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ARTS

RITUAL FEATURES OF THE "81 POEM SONGS" COMPOSED BY URADIAN SAINT LUVSANDAMBIIJANTSAN (1717-1766)

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In this article, we aim to introduce the "three circle songs" from the "81 original poem songs" composed by Luvsandambiijantsan (1717-1766), who is known as a wise saint among the people of the local "Mergen Church" in Inner Mongolia of China.

In an era of globalization, reviving, preserving, passing down, and researching traditional folk music according to its national and ethnic characteristics is one of the most critical issues of the world's cultural heritage, which is the reason for this research.

In this work, we have prepared to briefly introduce the educational "three songs of the circle" in Mergen Gegee's "81 Original Poems."

The theme was chosen to study and clarify the characteristics of the song composed by Mergen Gegee. The song is dominant in its teaching and education characteristics and is sung as "starting the feast," "enjoying the feast," and "setting the feast" at weddings.

A problematic aspect of the research

✓ Today, many scholars study the sages of Urad. Although "81 original poems and songs" have been studied in terms of oral and religious literature, they have rarely been studied from the point of view of teaching and behavior in song art.

✓ There has not been any research on the types and features of Mergen Gegee's 81 original poems within the framework of a single topic.

Purpose of research

The 81 original poems of Mergen Gegee are considered to help research and elucidate how to sing ritually, further expanding, developing, and passing them down.

Objectives of research work

✓ Researching and collecting the original manuscripts of "81 original poems" by Luvsandambiijantsan, the sage of Urad,

✓ To clarify the types of feast songs of "81 original poem songs",

✓ Clarifying the behavioral characteristics of poetry,

✓ Based on the research, the goal was to include those songs in the research cycle.

Research Methodology

✓ When including books, the method of fact analysis,

✓ Analyzing and summarizing methods of music theory,

✓ Historical comparative study of ethnomusicology is the main focus.

For research

✓ Clarifying ritually significant songs in sage poems,

✓ The behavioral characteristics of poetry will be studied.

Innovative aspects of research

Another innovative aspect of this research is the attempt to clarify the behavioral characteristics of poetry.

The innovative aspect is that it is clarified whether the characteristics of wisdom poems are reflected in Urad folk songs.

Research Hypothesis

✓ Urad Mergen Gegee's "81 Poem Songs" is a part of folk songs based on the wisdom of the Mongolian nation.

✓ The characteristics of the ritual of the feast song in the poem are: rather than entertaining the people who came to the feast, to enlighten people through the poem, to develop the mind, to educate everyone with culture and knowledge, to protect morals, customs, the environment, and the mother earth. It is assumed that it was an attempt to teach respect and compassion to people through folk songs at that time when there was no literacy.

Research object -/actual subject/, subject/abstract side/

The research's fundamental aspect is to clarify the songs of teaching and upbringing from the "81 original poems and songs" of Urad sage Luvsandambiijantsan. More than 60 bibliographies, including textbooks, biographies of sages, works, and reports, were used in the research.

This study's subjects are as follows: Mergen Gegee's 81 original poems are believed to be based on a didactic ritual song based on Mongolian folklore, proverbs, and sayings.

Importance of research:

Significantly, 20 features of teaching songs were clarified from the 81 original poems of the sage. Mergen Gegee's poem is important because it highlights the characteristics and categories of the melody of the song and the structure of the poem and brings them into the circulation of research.

Study of the topic

Many books and articles have been studied on the subject. For example, Researcher Borjtoi Vanjil's 2003 work "Historical Bureau of the Urad" was important because it gave us the first information about the historical arrival of the Urad and the Temple of the Mergen.

Researcher Todsetsen¹/2006/In the work "Study of Urad Rituals," we wrote about the characteristics of the Urad people's ethnic behavior, especially the "big feast" or "mud" feast at the Urad wedding, which became necessary for our work. Researcher Ch.Enkh /2019/. "Sketches of Urad History"² And "Urad Culture Studies / 2019" became crucial to our work. In addition, researcher Y. Naranbat /2011/³ He wrote about the sage's biography in his "Collection of Mongolian Literary Works" and "Study of Oral Literature of Rituals."

Researcher Ba.Munkh⁴work /1995/ became critical when he wrote the book "Sage Luvsandambijantsan." Researcher Ba.Munkh⁵ /2004/. "Traditional reform of cultural activity of the wisdom of Urad." /2004/, Researcher Y. Naranbat⁶/1983/. "The Sage and His Language Textbook," wrote researcher Buteelt.⁷ in 2003

He wrote about "Mergen Gegeen, meritorious song of the Mongolian nation of the XVIII century."

Researcher Dursgalt⁸ /2007/ "Urad's poem song" /2007. 6. 5/, researcher Zorigt⁹/2007/. "Study of the Philosophical Ideas of Wisdom". The work became essential to know the characteristics of his art.

Researcher Khugjilt¹⁰ /1997/ "History of Mongolian folk music." Writing about sages is essential for this study.

Here are some examples of ritual symbols in the Sage's poem:

- ✓ A symbol of the beautiful seed of virtue,
- ✓ The symbol of Lord Lama's salvation,
- ✓ A symbol of the blessing and love of the ancestors,
- ✓ A symbol of mercy and grace,
- ✓ Symbol of endowment insurance,
- ✓ A symbol of order, grace, and love,
- ✓ A symbol of all world life,
- ✓ A symbol of happiness for all animals,
- ✓ A symbol of health and peace,
- ✓ Symbols of the past, present, and future,
- ✓ A symbol of good aspirations,
- ✓ A symbol of prophecy, praise, and blessing.

Sages' poetry is excellent because it embodies the virtues of human well-being, passion, beauty, salvation, mercy, love, and the ability to create bodhisattva through good deeds.

Therefore, "The poem of the sage is: to condition the harmony of social life and human relations, to establish a state, a clear, beautiful and orderly state, and may everything prosper! It is characterized by the idea that¹¹ / BAtsaaan. Forever. B. 2007.7.635/

That is why the tradition of chanting the sage's poem as a chant at the beginning of a large gathering of people has spread.

The reason why it is called "Song Poem" is:

The oral poetry of our Mongolian nation is characterized by its development of harmony and sanctity, from blessing, praise, and connection poems to "poetry songs."

Mergen Gegeen's poetry combines Buddhist ethics and Mongolian poetic tradition. Two types of songs are sung during folk feasts in Urad: "poetry songs" and "huar songs." The rhymer sings a central song in threes, and such a song has a tide in the middle of each stanza.

It was customary for elders and dignitaries to be the center of attention when singing poems and not to sing "huar duu" or short songs.

It is commendable that the "81 original poems and songs" written by Mergen Gegeen have reached us today and are being handed down among the people. Still, there has been a danger of forgetting the oral tradition recently. Therefore, the problem of researching, elucidating, and developing his didactic song is still faced.

Because music has this kind of magic, the sage respected this characteristic, matched the melody to his literature, created his "Eighty-One Original Poems," and promoted his concepts, teachings, and messages to a broad audience. It has been handed down, memorized, and remembered by the people. Orshivoy is a large-scale vocal work.

