lessons."

3. Autonomous Learning

The flipped classroom encouraged greater learner autonomy. Participants noted that they could pause, replay, or review the video materials as needed, which helped them understand grammar and vocabulary at their own pace.

"I could watch the video twice if I didn't understand. In normal class, the teacher moves on quickly."

4. Engagement and Motivation

Several students described a higher level of interest and motivation compared to traditional classes. They found the digital materials more engaging and appreciated the active, student-centered learning environment.

"It was more interesting because we were doing things, not just listening to the teacher all the time."

5. Challenges with Technology

Despite the positive feedback, some students mentioned challenges with access to technology or distractions at home. A few expressed difficulty maintaining focus while studying independently.

"Sometimes I had problems with internet or didn't understand everything in the video."

Overall, the interview data supported the quantitative findings, indicating that the flipped classroom model not only improved students' speaking performance but also contributed to increased confidence, engagement, and learner autonomy. However, the results also suggest that successful implementation requires careful consideration of students' access to technology and support for self-regulated learning.

Discussion

The findings of this study provide strong evidence that the flipped classroom model can significantly enhance English speaking performance among high school EFL learners. The quantitative results demonstrated notable improvements in fluency, pronunciation, accuracy, and overall performance, all with statistically significant gains ($p < .001$) and large to very large effect sizes. These results align with global studies (e.g., Hung, 2015; Mehring, 2016) that have reported improvements in students' oral communication skills following flipped instruction.

One key factor contributing to this success was the reallocation of class time from passive content delivery to active language use. In the flipped model, students arrived to class already familiar with vocabulary and grammar structures, allowing more time for speaking activities, peer collaboration, and teacher feedback. This shift aligns with communicative language teaching (CLT) principles and supports Vygotsky's theory of scaffolding within the zone of proximal development, as learners engaged in tasks that were slightly beyond their current competence but achievable with support.

The qualitative data further reinforced these outcomes. Students reported increased confidence, engagement, and autonomy-critical affective factors known to influence language learning success. Many learners appreciated the flexibility of reviewing materials at their own pace and felt better prepared to contribute during speaking tasks. However, some challenges were also noted, such as uneven access to technology, internet issues, and difficulty managing time and motivation at home. These findings highlight the importance of providing guidance in self-regulated learning and ensuring equitable access to digital resources.

Importantly, the study responds to a gap in regional literature by offering empirical evidence from the Kazakhstani secondary school context. While national education policy increasingly supports ICT integration, practical applications like the flipped classroom are still emerging in public school settings. This study suggests that with appropriate support, such innovations can have a measurable and meaningful impact on language proficiency.

Conclusion

This study examined the implementation of the flipped classroom model in a Kazakhstani high school and its effectiveness in improving English speaking performance. Using a mixed-methods approach, the findings revealed significant gains in fluency, pronunciation, and accuracy, as well as high student satisfaction and increased confidence in speaking.

The results affirm that the flipped classroom is a pedagogically sound and effective approach for fostering communicative competence in EFL settings. By freeing class time for interaction and leveraging technology for content delivery, it creates a more engaging and student-centered learning environment.

However, successful implementation requires careful planning, teacher training, and attention to technological equity. Future studies should explore long-term impacts, include larger and more diverse samples, and investigate the integration of other language skills within flipped learning models.

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THE ROLE OF ARTIFICIAL INTELLIGENCE AND SPEECH TRAINERS IN TEACHING PRONUNCIATION

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Abstract

This article explores the integration of artificial intelligence (AI) and speech training technologies in modern education, focusing on their role in improving learners' pronunciation, fluency, and communicative competence. As educational practices evolve, AI-powered speech trainers offer adaptive, real-time feedback and create personalized learning experiences that address individual learner needs. These tools use advanced speech recognition, natural language processing, and machine learning algorithms to assess pronunciation accuracy, intonation, and rhythm, thereby fostering more effective language acquisition. The study analyzes the pedagogical implications of these tools in both classroom and autonomous learning settings. Emphasis is placed on their utility in second language acquisition (SLA), especially for learners in non-native English-speaking countries, where access to natural language environments is limited. In addition, the article discusses the challenges and ethical considerations of incorporating AI into teaching, such as data privacy, teacher preparedness, and algorithmic biases. Through a theoretical and practical lens, this study concludes that while AI speech trainers cannot replace human educators, they serve as powerful supplementary tools that enhance the language learning experience and support the development of speech proficiency.

Keywords: *language acquisition, pronunciation improvement, adaptive learning, machine learning in education, speech recognition tools, digital pedagogy, AI in language learning, s*

In recent years, the global education sector has witnessed a paradigm shift driven by the rapid advancement of digital technologies, among which artificial intelligence (AI) occupies a central place. Within the domain of language education, particularly in teaching speaking and pronunciation skills, AI-based tools and speech trainers have emerged as transformative instruments capable of enhancing the quality, personalization, and efficiency of instruction. These technologies leverage sophisticated algorithms based on machine learning, speech recognition, and natural language processing to simulate near-human feedback and enable learners to practice speaking in a realistic, adaptive, and autonomous manner.

Since 2022, the rapid evolution of generative artificial intelligence (AI) systems—most notably ChatGPT—has spurred a surge of interest in their application across a wide range of educational contexts. These breakthroughs have reignited scholarly attention to earlier advances in natural language processing and computer vision, now re-evaluated through the lens of teaching and learning innovation. As a result, the integration of AI into education has become a dynamic area of interdisciplinary research. Increasingly, studies are investigating how AI-driven tools—such as virtual assistants, intelligent learning environments, behavior analytics platforms, and data-supported pedagogical systems—can support and transform instructional practices [1].

Despite this optimistic trajectory, the widespread implementation of AI in classrooms has prompted debate. Critics caution against potential downsides, including reduced pedagogical depth, over-reliance on automation, and negative impacts on student cognitive and emotional development. Nonetheless, much of the current academic discourse remains centered on the transformative promise of AI technologies in enhancing educational outcomes.

Before the mainstream adoption of generative AI, educational AI applications were mainly limited to automating routine academic tasks—such as personalized feedback, learning management, and automated grading. For example, Baker and colleagues (2019) documented how AI served three key educational stakeholder groups: students, instructors, and institutional leaders. Tools like the CENTURY platform enabled learners to engage in adaptive, self-paced learning, while classroom software such as ClassCharts supported educators by streamlining administration and monitoring performance trends. For school administrators, AI-driven decision support systems offered valuable insights for managing institutional effectiveness. However, these early AI systems had limited capacity to engage with higher-order thinking skills or generate truly individualized learning content.

With the rise of large language models, the educational landscape has shifted dramatically [2]. Generative AI systems—capable of producing human-like language, images, code, and even multimedia content—now offer unprecedented flexibility and creative potential in instructional design. These tools are expanding the range of possible learning scenarios, allowing teachers to automate content creation, design differentiated learning paths, and devote more time to high-impact instructional strategies and student mentorship.

A growing number of comprehensive reviews have mapped the trajectory of AI in education. Ng et al. (2023), for instance, traced the incorporation of AI from higher education into K–12 classrooms and emphasized a global trend toward embedding AI literacy in curricula. Chiu and co-authors (2023) highlighted both the opportunities and systemic challenges posed by AI technologies, noting their impact on various pedagogical domains. Similarly, research by Crompton and Burke (2023) observed a surge in AI adoption within tertiary education since 2021, while Zawacki-Richter and colleagues (2019) provided a structured overview of how AI supports institutional functions and student services. Bozkurt et al. (2021), analyzing half a century of research, identified recurring themes but pointed to a persistent lack of exploration into the ethical and social dimensions of AI use in schools and universities [3].

Table 1 – Applications of Artificial Intelligence and Speech Trainers in Teaching

No.	Area of Application	Purpose of Use	Expected Outcome	Examples of Tools / Technologies
1	Automatic pronunciation assessment	To evaluate students' pronunciation accuracy in real time	Improved phonetic precision and self-monitoring	ELSA Speak, Speak & Improve, Google Speech API
2	Personalized learning paths	To generate individualized tasks based on learners' performance and errors	Better results through adaptive and targeted instruction	Duolingo AI, Lingvist, SpeechAce
3	Feedback on intonation and speech rhythm	To correct prosodic errors such as intonation and rhythm	Enhanced fluency and more natural-sounding speech	Carnegie Speech, FluentU
4	Real-time speech recognition	To enable instant transcription and error detection during oral tasks	Increased awareness of speech structure and real-time self-correction	Google STT, Amazon Transcribe, Microsoft Azure Speech
5	Speaking practice with virtual tutors	To simulate conversation with AI-powered chatbots or avatars	Improved spoken interaction skills and confidence in communication	ChatGPT voice mode, Mondly VR, Replika
6	Grammar and syntax correction	To identify and correct grammatical errors during speech production	Better grammatical accuracy in spontaneous speech	Grammarly AI, Speechling
7	Classroom activity support for teachers	To automate repetitive teaching tasks like drills or pronunciation modeling	More time for teachers to focus on creative and interactive instruction	ClassPoint AI, Socrative AI assistants
8	Data analytics for progress tracking	To collect and analyze speech data for monitoring student improvement	Data-driven assessment and targeted interventions	Power BI with AI plugin, custom LMS analytics
9	Motivation through gamification	To increase engagement with interactive and reward-based AI tools	Higher motivation and consistent practice habits	Kahoot AI, ELSA Pro missions
10	Accessibility for diverse learners	To support learners with speech, hearing, or language difficulties	Inclusive education with customized feedback and accessibility options	Microsoft Immersive Reader, AI speech simplifiers

Artificial intelligence (AI) and speech trainers offer a wide array of applications in the educational process, particularly in language instruction, enhancing both teaching effectiveness and learner outcomes. These technologies enable automatic pronunciation assessment, providing real-time feedback on phonetic accuracy, intonation, and rhythm, which supports learners in achieving more native-like speech patterns. By analyzing user performance, AI systems can generate personalized learning paths tailored to each student's strengths and weaknesses, fostering adaptive learning environments that are responsive to individual progress [4]. Tools such as ELSA Speak, Duolingo AI, and SpeechAce exemplify the integration of intelligent feedback and speech analysis in self-directed learning. Moreover, speech trainers simulate interactive dialogues through virtual tutors, improving learners' communicative competence and confidence in spoken interactions. For teachers, AI technologies reduce the burden of repetitive instructional tasks, offering automated drills, speech modeling, and grammar correction, thus allowing educators to dedicate more time to creative pedagogical strategies and direct student engagement. Real-time speech recognition and speech-to-text systems also promote inclusive learning by supporting students with diverse needs, including those with speech or hearing impairments. Furthermore, these tools generate valuable data analytics, allowing for precise tracking of student progress and enabling timely

interventions. Gamification elements built into AI speech platforms increase motivation and retention, making language practice more engaging and consistent. Collectively, the implementation of AI and speech trainers transforms the educational landscape by facilitating personalized, scalable, and data-informed instruction while enhancing learner autonomy and speech proficiency. Overall, the scholarly literature presents a compelling case for the transformative impact of AI in education while simultaneously recognizing the need for thoughtful implementation, ongoing research, and critical ethical reflection [5].

AI-powered speech trainers operate by analyzing various parameters of spoken language, such as articulation, intonation, rhythm, stress, and fluency. They compare the learner's speech against standard phonetic models and provide immediate, data-driven feedback on errors, often with visual indicators and suggested corrections. These systems can assess nuanced pronunciation patterns, identify phonological interference from the first language, and track the user's progress over time. One of the notable advantages of such tools is their capacity to support mass personalization; that is, they can deliver customized practice paths based on an individual learner's strengths and weaknesses without the constant presence of a teacher. This becomes particularly crucial in contexts with limited access to qualified language instructors or native-speaking environments.

The pedagogical utility of AI-based speech trainers extends beyond simple correction. These tools can serve as catalysts for learner motivation by gamifying the pronunciation practice process, integrating achievements, levels, and rewards into the interface. Moreover, they contribute to the development of learner autonomy, as students gain the ability to control the pace, frequency, and difficulty level of their practice sessions. Importantly, these systems facilitate the transition from receptive to productive language skills by encouraging regular oral output and enhancing learner confidence [6].

Research in the field of second language acquisition (SLA) supports the efficacy of pronunciation-focused feedback and repeated speech practice, especially when delivered in real time. AI technologies address this need by offering scalable, on-demand pronunciation training that aligns with communicative teaching approaches. The integration of speech trainers into formal curricula or supplementary learning programs can therefore optimize classroom time, allowing teachers to focus on higher-order communicative tasks while learners independently refine their pronunciation skills. In addition, data collected by these applications can be used for formative assessment, providing educators with valuable insights into student progress and persistent difficulties.

Nonetheless, the adoption of AI speech trainers in teaching raises several challenges. First, technical limitations still exist: current speech recognition systems may struggle with non-standard accents, background noise, or speech disfluencies common among beginners. Additionally, cultural and linguistic biases embedded in AI models, often trained on native speaker corpora, may inadvertently penalize legitimate variations in global Englishes. These issues necessitate the development of more inclusive training datasets and adaptable models capable of recognizing linguistic diversity. Furthermore, ethical considerations must be addressed, particularly regarding data privacy, consent, and the potential over-reliance on automated systems at the expense of human interaction.

Educators also face the need for professional development in integrating these tools effectively. Teachers must acquire not only technical skills to operate AI tools but also pedagogical strategies for incorporating them meaningfully into lesson plans. This includes selecting appropriate tools, interpreting the feedback provided, and aligning AI-driven activities with learning objectives and standards. Institutional support and curriculum design flexibility are essential to facilitate this integration without overwhelming the existing workload of teachers[7].

While AI speech trainers are not intended to replace language educators, they offer substantial support in areas that are traditionally time-intensive and difficult to scale. Their contribution lies in augmenting the teaching process, extending learning beyond classroom walls, and providing equitable access to high-quality pronunciation training. In hybrid and distance learning environments, their importance becomes even more pronounced, offering continuity and consistency in language practice regardless of physical location.

Artificial Intelligence technologies can be classified into distinct types based on their application in teaching, particularly in foreign language instruction. One major type is Natural Language Processing (NLP), which enables machines to understand and generate human language. NLP powers tools such as chatbots, automated translation systems (e.g., DeepL, Google Translate), and speech recognition platforms (e.g., Google Speech-to-Text), allowing students to engage in realistic conversation practice and receive real-time feedback on pronunciation and grammar.

Machine Learning (ML) and Predictive Analytics (PA) are widely used to personalize learning trajectories. Systems like Duolingo and Lingvist analyze learner behavior and adapt content accordingly. ML also supports error prediction and automated progress tracking, optimizing the learning process.

Computer Vision enables machines to interpret visual input. In language learning, it is applied in handwriting recognition (e.g., Microsoft Ink), lip-reading software, and emotion recognition tools that help monitor student engagement during digital lessons.

Robotics and automation involve intelligent agents capable of performing physical tasks. Language-learning robots like NAO and EMYS are used to teach vocabulary and pronunciation through interactive play, especially in early education and special needs contexts. Expert systems simulate human decision-making using rule-based logic. In education, they assist teachers by recommending learning materials or identifying at-risk students based on performance data, as seen in platforms like Squirrel AI[8].

Autonomous systems combine multiple AI technologies to operate independently. AI tutors and intelligent learning environments, such as Carnegie Learning and iTalk2Learn, dynamically adapt content and feedback without teacher intervention. Virtual assistants (e.g., Siri, Alexa, Google Assistant) are also used for informal language practice and task-based instruction, helping learners reinforce speaking skills through natural interaction. Finally, Generative AI tools (e.g., ChatGPT, Bing Copilot) can create customized dialogues, exercises, and even simulate exam scenarios, making them valuable for both classroom support and autonomous learning.

Table 2 – Advantages and Disadvantages of AI and Speech Trainers in Education

Aspect	Advantages	Disadvantages
Personalization	AI enables adaptive learning tailored to individual progress and learning styles.	Over-reliance on AI may reduce learner autonomy and critical thinking development.
Pronunciation	Real-time feedback from speech trainers improves phonetic accuracy and fluency.	Limited recognition accuracy with regional accents or speech impairments.
Efficiency	Automates routine tasks (e.g., assessment, repetition drills), saving teacher time.	Risk of de-skilling teachers in basic instruction tasks.
Engagement	Gamification and interactive AI agents increase motivation and learner participation.	Engagement may decline if AI responses become repetitive or unnatural.
Accessibility	Supports learners with disabilities (e.g., speech-to-text for hearing-impaired students).	High-quality tools may require expensive devices and strong internet connection.
Scalability	Allows mass instruction without increasing teacher workload.	May not account for emotional or cultural aspects of communication.
Assessment	Provides instant, objective performance tracking and feedback.	Can misinterpret nuanced or creative responses, especially in writing and speaking.
Content Generation	Generative AI can produce exercises, tests, and dialogues on demand.	Quality and appropriateness of generated content require careful human validation.
Teacher Support	Assists in lesson planning, curriculum design, and student diagnostics.	Teachers may lack training to integrate AI effectively into pedagogical practice.

These technologies are increasingly embedded across all stages of the instructional process—from curriculum design and lesson delivery to assessment and feedback—thus redefining the role of educators and the structure of foreign language education [9].

In conclusion, the role of artificial intelligence and speech trainers in teaching is multifaceted, encompassing technological, pedagogical, and ethical dimensions. Their effective integration into language education holds the potential to significantly enhance learners' pronunciation skills, foster engagement, and support the personalization of instruction. As AI technologies continue to evolve, future research and development should focus on improving model accuracy, inclusivity, and transparency, while educational institutions must prioritize teacher training and data protection. Ultimately, the synergy between human instruction and AI augmentation can lead to more effective, inclusive, and dynamic language learning environments.