The following characteristics of the sage's "poetry sound" can be observed. It includes:

- ✓ doctrinal,
- ✓ laudatory,
- ✓ prayerful,
- ✓ dreamy,
- ✓ philosophical,
- ✓ autobiographical,
- ✓ wedding ceremony,
- ✓ artistic and aesthetic qualities

Behavioral characteristics of poetry

It is customary for the Urad people to sing "poem songs" beforehand in any celebration or main wedding ceremony. These poems are sung by exceptional singers invited to wedding feasts, and people in the region believe it is vital to listen and understand them. The poem shows the following characteristics. It includes: The poem of Sage has the following songs. It includes:

In a doctrinal song:

- ✓ "Intelligence",

¹ Todsetsen, /2006/. Urad Behavioral Science. Publishing Committee of Inner Mongolian Culture. 3.

²Ch. Enkh /2019/. Urad cultural studies. Published by Shin Shin Printing Limited Company of Bayannuur Province. 4.

³ Naranbat, Y./ 2011/. "Collection of Mongolian literary works", 4, study of ritual oral literature", Inner Mongolian Scientific and Technical Publishing Committee, 3.

⁴ Munkh, Ba./1995/. "Sage Hegan Luvsandambijilja". Publishing Committee of Inner Mongolian Culture. 6.

⁵ Mukh, B. /2004/. "Traditional renewal of cultural activities of Urad sage", Inner Mongolian Culture Publishing Committee, 2004.

⁶Naranbat, Y. /2003/. "The sage and his language textbook", Journal of Social Studies of Inner Mongolia (Mongolian edition), 1983. 2,

⁷ Buteelt. /2003/. "Mergen Gegeen, the meritorious song of the Mongolian nation of the 18th century". 30.1.2003.

⁸ Dursgalt./2007/. "Urad's poem and song," 2007. 6. 5. Master's degree thesis,

⁹ Zorigt. /2007/. "Study of the Philosophical Ideas of Wisdom." 2007. 6. 5.

¹⁰Khugjilt. /1997/. "History of Song and Music of the Mongolian Nation," Publication Committee of the Leonine Nation, 1997,

¹¹Munkh. B./2007/ "Conference of Wisdom Studies." Publishing Committee of Inner Mongolian Culture. 7.635

✓ "Full wall willow",
 ✓ "Avral Supreme Three Bogds" songs are included,

In a dreamy song:

- ✓ "White horse",
- ✓ "Aran taliin arts",
- ✓ "Half Round Moon"

In a song of praise:

- ✓ "Spring water",
- ✓ "Broad and beautiful Khangai,"
- ✓ "Moni Khan's Country,"

In the song about Religion:

- ✓ "Ach perfect,"
- ✓ "Manlay Three Treasures",
- ✓ "Shajint Pass"¹².

Generally, a folk song is a unique song that is not limited to a particular region but quickly passed down and transformed into a poem.

For example, while singing the same song in different tunes in different areas, in some places, singing the same song with other verses, or singing many songs in one movement,

There are cases where the same version is sung in different regions.

The lyrics are mostly the same, but the melody has become more regional. It is characterized by singing poems nobly and nobly.

Considering the narrative and characteristics of his "poems," it is clear that the sage wrote poems in a way to be sung at weddings. For example, the poem composed by him:

At the Urad wedding feast, it is called "three songs" because it is sung in threes at the beginning, in the middle, and at the end of the feast. For example:

In the song to start the feast at the beginning of the feast:

1. "Combined Virtue"
2. "Ancient Blessings and Virtues"
3. "Ulemj bayan,"

In the festive song sung during the feast:

1. "Your Highness"
2. "Venerable blessing"
3. "Ach perfect"

In the Song of Rejoicing:

1. "Eight Lion Deck"
2. "Eight Continent Sumber Mountain"
3. "Eight Funny Melody"

In summary:

Folk songs are the noblest, most beautiful, and highest level of art, which people create and develop from person to person and from community to community. Therefore, folk songs have a charm that moves and educates people's hearts. Thus, the Mongolian feast is a folk school that educates people. Thus, when defining the characteristics of a good man, Mongolians said: "having three songs at a feast" and "having three dances at a festival." Music gives people excitement, aspiration, harmony, joy, and love. Many people are happy

with songs, sustained by songs, enlightened by songs, and educated by songs.

"In Urad, they focus on singing the wedding song together, and when a famous singer starts singing the song, everyone in the crowd joins in and sings it together, forming a chorus. Because Urad folk songs are embedded in blessing and praise poems, they can command morals, express their thoughts with lyrical poems, express their customs, perform all the wedding ceremonies, and clearly express the tone of their Urad songs among the vast number of Mongolian ethnic groups.¹³" / Creation. 2019.8. 91/ said. The "poetry song" of the sage has several features. His poems include teaching poems, educational poems, insight poems, behavioral guidelines, blessings, and praises. Mergen Gege's poems have been sung until now in the form of the "three-circle song" of the feast sung among the Urad.

Thus, it is clear that Luvsandambijantsan, the Sage of the Urad, was a noble person who inherited the miracle of the Mongolian people's written and oral literature.

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¹² Bayanjargal, S./2010/. "Eighty-one original poems of Mergen St. Luvsandambijalsantan, Orshivoi, Folk Publishing Committee of Inner Mongolia. 9. 1st

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Appendix



ECONOMIC SCIENCES

CURRENT ASPECTS OF THE USE OF GREEN ENERGY RESOURCES IN THE CONTEXT OF POST-CONFLICT TERRITORIES AND SUSTAINABLE DEVELOPMENT PRINCIPLES IN AZERBAIJAN

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Abstract

The current aspects of the use of green energy resources in the context of post-conflict areas and sustainable development principles in Azerbaijan were examined. The problems of strengthening the country's energy security were explained. Priorities for increasing the share of green energy in the energy production structure were given. The economic efficiency of creating green energy infrastructure in post-conflict areas was substantiated. The importance of expanding green energy projects was noted. The existing potential of green energy in Azerbaijan was assessed. Targets were given for the efficient use of wind and solar energy. Proposals were given to ensure the efficient use of green energy resources in Azerbaijan in the near future.

Keywords: Azerbaijan, green energy, sustainable development, sustainable development principles, post-conflict areas, green energy infrastructure.

It should be noted that in modern times, the green energy paradigm is coming to the fore in the world as one of the means of solving environmental problems. This industry involves the use of alternative energy sources (sun, water, wind, etc.) in various fields of human activity. Currently, the topic of resource conservation and ecology is widely discussed and is reflected in the works of various scientists. The term “green energy” is widely spread not only in the scientific community, but also in the media. This topic has intensively risen to the maximum level of relevance by being included in international, national programs and conferences. We believe that sustainable development is a concept put forward on how to build the future world in order not to disrupt the development of the new (future) generation in the current conditions. The world is increasingly paying attention to climate and environmental risks, modification of tools and infrastructure for sustainable development. The use of green economy in this concept is a tool that combines unique methods and means by which the desired economic result can be achieved [1].

It is known that for the first time the term “green energy” began to take shape and spread widely in the United States in 1978 with the signing of a law promoting the use and development of renewable energy sources. Green energy is a term that means energy production technologies that do not pollute the environment (harmful emissions, greenhouse gases). The growth of the world's population leads to an increase in electricity consumption. Every year, people rely more and more on technology, they cannot imagine a day without it. However, the development of technologies does not stand still, they become more compact and are very demanding on the quality of electricity. As a result, electricity consumption is becoming more and more and continues to grow. The main possible solution to this problem is the acquisition

of green energy sources [2]. On the other hand, green energy is the type of energy that most fully meets the interests of society as a whole. It is characterized, first of all, by low emissions of carbon compounds. In the economy of a country where green energy is at the forefront, a large number of private and public investments are directed to various activities, the main purpose of which is primarily related to: increasing the efficiency of using natural resources; reducing negative factors that directly affect the decline of biodiversity; reducing emissions of harmful substances into the atmosphere, which ultimately leads to global pollution of all nature; partial restoration of natural capital [3]. As civilization develops and the world population increases, as production capacities increase, there is a greater demand for fuel resources, and these are considered one of the most complex problems of the modern era. Thus, the main sources of fuel resources currently used are exhaustible sources, and these resources are also unevenly distributed in the world. Most countries in the world are deprived of access to important energy resources, and the struggle for energy is increasingly global in nature [4].

It is no coincidence that in the context of global challenges, energy security and energy supply issues occupy a central place. But is there a solution to these problems? Or, are the elements of the “green” economy, including green energy, which have been in intensive circulation in recent times, capable of solving these problems? We are witnessing the complexity of global problems considered in countries around the world and at the level of international organizations. For example, problems related to climate change are becoming more complex every year, or the efficient organization of the exchange of energy resources, including the active introduction of green energy to world markets, are becoming a priority. It is commendable that Azerbaijan, which has been

strengthening its status as a strategic partner in Europe's energy security year after year, is taking important steps to export its hydrocarbon resources to European countries experiencing problems with energy supply. At the same time, along with natural gas raw materials, the issues of producing other alternative energy resources and exporting them to the European market, which is in high demand, are also of serious importance. Strengthening the "green" economy and increasing the production of green energy play an important role in solving many problems, including environmental problems and resource shortages. Along with this, it allows reducing the negative impacts of human activity and intervention on the environment. It reduces atmospheric pollution and forms sources of energy resources that are more harmless to nature and people. According to the Memorandum of Understanding signed between Azerbaijan and the European Commission, by 2027, natural gas exports to Europe will increase by 2 times and will reach 20 billion cubic meters. Azerbaijan, not content with natural gas extracted from the ground alone, objectively assesses its green energy potential and is continuously working on this. The green energy potential obtained from wind in the Azerbaijani part of the Caspian Sea is 157 gigawatts. In addition, there are an additional 27 gigawatts of green energy potential in the land areas of our country. According to the agreement signed with the United Arab Emirates' Masdar company, wind and solar energy production in our country will reach 4 gigawatts by 2027 and 6 gigawatts by 2037. An agreement has already been signed to lay an underwater cable line from Azerbaijan to Europe, that is, through Georgia, to Romania, and the transmission capacity of that line is at the level of 4 gigawatts. Another significant event is that, according to the Memorandum of Understanding signed with the Australian company Fortescue Future Industries, targeted investments will be directed to increase green energy production in Azerbaijan to 12 gigawatts. In general, based on the agreements and memorandums signed to date, the production and export of 25 gigawatts of green energy in Azerbaijan to world markets may be realized in the near future. Thus, the production and export opportunities of green energy in Azerbaijan will increase significantly, and our country will further increase its competitiveness and image as a reliable energy supply partner. Economic construction in Karabakh is currently underway intensively. On the other hand, it is known that there are serious resources for the development of the Karabakh economy [5].

It should be noted that Azerbaijan has already gone down in history as one of the rare countries that has restored and revived the liberated territories at the expense of its financial strength and economic power. We believe that the main goal of organizing the "Green Energy Zone" in Karabakh is to create renewable energy sources and, in general, to take targeted measures to reduce carbon dioxide emissions in our country. By the decree of the Head of State dated May 3, 2021, measures are envisaged to create a "green energy" zone in the liberated territories. Energy projects implemented in a complex and systematic manner in these territories will be of strategic

importance in creating an exemplary and efficient "green energy" space in Azerbaijan in the near future. These factors will also give a significant impetus to the development of the non-oil sector of our country, and it should be noted that our state has also developed and implemented stimulating tax mechanisms in these areas [6]. The essence of the "green energy" approach adopted in Azerbaijan is that, on the one hand, energy will increasingly come from renewable sources, and on the other hand, our energy savings are more efficient than producing the same amount of energy. As part of the "green growth" concept, a policy is being implemented in Azerbaijan to transform the Karabakh and East Zangezur regions into "green energy" zones [7]. Another important issue is the historical work that Azerbaijan has begun to transition to a new socio-economic development model based on the principles of green energy and a green economy. These factors, in addition to strengthening the economic security of our country, form additional potential for significantly increasing its important component, energy security [8].

One of the main directions in the National Priorities for Socio-Economic Development until 2030 is the formation of a "Country of Clean Environment and Green Growth". Taking these into account, 2024 was declared the "Year of Solidarity for a Green World" by the Decree of the Head of State. Another historic and important issue is the high-level organization of the next Session of the Conference of the Parties to the UN Framework Convention on Climate Change (COP-29) in Azerbaijan in November 2024. By hosting such an internationally prestigious event, Azerbaijan has significantly increased its international image and competitiveness. This will also give an additional impetus to the development of green energy, and the development of green energy is of strategic importance in the state's security system. The construction of modern cities and villages based on "smart" technologies in the Karabakh economic region, the intensive implementation of the First State Program on the Great Return, and the creation of a "green" energy zone at the same time have a multiplicative effect on the development of the region. Similar development processes are shaping a new progressive and modern model of regional development in our country [9].

Environmental problems are becoming acute worldwide. The problems caused by climate change make it difficult to provide essential food products. Land areas are being flooded or are being lost due to drought. In addition, in order to ensure sustainable development, it is necessary to save resources and take into account the needs of future generations. For this, the development of green energy sectors and the establishment of green economy principles are necessary. In such a situation, Azerbaijan, while sharing its oil and gas resources with countries around the world, primarily the European Union countries, attaches strategic importance to the creation of renewable energy sources. As we mentioned earlier, the renewable energy potential in Azerbaijan is 135 GW on land and 157 GW at sea. Also, the wind energy potential is 3,000 MW, and the solar energy potential is

23,000 MW. On the other hand, of the 8.3 thousand MW of electricity currently produced in our country, 1.7 thousand MW is due to the power of hydroelectric power plants. This is a 20% share. The expansion of the network of hydroelectric power plants in the liberated territories will allow increasing the share of green energy. Currently, an action plan is being implemented to create a green energy zone in the liberated territories in 2022-2026. In the context of these factors, it should be taken into account that approximately 25% of Azerbaijan's internal water resources are in the liberated territories. Therefore, new opportunities have been formed for the efficient use of water resources.

After the Great Karabakh Victory, the processes of creating infrastructure and forming fundamental foundations for socio-economic development in the liberated territories are accelerating [10]. Conceptual approaches and priorities in this direction have been almost completely determined. The head of state's consistent visits to the liberated territories and his on-site acquaintance with the revival measures carried out generally provide a strong impetus and additional incentives to the socio-economic development of the newly created Karabakh economic region. Among the successfully implemented projects, the creation of energy infrastructure and the uninterrupted and reliable supply of the liberated territories with electricity are noteworthy. In a short period of time, the construction of 110 kW electricity lines in the directions of Shukurbayli - Shusha (75 km), Shukurbayli - Zangilan (110 km), Khindiristan - Agdam (35 km) was completed.