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HISTORY OF THE DEVELOPMENT OF SPORTS IN AZERBAIJAN: FROM THE PAST TO THE PRESENT

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Abstract

Sport and physical education have undergone a great evolutionary process as a system of competition and physical training. The emergence of sport and physical education, one of the greatest achievements of human culture, was because ancient people had to test their physical abilities among themselves. Those who passed through these trials were given the right to lead their tribe and clan. Thus, there is a need for people to test their physical qualities in combat. As society has evolved, the forms and methods of this trial and struggle have changed, different types of them have emerged. The roots of development of Azerbaijani sport go to a very distant past. In the Stone Age, there were a number of discoveries that had a great impact on the development of society. The invention of a bow and arrow during these discoveries is a clear confirmation.

Xülasə

İdman və bədən tərbiyəsi müxtəlif hərəkət kompleksləri üzrə yarış və fiziki hazırlıq sistemi kimi böyük təkamül prosesi keçmişdir. Bəşər mədəniyyətinin ən böyük nailiyyətlərindən biri olan idmanın və bədən tərbiyəsinin yaranmasının əsasında qədim insanların öz aralarında fiziki qabiliyyətlərini sınamaq məcburiyyətində qalması olmuşdur. Bu sınaqlardan keçənlər tayfa və qəbiləyə rəhbərlik etmək hüququ qazanmışlar. Beləcə, insanların öz fiziki keyfiyyətlərini mübarizədə sınamaq tələbi meydana çıxmışdır. Cəmiyyət inkişaf etdikcə bu sınağın, mübarizənin forma və üsulları dəyişmiş, müxtəlif növləri yaranmışdır. Azərbaycan idmanının inkişafının kökləri çox uzaq keçmişə gedib çıxır. Cəmiyyətin inkişafına böyük təsir göstərən bir sıra kəşflər daş dövründə baş vermişdir. Bu kəşflər zamanı ox və yayın ixtira edilməsi buna əyani sübutdur.[1]

Keywords: *Chovgan, national spirituality, successful politics, international arena, Olympic games*

Açar sözlər: *çovqan, milli mənəviyyat, uğurlu siyasət, beynəlxalq arena, olimpiya oyunları*

Azərbaycan idmanın inkşaf tarixi. *Eramızdan II min il əvvəl tunc dövründə Azərbaycanda tunc alətlərin işləndiyi vaxtlarda insanların müxtəlif fiziki hərəkətlərini əks etdirən yazılara, rəqslərə rast gəlirik. Buna parlaq nümünə dünya tarixçilərinin böyük marağına səbəb olan Qobustan qayaüstü təsvirlərində həkk olunmuş çoxlu rəsmlər, cizgilər ov səhnələrini, döyüş səhnələri, heyvan fiqurlarını, insanların rəqs və dənizdə qayıq yarışları, qurşaq tutma güləşi diyarımızda fiziki tərbiyənin qədim zamanlardan belə inkişaf etməsindən xəbər verir.*

Şəkil 1. "Çovqan" oyunu

Şəkil 1. "Güləş"

Ənənəvi idman növləri Azərbaycanda qədim zamanlardan geniş yayılıb. Əfsanə və nağıllarda, qədim ədəbi mənbələrdə güləş yarışlarından çox danışılır. "Kitabi-Dədə Qorqud" dastanında güləşlə yanaşı, döyüş sənətinin başqa növləri də təsvir edilmişdir. XI əsr Azərbaycan şairi Xaqani Şirvaninin yaradıcılığında "çovqan"dan – atlı komanda oyunu, at sürmə, şahmat, qılıncoynatma oyunlarından bəhs edilir. "Çovqan" sözü türk mənşəli olmaqla, "çubuq ilə vurmaq" mənasını verir. Qədim türkdilli xalqlar ömürlərinin çox hissəsini at belində keçiriblər. Tarixi qaynaqlardan məlum olur ki, oğuzlar arasında ən çox idman yarışları at üzərində keçirilirdi. Oyunçular yarış zamanı uzunluğu 1,5 metr olan "kişüyə"lərlə (çövkənlər) kiçik taxta topu rəqibin qapısına vurmağa çalışırlar. Bunun üçün xüsusi olaraq öyrədilmiş atlardan istifadə edilir.[2] Bu oyunun IX əsrdə yayılması faktını Beyləqan rayonunda Oranqalada aparılan arxeoloji qazıntılar zamanı tapılmış qabların üzərində təsvir edilməsi sübut edir. Çovqan yarışlarına əsasən zəngin ailəsinin nümayəndələri qatılırdılar. Təəccüblü deyil ki, çövkən bütün dünyada geniş yayılmış, "şahların oyunu və oyunların şahı" kimi müasir polo oyununun əcdadı hesab edilir. Mübarizlik və məğlubedilməzlik rəmzi olan çövqan oyunu Azərbaycanda hələ qədim zamanlardan atçılığın inkşaf etməsinin sübutudur. Böyük İpək Yolu sayəsində çovqan Hindistanda məşhurlaşmışdır, oradan XII əsrdə Avropaya gətirilmişdir və Avropada, eləcə də Amerikada geniş yayılmışdır. İngilislərin təşəbbüsü ilə bu oyun at polosu adını aldı və 1900-cü ildə Parisdə keçirilmiş İkinci Olimpiya Oyunlarının proqramına daxil edilmişdir. Sovet vaxtlarında çovqan oyunu Qarabağda və Azərbaycanın müxtəlif regionlarında keçirilirdi. Bu oyun müntəzəm olaraq müxtəlif respublika və ümumittifaq şənliklərinə daxil edilmişdir. Qarabağda bu oyun keçmiş əsrin 80-ci illərinin axırına kimi məşhur olmuşdur.

Son illərdə Qarabağ atlarının yetişdirilməsinin çətinliyi səbəbindən, eləcə də çovqan oyununun tarixinin unudulmasının qarşısının alınması məqsədilə çovqan oyununun qorunması məsələsi gündəmə gəlmişdir. 3 dekabr 2013-cü ildə Bakıda keçirilmiş Təcili Qorunmaya Ehtiyacı olan Qeyri-maddi Mədəni İrs Siyahısına daxil edilmişdir.[3]

Azərbaycanda idmanın qədim tarixi var və idmanın müxtəlif növləri olub: çovqan, at yarışı, nizə atma, müxtəlif güləş növlərindən tutmuş şahmata qədər. Bu oyunların qədim ənənələri müxtəlif idman növlərində bu və ya digər formada qorunub saxlanılaraq günümüzə qədər gəlib çatmışdır. Hələ qədim dövürlərdə Azərbaycanda fiziki hərəkətlər və idman hərəkətləri xüsusi vərdişə yiyələnmək, zəhmətsevərlik, təşəbbüskarlıq bacarığının artırılmasına, sağlamlığın qorunmasına və nəticədə döyüş hazırlığının möhkəmləndirilməsinə yönəldilmişdir.

Azərbaycan idmanı Heydər Əliyev dövründə. *XX əsrdə Azərbaycan xalqının bəşəriyyətə bəxş etdiyi nadir şəxsiyyətlərdən biri, dünya şöhrətli siyasətçi, təcrübəli dövlət rəhbəri Heydər Əliyevin hakimiyyətə gəlməsi ilə Azərbaycan idman tarixi inkişafında yeni mərhələsinin əsası qoyuldu. Məhz onun şəxsi nüfuzu və bacarığı sayəsində Azərbaycanda idmanın maddi-texniki bazası yaradılmışdır. Onun rəhbərlik etdiyi illər ərzində respublikamızda stadionlar, 420 futbol meydançası, 110 voleybol, basketbol və tennis meydançası və xeyli sayda idman zalı tikilərək istifadəyə verilmişdir. 1974-cü ildə Bakıdan başqa respublikanın 36 rayonunda 59 uşaq-gənclər idman məktəbi fəaliyyət göstərirdi. Təkcə 1975-ci ildə yalnız Bakı şəhərində 250 idman meydançası və şəhərciyi salınmışdı. Heydər Əliyevin göstərişi ilə Azərbaycanın demək olar ki, bütün rayonlarında şahmat məktəbləri tikilmiş, istedadlı uşaqlar bu məktəblərə cəlb olunmuşdu. Bu gün biz gənc və istedadlı şahmatçılarımız Teymur Rəcəbov, Şəhriyar Məmmədyarovla fəxr edirik. Onlar dünya və Avropa miqyasında keçirilən ən məsul yarışlardan vətənə qızıl medallarla qay1- dırlar.*

1995-ci ildə Heydər Əliyevin təşəbüssü ilə Azərbaycanda idman fondu yaradıldı. İdman fondunun olması ölkəmizdə sağlam həyat tərzinin təbliğ edilməsinə, uşaq və yeniyetmələrin idmana kütləvi surətdə cəlb edilməsinə, bu sahəyə marağın artmasına, maddi-texniki bazanın möhkəmləndirilməsinə, Azərbaycan idmanının beynəlxalq idman ailəsinə inteqrasiya olunmasına təminat verdi. Bütün bunlarla bərabər dövlətimizin mahir qurucusu həmişə idman qurğularının bərpasını, yeni obyektlərin tikilib

istifadəyə verilməsini, Olimpiya idman növləri ilə yanaşı, qeyri-olimpiya o cümlədən zehni bacarıq, istədad tələb edən idman növlərinin də tərəqqisinə xüsusi diqqət yetirməyi vacib hesab edirdi.[4]

O dövrün ən mühüm hadisəsi isə 1996-cı ildə Azərbaycanın, müstəqil dövlət kimi, ilk dəfə Olimpiya Oyunlarına qatılması idi. Elə bunun nəticəsidir ki, 1997-ci ildə idmançılarımız müxtəlif səviyyəli beynəlxalq yarışlarda 54 qızıl, 45 gümüş və 37 bürünc medal, ümumilikdə - 136 medal əldə edərək, ölkəmizin idman salnaməsinə şərəfli səhifə yazmışdılar. [4]

***Şəkil 3.4** Heydər Əliyevin gənc idmançıları ilə görüşdən*

***Azərbaycan idmanın yüksəliş dövrü.** Azərbaycan idmanın inkişaf səviyyəsinə görə dünyada irəlidə gedən ölkələrdən biridir. Bu danılmaz həqiqət və təsdiq olunmuş bir faktdır. Respublikada bu sahəyə dövlət tərəfindən göstərilən diqqət və qayğı nəticəsində idmançılarımız beynəlxalq yarışlarda möhtəşəm qələbələr qazanmaqda davam edirlər. Heydər Əliyevin əsasını qoyduğu bu uğurlu siyasət hazırkı başçısı İlham Əliyev tərəfindən indi də davam etdirilməkdədir.*

Azərbaycan Prezidentinin 2005-ci il 4 mart tarixli sərəncamı ilə hər il martın 5-i ölkəmizdə Bədən Tərbiyəsi və İdman Günü kimi qeyd olunur. 30 iyun 2009-cu ildə "Bədən tərbiyəsi və idman haqqında Azərbaycan Respublikasının Qanunu" təsdiq edilmişdir. [5]

Azərbaycanın beynəlxalq arenada idman ölkəsi kimi tanınmasını ölkənin dövlət siyasətinin əsasını təşkil edir. Son illərdə Azərbaycanda keçirilən dünya çempionatları, Avropa oyunları, bir çox beynəlxalq yarışlara ev sahibliyi etməsi ölkəmizin bu siyasətin uğurla heyata keçirməsinin bariz nümünəsidir. Müasir gənclərin hərtərəfli formalaşmış, rəqabətədavamlı yetişdirilməsi məhz dövlətin uğurlu gənclər siyasətinin davamıdır. Gənclərimiz tək idman deyil, bütün sferalarda aktiv rolu ilə seçilir, ictimai-siyasi, sosial-iqtisadi tədbirlərin təbliğində də mühüm rol oynayırlar. Bütün bunlar ölkə başçısı İlham Əliyevin və Birinci Vitse- prezident Mehriban xanım Əliyevanın gənclərin fəaliyyəti üçün yaratdığı geniş imkanların, yüksək diqqət və qayğının nəticəsidir. 2022-ci ildə dünya ölkələrinin qlobal idman reytinqində Azərbaycan dərhal 43 pillə yüksələrək 162 xalla 46-cı yeri tutdu. Eyni zamanda, Avropada isə 26-cı yerdədir. [6]

***Nəticə.** Bu uğurlu siyasət azad olunmuş torpaqlardada davam etdirməkdədir. Şanlı zəfərimizdən sonra azad edilmiş torpaqlarda beynəlxalq idman yarışları keçirilmişdir. Şuşada beynəlxalq şahmat yarışı, Suqovuşanda, Suqovuşan gölündə beynəlxalq avarçəkmə yarışı keçirilmişdir. Zəngilanın Ağalı kəndinin ətrafında triatlon üzrə yarış keçirilmişdir. Qarabağda idmanı inkişaf etdirmək üçün "Qarabağ"ın vaxtilə ev oyunlarını keçirdiyi, "Qafqazın Xirosiması" adlandırılan Ağdam şəhərindəki "İmarət" stadionunun yenidən qurulması da planlaşdırılır.[7]*

İdman yeganə vasitədir ki, ölkəni, onun rəmzlərini bütün dünyada təmsil edir. Azərbaycan artıq beynəlxalq aləmdə idman ölkəsi kimi tanınır. Azərbaycanın qısa müddətdə idman sahəsində əldə etdiyi nailiyyətlər beynəlxalq idman təşkilatlarının diqqətindən yayınmamış, məhz onların istəyi ilə son illərdə ölkəmizdə saysız-hesabsız mötəbər beynəlxalq turnirlər, dünya və Avropa çempionatları keçirilmişdir. Azərbaycan Respublikası bu gün öz tarixinin çox şərəfli, böyük irəliləyişlər, inkişaf və tərəqqi dövrünü yaşamaqdadır.

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THE ROLE OF ARTISTIC THINKING OF A WEB DESIGNER IN FORMING USER EXPERIENCE (UX)

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Abstract

To be successful, a web designer needs knowledge of digital technologies and databases, the basics of art history, the psychology of visual perception of various audiences, developed communication skills, as well as the ability to think artistically and visually. Only with these competencies will the web designer's creative products be able to achieve the desired informational and psychological effect on website users. The author analyzes the factors that shape the user experience (UX). The article emphasizes that the integration of artistic thinking into the process of developing websites and applications not only increases user satisfaction, but also contributes to the creation of unique brands. Based on her own teaching and web design experience, the author identifies a number of aspects emphasizing the key role of the web designer's artistic thinking in shaping the user experience.

Keywords: *web design, web designer, web designer's artistic thinking, user experience, emotional response.*

Web designer tasks.

The Internet has radically changed people's lives, becoming an integral part of everyday reality. Today, it is impossible to imagine a day without access to the network: we go to applications, browse websites, use various online services, communicate with friends and colleagues. Every day we interact with many digital platforms, and our perception of these resources largely depends on their convenience, appearance and information content, which play a key role in shaping the user experience (UX, from the English User Experience - the user's overall perception and impression of interaction with a product, system or service) [1].

One of the main tasks of a web designer is to create a user experience that allows users to easily and effectively interact with a site or application. This includes researching the target audience, analyzing its needs and preferences, and testing various solutions to optimize interaction. A well-designed UX can significantly increase user satisfaction and, as a result, increase conversion - the number of visitors who perform target actions, such as purchasing a product or subscribing to a newsletter [2].

Shaping the User Experience.

The user experience is shaped by many factors that influence how users interact with a product or service:

– Usability. This is one of the most important aspects of UX. Usability includes ease of navigation, logical interface, and availability of information [3].

– Interface design. Visual design, including color palette, fonts, icons, and overall aesthetics, influences the user's first impression. An attractive and modern design can increase interest and trust in a product [4].

– Informativeness. Users expect information to be presented clearly and accessibly. This includes the presence of clear instructions, tips, and help information.

– Loading speed. The loading time of pages or applications has a significant impact on the user experience. Long waits can lead to user frustration and abandonment. And, for example, media overload not only greatly reduces loading speed, but also leads to difficulty in perception and gaudiness.

– Adaptability. Products should be easy to use on different devices (desktops, tablets, smartphones). Responsive design ensures the same level of usability across all platforms.

– Personalization. The ability to customize the interface to the user's individual preferences can significantly improve their experience. This may include recommendations based on previous actions or the ability to change interface settings.

– Feedback. Users should receive feedback about their actions in the system (for example, notifications about actions being performed or errors). This helps them understand what is happening and how they can continue the interaction.

– Emotional response. UX also includes an emotional component – how users feel when interacting with the product. Positive emotions can be caused by beautiful design, successful task completion, or pleasant surprises.

– Accessibility. Products should be accessible to all users, including people with disabilities. This includes the use of appropriate fonts, contrasting colors, and alternative text for images.

– Context of use. Considering the settings and purposes in which users will use the product (e.g. at home, at work, or on the go) also impacts UX [5].

All of these factors are interconnected and together form the overall user experience of the product. A well-designed user experience by a web designer contributes to user satisfaction and increases the likelihood of them returning to the product or service in the future.

The Importance of a Web Designer's Work.

It is obvious that the work of a web designer is becoming increasingly important in the modern digital world. A qualified web designer must offer creative ideas and artistic images that, firstly, meet the requirements and corporate style of the organization, secondly, take into account the socio-cultural characteristics of the target audiences, and thirdly, raise the project being developed to the level of works of artistic culture [6]. Orders for the creation of websites for shopping and entertainment centers, clubs, art galleries, educational institutions, financial organizations, trading companies, medical centers and other organizations should be based on different artistic images and solutions. For example, the extravagant and futuristic "grunge" style is unlikely to be appropriate for a dental clinic website, just as the classic style will not meet the expectations of the organizers and visitors of a sports fan club. At the same time, it is safe to say that the rapidly growing number of websites causes some customers to need "exclusive" products that attract with their unique authorship, artistic images of which are perceived by users as confirmation of the business reputation of the customer organizations and evidence of their relevance in society [7].

The study of the artistic thinking of web designers is an interesting and multifaceted topic that attracts the attention of scientists and practitioners in the field of design, psychology, and pedagogy in different countries:

- Jesse James Garrett is the author of the book "The Elements of User Experience", which examines aspects of user experience design.