It should be noted that a powerful electricity network was formed in the Karabakh region during the Soviet Union, and 10 electricity networks operated here. The hated enemy completely destroyed or plundered this infrastructure during the occupation. In the current reality, the presence of strong energy sources in the region and the fact that it attracts attention with its great potential give grounds to say that a new energy infrastructure and network based on more modern technologies will soon be created in Karabakh. If we look at the resource possibilities for this, we will see that there is a prospect of creating a network of hydroelectric power stations on the basis of the rivers Tartar, Bazarchay, Hakari, etc. Work is already being intensified in this direction, and the work of some previously operating hydroelectric power stations has been restored. Thus, the restored 20 MW hydroelectric power station in Sugovushan was put into operation ("Sugovushan-1" and "Sugovushan-2"), etc.

In modern times, Azerbaijan is experiencing its own dynamic development as an independent state and has become a strong country where global initiatives are taking shape. Based on the initial results of COP29, we can note that it is possible to make serious contributions to solving complex problems that concern the peoples and states of the world. However, for this, it is important to unite the efforts of the world's states and use them effectively to take more effective measures. At COP29, the consolidation of important financial resources required to eliminate the negative consequences of global climate change has acquired strategic importance. The issues of establishing

specialized institutions for climate finance, preparing investment and financial mechanisms, assuming obligations by states on green energy, especially accepting obligations related to the maintenance of green energy, have become quite relevant.

It should be noted that the transformation taking place in the development processes of the global economy determines new trends and development impulses in modern conditions [11]. The issues of building a green energy infrastructure are of exceptional importance, and in this regard, taking into account the need to create an appropriate infrastructure based on the basic principles of sustainable development, special attention is paid to the efficient use of energy resources. Thus, the negative consequences of complex processes and global problems in ensuring the energy security of countries around the world are increasing. Problems in these areas are becoming more complex every year, and the negative consequences of climate change are increasing. At the same time, there are difficulties in the rational distribution of energy resources, therefore, the task of ensuring the production of green energy and its entry into the world market is of the highest priority. Based on the priority of ensuring green energy, the issues of forming a green economy, creating an efficient structure of the economy, and improving existing economic mechanisms are becoming increasingly relevant. Among such problems and issues, the need to solve problems of economical and productive use of resource potential, and intensify the transfer of high technologies, especially waste-free technologies, are more noticeable [12]. In this regard, there is a serious need for fundamental research, synthesis, comparison, and generalization of such issues. In addition, there is a serious need to accelerate the establishment of a green energy structure and ensure the efficiency of the mechanisms applied in this direction. We would also like to draw attention to the issues of forecasting world population growth by 2050. On the other hand, since energy resources are unevenly distributed between regions and countries of the world, additional difficulties, problems, conflicts, etc. arise. Against this background, energy security problems are rapidly increasing and diversification of energy sources is required. It is this factor that makes it more necessary to intensify the development of the green economy and, first of all, the creation of the necessary high-tech green energy infrastructure, which requires large investments.

In our opinion, the countries of the world should make greater efforts and take the necessary measures to solve global energy problems. They should ensure the creation of more economical regimes (mechanisms) of using natural resources and non-renewable energy resources. It is necessary to deepen the processes of transfer and application of high technologies between countries and ensure the development of effective mechanisms for the efficient use of energy resources [13]. We believe that despite the intensity of the creation and implementation of green energy infrastructure, the ecological situation in the world is worsening from year to year. This factor clearly shows the importance of the transition of countries around the

world to a green economy and especially green energy. It is in the context of the above-mentioned problems that more intensive measures are being taken in most countries of the world to improve the concept of a green economy and create a green energy infrastructure.

In our opinion, against the background of these problems, factors arising from the concept of sustainable development come to the fore. First of all, the issues of economical use of resources, taking into account the needs of future generations for these resources, the development and application of more efficient regulatory mechanisms and incentives for existing mechanisms have risen to a strategic level. In addition, there are tendencies for countries around the world to seek alternative ways to ensure energy security. In such a case, bringing the problems of greening the economy and efficiency to the agenda, conducting in-depth scientific research in the direction of creating and implementing new progressive models of the economic regime are considered an inevitable process [14]. At the same time, achieving the effective application of the results of scientific research in various segments of the economy is of great importance. Let us note that in the conditions of increasing economic demand in the modern era, the productive use of green energy sources is of great importance. In recent decades, humanity has become more aware that the burning of fossil fuels such as coal, oil and natural gas has caused large-scale global problems that have become uncontrollable. We have specifically distinguished a group of issues related to these:

Modern energy sources are obtained from depleted natural resources. It is understood that in the relatively near future there will be a shortage of natural resources, as a result of which future generations will face difficulties in energy production and ensuring the viability of the population. As a result of the active development of energy, the problem of environmental pollution is becoming more and more acute. However, green energy minimizes damage to the environment and thereby reduces the negative consequences of the global problem. The cost of current non-renewable energy resources is constantly changing, creating difficulties in the world and the global economy. However, green energy can help maintain stable prices, since after the initial costs associated with the creation of a renewable energy source, the costs of maintaining and operating this source are often lower than those of using fossil fuels.

On the other hand, green energy can act as a catalyst for energy security, sustainable development, and social, technological, and industrial innovations in a country. Increasing the consumption of green energy has a positive effect on its economic and social development. Moreover, since energy plays an important role in industrial and technological development, the supply and use of cheap, clean fuel is of particular importance for global stability in the world [15]. In this regard, there is a need to use renewable energy sources that can have a positive impact on all spheres of life, including the stable development of national economies. In our opinion, the development of green energy in the economic sphere can have a

positive impact on solving a group of issues: 1. Increasing the number of jobs and alleviating the employment problem. 2. Reducing consumer spending and creating more resources. 3. Eliminating dependence on fossil fuels imported from other countries and 4. Green energy is not only a solution to global problems, but also a means of stimulating the economic activity of entrepreneurs, business entities and the population.

Along with this, we believe that it is logical to create an environmentally friendly, that is, green energy potential that will help solve the problem of environmental pollution. These facts help stimulate the areas of sales and consumption. "Until a green energy source is created that can fully meet the demand for electricity, even if humanity realizes that it causes irreparable damage to the environment, it will not be able to stop burning fossil fuels" [16]. Currently, researchers and experts are increasingly engaged in the study and development of mechanisms for the formation of new clean and sustainable energy sources, which means that fossil fuels will soon be replaced by a more environmentally friendly resource. It should be noted that Azerbaijan has committed to reducing greenhouse gas emissions by 40% by 2050. In addition, it is planned to increase the share of renewable energy in the structure of total energy resources to 30% by 2030. Azerbaijan has made serious and long-term commitments to implement the necessary measures to ensure a 1.5°C temperature limit in the global context. Azerbaijan is implementing permanent and consistent measures in these conceptual directions [17].

In addition, Azerbaijan plans to increase the volume of natural gas exported to the European market to 20 billion m³ by 2027. At the same time, the creation of infrastructure for alternative energy sources has begun in various regions of the country. In 2037, 6 GW of renewable energy can be produced. President Ilham Aliyev noted at the opening ceremony of the COP29 Leaders' Summit: "Now I would like to say a few words about Azerbaijan's Green Agenda. Our technical potential in renewable energy is 135 gigawatts onshore and 157 gigawatts offshore. Last year, the UAE's Masdar company inaugurated a 230-megawatt solar power plant in one of our regions. Saudi Arabia's Acwa Power is currently building a 240-megawatt wind power plant. Within the framework of COP29, an agreement will be signed with the United Kingdom's BP company on the construction of a 240-megawatt solar power plant in the Jabrayil region, which was liberated from Armenian occupation four years ago. Thanks to this project, decarbonization will be ensured at the Sangachal terminal, one of the largest oil and gas terminals in the world. We are also focusing on export markets and are actively working with our partners to implement another important energy security project, which involves laying an energy cable from the Caspian Sea to the bottom of the Black Sea. This will allow us to export green energy to Europe, and the technical potential of this cable is four gigawatts. By the way, the feasibility study will be completed soon. "But still, this is just the beginning [18].

At the same time, Azerbaijan will implement joint projects with Kazakhstan and Uzbekistan to create

green energy infrastructure. Azerbaijan, together with a group of world countries, has increased its activity in developing financial mechanisms for green energy projects. Another important issue is related to the formation of a green economy structure and the creation of green energy infrastructure in the processes of revitalizing post-conflict territories. "The newly created Karabakh and East Zangezur economic regions have great resources in terms of forming and increasing green energy potential" [19]. Development projects for the Karabakh and East Zangezur economic regions mainly cover priorities until 2040. In particular, taking into account the current issues arising from the tasks of the First State Program on the return of internally displaced persons to their native lands, the prospects for forming and increasing green energy potential in these economic regions are becoming increasingly attractive. The liberated territories have been declared green energy zones in general and a targeted action program has been formed in this regard. Green energy projects will make a significant contribution to improving the structure of energy resource production in our country. On the other hand, in a context of increasing modern global threats, the development of green energy is characterized as one of the highest priority tasks of the country's national and economic security.

In addition to the above, we believe that in the near future, more intensive development of green energy infrastructure will be ensured in post-conflict areas. In addition, in order to implement the priority tasks of the transition to green energy in Azerbaijan in the context of sustainable development and prepare effective mechanisms for action, we consider it important to seriously consider a group of factors:

- First of all, the green energy potential of the region should be studied in more depth, and the reserves should be objectively assessed;
- There is a need to accelerate the processes of creating green energy infrastructure in the economic region, this factor is of serious importance in settlement, creation of new jobs and realization of the Great Return;
- Launching targeted scientific research at Karabakh University to ensure the efficient use of the region's green energy resources;
- In order to intensify green energy infrastructure in the Karabakh economic region, it is necessary to use the experience of more developed countries and companies in this field in the world, and comprehensive measures should be taken in this regard, etc.
- It is important to expand the scale of the investment projects launched to create a large and promising green energy infrastructure and to implement projects aimed at creating a similar infrastructure in all regions of the country;
- A thorough study of the green energy potential in the Karabakh economic region, an optimal assessment of resources and related reserves should be ensured;
- There is a need to develop a separate action strategy and, more precisely, a state program for the efficient use of water resources, small rivers, and

especially rivers with water all year round, in the Karabakh economic region, and in this regard, it is advisable to prepare and implement a special state program for the expansion of the network of hydroelectric power plants in the Karabakh economic region for the period up to 2030;

– In order to more effectively organize the processes of implementing the green energy concept in our country, we propose to improve management mechanisms and create a specialized "Green Energy Corporation" that meets international requirements, etc.

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HISTORICAL SCIENCES

DAVID GAREJI MONASTERY COMPLEX IN THE SERVICE OF CHRISTIAN SPIRITUALITY AND THE UNITY OF STATEHOOD IN GEORGIA

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Abstract

This work is an attempt to consider and explore interesting details in such an important and very responsible issue for the history of Georgia as the formation of the church and monastery complex, in particular, the David Gareji monastery complex, and its being under the jurisdiction of both the state and the Church of Georgia.

The purpose of the article is to review all Georgian and foreign sources and literature that testify to the David Gareji monastery from the moment of its foundation to the present day, about the foundation of these monasteries on the territory of Georgia, their location, number, as well as how these monasteries were managed under the jurisdiction of the Georgian Church by both kings and high hierarchs.

The topic is relevant, since it touches upon a spiritual center that is of fundamental importance for Georgia. The significance of the David Gareji complex, both for the state and for the church, has always occupied a leading place in spiritual and educational development. However, recent times, caused by a number of unfounded and meaningless opinions regarding the David Gareji complex, have made the presentation of research components of the history of Gareji and its coverage doubly relevant, in principle. Therefore, Georgia's interest in the David Gareji complex has become even more significant.

For the study, we used the survey methodology. According to this method, we consider issues related to the research topic and draw final conclusions based on the analysis. The review of the topic includes discussion, evaluation and ordering of the research results of various authors based on the research question in logical, conceptual or chronological order, consideration of existing scientific works on the research topic and drawing conclusions based on their analysis.

The practical significance of the topic is determined by the fact that it reasonably, convincingly and accessibly describes the location of the Gareji complex in the jurisdiction of the Georgian Church from the moment of its foundation to the present day, both from a historical and legal point of view, according to which the boundaries of church jurisdiction coincide with the state borders. Thus, we believe that the development of thought in this direction and the innovations revealed in it will inspire many researchers in the future to expand on this topic.

The Lavra of David was the center of the monastic life of Gareja. Over time, branches were added to it. Gareja is mentioned in historical sources as "the twelve monasteries of the Gareja range." "Life of Kartli" tells

us: during the reign of King Demetrius II, Sadun "did good deeds to the monasteries and the poor, in those days of his life he distributed the lands and property of the twelve Gareja hermitages and liberated the land of Gareja and served King Demetrius." (Life of Kartli, vol. II, 1959, p. 272.)

According to Vakhushti Bagrationi, "on Mount Gareja there are monasteries carved into the rock, with cells, refectories and chambers; it is warm in winter, cool in summer. The archimandrite sits in the Baptistery, the prelate in Chikhtitura, the archimandrite in David Gareji, and the prelate in Bertubani. But there were many monasteries, even to the bitter water, and they were full of monks, and now only five monasteries remain" (Vakhushti, Geography, p. 50, Tver, 1941).

It should be especially noted that famous political and cultural figures worked in the David Gareji monastery at different times: Demetre I, Onofre Garejeli (17th-18th centuries), Onofre Machutadze (17th-18th centuries), Sulkhan-Saba Orbeliani, Bessarion Baratashvili-Orbelishvili, Nikoloz Cherkezishvili (18th century), Gavriil Saginashvili (18th century), Grigol Dordorkeli, Anton I, Timothy Gabashvili, Gavriil Mikhail and others.

Mose Janashvili describes David Gareji in his essay as follows:

"David Garejeli was the first to settle in Gareja. His disciples and followers built eleven hermitages: 1) Martyrs, 2) Bertubani, 3) Dodorkis, 4) Forerunners, 5) Chichkhrituri, 6) Tetrisenaki, 7) Mgville, 8) Kolageri, 9) Mokhatuli, 10) Veran-Gareja, 11) Pirukugmarti. In the 17th century, David Gareja was destroyed by Shah Abazi, and about 6,000 monks were exterminated. "The hermitage was restored by Machutadze at the beginning of the 18th century, and he found many valuable books, jewelry and income." (Geography of Georgia by Vakhushti Batonishvili. Ed. by M. G. Janashvili, 1904, p. 67). Platon Ioseliani lists eleven more monasteries besides the Lavra of David: Paskha Martyr, Bertubani, Dodo Rka, John the Baptist, Chichkhrituri, Tetri-Senaki, Magazana or Peshter, Kolagori, Mokhatuli, Verangareja and Pirukugmarti. (Platon Ioseliani).