- Alexey Petrov is a designer and teacher who deals with issues of visual perception and aesthetics in web design.

- Irina Kuznetsova is a researcher in the field of graphic design and visual communication, studying aspects of artistic perception and creativity.

- Mohammad Reza Nourizadeh is a researcher in the field of graphic design and visual communication, studying aspects of perception and artistic thinking. – Saeed Mohammadi is a user interface and interaction design specialist who conducts research on aesthetics and functionality in web design.

– Naoko Ito is a visual communication and design researcher who studies aesthetics and perception in web design. And others.

The Role of Artistic Thinking in UX Formation.

Based on research by experts and scientists, we can find that the artistic thinking of a web designer plays a key role in UX formation, as it contributes to the creation of deeper, more intuitive and emotionally rich interactions with products and services. Here are some aspects that highlight its importance:

– Creativity and innovation. Artistic thinking allows web designers to approach tasks from an unconventional point of view, generating original ideas and solutions. This can lead to the creation of unique interfaces that stand out from the competition and attract the attention of users.

– Aesthetics and visual appeal. Web designers with artistic thinking are able to create visually attractive interfaces that are not only pleasing to the eye, but also contribute to better perception of information. Aesthetically pleasing design can increase user trust in a site or application [8].

– Emotional response. Artistic thinking helps designers create elements that evoke an emotional response in users. This can be achieved through the use of color, shape, texture, and other visual elements, making the interaction more personal and memorable [9].

– Narrative and storytelling. Web designers can use artistic thinking to create a narrative on a website or application. This helps users better understand the content and its structure, and makes the interaction more engaging.

– Intuitive interaction. Artistic thinking contributes to the creation of intuitive interfaces. Designers can use the principles of composition and visual hierarchy to simplify navigation and improve the user experience [3].

– Cultural context. Artistic thinking allows you to take into account the cultural characteristics of the target audience when developing a design. This is important for creating products that will be understandable and acceptable to different groups of users.

– Empathy for the user. Artistic thinking includes the ability to understand the needs and desires of users. This allows designers to create solutions that truly meet user expectations and improve their experience [10].

– Experimentation. Artistic thinking encourages experimentation with shapes, colors, and concepts, which can lead to new ideas and improvements in UX design. Designers can test different approaches and find the most effective solutions.

– Consistency of style. Artistic thinking helps maintain consistency in visual style throughout a website or app, which creates a holistic perception of the product.

– Adaptability. Web designers with artistic thinking can better adapt their solutions to different devices and screens, creating responsive interfaces that provide good UX regardless of the platform [11].

Conclusion.

In general, the artistic thinking of a web designer enriches the process of designing the user experience, making it more multifaceted and human-oriented. This not only improves the functionality of the product, but also creates positive emotions in users, which contributes to their loyalty and satisfaction.

Thus, the artistic thinking of a web designer not only enriches the visual component of the product, but also significantly affects the quality of the user experience, making it more intuitive, emotional and memorable.

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PROSPECTS FOR INCREASING THE DIGITAL COMPETENCIES OF TEACHERS IN THE PROCESS OF DIGITAL TRANSFORMATION OF EDUCATION

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ПЕРСПЕКТИВЫ ПОВЫШЕНИЯ ЦИФРОВЫХ КОМПЕТЕНЦИЙ ПЕДАГОГОВ В ПРОЦЕССЕ ЦИФРОВОЙ ТРАНСФОРМАЦИИ ОБРАЗОВАНИЯ

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Abstract

The digital transformation of the educational space has given many prospects for self-education, and has also led to problems associated with finding solutions aimed at eliminating the existing gap between the pace of digitalization of society and education and the preparation of teachers to work in the conditions of digitalization of the educational process. This article monitors and analyzes the possible risks of digital transformation in the general education system.

Аннотация

Цифровая трансформация образовательного пространства дала много перспектив для самообразования, а также привела к возникновению проблем, связанных с поиском решений, направленных на устранение имеющегося разрыва между темпами цифровизации общества и образования и подготовкой педагогов к работе в условиях цифровизации образовательного процесса. В данной статье проводится мониторинг и анализ возможных рисков цифровой трансформации в системе общего образования.

Keywords: *teacher, digital transformation of education, digitalization, risks of digital transformation of education, distance education,*

Ключевые слова: *педагог, цифровая трансформация образования, цифровизация, риски цифровой трансформации образования, дистанционное образование*

The active introduction of computer and telecommunication means into the educational process, which facilitates students' mastery of the possibilities of modern technologies, has become one of the main directions of development of the professional education system at all its levels. The digital educational environment provides new opportunities: to move from classroom learning to learning anywhere and at any time; to design an individual educational trajectory, thereby satisfying the educational needs of the student. The concepts of "information society", "digital economy", "electronic educational environment" have become integral parts of our lives.

Digitalization of higher education always includes the creation of more effective teaching methods and processes that do not simply replace pens or boards with an electronic version, but make new promising pedagogical processes possible. The development of information and communication technologies for higher education has become especially important, because modern technologies provide the vast majority of those who wish to study comfortably from anywhere in the world, as well as access to free and comprehensive information and the ability to exchange materials. In the context of the development of digital technologies, so-called digital literacy and digital skills, which characterize a person's ability to use certain knowledge and information technologies in practice, are acquiring great importance. Digital skill is defined as a person's ability to perform any activity.

A modern teacher must be able not only to use already widespread text and other editors, create electronic presentations for presenting information to students, but also be able to use new means of information processing. Thus, with the help of digital technologies, it will be much easier for teachers to present educational material, which entails the possibility of significantly expanding learning.

In the process of implementing high-tech processes in terms of organizing educational activities, it is important to pay attention to involvement and interest. Currently, pedagogical activities based on

distance platforms are designed to achieve set goals and attract, engage and maximally retain the attention of students in the learning process.

During the study, the author used a set of theoretical, practical and mathematical methods of scientific knowledge, such as: a survey using open, semi-closed and closed questions, rating assessment, data generalization, mathematical and statistical data processing.

The impact of possible risk factors of digital transformation on the development of general education is often associated with the existing working and socio-cultural conditions in which teachers find themselves. To evaluate the results of the study, we consider information about the volume of the study load of the survey participants to be of no small importance. More than 50% of survey participants work more than one full-time job, 42.6% work full-time, 6.6% work less than one full-time job. The workload of teachers affects the decrease in motivation to improve their professional competencies related to the use of innovative technologies in the educational process, and, therefore, is a significant factor in the formation of possible risks of digital transformation of general education.

The performance of teachers' professional duties in the context of digitalization is directly related to the quality of Internet connections available to teachers. Therefore, the developed questionnaire included questions reflecting this condition. The digital transformation of education requires teachers to have a stable Internet connection, both at home and at work. 42.6% of respondents consider the quality of the Internet connection at home for conducting online classes with students to be only satisfactory, an equal number of survey participants (24.6%) consider it excellent and good, and 8.2% noted that the connection quality was unsatisfactory.

Of great interest to our study is the availability of technical means that survey participants use to solve professional tasks that require access to the Internet or the use of computer programs. Data analysis shows that 64% of survey participants use a telephone or smartphone to solve professional tasks that require access to the Internet or the use of computer programs, 63.4% use a laptop, 33.3% use a desktop computer, and 3.3% noted that they can only perform professional actions at the university, since they do not have technical devices at home.

Of particular interest is the information on whether the teachers who participated in the survey are able to use various computer programs when solving professional problems. The questionnaire list included programs that teachers most frequently encounter in their work, allowing them to expand this list on their own if necessary. 94.9% of survey participants use Microsoft Word in their work, 74.6% use Microsoft PowerPoint and Microsoft Excel, 54.2 use ChatGPT, 25.4% use neural network programs, 1.7% noted that they use video and audio editors, graphic programs, etc.

We believe it is important to find out the opinions of survey participants regarding the effectiveness of teaching in a face-to-face format. 77% of surveyed teachers believe that classes in their subjects are best taught only in a face-to-face format, 9.8% of survey participants believe that their subject can be taught remotely, and 13.1% of respondents found it difficult to express their attitude to this statement.

We consider it equally important to find out the attitude of survey participants to the statement "The distance learning format is convenient and comfortable for me personally." The survey results show that only 14.8% of teachers who participated in the survey agree with it, 70.5% disagree, and 14.8% found it difficult to answer. Only 9.8% of survey participants agree with the statement "Distance learning is convenient and comfortable for students", 72.1% disagree, and 18% found it difficult to express their attitude.

The majority of respondents fully or mostly agree that the use of digital technologies in the educational process helps improve the quality of education, saving time, developing the independence of the student, increasing the level of knowledge necessary in modern life and interest in learning, etc. The attitude of survey participants towards the digital transformation of education is ambiguous and contradictory.

Social networks, email and instant messengers play a significant role in the life of a modern person, including a teacher, who can use them as a tool for remote interaction with other subjects of the educational process in the context of the digital transformation of general education. Based on the survey results, it can be seen that the majority of survey participants are active users of social networks.

The teachers who took part in the survey do not have a single, clear idea of the directions and trends of educational development in the context of digitalization. About 25% of respondents found it difficult to answer questions about the impact of digitalization on education in the near future.

Conclusion: every person understands perfectly well that in the modern world, learning without digital technologies and skills is almost impossible, since technology and the Internet are increasingly being introduced into people's lives all over the world. In addition, the use of digital technologies makes

many tasks much easier for the teacher, allows to interest students and reveal their creative potential, and not only to convey information, but also to teach them to think independently and solve emerging problems.

The formation of a digital educational resource greatly simplifies the work of teachers and students, in addition, modern educational technologies have significantly expanded the possibilities for learning certain subjects. There is an opportunity for constant access to the necessary information through the creation of electronic educational resources.

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Pharmaceutical sciences

DEVELOPMENT OF GRANULE TECHNOLOGY BASED ON (GLYCYRRHIZA GLABRA L.) EXTRACT

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Abstract

Nowadays, phytopreparations are widely used for the treatment and prevention of various diseases. These herbal remedies are primarily applied to treat chronic conditions affecting nearly all systems and organs of the human body, including the cardiovascular system, respiratory tract, gastrointestinal tract, nervous system, liver, skin, gums, throat, and others. Herbal medicines are medicinal products that contain plant-derived biologically active substances or medicinal plant materials and are used for the treatment and prevention of various diseases.

Keywords. Licorice (Glycyrrhiza glabra L.), extract, granule, phytopreparations, dosage form, therapeutic effect, pharmaceutical technology, herbal formulation.

Relevance. (Glycyrrhiza glabra L.) is a plant widely used both in traditional medicine and modern pharmaceutical practice. Its composition includes glycyrrhizic acid, flavonoids, and other biologically active substances that exhibit therapeutic properties such as anti-inflammatory, antiviral, and immune-modulating effects. Therefore, the use of licorice extract in various dosage forms is considered highly relevant.

Developing this specific dosage form offers several advantages, including convenient dosing, prolonged shelf life, and improved bioavailability. Additionally, the increasing demand for natural plant-based products and the growing quality standards for pharmaceutical dosage forms highlight the importance of creating effective, safe, and high-quality medicinal products based on (Glycyrrhiza glabra L.).

Thus, the formulation and technological development of granules based on licorice extract, as well as the assessment of their quality parameters, represent one of the urgent tasks of contemporary pharmaceutical production. This research contributes to expanding the range of domestic herbal products using Kazakhstani plant materials and improving public health outcomes [1].

Materials and Methods. (Glycyrrhiza glabra L.) is a perennial plant belonging to the Fabaceae family. It grows primarily in the temperate and subtropical regions of Eurasia. Pharmacologically valuable, the plant contains:

- Glycyrrhizic acid – provides anti-inflammatory and immunomodulatory effects.
- Flavonoids – have antioxidant activity and strengthen capillaries.
- Saponins – act as expectorants and aid in cleansing the respiratory tract.
- Carbohydrates – serve as an energy source and contribute to the extractives.
- Coumarins – exhibit antispasmodic effects.
- Organic acids – participate in regulating metabolism [2, 3].

The plant's composition includes:

- Moisture – 8–12%
- Ash – 4–8%
- Extractives – 40–50%
- Tannins – 1–3%
- Carbohydrates – 10–20%
- Saponins – 2–6%
- Flavonoids – 2–4%
- Glycyrrhizic acid – 6–15%

Excipients:

• *Purified water (Aqua purificata): sterile and pyrogen-free water, colorless and tasteless; used as a binder in granule formation.*

• *Sucrose (Saccharum): white crystalline powder, easily soluble in water.*

• *Glucose (Glucosum): sweet, white crystalline powder.*

• *Fructose (Fructosum): white crystalline powder, easily soluble in water.*

• *Corn starch (Maydis amylum): fine white or slightly yellowish powder with crepitating sensation when rubbed.*

• *Starch paste (Mucilago Amyli): viscous liquid prepared from starch and water; used as a binder and thickener.*

• *Potato starch (Solani amylum): very fine white or yellowish powder, swells in water but does not dissolve.*

• *Menthol (Mentholum): colorless crystals with strong odor and cooling taste; slightly soluble in water.*

• *Citric acid (Acidum citricum): white or colorless crystalline powder, highly soluble in water [4, 5].*

Results of Analysis. *To determine the optimal granule formulation, five model samples (100 g each) were prepared (Table 1). Dry extract of (Glycyrrhiza glabra L.) was used as the active pharmaceutical ingredient. To ensure proper granulation, the base formulation and excipients were selected considering their properties and compatibility, and each technological stage was carefully followed. The choice of ingredients and their effects were based on a review of relevant literature. The five models were produced according to standard pharmaceutical procedures at the simulation center of KazNMU.*

Table 1

Sample Granule Formulations with (Glycyrrhiza glabra L.) extract

No	Ingredient Name	Purpose of Ingredient	Model 1 (g)	Model 2 (g)	Model 3 (g)	Model 4 (g)	Model 5 (g)
1	Licorice extract	Active ingredient	10	10	10	10	10
2	Sucrose	Sweetener	40			40	
3	Glucose	Sweetener		38			
4	Fructose	Sweetener			20		40
5	Corn starch	Filler, disintegrant		40		45	
6	Starch paste	Binder			1:4:45 (20)		
7	Potato starch	Filler, disintegrant	40				35
8	Menthol	Flavoring agent	2				
9	Citric acid	Flavoring agent		2			5
10	Purified water	Binder	7,5-8	10		5	10

Production Technology of Granules with (Glycyrrhiza glabra L.) extract:

Step 1: Raw material preparation. Licorice extract, glucose, corn starch, and citric acid were weighed using an analytical balance and sieved through a vibro-sieve. Production process control: weight and uniformity of dry components.

Step 2: Preparation of wet mass. Purified water was measured and added to a reactor mixer, mixed until a uniform wet mass was obtained. Production process control: mixing time, rotation speed (rpm), uniformity, and volume of the mass.

Step 3: Granulation of wet mass. The wet mass was transferred to a granulator for granulation. Production process control: sieve mesh size, granule size.

Step 4: Drying of granules. Wet granules were placed in a drying oven and dried at 30–40 °C. Production process control: temperature and drying time.

Step 5: Coating of granules. Granules were mixed with calcium stearate in a mixer for coating. Production process control: mixing time and quality.

Step 6: Primary packaging. Granules were packed into sachets. Production process control: completeness and labeling accuracy.

Step 7: Secondary packaging. Sachets were packed into secondary packaging. Production process control: completeness, labeling accuracy, and quality of instructions.

Table 2

Quality Evaluation Parameters of Granules with (Glycyrrhiza glabra L.) extract

Quality Parameter	*Acceptance Criteria*	*Analysis Methods*
Appearance	*Brown color, 0.3–0.5 mm granules*	*State Pharmacopoeia of Kazakhstan (SPK) I, Section "Granules"*
Identification	*Brown color appears when 2–3 drops of $FeCl_3$ solution are added to the solution*	*SPK I, 1st part, 2.3 quality reaction*
Granule size	*Approximately 2 mm*	*SPK I, 2.9.12 "Sieve analysis"*
Loss on drying	*Not more than 10%*	*SPK I, General Pharmacopoeia Monograph "Loss on drying"*
Disintegration time	*No more than 15 minutes*	*SPK I, 2.9.1*
Dissolution	*15–45 minutes in buffer pH 6.8–7.6 and water mixtures*	*SPK I, 2.9.3 "Dissolution test for solid dosage forms"*
Content uniformity	*Allowed deviation ±10% for 300 mg or ±7.5% for 10 units*	*SPK I, 2.9.6 (B)*
Quantitative determination	*not less than 5.0%*	*UV-visible spectrophotometry, SPK I, 1st part, 2.2.25*
Microbiological purity	*Absence of Salmonella (10 g or ml), Escherichia coli (1 g or ml), Staphylococcus aureus (1 g or ml)*	*SPK I, 5.1.4 "Microbiological purity of medicinal products"*
Container weight (for multi-dose containers)	*Plastic sachets, pink-orange glass jars, or aluminum glass vials*	*SPK I, 3.1, 3.2 "Applicable container materials"*
Packaging	*Polymer sachets*	*According to regulatory requirements*
Labeling	*Label includes country of manufacture, manufacturer details, drug name (Kazakh, Russian, Latin), weight, batch number, production and expiration dates, storage conditions*	*According to regulatory requirements*
Storage	*Granules should be stored in a dry place, protected from light if necessary*	*According to regulatory requirements*
Main pharmacological effect	*Anti-inflammatory, antiviral, anti-allergic, and calming effects*	

Conclusion

Five experimental formulations of granules based on (Glycyrrhiza glabra L.) extract were developed to select the optimal composition and subsequently subjected to comparative analysis. Based on a comprehensive assessment of organoleptic, technological, and pharmacological parameters, formulation No. 2 demonstrated the best results. This formulation met all established standards and requirements, and therefore was selected as optimal. Further studies were conducted using this particular formulation.