In addition, King Vakhtang VI in one of his poems mentions the Lavra of David, Bertubani, Chichkhrituri,

Baptist, Martyr and Dodo. Of these, P. is the only martyr not mentioned by name in Ioseliani's book, located a couple of kilometers from Baptist.

A list of the monasteries can be found in the Sitar-khani Gujar of the Catholicosate: "... in the east, the monastery of Sioni and the monasteries of Kuabni with their fathers... the tomb of David and the horn of Dodo, the monastery and hermitage at the entrance to Tuisi." According to Teimuraz Todua, "Yorze Sioni Monastery" should mean Ertso Sioni, however, since its location has no relation to the Gareji monasteries, Todua considers it questionable to include this monument among them.

According to the territorial distribution of the early feudal period, the Gareji monasteries occupied the territory of Kambechani, and later Kukheti, in the southern border zone of the Kakheti bishopric. These monasteries are located in the Gareji Mountains, which run parallel to the Kura River, and on steep cliffs located in the lower reaches of the Iori Valley. Subsequently, a network of cave monastery complexes gradually formed, located everywhere.

From a jurisdictional point of view, information about the Gareji community is important; In 1702, a church council was convened in David Gareji or its environs, which issued a decree - "Decree of the Church Council on the monastic charter and order." (Metropolitan Anania; Monuments of Ancient Georgian Law, Vol. III, p. 633).

It is also known that Iv. participated in the government commission of the First Republic (1918-1921), which established the Azerbaijani-Georgian border. Javakhishvili and P. Ingorokva. In 1919, under the auspices of the Military Ministry of the "Republic of Georgia", Iv. Javakhishvili's study "The Borders of Georgia in Historical and Modern Perspective" and the map attached to it have not lost their great scientific value even today. As well as P. Ingorokva's essay: "On the Borders of the Territory of Georgia" (Publishing House of the Rustaveli Society "Sarangi", Tbilisi, 1990, pp. 13-15). The research materials of great scientists should undoubtedly be taken into account for an objective determination of the real borders of Georgia.

David Gareji developed its own rules of monastic life and construction, as well as its own school of fresco painting. The appearance of the David Gareji monasteries of this period differs markedly from the monasteries of earlier periods. In the main churches and refectories, instead of the former simplicity and spontaneity, there appeared grandeur, grandeur, interest in

wide, free space. The impression was further enhanced by the paintings on the walls of the main churches and common refectories. Numerous images of the founders of M. give special significance to the painting of David Gareji. Portraits of Georgian kings (Queen Tamara and her son George IV Lasha - the Bertubani Church, now the State Museum of Art, Tbilisi; King Demetre II the Pious - painting of the Annunciation Church of the Desert Monastery). The portraits of the founders are significantly larger than the images of religious figures, which testifies to the independence of the Georgian master from the schemes legitimized by Byzantine art. The paintings of the Bertubani refectory are noteworthy, leaving a solemn and majestic impression. The main church of Udabno depicts scenes from the life of David Garejeli. Also interesting are the paintings of the apse of the Church of the Ascension of the Udabno Monastery, which are distinguished by the expressiveness of forms and dynamism.

Georgian inscriptions have been preserved, including a six-line asomtavruli inscription on a stele from the 6th-7th centuries.

Thus, from the moment of its foundation to the present day, the David Gareji monastery complex has always been an object of concern for the Georgian state and its leaders, kings and princes, serving both as spiritual food for Georgia and as a means of unifying the state.

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A HUNGARIAN MAYOR UNDER ATTACK – INTERPRETATION OF THE VÁSÁRY CASE THROUGH THE ARTICLES OF THE *DEBRECZEN* NEWSPAPER

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Abstract

The study analyzes the legal case of István Vásáry, mayor of Debrecen, Hungary's second-largest city, between 1934 and 1935. The research focuses on the political attacks against him, the smear campaigns led by radical right-wing groups, and the investigations related to the property affairs of the Vásáry family. The accusations generated significant press coverage, with *Debreczen*, a conservative daily newspaper, defending Vásáry by emphasizing his integrity as mayor. The study examines the relevant issues of *Debreczen*, offering a chronological overview of the unfolding events in the city and the clash of various political perspectives. Additionally, the research is based on a detailed analysis of the collection of *Debreczen*'s editor-in-chief, József Pálffy. The final section of the study presents the conclusion of István Vásáry's case, outlining the outcome of the disciplinary investigation and legal proceedings.

Keywords: Hungarian politics, political defamation, István Vásáry, Debrecen, Hungary in the 1930s

*"In a world like this, the cruel struggle between man and man, nation and nation, race and race begins. Few people will become rulers, holding power over the world and the masses. The masses will sink into the hell of misery and suffering, where they will be driven only by the savage whipping of life instinct that drives humanness out of humans."*¹⁴

In the 1930s, Debrecen, Hungary's second-largest city, experienced a particularly vibrant and diverse press scene, which became a defining element of its cultural and political life. The *Debreceni Független Újság* [Debrecen Independent Newspaper] was one of the left-wing press organs, while the *Hajdúföld* newspaper supported radical right-wing views. *Debreczen*, owned by Gyula Szigethy and edited by József Pálffy, played a prominent role in the press life of the city.¹⁵ This newspaper was a leading representative of conservative tendencies and was also the most popular political daily in Debrecen. The content of the paper was primarily determined by local political events and their evaluation. The case of István Vásáry stood out among them, generating lively debates in the local press.¹⁶ A study of the relevant issues of the newspaper provides an opportunity to follow step by step the events in the city and the clash of different political and social positions. A more detailed understanding of the events is greatly aided by the collection of the editor-in-chief of *Debreczen*, József Pálffy, which serves as a valuable

source for exploring the local public life of the period in a broader sense. By comparing the articles published in the press with Pálffy's collection, we can get a comprehensive picture of how *Debreczen*'s political position was expressed in relation to political events in the city.¹⁷

The Vásáry family was one of the oldest landowners in Debrecen, Hungary, and their prominent members played an important role in the life of the city for generations. István Vásáry started his career in 1909 at the Debrecen Municipality and continued his work as a councillor from 1914, during which he was actively involved in the management of the city for two decades. Until the end of World War I, Vásáry was responsible for administration, focusing on maintaining the stability of the city, while during the revolution and the subsequent Romanian occupation he was the de facto leader of Debrecen. He paid particular attention to preserving the autonomy of the city, protecting its population and ensuring basic living conditions. His local career culminated in his appointment as deputy mayor in 1925 and mayor in 1928, as an active supporter of István Bethlen's governmental policy.¹⁸

1934 was a year of political struggles in Debrecen. After Gömbös became prime minister, he apparently reconciled with István Bethlen, while at first covertly, then more openly, he tried to oust him and his supporters from their positions of power.¹⁹ This also marked

¹⁴ István Vásáry's speech. *Debreczen*, 27 August 1935.

¹⁵ József Pálffy's name appears in several spelling variants in the archival documents (*Pálfi*, *Pálfy*, *Pálffy*). In the present study, the latter one will be used.

¹⁶ By the mid-1930s, during the Gömbös government, the newspaper faced increasing difficulties, receiving neither state support nor a neutral stance from official press policies. The editor of *Hajdúföld*, Mihály Kolosváry-Borcsa, who was also the president of the Journalist Association of Debrecen, played a leading role in the struggle against Vásáry. Pálffy, József: *Az első tíz év, a kormánytámogatás időszaka* [Pálffy, József: The first ten years, the period of government support] (hereafter: Pálffy documents – The first ten years), University

and National Library of the University of Debrecen, Manuscript Library of the Kassai Street Campus MS 11/1:8. 70.

¹⁷ The documents of József Pálffy are particularly valuable parts of the press history material of the University of Debrecen, including a description of his professional work and the press life of the city. Pálffy meticulously prepared his works, relying not only on memory, but also on old newspapers, personal notes, and contemporary documents, which he attached as appendices to his manuscripts. His writings thus provide a reliable and accurate picture of the newspapers and people he worked with, as well as a comprehensive insight into the press relations he knew. Korompai 1979. 74. Bényei 2007.

¹⁸ Veress 1999. 15-17.

¹⁹ For background information, see Vonyó 2018.

the beginning of the advance of the radical right movement in Debrecen, one of the key moments of which was the appointment of Mihály Kolosváry-Borcsa as local secretary general of the Party of National Unity, who also retained his post as editor-in-chief of *Hajdúföld*, which played a decisive role in the local dissemination of racist ideas. Kolosváry-Borcsa and his circle were the first to launch smear campaigns against István Vásáry. They encouraged Gyula Bíró, a printer, to produce slanderous pamphlets, which they intended to use as blackmail against Vásáry. Vásáry, however, did not give in to the threats and immediately reported the matter to the Minister of Interior, accusing them of libel. Gyula Bíró soon admitted that he had financed the production of the leaflets in question with the financial support of members of the National League. Bíró was sentenced to one month in prison for defamation and a fine of 150 pengos for extortion. Kolosváry-Borcsa and his associates launched their actions primarily to retaliate for perceived or real grievances, but many of their followers were motivated by political and social ambitions.²⁰ The local branch of the National-Christian Defense League, whose main supporter was Lord-Lieutenant László Vay, also played a key role in the unfolding political struggle.²¹ Since the government had no power to directly replace the officials of the provincial jurisdictions, it used a variety of methods to gradually remove those it considered undesirable.²² It was these changes that launched the campaign against István Vásáry, the mayor of Debrecen. The events quickly attracted considerable coverage, with the result that not only the city press but also the national press covered the case on a daily basis.

On 12 April, the Minister of Interior, Ferenc Keresztes-Fischer, ordered a disciplinary inquiry into a rent rebate of an estate in Ohat, whose tenants were István Vásáry's mother and siblings. The Vásáry family justified their application for a rent rebate by claiming that the tenants had not previously received any rent rebates, but the minister called this a deliberate misrepresentation. An important factor, however, is that the lease was signed when István Vásáry was not yet a mayor, although he was already a member of the city council. Before his election as mayor, the leading figures of the city carefully checked whether the fact that his siblings and mother were tenants of certain areas of the city would be an obstacle to Vásáry's candidacy,

but the then Minister of Interior replied that older contracts could not be an obstacle in such a case.²³

The disciplinary investigation was initially launched against Town Clerk József Zöld, whose signature appeared on a document allowing the Vásáry siblings to repay their debt of more than 115,000 pengos in equal, interest-free installments in wheat, over five years, starting on 26 July 1933.²⁴ It soon became evident that the proceedings against the Vásáry family were initiated by a fictitious person named József Kovács, whose address was never provided and who was never interrogated throughout the entire process. According to Pálffy, it is possible that the individual in question was, in fact, an economic employee of Baron Vay.²⁵ On 23 April, the Minister of Interior, referring to recent abuses, described the actions of the municipal administration as *"rightly objectionable and worrying in terms of the consequences of careful foresight and targeted management."*²⁶ Debreczen, however, stood firmly by Vásáry, publishing statements in his defense: *"István Vásáry's puritanism, his absolute honesty, his official correctness, his unquestionability in the management of his assets are well-known and irrefutable facts, but no defence could be found against the whispered accusations and rumours until the recently ordered official investigation will convince the higher forums that István Vásáry, mayor of the city, and his valuable staff... are in all respects at the top of their profession, they run the affairs of the city with a clean hand, and not even the shadow of selfish financial interest can be connected to them."*²⁷ On behalf of the city, Debreczen called on the Minister of Interior to conduct a detailed investigation as quickly as possible. The newspaper's staff, in addition to standing by Vásáry's side, launched a separate investigation into some of the allegations of the legal proceedings, refuting them with detailed and substantiated arguments.²⁸ It was admitted that the family members had received concessions to settle the arrears, but the mayor said he had not attended any of the committee meetings at which the case was discussed. The city did not suffer any financial loss due to the concessions, and it is not uncommon for tenants to seek support from the city administration.²⁹ Debreczen published the transcript of Minister Keresztes-Fischer's statement, along with the opinion of József Vásáry³⁰, one of the managers of the Ohat estate: *"...we did receive apparent concessions,*

²⁰ Veress 1999. 63-68. Pálffy documents – The first ten years. 44.

²¹ László Vay was appointed lord-lieutenant by the Károlyi government in February 1932, but he soon allied with local supporters of Gömbös, choosing to oppose István Vásáry in the Bethlen-Gömbös political conflict. In the autumn of 1933, Vay began to prepare attacks against Vásáry by means of anonymous letters and denunciations, which were the basis for the subsequent proceedings. Vay not only provided the details of the proceedings, but also prepared briefings for the ministerial investigators, in which he portrayed the Vásáry family's rent affairs as unfair and unlawful special rebates, deliberately distorting the facts. Veress 1999. 68-70.

²² Püski 2006. 197.

²³ Pálffy documents – The first ten years. 65.

²⁴ During these years, many farmers and tenants faced financial ruin due to low production prices and poor harvests. Pálffy documents – The first ten years. 65.

²⁵ Pálffy documents – The first ten years. 46.

²⁶ The procedure was based on Article 48 of Act V of 1927. Debreczen, 24 April 1934. 1-3.

²⁷ Debreczen, 24 April 1934. 1-3.

²⁸ The indictment also includes charges of abuses in connection with taxes of consumption and entertainment. In both cases, the charges against the mayor were disproven, who had been denying all accusations of tax fraud from the first minute. Thus, according to the newspaper, Vásáry is merely the victim of a smear campaign, which he is forced to tolerate in the absence of a law on defamation.

²⁹ Debreczen, 24 April 1934. 1-3.

³⁰ József Vásáry was the brother of István Vásáry, who owned the Ohat estate.

but always with the approval of the Minister. However, these concessions were only apparent... The ordered investigation will clarify everything.”³¹ In the meantime, investigations of nearly 30 companies and institutions have been launched by various external experts, Interior Ministry under-secretaries and officials from other high authorities. The investigation was led by State Secretary Árkád Tatich and Minister Counsellor Béla Janda, with Sándor Hódy and István Cserzy reviewing the books under the supervision of the department head.³² The leases were checked by a member of staff from the Ministry of Land Reclamation, who arrived later.