The optimal No. 2 granule formulation includes licorice (Glycyrrhiza glabra L.) extract, glucose, corn starch, citric acid, and purified water. The combined effect of these components contributes to a pronounced expectorant effect, softening of the respiratory tract mucosa, and exhibits anti-inflammatory properties.

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ON THE POSSIBILITY OF USING ALMOND OIL AND ITS PRODUCTION BY-PRODUCTS

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Introduction. *Owing to its biological activity, as well as physicochemical and sensory properties, almond (Prunus dulcis Mill. DA Webb), ranks first in the world nut production. According to the reports of Food and Agriculture Organization (FAO), more than 3 million tons of almonds are produced annually [1].*

Goal of the Study. *Georgia has a rich flora with many valuable plants. The present report describes the substances that are contained in the main structural parts of Almond - Prunus dulcis (Mill.), capable of using in medicine and cosmetics [2,3].*

Materials and methods. *The almond is a stone fruit, Prunus dulcis (Mill.), unlike other stone fruits, the pulp (mesocarp) is discarded and the seeds (endocarp) are utilized. The main structural parts of the almond include the outer greenish shell called the husk, the intermediate shell, the brownish skin, and the seed and kernel. The husk makes up to 50 to 55% of the total fresh weight, the kernel up to 15 to 20%, and the skin up to 4 to 8%. In the industry, the kernel is obtained by removing the outer parts of the almond fruit, then roasting, where the almond skin is separated by blanching and obtaining blanch water. From 1 kg of nuts 0.6 kg and 2.5 kg of shells and husks are obtained. Annually their proportions in waste are 0.5 and 2.2 million tons respectively. In recent years, almond tree plantations have been intensively cultivated in Georgia. According to available data, there are about 6 thousand hectares of intensive developing almond orchards in Georgia. Export of almonds is up to 200 tons (Agronovosti RSS). All this, taking into account the chemical composition and large amount of waste, causes the need to create methods and technologies for their utilization, and this is the topic of the present work [4-7].*

Results obtained. *Consider the biologically active substances contained in individual parts of almond. Kernels contain fatty acids up to 30-60%, of which 20-25% are monounsaturated, mainly consisting of linoleic, palmitic and stearic acids, 60-75% are saturated acids: oleic, linoleic, palmitoleic, vaccenic and heptadecenic acids. Other fatty acids are found in trace amounts. Almond sontains phenolic compounds as well: condensed and hydrolyzable tannins, flavonoids and phenolic acids (catechin, epicatechin, naringenin-7-O-glucoside, kaempferol-3-O-rutinoside, dihydroxy kaempferol, isoramnetin-3-O-rutinoside, isoramnetin-3-O-glucoside and naringenin. It contains stilbenes, e.g. polydatin was found in almond kernels, almond peel and blanch water (0,7, 1,8 and 72 (0.7, 1.8 and 72 ng/g), as well as piceatannol and oxiresveratrol. Almond oil is used in medicine, cosmetics, cosmeceuticals, exhibiting various biological activities, including antimicrobial, antioxidant, anti-inflammatory, anti-cancer, UV-protective, laxative, etc. Similarly, by-products of almond processing (skin, blanching water and others) contain many similar bioactive compounds with the same activity [8-10]. For example, almond shells, which make up to 30% of the total weight of the fruit, contain 30-60% polysaccharides and 25-35% phenols, flavonoids and tannins, as well as cellulose, lignin and terpenes. Blanched water contains flavonols, phenolic acids and flavanones. The amount of polyphenols in the skin reaches 74 - 80%.*

Conclusion*. Based on the content of bioactive substances in wastes, we can suggest the following application for almond: the skin can be used in the preparation of creams, ointments and masks according to our proposed technology [11], peels and husks in skin scrubbing agents and powders, blanching water can be used an aqueous phase in the preparation of bases for ointments, creams and masks.*

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Philological sciences

ON THE CHARACTERISTIC FEATURES OF ENGLISH SONOROUS

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Abstract

When people communicate with each other, they do not use sounds in isolated form, they use expressions and sentences formed by combining these sounds. For people to understand and comprehend one another, it is essential to have clear and precise speech. The clearer, more complete and more literate a person's speech is, the easier communication becomes. For this reason, speech plays a crucial role. The clarity of speech depends on a person's skillful and literate use of a particular language. To use a language skillfully, it is necessary to know its pronunciation rules, intonation features, word formation and so on.

Language is a system of signs, in other words language is basically sound. Each sign has two aspects: content and form of expression. The form of expression is the external, visible side of the language. Content, on the other hand, is the sequence of ideas expressed in the language, serving as a source of meaning.

Keywords: *phoneme, consonant, vowel, sonorant, syllabic consonants, syllable*

Annotation. *The phonetic aspect of a language consists of sounds, phonemes, and allophones. A "phon" is the smallest sound level of a language. Unlike phonemes and allophones, phons belong to speech. Phonemes and allophones, in their turn, pertain to the language. A phoneme is the smallest distinctive unit of a language, while an allophone is a variation of a phoneme realized in different positions. Phonemes also differentiate grammatical forms. They are realized in connected speech through spoken sounds.*

Introduction. *It is known that the phonological systems of all world languages consist of vowel and consonant subsystems. Traditional phonetic studies differentiated vowels and consonants based on physiological principles, explaining that vowels involve no obstruction of the airflow during pronunciation, whereas consonants are produced when the air passes through mouth and nasal cavity with obstruction. However, the emergence of phonology overturned this theory, as phonology is based on linguistic criteria. Differences in the phonological systems of languages cannot be scientifically explained only through acoustic or physiological criteria. The quantity and quality of phonemes in a language are tied to its systemic characteristics.*

The contrastive study of phoneme systems in languages has both confrontational and phonological significance. In contrastive research, the phonological systems of the languages being compared—including phoneme compositions, phonological structures, functional loads of phonemes, and phoneme combination properties—are analyzed. The phonematic analysis of a language first requires determining its phoneme inventory and the variants of phoneme manifestation in syntax. By contrasting with other phonemes, they can create new sounds and meanings. Materialistic views on phonemes were first proposed by L.V. Shcherba, who suggested that phonemes are functional, material, and abstract units [9, p. 150].

Allophones are the various realizations of a phoneme in different positions with different pronunciations. In English, there are specifically 44 phonemes, while the number of allophones is countless. A phoneme may have several variants, one of which is the primary variant containing all the characteristics of the phoneme and capable of distinguishing words. Other variants are combinatorial or optional.

One of the key aspects of phonological research is identifying the "features that are common to all variants of a phoneme and distinguish it from other phonemes." Determining the phonological content of a phoneme is crucial in the context of phonological contrasts. It is necessary to note that phonemes in a language's phonological system establish paradigmatic and syntagmatic relationships among

themselves. Discussing the paradigmatic and syntagmatic relationships among language units, Shcherba L. states that these relationships at the systemic and speech levels condition and complete each other mutually [9, p. 157].

Phonemes, which constitute the phonological system of a language, are sequential units or segmental entities, meaning phonemes of varying lengths that follow one another in connected speech. This is characterized by suprasegmental features that coexist with segmental units and are realized simultaneously in the speech process. Phonemes interacting with each other form thousands of combinations that serve as exponents of meaningful units of language. F. Veyselli emphasizes the importance of studying the coarticulatory aspects of discrete units in the speech stream, noting that "without studying the mutual influence of language units in the connected speech chain, achieving significant scientific breakthroughs is impossible. Meaningful units in a language, which can function independently morphemes, lexemes, etc. mainly consist of two or more phonemes combined in a linear sequence" [13, p. 67].

The study of the regularities between phoneme combinations in syntagmatics is the only correct way to uncover genetic relationships between languages and the systemic relations within a language. According to F. Veyselli, "the obstacles in learning a non-native language are not limited to the systemic and structural differences between the native and target languages but also include the differences in the possibilities of interaction among the units of the two languages" [13, p. 43].

Although vowels and consonants function differently in the systems and speech of various languages, their differentiation is universal and is determined by the acoustic-physiological nature of the language's expression. Acoustically, the distinction between vowels and consonants lies in the presence of a precise formant structure in vowels, while consonants lack this feature. Additionally, vowels are characterized as sounds with higher general energy and are dominated by tone, whereas consonants are predominated by noise. According to L.R. Zinder, none of these criteria alone is sufficient to draw a clear boundary between vowels and consonants.

The most general criterion for distinguishing vowels and consonants was proposed by I.A. Boduen de Courtenay as the centralization criterion. According to this criterion, the pronunciation of consonants involves the concentration of tension in a specific location of the speech organs, producing noise characteristic of the consonant. In contrast, in vowel production, tension is distributed among the articulatory organs. Thus, a sound is considered a consonant if there is centralization in any part of the speech apparatus, and a vowel if there is no centralization.

Later, J.A. Boduen de Courtenay further advanced the concept of the phoneme, evaluating it as an abstract (psychophonetic) unit within the framework of morphological alternations (allomorphemes)[9, p. 137].

According to Prof. D. Jones, the difference between "vowels and consonants" is not physiological but rather based on acoustic relationships. Vowel sounds are defined as those formed by uninterrupted airflow through the pharynx and mouth cavity without any constriction or obstruction. He argues that vowels are distinguished from consonants primarily by their higher sonority. However, in English, some consonants exhibit sonority levels comparable to vowels, such as sonorant consonants. There are seven sonorant sounds in English: [m], [n], [ŋ], [l], [r], [j], and [w]. Sonorant consonants are divided into nasal and constrictive sonorants.

During the articulation of nasal sonorants, the speech organs form a complete closure in the mouth cavity, the soft palate is lowered and air passes through the nasal cavity. Examples in English include [m], [n], and [ŋ]. Each nasal sonorant forms its closure in different articulatory centers: for [m], the closure occurs at the lips; for [n], between tip of the tongue and alveolar ridge; and for [ŋ], between back of the tongue and soft palate. Nasal sonorants are also characterized as nasal sounds.

Constrictive sonorous form a channel during articulation, allowing air to pass through with minimal friction, thereby producing sounds where the musical tone dominates over noise, resulting in constrictive sonorants. In this context, sonorants occupy an intermediate position between vowels and consonants. Their articulation, similar to that of vowels, is characterized by a high level of musical resonance. Constrictive sonorants are divided into two categories: lateral and medial.

During the articulation of medial sonorants, the airflow is directed along the middle of the tongue. Examples of these sounds include [w], [r] and [j].

For lateral sonorants, the tongue approaches either the alveolar ridge or the teeth while the sides of the tongue lower to allow airflow. The English phoneme [l] is lateral sonorant.

Nasal sonorants are characterized by the release of airflow through the nasal cavity. While some sources emphasize the exclusive role of the nasal cavity, others acknowledge the involvement of the oral

cavity. During the articulation of nasal phonemes, the oral cavity remains partially open, creating additional resonance pathways. This dual resonance distinguishes nasal sonorants from other consonants and contributes to their musical quality. Experimental phonetic research indicates that nasal sonorants, such as [m] and [n], require greater muscular tension compared to other consonants.

A unique feature of [m], [n], [ŋ] sonorants is their ability to form syllables. Although some sources do not attribute this property to the [ŋ] phoneme, modern literature confirms its syllable-forming capacity. Among occlusive sonorants, [n] is the most common syllable-former, with [m] and [ŋ] being less frequent. Sonorants form syllables when positioned next to another consonant, often incorporating the preceding consonant into the syllable. For example: garden: [ˈgɑː-dn]; didn't: [ˈdɪd-nt]

The ability of sonorants to form syllables depends on the quality of the preceding vowel. If the vowel is long or a diphthong, the sonorant combines with a consonant to form a syllable, as in garden. Conversely, short vowels unable to stand alone in an open syllable, force the sonorant to form a closed syllable, such as in film [ˈfɪl-m] and bottom [ˈbɒt-m].

The [ŋ] phoneme does not occur at the beginning of words in British English but is common in final and medial positions, represented orthographically as "ng". For example: thing: [θɪŋ]; thinking [ˈθɪŋkɪŋ].

Exceptions to this pattern occur in New Zealand English, where [ŋ] can initiate words, often in indigenous names or terms.

In compound words, stress placement can influence the realization of [ŋ]. For instance: congress: [ˈkɒŋgres]; congressional: [kənˈgreʃənəl]

Constrictive sonorants are notable for their glide-like transitions, quickly moving towards the articulation of subsequent vowels. For instance, [r], [j] and [l] are single-point articulation(unicentral) sounds, whereas [w] is a dual-point articulation (bicentral)sound.

Phoneme [j] is articulated with the middle of the tongue raised towards the hard palate, allowing smooth airflow. It resembles the short [ɪ] vowel initially but transitions into a distinct sound, as in your [jɔː], beyond [bɪˈjɒnd], and yield [jiːld].

Phoneme[l] exhibits two variants in English. The "clear l" occurs before vowels and [j], as in like [laɪk] and value [ˈvæljuː].

The second is called dark [ł]. The dark [ł] sound can occur at the end of a word or before a consonant. Like the clear [l] sound, the tip of the tongue touches the alveolar ridge and air is released by the sides of the tongue. In words like kill [kił], rule [ruːł], children [ʧɪldrən], silk [sɪłk], the distribution of the sound occurs either at the end of the word (syllable) or before a consonant. In other words while producing dark [ł] back part of the tongue is raised against soft palate.

In the articulation of the clear variant of the [l] phoneme, the front part of the tongue is raised towards the hard palate (front articulation). It gives soft pronunciation to this sound. In the articulation of the dark [l] variant, the back part of the tongue rises towards the soft palate (back articulation)? giving it dark form. During the articulation of both [l] variants, the vocal cords drawn together and vibrate. The [l] phoneme is an alveolar, lateral, apical and sonorous sound, articulated with front articulation in the clear variant and back articulation in the dark variant [15, p. 83]. Let us compare the soft and dark variants of this phoneme with examples:

late [leɪt]; tale [teɪł]
lead [liːd]; deal [diːł]

The consonant [w] is articulated with rounded narrowing formed by the lips and the back of the tongue rising towards the soft palate. The sides of the tongue are raised, and air flows out along the middle of the tongue. Air exits through a rounded channel between the lips. The [w] sonorant is accompanied by noise during articulation. The vocal cords come close and vibrate. The sound is very short and weak. Thus [w] is a bilabial, consrtictive medial sonorant,voiced consonant with back articulation.

Due to their glide-like characteristics, English has two glide consonants: [w] and [j]. These sounds differ from their vowel counterparts ([i, u]) in distribution, articulation strength, and duration. They are referred to as semi-vowels or semi-consonants. Unlike vowels, they never occur in final position, before a consonant, and are always followed by a vocalic (vowel) sound.

Initially, its articulation resembles the vowel [u], but the articulators shift to different positions to pronounce other sounds. Its distribution occurs before a vowel in the syllable-initial position, e.g., wet [w e t]; world [w ɜː l d]; walk [w ɔː k]. Before the consonant [r], the [w] sound is not pronounced, e.g., write [raɪt].

In the articulation of the phoneme[r] the tip of the tongue curls back to a post-alveolar position, and air flows out along the center of the tongue. The vocal cords come close and vibrate. [r] is a post-alveolar, cacuminal, constrictive medial sonorant. It has several variants:

1.Rhotic [r]: In RP-BBC pronunciation, it is a non-fricative sound that resembles a fricative. The tip of the tongue slightly touches the back of the alveolar ridge, while the tongue body is in the front part of the mouth.

2.Flapped [r]: Commonly used in unstressed syllables, especially at the beginning, where the tongue taps the alveolar ridge briefly.

3.Rolled [r]: Found in northern dialects and Scottish English, this variant involves repeated, rapid tapping of the tongue against the alveolar ridge.

In standard English, the [r] sound is not pronounced in post-vocalic or syllable-final positions, e.g., star [stɑ:], party [ˈ pɑ:ti]. If the word continues with a vowel, [r] is pronounced, e.g., a car is mine / ə ˈ kɑ:r ɪz ˈ maɪn //.

When a suffix is added to a base ending in silent [r], the [r] sound is pronounced, e.g., hear [hɪə] / hearing [ˈ hɪərɪŋ]; Moor [mʊə] / Moorish [ˈ mʊərɪʃ]. This type of [r] is called "linking r."

In summary, the [r] sonorant only occurs pre-vocalically (before vowels) and inter-vocalically (between two vowels), e.g., remain [rɪˈ meɪn]; very [ˈ veri].

When sonorants occur next to voiceless consonants, their sonority is reduced, leading to a voiceless variant. So they are partially devoiced. For instance, cry [k r aɪ]; after alveolar consonants the [r] phoneme is pronounced as an alveolar variant rather than post-alveolar. For example, try [t r aɪ].

As we noted, a unique feature of sonorants is their ability to form syllables. There are two approaches to the concept of syllables in linguistics. From a physiological perspective, a syllable is a small unit formed by the combination of one or more sounds and pronounced in a single breath. Acoustically, a syllable is distinguished by one of its sounds being louder or differing in articulation from the others. Among these sounds, vowels stand out the most because they play a significant role in syllable formation due to their strength. This distinction separates them from consonants, which cannot form syllables. However, some consonants-sonorants possess syllable-forming qualities in certain contexts. These sonorants can form syllables due to their melodious and resonant qualities, setting them apart from other consonants [2, p. 25].

When analyzing the articulatory-acoustic properties of the phonemes [m], [n], and [l], it is evident that they differ from other consonants due to their longer duration, higher intensity, and the greater tension in the muscles during pronunciation. Research indicates that muscle tension in the speech organs increases significantly during the articulation of sonorants. This is associated with their prolonged and intense articulation. During their articulation, the size of the resonators increases, particularly the oral resonator, which changes in shape and size. As a result, sonorants are pronounced with a vowel-like effect, enabling their syllable-forming function.

The syllable formation of [m], [n], and [l] sonorants occurs when they are used in final position after another consonants at the end. For example: cotton [ˈ kɒt-n], cable [ˈ keɪ-bl], rhythm [ˈ rɪð-m].

It should be noted that the syllable-forming property of sonorants is not limited to the ends of words but also occurs at the end of morphemes. In some cases, the end of a morpheme does not coincide with the end of the word. For example:

settle [ˈ set-l] → settlement [ˈ set-l-mənt].

If two sonorants are adjacent in such positions, each can form a separate syllable. For instance: nation [ˈ neɪ-ʃn̩], national [ˈ næʃ-n̩-l̩].

The syllable formation of the phoneme [ŋ] can occasionally be observed at the juncture of two words. However, this is rare: broken key [ˈ broʊkŋ̩ ki:].

The syllable formation of sonorants can also occur when the neutral sound [ə] is omitted in weak prefixes. For example: correct [kəˈ rekt] → [ˈ krekt].

These examples are more commonly used in spoken language. In slower speech tempos, the omission of the neutral sound and the syllable formation of sonorants is not a typical occurrence.

In English, the sonorants [w] and [j] lack the ability to form syllables because they are always used before a vowel. Their weak and gliding characteristics prevent them from being used alongside consonants, which is why they cannot form syllables. In words where they occur with vowels, the syllables are formed by the vowels, rendering these sonorants devoid of syllable-forming properties.

Conclusion. *English sonorants may be occlusive and constrictive. There are 7 sonorous consonants. Most of them are syllabic, all of them are voiced, as in their articulation vocal cords drawn together and vibrate. Although sonorants possess syllable-forming functions similar to vowels, they cannot carry stress like vowels. The stress in a syllable always falls on the vowel.*

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Sociological sciences

IMPROVE THE ACCOUNTING AND CONTROL EFFICIENCY OF BUDGET PROJECT EXECUTION SUMMARY

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This article deeply explores the accounting and control issues for improving budget project execution. By analyzing the current situation, it reveals pain points such as budget estimation deviation, internal control failure, and evaluation deficiency. Combining a large amount of actual data, using cases and charts, it proposes improvement strategies such as data-driven compilation, intelligent internal control, and multi-dimensional evaluation, providing detailed reference for organizations to optimize budget management and help efficiently allocate resources and achieve strategic goals.

1. Introduction

In the era of digital transformation and refined management, accounting and control of budget project execution have become the core link for organizations to achieve their strategic goals. Effective accounting and control can ensure accurate implementation of budgets and improve resource utilization efficiency. However, surveys show that more than 60% of companies have budget execution deviations, which seriously affect operational benefits and development plans. Therefore, it is urgent to conduct in-depth research and improve the accounting and control system for budget execution.

II. Current status and existing problems of budget project implementation

1. Inaccurate budget estimates

Currently, many organizations lack scientific basis in the budget preparation stage, resulting in a large deviation between the budget and actual execution. According to the survey data of 100 companies, in the past year, the deviation rate between the budget and actual execution of each company was generally high. The specific data is shown in the following table:

Industry Type	Average budget deviation rate	Highest deviation case	Main causes of deviation
manufacturing	18.7%	An automobile manufacturing company (32%)	Insufficient forecasting of raw material price fluctuations
Services	15.3%	A large hotel group (28%)	Miscalculation of passenger flow
Construction Industry	22.5%	A municipal engineering company (38%)	Quantity calculation error

This inaccurate budget estimate makes it impossible to allocate resources reasonably, and accounting cannot truly reflect project costs, which seriously interferes with the normal implementation of budget projects.

2. Weak internal control

The imperfect internal control system is obvious in many organizations. Taking the audit data of 50 administrative institutions in a certain province as an example, the proportion of units with internal control problems is as high as 72%. The specific problems are as follows:

Question Type	Proportion of units involved	Typical manifestations
Unclear division of responsibilities	35%	Financial approval and execution positions are not separated
Lack of supervision mechanism	28%	No special audit of budget execution was conducted during the year
Poor implementation of the system	19%	Expenditure beyond budget was not approved according to procedures

Weak internal control leads to frequent violations of regulations during budget execution and inefficient use of funds, which seriously threatens the smooth progress of budget projects.

3. Lack of effective performance evaluation

Most organizations have not yet established a sound budget performance evaluation system. A questionnaire survey of 200 companies found that only 31% of companies regularly conduct budget performance evaluations, and the evaluation indicators are single. Among the companies that have not conducted evaluations, 42% believe that there is a lack of professional evaluation methods, and 35% say there are no clear evaluation standards. Due to the lack of scientific performance evaluation, it is impossible to discover problems in budget execution in a timely manner, making it difficult to provide effective support for subsequent budget decisions.

Ⅲ. Theories and principles related to accounting and control of budget project execution

1. Budget management theory

Budget management theory emphasizes full-process management, covering budget preparation, execution, monitoring and evaluation, and aims to achieve organizational strategic goals through reasonable resource planning and coordinated departmental actions. This theory provides a systematic management framework for budget project execution.

2. Internal Control Theory

Internal control theory focuses on the construction of control mechanisms within an organization to ensure reliable financial information and efficient and compliant operations. In budget execution, internal control can effectively prevent risks and ensure the safety and rational use of funds.

3. Performance evaluation theory

Performance evaluation theory provides methods and standards for measuring the results of budget project execution. By setting reasonable indicators and evaluating the execution effects, it provides a basis for budget optimization and promotes continuous improvement of the organization.

Ⅳ. Strategies to improve budget project execution accounting and control

1. Improving the accuracy of budget preparation

Data-driven model : Use big data, artificial intelligence and other technologies to collect historical data, market dynamics, industry trends and other information to establish predictive models. For example, an e-commerce company reduced its budget deviation rate from 15% to 8% by analyzing its sales data, user behavior data, and market promotion activities over the past three years.

Participatory budgeting : Encourage all departments and employees to participate in budget preparation and make budget suggestions based on actual business needs. After a manufacturing company implemented participatory budgeting, the rationality of the department's budget was significantly improved and the efficiency of budget execution increased by 20%.

2.Optimizing the internal control system

Clarify the division of responsibilities : Develop detailed job descriptions to clarify the responsibilities and authorities of each department in budget execution to ensure clear authority and accountability. A multinational company improved the efficiency of its budget approval process by 30% by optimizing the division of responsibilities.

Establish a multi-level supervision mechanism : set up an internal audit team to conduct regular budget execution audits; introduce an intelligent monitoring system to track budget execution in real time. After a financial institution implemented intelligent monitoring, the time to discover abnormal transactions was shortened from an average of 5 days to 2 hours.

3. Establish a scientific performance evaluation mechanism

Set reasonable performance evaluation indicators : Build a comprehensive evaluation system that includes financial indicators (such as cost savings rate, capital return rate) and non-financial indicators (such as project progress compliance rate, customer satisfaction). The following table is an example of a project performance evaluation indicator:

Indicator Category	*Specific indicators*	*Weight*
Financial indicators	*Budget execution rate*	*25%*
	Cost Savings	*20%*
Non-financial indicators	*Project completion rate on time*	*25%*
	Customer Satisfaction	*30%*

Regular performance evaluation and feedback : Conduct performance evaluation on a quarterly and annual basis, provide timely feedback on the results, and link the evaluation results with department assessments and employee rewards. After a certain technology company implemented this mechanism, employees' enthusiasm for participating in budget management increased and the budget execution effect improved significantly.

V. Case Analysis

Take a large construction group as an example. Before the improvement, its annual budget deviation rate was as high as 25%. Internal control loopholes led to multiple fund misappropriation incidents, and the lack of performance evaluation made project management chaotic. After the implementation of the improvement measures, through data-driven budget preparation, combined with the market material price fluctuation model, the budget deviation rate dropped to 12%; internal control was optimized, and an intelligent approval and monitoring system was established, and fund misappropriation incidents did not occur again; the introduction of a scientific performance evaluation system increased the project on-time delivery rate from 70% to 95%, and the cost savings rate reached 18%, effectively improving the company's economic benefits and management level.

VI. Conclusion

Improving the accounting and control level of budget project execution is the key to achieving efficient management and sustainable development for organizations. By strengthening the accuracy of budget preparation, optimizing the internal control system, establishing a scientific performance evaluation mechanism, and analyzing and applying actual data and cases, current problems in budget execution can be effectively solved. In the future, with the development of digital technology, organizations should continue to innovate management methods and continuously improve the budget management system to adapt to the complex and changing market environment and enhance core competitiveness.

This journal article uses rich data and tables to more intuitively show the current status and improvement effects of budget project execution. If you have other requirements for data types and case industries, please feel free to tell me.

Technical sciences

DYNAMIC MODEL OF THERMODIFUSION PROCESSES UNDER LASER ACTION ON THE CONFUSION OF TWO MEDIA

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Abstract

Based on the numerical solution of the axisymmetric heat–mass transfer problem, the distribution of temperature fields in a two-layer metal-semiconductor system is analyzed. The values of the diffusion coefficients in these media are determined for various parameters of the heat source generated by laser radiation. The results of modeling can be used in the technology of manufacturing electronic components.

Keywords: *heat, and mass transfer, heat conduction equation, laser radiation.*

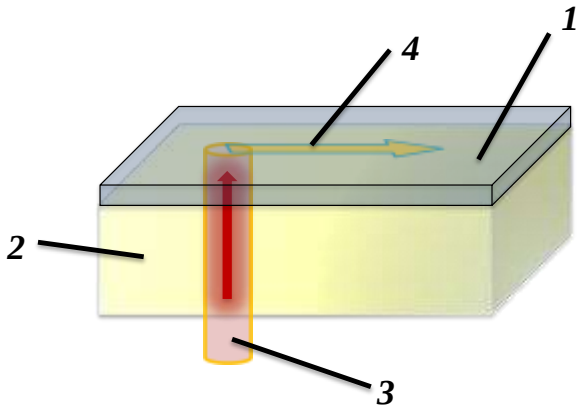
Introduction. *The development of semiconductor materials in submicron electronics technologies is carried out, among other things, using laser radiation. In the traditional use of laser radiation for dimensional processing of materials (laser cutting, engraving, marking, etc.), the material is removed along a given processing path [1]. However, in such cases, material losses associated with the removal of small fractions from the processing area are inevitable, which also has environmental consequences.*

In order to solve these problems, the most promising methods are those based on the catalytic properties of metal coatings previously deposited on semiconductor or dielectric substrates. For example, the thermochemical method of microforming on the diamond surface [1].

As such coatings, metals are used that can accumulate neutral atoms of the dissolved material in their volume to a certain concentration due to diffusion. Thus, the material can be extracted in a "non-contact" way. To maintain the described physical and chemical transformations in the selected treatment zone, the activating thermal effect of laser radiation is used. [1, 2]

Statement of the modeling problem. *In general, the solution of the heat and mass transfer problem in the described system is reduced to solving a system of differential equations, including heat conduction equations, with mixed boundary conditions, as well as diffusion equations in two media.*

To select the optimal modes of this treatment method, it is necessary to study the physico-chemical mechanisms of thermal and diffusion processes. Laser radiation is used to localize the heat source at the metal coating-substrate interface. A simplified scheme of thermochemical treatment is shown in Fig. 1.



1 – thin-film coating (metal), 2 – processed material (semiconductor), 3 –direction of propagation of laser radiation, 4 – direction of movement of the laser heat source during processing.
Fig. 1 – Diagram of the effect of laser radiation on the boundary of two media

Since laser radiation forms an axisymmetric heat source [2], we should look for a solution in the cylindrical coordinate system.

$$c \cdot \rho \cdot \frac{\partial T}{\partial \tau} = \frac{1}{r}\frac{\partial}{\partial r}\left(\lambda(T) \cdot r \cdot \frac{\partial T}{\partial r}\right) + \frac{\partial}{\partial z}\left(\lambda(T) \cdot \frac{\partial T}{\partial z}\right) \quad (1)$$

Thus, the nonstationary problem of heat and mass transfer in a two-layer metal-semiconductor system is considered. We assume that there is no convective heat exchange with the gas phase, and the gas is maintained at a constant temperature T_0T0. The initial temperatures of the semiconductor and the metal coating are also equal $T_0$to T0. In general, the system under consideration can be considered thermally insulated. Laser radiation acts on the metal-semiconductor interface, forming a surface heat source with a power density quniformly distributed over the cross-section of the laser spot. This ensures heating of the metal layer and its saturation with the products of dissolution of the semiconductor, as well as activates diffusion processes at both phase boundaries: "metal-semiconductor".

In addition, the following conditions are accepted:

– the temperature range at which laser processing is performed is limited by the melting point of the metal under normal conditions;

– the pressure in the gas phase is normal atmospheric.

At the metal – semiconductor interface, boundary conditions IV-th kind are realized in the well-known form (2):

$$\lambda_2(T_2) \cdot \frac{\partial T_2}{\partial z} = \lambda_1(T_1) \cdot \frac{\partial T_1}{\partial z}. \quad (2)$$

The system (1) – (2) is solved together with the diffusion equations for two media, presented in the form (3):

$$\frac{\partial C}{\partial \tau} = \frac{\partial}{\partial z}\left(D(T) \times \frac{\partial C}{\partial z}\right), \quad (3)$$

ddde: C is the mass concentration of the catalytically transported substance across the boundary of the mediaunder consideration, and the diffusion coefficients D depends on the temperature in accordance with закономthe Arrhenius law:

$$D(T) = D_0 \cdot exp\left(-\frac{E}{k \cdot T}\right), \quad (4)$$

where: D_0 diffusion factor, E is the corresponding activation energy of masstransfer, k = 1.38· 10^{-23} J/ K is the Boltzmann constant.

At the initial moment of time, the mass concentrations of the catalytically transferred material in both media are set: C_1=C_{01};C_2=C_{02}.

With the condition that на границе сред the conditions of continuity of the mass flow are realized at the boundaries of e media:

$$D(T)_i \cdot \frac{\partial C_i}{\partial z} = D(T)_j \cdot \frac{\partial C_j}{\partial z}. \quad (5)$$

Dynamic modeling

The system differential equations (1) – (5) to be solved can be approximated by a finite-difference scheme made with the first order of accuracy in time t and the second in spatial coordinates z and r. In this case, an implicit difference scheme was chosen, since it is the most stable [3], i.e. it allows integrating the boundary value problem with any time step of a given smallness.

On the MathCad, script files were developed for dynamic modeling of the temperature distribution in the framework of the task. This made it possible задачи неограниченных диапазонахto obtain instantaneous values of the diffusion coefficients in selected planes near the interface by varying the problem parameters in unlimited ranges вблизи границы раздела. Fragment aof lgorithma is shown in Fig. 2.

The proposed model makes it possible to determine the temperature distribution in a two-layer system ("metal"-"semiconductor") at a selected time in any range of laser radiation intensities for metal coatings with specified thermophysical parameters, excluding, of course, limit values that lead to a change in the aggregate state of the coating and (or) substrate.

For example, Fig. 3 shows a general view of the temperature distribution in the z and r coordinates for the power density of a heat source q = 10^8W /m^2 at time τ= 20 s.

Temperature :=
time ← 0
while time < final
time ← time + τ
$\alpha_1 \leftarrow \frac{2 \cdot a1 \cdot \tau}{2 \cdot a1 \cdot \tau + d^2}$
$\beta_1 \leftarrow \frac{d^2 \cdot T_1 + 2 \cdot a1 \cdot \tau \cdot d \cdot \frac{q}{\lambda 1}}{2 \cdot a1 \cdot \tau + d^2}$
for i ∈ 2..N1
$aa \leftarrow \frac{\lambda 1}{d^2}, bb \leftarrow \frac{2 \cdot \lambda 1}{d^2} + \frac{\rho 1 \cdot c1}{\tau}, ci \leftarrow \frac{\lambda 1}{d^2}, fi \leftarrow \frac{-\rho 1 \cdot c1 \cdot T_i}{\tau}$
$\alpha_i \leftarrow \frac{aa}{(bb - ci \cdot \alpha_{i-1})}, \beta_i \leftarrow \frac{ci \cdot \beta_{i-1} - fi}{bb - ci \cdot \alpha_{i-1}}$
$\alpha_{N1+1} \leftarrow \frac{2 \cdot a1 \cdot a2 \cdot \tau \cdot \lambda 2}{2 \cdot a1 \cdot a2 \cdot \tau \cdot [\lambda 2 + \lambda 1 \cdot (1 - \alpha_{N1})] + d^2 \cdot (a1 \cdot \lambda 2 + a2 \cdot \lambda 1)}$
$\beta_{N1+1} \leftarrow \frac{2 \cdot a1 \cdot a2 \cdot \tau \cdot \lambda 1 \cdot \beta_{N1} + d^2 \cdot (a1 \cdot \lambda 2 + a2 \cdot \lambda 1) \cdot T_{N1+1}}{2 \cdot a1 \cdot a2 \cdot \tau \cdot [\lambda 2 + \lambda 1 \cdot (1 - \alpha_{N1})] + d^2 \cdot (a1 \cdot \lambda 2 + a2 \cdot \lambda 1)}$
for i ∈ N1 + 2..N − 1
$aa \leftarrow \frac{\lambda 2}{d^2}, bb \leftarrow \frac{2 \cdot \lambda 2}{d^2} + \frac{\rho 2 \cdot c2}{\tau}, ci \leftarrow \frac{\lambda 2}{d^2}, fi \leftarrow \frac{-\rho 2 \cdot c2 \cdot T_i}{\tau}$
$\alpha_i \leftarrow \frac{aa}{(bb - ci \cdot \alpha_{i-1})}, \beta_i \leftarrow \frac{ci \cdot \beta_{i-1} - fi}{bb - ci \cdot \alpha_{i-1}}$
$T_N \leftarrow \frac{\lambda 2 \cdot d^2 \cdot T_N + 2 \cdot a2 \cdot \tau \cdot (\lambda 2 \cdot \beta_{N-1} + \kappa \cdot d \cdot Te)}{\lambda 2 \cdot d^2 + 2 \cdot a2 \cdot \tau \cdot [\lambda 2 \cdot (1 - \alpha_{N-1}) + \kappa \cdot d]}$
for i ∈ N − 1, N − 2..1
$T_i \leftarrow \alpha_i \cdot T_{i+1} + \beta_i$
T

Fig. 2 – Fragment of an algorithm for dynamic temperature modeling using the MathCad platform (final=FRAME·timescale)

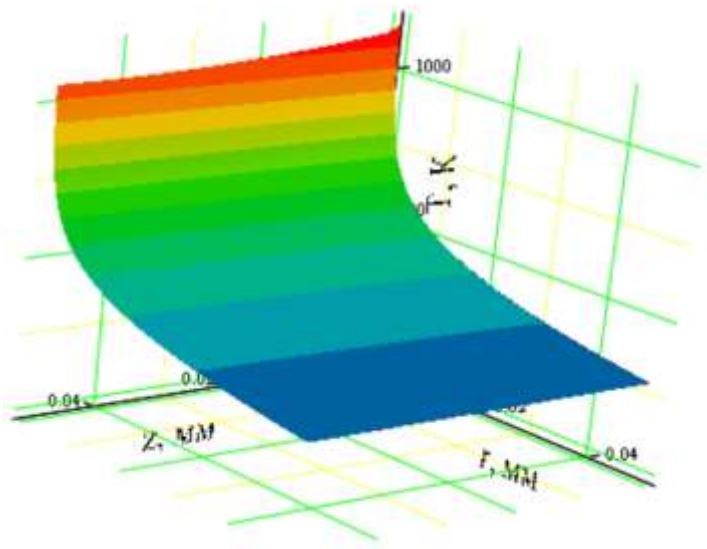


Fig. 3 – Temperature distribution T (K) over the volume of a two-layer metal-semiconductor system at a time of 20 s under the action of laser radiation

Taking into account the temperature values, we can estimate интенсивностьthe diffusion intensity in any plane of the studied two-layer system at a given time and градиент the diffusion gradient. Fig. 4 shows the distribution of the values of the diffusion coefficients D for the power density of a heat source q = 10^8W /m^2 at the same time.

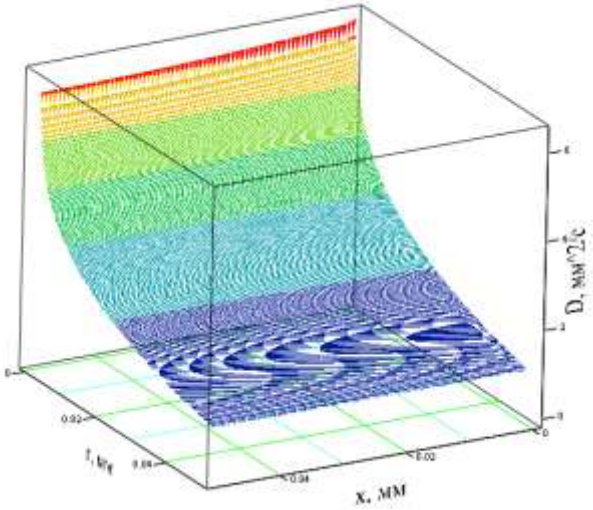


Fig. 4 – Field of diffusion coefficients D (10-11^{-11} м^{m2}/s) of a two-layer metal-semiconductor system at time of 20 seconds.

The presented model also makes it possible to estimate the dependence of the diffusion coefficients on the thickness of the metal coating directly in the coating and at the metal-semiconductor interface. This makes it possible to select criteria for the efficiency of material removal by laser thermocatalytic treatment, depending on the thermophysical and geometric parameters of the metal layer.

Results and conclusions

A nonstationary two-dimensional axisymmetric nonlinear mathematical model of heat and mass transfer in a two-phase cucmeме metal-semiconductor system when the phase boundary is heated by laser radiation is obtained. РезультатыSimulation results in technologically acceptable ranges of power densities of a thermal laser radiation source q = 10^{5}– 10^{8}W /^{m2} and the thickness of the metal coating d= 10nm -1μm, which allows ustom predict the most effective modes of thermo-catalytic treatment and provide the necessary rate of material removal.

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STUDY OF THE MORPHOLOGICAL AND QUANTITATIVE FRACTIONAL COMPOSITION OF SOLID HOUSEHOLD WASTE

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ҚАТТЫ ТҰРМЫСТЫҚ ҚАЛДЫҚТАРДЫҢ МОРФОЛОГИЯЛЫҚ ЖӘНЕ САНДЫҚ ФРАКЦИЯЛЫҚ ҚҰРАМЫН ЗЕРТТЕУ

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Abstract

The article discusses the classification of solid household waste, the morphological and fractional composition of solid household waste (SHW), the chemical and physical properties of SHW, SHW collection standards, and the disposal and recycling of solid household waste. Changes in the composition of SHW depending on the season are characterized by an increase in food waste content — 22–25.5% in spring and 42–46% in autumn. This is due to the increased consumption of vegetables and fruits during these seasons. In contrast, during the winter and autumn months, there is a noted decrease in small street litter, from 20% down to 7%.

Түйін

Мақалада қатты тұрмыстық қалдықтар классификациясы, қатты тұрмыстық қалдықтардың (ҚТҚ) морфологиялық және фракциялық құрамы, ҚТҚ химиялық және физикалық қасиеттері, ҚТҚ жинау нормалары, қатты тұрмыстық қалдықтарды жою және қайта өңдеу. ҚТҚ құрамының өзгеруі жыл мезгіліне байланысты құрамындағы азық – түлік қалдықтарының көктемде 22-25,5%, ал күзде 42-46% көбеюімен сипатталған. Бұл адамдардың осы мезгілдерде рационында көкөніс пен жеміс жидекті көп тұтынуымен сипатталады. Ал, қыс және күз айларында майда көше қоқыстары 20% дан 7% дейін азаюымен сипатталғандығы қарастырылған.

Keywords: *collection of waste, morphological, physical properties, solid household waste.*
Кілтмік сөздер: *қалдықтарды жинауға, морфологиялық, физикалық қасиеттерін, Қатты тұрмыстық қалдықтар.*

Шымкент қаласының көлемі мен халық саны күн арта өсуде. Халық саны мен қоса пропорционалды түрде қатты тұрмыстық қалдықтар көлемі де өсуде. Қатты тұрмыстық қалдықтар классификациясы, қатты тұрмыстық қалдықтардың (ҚТҚ) морфологиялық және фракциялық құрамы, ҚТҚ химиялық және физикалық қасиеттері, ҚТҚ жинау нормалары, қатты тұрмыстық қалдықтарды жою және қайта өңдеу әдістеріне жалпы сипаттама, қатты қалдықтарды өңдейтін жеке компаниялар, Шымкент қаласының қатты қалдықтарының көлемін азайтудың оптималды шешімі, қатты қалдықтарды өңдеуді автоматизациялау мен цифровизациялау бөлімдеріне зерттеулер жүргізілдіп қатты қалдықтар көлемін тиімді азайту жолы баяндалады. Қатты тұрмыстық қалдықтар (ҚТҚ, тұрмыстық қоқыстар) – бастапқы міндеті орындалғаннан кейінгі қолдануға жарамсыз әр түрлі физикалық тұрғыдағы заттар. Мынадай ҚТҚ классификаттары белгілі: тұрғын үйлерден шығатын қалдықтары, өндіріс орынында қолданылған тұрмыстық қалдықтары, көшелер қоқыстары, базар қоқыстары, бақша мен саябақтардан жиналатын және т.б. болып бөлінеді.

Қатты тұрмыстық қалдықтарды жинауға, қайта өңдеуге және жоюға байланысты барлық мәселелерді қарастырамыз бұрын, осы материалдың құрамы мен қасиеттері туралы

ақпараттар қажет. ҚТҚ морфологиялық құрамы бойынша мына құраушылардан тұрады: сүйектер, азық-түлік және көкөніс қалдықтары, қағаз, газеттер, журналдар, орау материалдары, картон қағаздары, ағаш, пластмасса, текстиль, былғары, резеңке, түрлі металдар (түсті және қара), шыны. ҚТҚ құрамының өзгеруі жыл мезгіліне байланысты құрамындағы азық – түлік қалдықтарының көктемде 22-25,5%, ал күзде 42-46% көбеюімен сипатталады. Бұл адамдардың осы мезгілдерде рационында көкөніс пен жеміс жидекті көп тұтынуымен сипатталады. Ал, қыс және күз айларында майда көше қоқыстары 20% дан 7% дейін азаюымен сипатталады (1-кесте).

Кесте 1 - Шымкент қаласының ҚТҚ-ның 2024 жылға морфологиялық құрамы, %

№	Құраушылары	Жыл мезгілдері			
		Қыс	Көктем	Жаз	Күз
1	Азық-түлік қалдықтары	32-39	35-45	40-49	45-55
2	Картон, қағаз	26-35	32-35	22-30	25-35
3	Ағаш	2-5	1-2	1-2	2-5
4	Кара металл	3-4	4-6	3-4	3-4
5	Түсті металл	0,5-1,5	0,6-1,8	0,5-1,5	0,5-1,5
6	Текстиль	4 -6	4 -6	5-7	4 -6
7	Сүйек	1-2	1-2	1-2	1-2
8	Шыны	4-6	4-6	4-6	4-6
9	Былғары,резеңке	2-3	2-3	3-5	2-3
10	Пластмасс	23-24	23-24	24-26	23-24

ҚТҚ морфологиялық құрамы мен қоса оның фракциялық құрамыда өте маңызды, себебі оның көлеміне байланысты, арнайы технологиялар мен техникалар пайдаланылады (2 - кесте). Осыған байланысты, ҚТҚ ішінде көлемі өте үлкен қоқыстар болады, олар стандартты 0,75 $м^3$ контейлерге сыймайды, сол себепті оларды арнайы орындарда жинақталады. Орташа есеппен 1 жыл ішінде 1 адамға тығыздығы 210 кг/$м^3$ болатын 40 кг ҚТҚ жиналады [1].

Кесте 2 - ҚТҚ морфологиялық және фракционды құрамы, %

Құраушылары	Фракциялар өлшемі, мм				
	250 –ден артық	150-250	100-150	50-100	50 – ден кем
Азық-түлік қалдықтары	-	0-1	2-10	1,0-12,6	17,0 -21,0
Картон, қағаз	3,0-8,0	8,0 -10,0	9,0-11,0	7,0-8,0	2,5-5,0
Ағаш	0,5	0,-0,5	0,-0,5	0,5	0,5
Кара металл	-	0,1	0,5	0,8-2	0,3-0,5
Түсті металл	-	0,1	1	0,6-2	0,5-1,0
Текстиль	0,2-1,3	1,0-1,5	0,5-1,0	0,3-0,5	0-0,6
Сүйек	-	-	-	0,3-0,5	0,5-0,9
Шыны	-	0-0,3	0,3-1,0	1,0-2,0	1,0-1,6
Былғары,резеңке	0	0-1,0	0,5-2,0	0,5-1,5	-
Пластмасс	-	0,5-1,0	1,0-22	1,0-2,5	0,2-0,5
Барлығы	7	13,3	22,1	25,3	32,3

ҚТҚ химиялық және физикалық қасиеттерін зерттеу, тұрмыстық қалдықтарды қайта өңдеу мен оны кәдеге жарату мақсатымен жасалынады. Көп жағдайда олардың орташа жылдық көрсеткіштерімен анықталады. Физикалық касиеттері бойынша: тығыздығы, ылғалдылығы, жылуөткізушілік қасиеті, салмағы мен көлемі ескерілетін болса, химиялық қасиеті бойынша: химиялық құрылысы, органикалық заттар мазмұны қарастырылады. ҚТҚ агрохимиялық көрсеткіштері бойынша құрамы екі бөлімге бөлінеді: биологиялық түрде өздігінен шіритін және жылдам биотермиялық бейтараптандыру процесінде механикалық түрде оңай өңделетін, яғни компост жасау уақытында өздігінен шіритін – ағаш, текстиль, сүйек және т.б. ҚТҚ жою мен оны өңдеу барысында қолданылатын технологиялар мен техникаларға ҚТҚ жылуөткізгіштігі және тығыздығы керек. Көктем-жаз кезіндегі контейнердегі ҚТҚ тығыздығы 0,18-0,22т/$м^3$, ал күз-қыс мезгілерінде 0,2-0,25 т/$м^3$ тең болады. ҚТҚ негізгі құрамының жылу өткізгіштігі: ағаш, картон- 2000-2500; су - 4190; шыны, тас- 800 -1000, қара металл – 400 дж/ (кг×град).

Шымкент қаласындағы қатты тұрмыстық қалдықтарды өңдеу әдістері және оларды жақсарту іс-шараларын жасау мақсатында қатты тұрмыстық қалдықтар мәселесі қандай дауа әкелетіндігіне анализ жасап, өткеніміз бен бүгінімізге және болашаққа көз салып зерттеуімнің мынадай қортындыларын жасасақ болады:

1. ҚТҚ қалдықтарға лайықты көңіл аудармасақ, онда 10 жыл ішінде Шымкент қаласы әлемдегі лас қалаларының 10 - шы орнын алатындығына, ал

оба ауруы мен туа біткен балалардағы кемшілік үйреншікті жағдай болуымен қатар індет аурулардың пайда болуы мен дамуына мүмкіндік беруіміз мүмкін.

2. ҚТҚ-тар ол аспаннан түскен мәселе емес, ол адам тіршілігінің нәтижесінде пайда болатын дүние. Социалды институттар арасындағы дұрыс ұйымдастырылған цикл және өндіріс орнында дұрыс таңдалған технологиялық процесс қоғамға тек пайда алып келеді.

3. Біздің өміріміз және қоршаған ортамыз, болашағымыз барлығы өзіміздің қолымызда.

Сол себепті, бүгінен бастап барлық жасаған қадамдарымыз бен істеріміз қоғамға және бір-бірімізге тек жақсылық әкелетін болсын.

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ECOLOGICAL MONITORING OF THE SANITARY-EPIDEMIOLOGY OF TECHNOLOGICALLY DISTURBED SOILS AT SOLID WASTE LANDFILLS

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ҚАТТЫ ТҰРМЫСТЫҚ ҚАЛДЫҚТАР ПОЛИГОНЫНДАҒЫ ТЕХНОГЕНДІ БҰЗЫЛҒАН ТОПЫРАҚТАРЫН САНИТАРЛЫҚ – ЭПИДЕМИОЛОГИЯЛЫҚ ЖАҒДАЙЫН ЭКОЛОГИЯЛЫҚ БАҚЫЛАУ

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Abstract

The article discusses the negative processes that arise as a result of the operation of solid household waste landfills - these are adverse environmental processes that significantly affect the environment and hinder the soil from performing its ecological functions. During the operation of solid household waste landfills, anthropogenic negative impacts occur not only within the landfill area but also extend to adjacent territories, leading to soil contamination with waste and its decomposition products, as well as the degradation of vegetation cover.

Түйін

Мақалада қатты тұрмыстық қалдықтар полигондарын пайдалану нәтижесінде туындайтын жағымсыз процестер - қоршаған ортаға айтарлықтай әсер ететін және топырақтың өз экологиялық функцияларын орындауына кедергі келтіретін қолайсыз экологиялық процестер болып табылады. Қатты тұрмыстық қалдықтар полигонын пайдалану барысында антропогендік жағымсыз әсер тек полигон аумағына ғана емес, сонымен қатар оған іргелес жатқан жерлерге де таралып, топырақтың қалдықтармен және олардың ыдырау өнімдерімен ластануына, сондай-ақ өсімдік жамылғысының бұзылуына алып келуі.

Keywords: *Pollutants, landfill, emission sources, solid household waste.*
Кілтмік сөздер: *ластаушы заттар, полигон, шығару көздері, Қатты тұрмыстық қалдықтар.*

Адамзаттың ең жаһандық мәселелерінің бірі - үлкен аумақтардың қатты тұрмыстық қалдықтармен, яғни адамдардың күнделікті өмірі нәтижесінде пайда болатын қалдықтармен ластануы. Бір жыл ішінде әрбір қала тұрғыны шамамен 450 кг қатты тұрмыстық қалдықтар шығарады, оның 50 кг-ы полимерлі материалдардан тұрады, олар қоршаған ортада ыдырамайды. Ондаған, тіпті жүздеген гектар жерді алып жатқан көптеген қалалық полигондар жиі болатын өрттер кезінде улы түтіннің көзіне айналып, жер асты суларын ластайтын қауіпті ошақтарға айналады. Сонымен қатар, мұндай полигондарда антисанитариялық жағдайлар қалыптасып, адамдар мен үй жануарлары үшін қауіпті патогенді флора, фауна және микроағзалардың дамуына ықпал етеді [1]. Қатты тұрмыстық қалдықтар полигондарының пайда болуы мен жұмыс істеуі нәтижесінде экологиялық сипаттағы мынадай бұзушылықтар болуы мүмкін: қоқыстану, ластану (химиялық, механикалық, биологиялық, жылулық) және топырақтың құнарлы қабатының бүлінуі. Қатты тұрмыстық қалдықтар полигондарының жұмыс істеуі нәтижесінде туындайтын теріс процестер қолайсыз экологиялық процестер - бұл қоршаған ортаға айтарлықтай әсер ететін және топырақтың экологиялық функцияларын орындауына кедергі келтіретін процестер. Қатты тұрмыстық

қалдықтар полигондарында өтетін процестерге мыналарды жатқызуға болады: атмосфераға қоқыс массасының биологиялық ыдырауы нәтижесінде пайда болатын қоқыс газының бөлінуі, бұл жарылыстардың пайда болу қаупіне, жағымсыз иістің болуына әкеледі, бірінші процеске тікелей байланысты қоқыс жанған кезде өрт пайда болады, жер асты суларының полигонның дренаждық суларымен (қоқыс сүзгіш) жанасуы кезінде ластануы, топырақтың технологиялық тозуының нәтижесі ретінде топырақ пен топырақ қабаттарының тығыздалуы [2]. Қатты тұрмыстық қалдықтар полигондары ауыр металдар топырағында жинақталудың тікелей көзі болып табылады. Полигон топырақты және жер асты суларын үлкен тереңдікке және едәуір аумаққа ластайды және уландырады. Полигон жанбай-ақ, органикалық заттардың анаэробты ыдырауы кезінде пайда болатын өте улы газдардың бөлінуі және желдің әсерінен полигон материалдарының ұсақ дисперсті бөлшектерінің таралуы арқылы атмосфералық ауаны ластайды. Қатты, әсіресе дауылды желдер кезінде полигон іргелес жатқан аумақтарды полиэтилен пакеттермен, қағазбен және басқа да жеңіл қоқыстармен ластайды. Полигон қоршаған ортаға ғана емес, сондай-ақ алыс аумақтар мен су айдындарына да экотоксикологиялық, бактериологиялық және гельминтологиялық тұрғыдан қауіпті ластану көзі болып табылады. Бұл эпидемиологиялық және эпизоотиялық салдарға, экотоксикоздар мен тұрғындар мен жануарлардың микоздарына әкелуі мүмкін. Осылайша, қатты тұрмыстық қалдықтар полигоны алыс жерлерге орналасқан және, тиісінше, халыққа зиянды әсер етуі мүмкін. Тұрғын үйлер мен ғимараттарға тікелей жақын орналасқан полигондарда жиналатын қатты тұрмыстық қалдықтар санының өсуі айтарлықтай зиян келтіреді. Қатты тұрмыстық қалдықтар қоршаған ортаға қауіп төндіреді. Қатты тұрмыстық қалдықтар полигонын пайдалану барысында полигон аумағының ғана емес, оған іргелес жатқан аумақтың да топырақ пен өсімдік жамылғысына теріс антропогендік әсер болып, топырақтың қалдықтармен қоқыстануына, оның ыдырау өнімдерімен ластануына әкеп соғады. Қоршаған орта объектілерінің экологиялық жайкүйінің нашарлауының себеп-салдарлық байланысы болады, соның нәтижесінде экологиялық тұрғыдан елеулі болып табылатын қоршаған ортаға зиян келтіріледі. Полигондарда ауыр металдардың қатты тұрмыстық қалдықтарының шамадан тыс жинақталуы биотаның және жалпы табиғи кешеннің тұтастығының бұзылуына әкелуі мүмкін. Топыраққа ауыр металдардың көп мөлшері түскен кезде оның қасиеттері өзгереді, бұл топырақ құнарлылығының нашарлауына әкеледі. Сонымен қатар, ауыр металдар өсімдіктерге тікелей әсер етеді және оларға еніп, метаболизмді бұзады, өнімділігін төмендетеді [3].

Биоремедиация - бұл табиғи немесе генетикалық түрлендірілген тірі организмдердің (негізінен микроорганизмдердің, саңырауқұлақтардың немесе өсімдіктердің) көмегімен қоршаған ортаны ластанудан тазарту процесі. Ол топырақтағы, судың және ауаның құрамындағы мұнай өнімдері, ауыр металдар, пестицидтер, органикалық қалдықтар сияқты ластаушы заттарды ыдырату немесе залалсыздандыру үшін қолданылады. Ластанған топырақты қалпына келтіру үшін биоремедиациялық технологиялардың сатты дамуы, ең алдымен, мұнай өндіруден кейін қалған жерлерді тазартуға, мұнай тасымалдау мен өңдеудегі апаттарға және мұнай өнімдерін қолдануға байланысты басталды. Бұл биотехнологияда мұнай көмірсутектерін тотықтыру қабілеті бар жергілікті топырақ микрофлорасын ынталандыру да, ластану орындарына биологиялық өнімдерді-мұнай құрылымдарын енгізу де қолданылады. Көмірсутекті субстраттардың белгілі бір түрлеріне мазуттар, креозоттар, битумдар, полиароматикалық қосылыстар, жаңа микробтық деструктивті препараттар және су мен топырақтың авариялық және жүйелі көмірсутекті ластануының салдарын толық жоюға, қоршаған ортаны қалпына келтіруге мүмкіндік беретін жаңа технологиялық шешімдер әзірленуде. Биоремедиациялық технологиялардың ең басты, артықшылықтарының бірі тірі жүйелердің, әсіресе микроорганизмдердің әртүрлі органикалық заттардың көп мөлшерін белгілі бір дәрежеде метаболиздеудің кең мүмкіндіктерімен байланысты. Сонымен қатар, биоремедиациялық технологияларды қолдану топырақтың негізгі көрсеткіштерінің айтарлықтай өзгеруіне әкелмейтін тазартылған ортаға жұмсақ әсер етуі өте маңызды [4].

Қазақстанда бүгінгі таңда жинақталған қатты тұрмыстық қалдықтардың көлемі 100 млн тоннадан асады. Сонымен қатар, жыл сайын елімізде 5-6 млн қалдық шығарылады. 2025 жылға дейін олардың көлемі біртіндеп артып, жыл сайын 7-8 миллион тоннаға жетеді. Қатты тұрмыстық қалдықтарды бірлесіп сақтау нәтижесінде пайда болған зиянды қосылыстар экологиялық ортаға үлкен зиян келтіреді, сонымен қатар оны жақсарту шығындарын арттырады. Төрағаның айтуынша, өткен жылы 210,1 мың тонна қатты тұрмыстық қалдық жиналып, оның 52,5 мың тоннасы қайта өңделген, бұл жалпы көлемнің 28%-

ын құрайды. Биыл бұл көрсеткішті 29%-ға жеткізу жоспарланып отыр. Мегаполисті абаттандыру және көгалдандыру жоспарына сәйкес алдағы бес жылда қоқысты бөлек жинау және қайта өңдеу жұмыстары қамтамасыз етіледі. Нәтижесінде 2025 жылға қарай қалдықтарды қайта өңдеу үлесі 35%-ға жетеді. "Ақтас-1" қатты тұрмыстық қалдықтар полигонында қалдықтар қайта өңдеудің барлық түрлері бойынша сұрыпталады. Қайта өңделетін қалдықтардың санын арттыру мақсатында қайта өңдеу жұмыстары да жүргізілуде. 2020 жылы полигонға 209 мың тонна қоқыс қабылданып, оның 52,5 мың тоннасы қайта өңделген. Атап айтқанда: 14,8 тонна картон, 2,3 тонна қағаз, 1,1 тонна желім, 26,1 тонна пластикалық бөтелке, 5,1 тонна пластмасса, 1,8 тонна шыны бөтелке, 0,1 тонна қара металл және 0,01 тонна түсті металл қайта өңделген. Сұрыпталған және қайта өңделген полиэтилен мен пластикалық бөтелкелерден химиялық шикізат алынады. Сонымен қатар, зауыт болашақта тұрмыстық қалдықтардан электр энергиясын өндіре бастайды деп жоспарлануда. Полигон аумағында 20 гектар жер телімі қарастырылған.

Түркістан облысы ірі өңірлердің бірі ретінде республика аумағының 4,2 %-ын (118,2 мың км^2) алып жатыр. Облыстың әкімшілік орталығы Шымкент қаласы болып табылады – бұл саны бойынша Алматыдан кейінгі екінші (1 100 мың адам) және алып жатқан алаңы бойынша бірінші (347 км^2) Қазақстан қаласы [5].

Шымкент қаласындағы қатты тұрмыстық қалдықтардың морфологиялық құрамы жылына орта есеппен 31,3 % органикалық қалдықтармен, 27 % қағазбен ұсынылған. Шымкентке 2017 жылдан бастап Ташкент тас жолының бойында қаладан 25 км қашықтықта орналасқан жаңа қатты тұрмыстық қалдықтар полигоны қызмет көрсетеді. Күн сайын ауданы 30 га Шымкенттің жаңа полигонына қатты тұрмыстық қалдықтардың жалпы көлемінің шамамен 78 % (бұл 1400 м^3 астам) түседі, ал 40% - ы Мартөбе ауылының полигонына түсіріледі [4]. 1-кестеде. Шымкент қаласындағы ҚТҚ полигонында іріктелген топырақ сынамаларында кадмийді анықтау бойынша нәтижелер көрсетілген. Кесте 1. Алынған топырақ сынамаларын химиялық талдау (мг/кг) [3].

Кесте 1. Алынған топырақ сынамаларын химиялық талдау (мг/кг).

Атауы	Топырақ сынамасы				Шекті концентрация	Қауіптілік классы
	1	2	3	4		
Кадмий	98,2	135,2	11,7	1,3	0,001	2

Қалдықтар, әдетте, техникалық, экологиялық және санитарлық талаптарға сай келмейтін коммуналдық полигонға шығарылады. Қалаларды қатты тұрмыстық қалдықтардан санитарлық тазарту бойынша қолданыстағы коммуналдық құрылымдармен қатар, ықшам түзілу орындарынан қатты тұрмыстық қалдықтарды мамандандырылған жинау және шығару жүйесі бар. Әдетте, мұны «Қайта өңделген шикізат» жүйесінің заңды органы және одан әрі пайдалану үшін жарамды қалдықтарды жинайтын және сататын көптеген тәуелсіз жаңадан ұйымдастырылған коммерциялық құрылымдар жасайды. Қайталама шикізатты сатып алу жүйесі қалдықтарды дер кезінде шығару үшін жоспарлы жөндеу объектілерін қамтиды: сауда кәсіпорындары; базарлар; өнеркәсіптік кәсіпорындар (тұрмыстық қалдықтар). Олардың қалдықтарды басқару қатынастары шарттық міндеттемелерге негізделген. Қара және түсті металдар (жиналған ұшақ көлемінің 90%-на дейін), шыны, қағаз, картон, тоқыма бұйымдары, ағаш ыдыстар (отын), полиэтилен қалдықтары, тозған шиналар мен аккумуляторлар қайта өңдеуге бөлінеді. Екіншілей шикізаттар негізінде жүргізілген қатты тұрмыстық қалдықтарды сұрыптау бойынша эксперименттер пайдаланылмайтын фракциялар 30 ± 5% құрайтынын көрсетеді. Сұрыпталған қалдықтар тұтынушыларға сатылады. Қайта өңдеуге жатпайтын қалдықтар қалалық полигонға жіберіледі.

Қатты қалдықтарды кәдеге жарату. Қазақстан Республикасының аумағында ТҚҚ-дың тек 3% жуығы термиялық залалсыздандыру және компосттау әдістерімен өнеркәсіптік өңдеуге ұшырайды. Өңдеу үшін ТҚҚ ағындарының жеке бағытының болмауы процестерді экономикалық және экологиялық тұрғыдан тиімсіз етеді.

Қалдықтарды орналастыру үшін экологиялық таза полигондардың болмауы көптеген елді мекендерге тән. Мұндай объектілердің жағдайы:

- объектінің орналасқан жері қолданыстағы нормативтік талаптардың толық спектрін есепке алмай таңдалған;

- полигонның жобасы техникалық және экологиялық қауіпсіздік талаптарына сәйкес келмеген;

- мұндай объектілерге қазіргі заманғы экологиялық және технологиялық талаптарды есепке алмай пайдалану жүзеге асырылады, нәтижесінде олар қоршаған ортаны ластаудың маңызды көзі болып табылады;

- ағынды суларды жинау және кәдеге жарату жүйесінің болмауы, полигон іргесіндегі шұңқырдың толып кетуіне әкеп соқтырады, соның нәтижесінде ағынды су беткейлер арқылы сіңіп, жер бетіне шығады, бұл жер үсті және жер асты суларының ластануын тудырады;

- оқшаулағыштың болмауы бетінің тұтануына ықпал етеді және жағымсыз иістердің ұзақ қашықтыққа таралуына ықпал етеді;

- пайдалану технологиясы шыбындардың, кеміргіштердің таралуына ықпал етеді, полигон аймағында және оның төңірегінде санитарлық-эпидемиологиялық жағдайды күрделене түседі;

- полигонды және оның әсер ету аймағын технологиялық және экологиялық бақылау жүйесі жоқ;

- полигон көлемін өндіру, олардың қоршаған ортаға кері әсері, әсер ету аймағында орналасқан объектілерде төтенше жағдайлар қаупін тудырады және т.б.

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THE ROLE OF THE DOCUMENTATION DIVISION IN HUMAN RESOURCES MANAGEMENT IN AZERBAIJAN

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РОЛЬ ОТДЕЛА ДОКУМЕНТАЦИИ В УПРАВЛЕНИИ ЧЕЛОВЕЧЕСКИМИ РЕСУРСАМИ В АЗЕРБАЙДЖАНЕ

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Abstract

The main purpose of the article is to study the role of the Documentation Division in the management of human resources in Azerbaijan. It highlights the department's responsibilities in legal compliance, recruitment, employee relations, archiving, and digital transformation. Drawing on examples from public institutions and private companies, the article emphasizes how effective documentation practices support transparent and efficient HR management. The integration of digital solutions is also discussed as a growing trend that enhances recordkeeping and legal accountability. This article is based on a qualitative review of publicly available institutional resources, including official websites of Azerbaijani government ministries, universities, and private consulting firms specializing in HR services. A descriptive analysis was conducted by examining regulations, departmental responsibilities, and service portfolios related to documentation and human resources.

Аннотация

В статье рассматривается роль отдела документационного обеспечения в управлении человеческими ресурсами в Азербайджане. Особое внимание уделяется функциям отдела в области соблюдения трудового законодательства, найма персонала, регулирования трудовых отношений, архивирования и внедрения цифровых технологий. На примерах государственных учреждений и частных компаний показано, как эффективное ведение документации способствует прозрачному и эффективному управлению персоналом. Также рассматривается тенденция к цифровизации процессов, улучшающая учет и правовую ответственность. Данная статья основана на качественном обзоре общедоступных институциональных ресурсов, включая официальные веб-сайты азербайджанских министерств, университетов и частных консалтинговых фирм, специализирующихся на кадровых услугах. Описательный анализ был проведен путем изучения нормативных актов, обязанностей департаментов и портфелей услуг, связанных с документацией и человеческими ресурсами.

Keywords: *Human Resources, Documentation Department, Azerbaijan, Labor Law, Recruitment, Digital HR, Personnel Management, Archiving*

Ключевые слова: *отдел документации, Азербайджан, трудовое право, цифровые технологии в HR, управление персоналом, архивирование*

Introduction

In Azerbaijan, the Documentation Department plays a crucial role in the effective management of human resources (HR). This department ensures legal compliance, improves organizational efficiency, and protects employee rights by managing HR records and documentation in line with national legislation. Across both public and private sectors, the Documentation Department is vital in aligning HR practices with labor standards and digital transformation.

Actuality (Relevance of the Topic)

The importance of documentation in HR management has grown significantly in Azerbaijan due to several recent developments. Firstly, the country is undergoing a broad digital transformation in public

administration, including the implementation of e-government and electronic HR systems. This shift demands greater documentation accuracy and integration of personnel data into secure digital platforms.

Secondly, compliance with local labor laws is becoming more closely monitored, particularly in the public sector and companies working with foreign partners or international standards. Documentation departments are now expected to ensure transparency and reduce legal risks through rigorous record-keeping practices.

Lastly, the increased mobility of the labor market, expansion of remote work, and reforms in civil service structures (especially in education, energy, and law) require institutions to maintain organized and accessible documentation. This makes the role of documentation specialists not only administrative but also strategic in modern HR departments.

These factors make this topic highly relevant to current administrative, legal, and technological trends in Azerbaijan.

Methodology

This article is based on a qualitative review of publicly available institutional resources, including official websites of Azerbaijani government ministries, universities, and private consulting firms specializing in HR services. A descriptive analysis was conducted by examining regulations, departmental responsibilities, and service portfolios related to documentation and human resources. Particular attention was paid to:

- *The HR regulations of the Ministry of Energy*
- *Internal policies of the Azerbaijan State Economic University (UNEC)*
- *Operational descriptions of the Institute of Law and Human Rights*
- *HR consultancy offerings from Nexia Azerbaijan*

These data sources were cross-compared and interpreted using a thematic approach to identify common practices, trends, and challenges in HR documentation across different sectors. All references used are listed according to APA citation style at the end of the article.

1. Legal Compliance and Recordkeeping

A primary function of the Documentation Department is maintaining compliance with Azerbaijani labor laws, including the Labor Code and the Law on Civil Service. This involves recording and safeguarding employment contracts, personnel files, workbooks, and attendance logs. For instance, the Ministry of Energy mandates its HR department to register personal files, archive official documents, and ensure confidentiality in accordance with legislation (Ministry of Energy of Azerbaijan, n.d.).

2. Recruitment and Staffing

The Documentation Department is also central to recruitment activities. It handles the preparation of employment agreements, organizes interviews, maintains job descriptions, and ensures that all new hires are properly documented. At Azerbaijan State Economic University (UNEC), for example, the HR department not only recruits staff but also drafts internal regulations and ensures that all hiring procedures comply with university policies and national standards (UNEC, n.d.).

3. Employee Relations and Disciplinary Oversight

This department also manages employee relations and monitors disciplinary measures. It drafts disciplinary reports, investigates grievances, and ensures that all HR actions are legally grounded and well-documented. Such practices promote fairness and transparency within the workplace (Ministry of Energy of Azerbaijan, n.d.).

4. Archiving and Data Management

Effective document archiving is essential for long-term data management. Institutions like the Institute of Law and Human Rights assign this responsibility to their Document Management Departments, which organize document circulation and ensure that archival materials are properly stored for future reference (Institute of Law and Human Rights, n.d.).

5. Integration with Digital HR Systems

Modern HR departments in Azerbaijan are increasingly digitizing documentation processes. Companies such as Nexia Azerbaijan provide services that include electronic personal file creation, digital employment contracts, and integration with the national e-government portal. These technologies reduce errors, improve access to HR records, and support organizational transparency (Nexia Azerbaijan, n.d.).

Conclusion. *The Documentation Department plays an indispensable role in HR management in Azerbaijan by ensuring compliance with national laws, supporting recruitment, managing employee relations, preserving records, and integrating digital solutions. As the HR landscape continues to evolve,*

the significance of this department grows, particularly in enhancing transparency and operational efficiency.

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EVALUATION OF THE PROSPECTS FOR THE IMPLEMENTATION OF EXPANDER -GENERATOR TECHNOLOGIES AT GAS INFRASTRUCTURE FACILITIES IN UZBEKISTAN

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ОЦЕНКА ПЕРСПЕКТИВ ВНЕДРЕНИЯ ДЕТАНДЕР-ГЕНЕРАТОРНЫХ ТЕХНОЛОГИЙ НА ОБЪЕКТАХ ГАЗОВОЙ ИНФРАСТРУКТУРЫ УЗБЕКИСТАНА

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Abstract

The article examines methods to improve the efficiency of expander-generator units (EGUs) used for electricity generation through the utilization of natural gas expansion energy. An analysis is conducted on various heat sources for gas preheating — a specialized boiler and exhaust gases from a gas turbine unit (GTU). Analytical expressions are provided for determining fuel consumption, EGU power output, and specific fuel consumption under different operating conditions. The results show that at low preheating temperatures, the use of a boiler is more effective, while at higher temperatures, utilizing the exhaust gases from a GTU is more advantageous. It is established that using GTU exhaust gases enables higher power output and greater economic efficiency due to waste heat recovery.

Аннотация

В статье рассматриваются способы повышения эффективности детандер-генераторных агрегатов (ДГА), применяемых для выработки электроэнергии за счёт использования энергии расширения природного газа. Проведен анализ различных источников тепла для подогрева газа — специализированного котла и дымовых газов газотурбинной установки (ГТУ). Представлены расчетные зависимости для определения расхода топлива, мощности ДГА и удельного расхода топлива при различных условиях эксплуатации. Результаты расчётов показывают, что при низких температурах подогрева более эффективно применение котла, в то время как при высоких температурах предпочтительнее использовать тепло дымовых газов от ГТУ. Установлено, что использование дымовых газов ГТУ позволяет достичь более высокой мощности и экономичности установки за счёт утилизации остаточного тепла.

Keywords: *natural gas, gas heating, expander generator, air-source heat pump unit, electricity generation, coefficient of performance, low-potential heat source, air turbine power*

Ключевые слова: *природный газ, подогрев газа, детандер-генератор, воздушная теплонасосная установка, выработка электроэнергии, коэффициент преобразования, низкопотенциальный источник теплоты, мощность воздушной турбины*

Введение. *Электроэнергетика Узбекистана является базовой отраслью народного хозяйства республики и, обладая значительным производственным и научно-техническим потенциалом, оказывает весомое воздействие на развитие всего народнохозяйственного комплекса.*

Единая электроэнергетическая система республики полностью обеспечивает потребность объектов экономики и населения в электрической энергии. Узбекистан является крупнейшей энергетической державой в Центрально-Азиатском регионе.

Одной из эффективных технологий, позволяющей снизить потребление топливно-энергетических ресурсов, является детандер-генераторная технология. В сочетании с теплонасосными установками детандер-генераторные агрегаты (ДГА) позволяют создать энергогенерирующие комплексы, которые способны вырабатывать электроэнергию без сжигания топлива, но их эффективность определяется источником тепла и способом подогрева газа перед детандером.

Технологические требования к эксплуатации газопроводов заставляют подогревать газ перед детандером ДГА до температуры 80-100°С. Обычно для этого используется энергия высокого температурного потенциала, полученная при сжигании топлива. Однако существуют технические решения, позволяющие эксплуатировать ДГА и без сжигания топлива.

В связи, с чем был проведен сравнительный анализ различных тепловых источников, используемых для подогрева газа, включая специализированный котел и дымовые газы газотурбинной установки [1-4].

В котельных для подогрева могут применяться дымовые газы, сетевая вода или отработанные газы ГТУ. При работе ДГА изменяется расход газа на оборудование, который пропорционален располагаемой теплоте газа:

$$Q_{\text{ртг}} = Q_{\text{нтс}} + h_{\text{г}} - h_0,$$

где $h_{\text{г}}, h_0$ *- энтальпия газового топлива при заданных температуре и давлении, и при 0°С и давлении 0,1 МПа соответственно, а* $Q_{\text{нтс}}$ *- низшая теплота сгорания топлива.*

Основная часть. *В условиях Узбекистана один из простейших способов подогрева газа перед детандером на пунктах редуцирования — применение специализированного котла [5,6] (рис.1).*

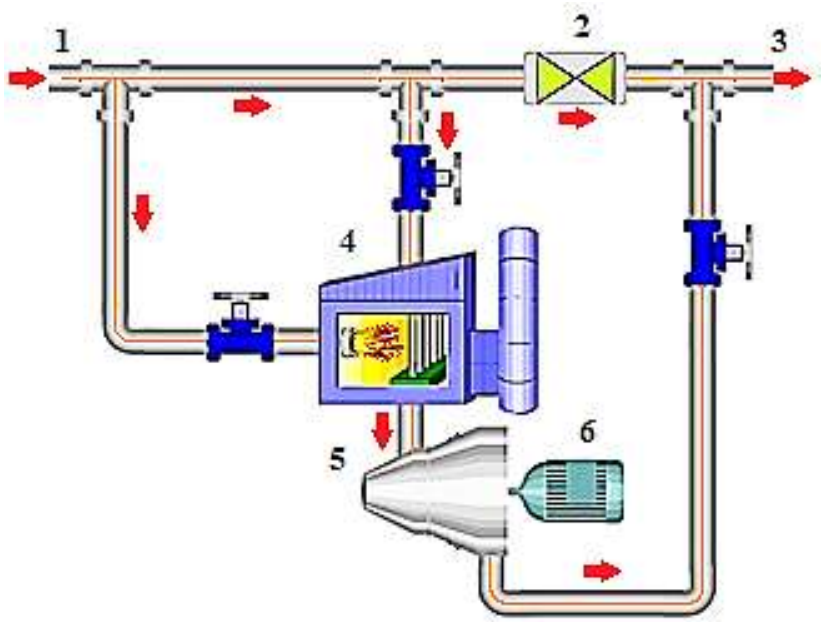

Рис. 1. ДГА с подогревом газа в котле:
1- трубопровод высокого давления; дроссельное устройство;
3- трубопровод низкого давления; 4- котел; 5- детандер; 6- генератор

При допущении равенства энтальпии газа на выходе из детандера и входе в установку, мощность детандера $N_{\text{ДГА}}$ *и расход топлива на подогрев* $\mathrm{V}G_{\text{топ}}^{\text{пер}}$ *определяются соответствующими выражениями:*

$$N_{\text{ДГА}} = G_{\text{топ}} \cdot (h_1 - h_2) \qquad (1)$$

и

$$VG_{\text{топ}}^{\text{пер}} = \frac{G_{\text{топ}} \cdot (h_1 - h_2)}{Q_{\text{нтс}} \cdot \eta_{\text{к}}}, \qquad (2)$$

а удельный расход топлива при выработке электроэнергии установкой $G_{\text{урт}}$ *рассчитывается как*

$$G_{\text{урт}} = \frac{1}{Q_{\text{нтс}} \cdot \eta_{\text{к}}}, \qquad (3)$$

где $\eta_{\text{к}}$ *- КПД котла, который предварительно подогревает газ перед его поступлением в детандер;*

$G_{\text{топ}}$ *- расход топлива в трубопроводе;*

h_1 *и* h_2 *- энтальпия газа до и после детандера, соответственно. Если* $h_{\text{ВХ}} \neq h_2$ *и изменение энтальпии газа при его поступлении в газопотребляющую установку влечет изменение его расхода (как, например, при использовании газа в качестве топлива), то формулы 1,2,3 примут соответственно следующий вид:*

б) расход топлива на подогрев газа в котле $VG_{\text{топ}}^{\text{под}}$ *:*

$$VG_{\text{топ}}^{\text{под}} = \frac{G_{\text{топ}} \cdot (h_1 - h_{\text{ВХ}})}{(Q_{\text{нтс}} + h_2 - h_{\text{ВХ}}) \cdot \eta_{\text{к}}}; \qquad (4)$$

г) мощность ДГА:

$$N_{\text{ДГА}} = G_{\text{топ}} \cdot \frac{Q_{\text{нтс}} + h_{\text{ВХ}} - h_0}{Q_{\text{нтс}} + h_2 - h_0} \cdot (h_1 - h_2); \qquad (5)$$

д) удельный расход топлива на выработку электроэнергии (все изменение расхода топлива относится на выработку электроэнергии):

$$G_{\text{урт}} = \frac{VG_{\text{топ}}}{N_{\text{ДГА}}} = \frac{1}{(Q_{\text{нтс}} + h_2 - h_0) \cdot \eta_{\text{к}}} \cdot \frac{(h_1 - h_{\text{ВХ}})}{(h_1 - h_2)} \cdot \left[1 + \frac{(h_{\text{ВХ}} - h_2) \cdot \eta_{\text{к}}}{(h_1 - h_{\text{ВХ}})}\right]. \qquad (6)$$

Результаты расчёта удельного расхода топлива для выработки электроэнергии по формуле (6) показаны на графике (рис.2). Тепло уходящих газов газотурбинной установки можно использовать для подогрева газа перед турбодетандером (рис. 3).

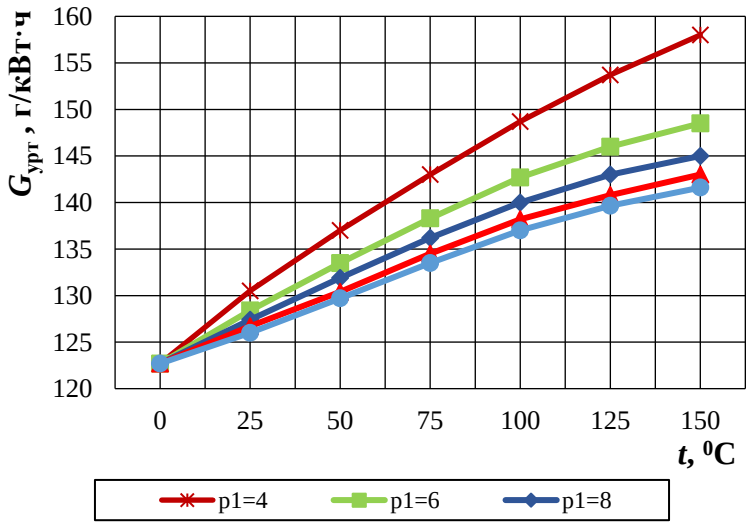

Рис. 2. Удельный расход топлива на выработку электроэнергии

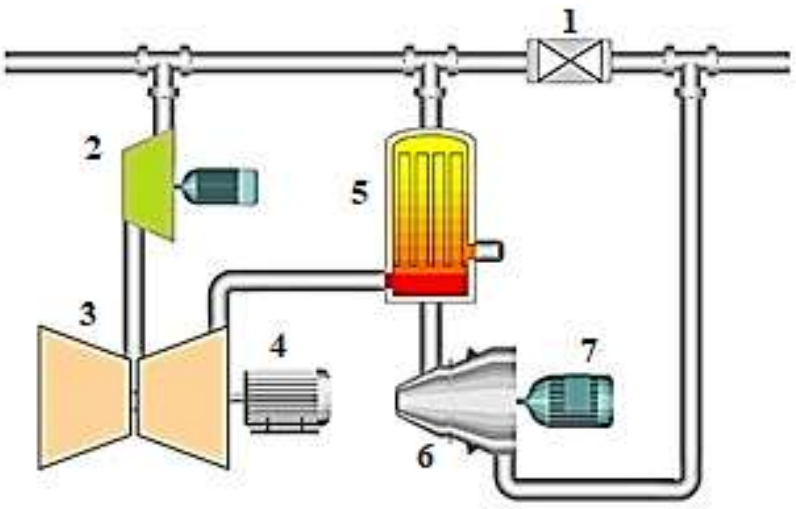

Рис. 3. Подогрев газа уходящими газами ГТУ
1-дроссельное устройство; 2- компрессор; 3- газотурбинная установка (ГТУ); 4 - генератор ГТУ; 5 - теплообменник; 6 - детандер; 7- генератор ДГА

Общее тепло, передаваемое дымовыми газами $Q_{дг}$ *, должно равняться сумме мощности детандер-генераторной установки и тепловых потерь после теплообменника*

$$Q_{дг} = N_{ДГА} + Q_{уг}, \qquad (7)$$

где: $N_{ДГА}$ *- мощность ДГА;* $Q_{уг}$ *- теплота уходящих газов.*

И мощность ГТУ составит:

$$N_{ГТУ} = N_{ДГА} \cdot \frac{t_{дг} - t_{хв}}{t_{дг} - t_{уг}} \cdot \frac{\eta_{ГТУ}}{1 - \eta_{ГТУ}},$$

где $\eta_{ГТУ}$ *– КПД газотурбинной установки.*

Удельный расход топлива на выработку электроэнергии рассчитывается как:

$$G_{урт} = \frac{1}{\left(Q_{нтс} + h_{ВХ} - h_0\right)} \cdot \frac{\left(\frac{t_{дг} - t_{хв}}{t_{дг} - t_{уг}} \cdot \frac{\eta_{ГТУ}}{1 - \eta_{ГТУ}} \cdot \frac{h_{ВХ} - h_2}{h_1 - h_{ВХ}}\right)}{\left(\frac{t_{дг} - t_{хв}}{t_{дг} - t_{уг}} \cdot \frac{\eta_{ГТУ}}{1 - \eta_{ГТУ}} \cdot \frac{h_1 - h_2}{h_1 - h_{ВХ}}\right)}. \qquad (8)$$

На графике (рис. 4) показаны результаты расчёта удельного расхода топлива для выработки электроэнергии по формуле (8).

Если изменение энтальпии газа на выходе из детандера не оказывает влияния на расход газа в газопотребляющем оборудовании, то формулы принимают следующий вид:

а) расход топлива:

$$\Delta G_{топ} = G_{ГТУ} = G_{топ} \cdot \frac{(h_1 - h_{ВХ})}{\left(Q_{нтс} + h_{ВХ} - h_0\right)} \cdot \frac{t_{дг} - t_{хв}}{t_{дг} - t_{уг}} \cdot \frac{1}{1 - \eta_{ГТУ}}; \qquad (9)$$

б) электрическая мощность:

$$N_{УСТ} = G_{топ} \cdot (h_1 - h_2) \cdot \left(\frac{t_{дг} - t_{хв}}{t_{дг} - t_{уг}} \cdot \frac{\eta_{ГТУ}}{1 - \eta_{ГТУ}} \cdot \frac{(h_1 - h_{ВХ})}{(h_1 - h_2)} + 1\right); \qquad (10)$$

в) удельный расход топлива на выработку электроэнергии:

$$G_{\text{урт}} = \frac{1}{\left(Q_{\text{нтс}} + h_{\text{ВХ}} - h_0\right)} \cdot \frac{\left(\frac{t_{\text{дг}} - t_{\text{хв}}}{t_{\text{дг}} - t_{\text{уг}}} \cdot \frac{1}{1-\eta_{\text{ГТУ}}}\right)}{\left(\frac{t_{\text{дг}} - t_{\text{хв}}}{t_{\text{дг}} - t_{\text{уг}}} \cdot \frac{\eta_{\text{ГТУ}}}{1-\eta_{\text{ГТУ}}} + \frac{\left(h_1 - h_2\right)}{\left(h_1 - h_{\text{ВХ}}\right)}\right)}. \quad (11)$$

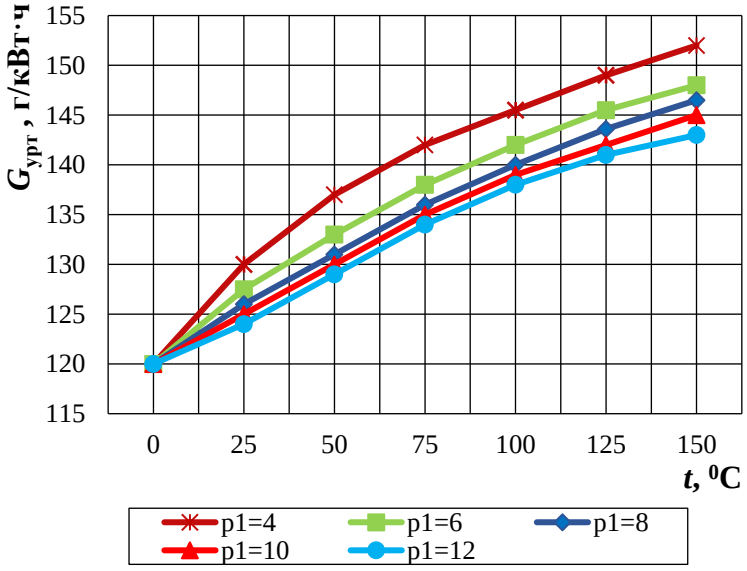

Рис. 4. Изменение удельного расхода топлива при повышении температуры газа перед детандером

Анализ показал, что при повышении температуры подогрева газа относительное снижение расхода топлива более заметно при использовании дымовых газов ГТУ, чем котла, благодаря большей мощности ГТУ.

Заключение. *Результаты проведённого исследования свидетельствуют о том, что выбор источника тепла для подогрева газа в детандер-генераторных установках должен основываться на анализе температурных режимов и энергетических характеристик процесса.*

При относительно низких температурах подогрева (до ~80 °C) использование специализированных котлов обеспечивает стабильную и управляемую подачу тепла, что делает данный подход обоснованным с технической и эксплуатационной точек зрения. С увеличением температуры подогрева применение тепла дымовых газов от газотурбинных установок становится не только технически осуществимым, но и экономически целесообразным благодаря более высокой энергетической эффективности.

Таким образом, интеграция детандер-генераторных агрегатов с альтернативными источниками тепла, особенно с использованием вторичных энергетических ресурсов, таких как тепло уходящих газов, представляет собой перспективное направление для повышения энергоэффективности и устойчивости энергетической инфраструктуры Узбекистана.

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