The title of the 24 April issue of *Debreczen* was “Public opinion in Debrecen in favour of Mayor Vásáry”, in which not only the paper as a whole stood up for Vásáry, but also reported that the city was standing as one man behind the mayor. Baron László Vay, lord-lieutenant of Debrecen, assured that the accusations against the mayor would not turn into a personal vendetta, but would serve only to clarify the city’s administrative matters. At the ruling party meeting on 26 April, the majority group of the committee declared confidence in Mayor Vásáry, and the lord-lieutenant repeatedly hinted that no one in the city’s leadership was being accused.³³ A large segment of the city’s population closely followed the case, with details becoming widely known through leaked information and verbatim quotes from official transcripts.³⁴ Despite the promises made, the public likely suspected from the beginning that this was far from a routine investigation. While *Debreczen* campaigned in favour of Vásáry, articles attacking the city’s leadership was published in *Hajdúföld*. In addition, the left-wing opposition paper *Debreceni Független Újság* [Debrecen Independent Newspaper] questioned the motives of the Minister of Interior, asking what had triggered the big turnaround, with previously ordinary affairs now considered dangerous.

A few days later, a general assembly was convened, which the *Debreczen* reported under the headline “Great excitement, renewed storms at the city assembly.” Quoting the ominous article, Baron Vay, lord-lieutenant of Debrecen, made a ceremonial opening speech in which he said the following: “There is no question of an action against Debrecen... On the contrary, it is a question of defending the city of Debrecen in all its aspects... Hungarian people must have confidence in other Hungarians, and this cannot be withdrawn from them until they are convinced otherwise.”³⁵ The first speaker of the assembly, György Magoss, said

that although he was investigated several times during his previous mayoral career, the present case was much more complicated. According to him, the entire city – not just its administration – had fallen victim to a smear campaign: “It has been presented to the public opinion of the country as if everything here was in moral decay, in moral decline... We cannot change this state of affairs without protests and we must strive to... remove this misconception from the moral public life of the city of Debrecen.”³⁶ Pál Hegymegi Kiss³⁷ criticized Vásáry’s opponents, who did not openly confront the mayor, but hid and did not take responsibility for themselves. He admitted that he himself had had many clashes with the mayor in the past, but that these conflicts had always been settled fairly. Bishop Baltazár³⁸ warned that the investigation threatened the peace of Debrecen, stating that “True government can only be over the free, because to rule over slaves is not pride but mockery.”³⁹ The assembly concluded with the adoption of the small assembly’s proposal, acknowledging the provisions of the Minister of Interior, but voicing concerns over the aggressive ambitions of radical right-wing groups. Although Vásáry retained his position, the city became divided into two opposing camps. The biased actions of the lord-lieutenant led to demonstrations in several areas, while at the same time, representatives from various city districts personally visited him, expressing their confidence and support: “The districts, one by one, have the utmost confidence and affection for the lord-lieutenant, Baron László Vay.”⁴⁰

In defense of Vásáry, the Debrecen Municipal Association was established on 30 April in the town hall’s council chamber at the initiative of Baltazár, with an estimated membership of 40 to 50 people.⁴¹ Their primary goal remained to preserve the autonomy of the city. According to Bishop Baltazár, “The association welcomes individuals from any political party who are looking after the interests of the city.” The other key initiator was Pál Hegymegi Kiss, who emphasized the importance of freedom of belief and expression in connection with the case. According to lawyer Dr. Jenő Fényes, “István Vásáry, who is worthy of trust and worthy to manage the affairs of the city, should soar with his God-given talent.”⁴² The membership of the association was growing by the day, despite the fact that many had been voicing their support only quietly because of their dependence on the state.⁴³ *Debreczen* wrote that “Disintegration can only be avoided if national unity here in Debrecen becomes true national unity, and the monopoly of far-right elements in the life

³¹ Debreczen, 24 April 1934. 1-3.

³² *ibid.*

³³ Debreczen, 25 April 1934. 1.

³⁴ The Vásáry case attracted nationwide attention, with newspapers across the country covering the unfolding events. *Függetlenség* [Independence], started by Gömbös, called the city a “wild jungle to be cleared.” The issue containing the previously mentioned article was distributed free of charge as an annex to *Hajdúföld*. Veress 1999. 58.

³⁵ Debreczen, 28 April 1934. 1-2.

³⁶ Debreczen, 29 April 1934. 2.

³⁷ Pál Hegymegi Kiss was at that time a prominent member of the local opposition and of the Independent Smallholders

Party. He was the main representative of the National Smallholders Party in the National Assembly. By expressing this opinion, the local left practically sided with Vásáry. Veress 1999. 60.

³⁸ Bishop Baltazár himself was related to the Vásáry family, as the wife of István Vásáry’s brother was the daughter of Baltazár. Pálffy documents – The first ten years. 64.

³⁹ Debreczen, 29 April 1934. 2.

⁴⁰ Debreczen, 5, 9, 10 May 1934.

⁴¹ Pálffy documents – The first ten years. 65.

⁴² *ibid.*

⁴³ Veress 1999. 78.

of the party is ended."⁴⁴ At the initiative of the association, extraordinary general assemblies were scheduled for 25 and 28 May, anticipated to be "stormy sessions."⁴⁵ After some initial difficulties, the extraordinary city meeting ended in a calmer atmosphere, with Vásáry commenting on the abuses that had occurred and pointing out that when the need arose, he had taken measures to punish and vigorously prosecute abuses.⁴⁶ The mayor emphasized that, due to the ongoing investigation, he was restricted in his ability to comment on all matters.⁴⁷ The assembly finally concluded with the adoption of the ministerial letter ordering the suspension of the mayor and several of his associates.⁴⁸

In the end, István Vásáry was prosecuted on 23 counts including the fact that he had not yet required his family members to deposit an assurance in cash, stocks or mortgages equal to the amount of one year's rent provided for in the lease contract. Furthermore, he provided his tenants with significant property discounts despite knowing the properties were mortgaged, granted his family members various financial concessions and payment deferrals between 1929 and 1932, and allegedly transferred used motor oil from city-owned vehicles to his siblings without compensation. On 29 September, 1933, he claimed that he had never interfered in the rental matters of his siblings and mother in any way, either directly or indirectly. However, the latter statements proved to be untrue: in 1929, for example, he chaired a meeting of the board of directors which granted his relatives a further extension of payment, and his signature was on the application for remission of the debt.⁴⁹ Not only the mayor, but also several city leaders were prosecuted for irregularities and omissions⁵⁰, and Vásáry was immediately suspended on the grounds that "his continued operation would cause irreparable damage to the city."⁵¹ Vásáry communicated the decision of the Ministry of Interior to his fellow officials on 24 August and handed over his office to Elemér Vargha, who was appointed by the lord-lieutenant.⁵²

Debreczen published the Minister of Interior's decree on 25 August, and while the newspaper continued to support Vásáry, its wording became more cautious: "We find it difficult to take a position on this matter,

because the officials against whom the proceedings have been initiated cannot, by the nature of the case, make a statement... any preliminary position would have the appearance of a certain amount of unilateralism."⁵³ Later, however, they were more explicit: the mayor had taken legal action to protect the entire agricultural community, including the Vásáry siblings, who were renowned for their diligence and professionalism. They also stressed the decency and individual integrity of city leaders.⁵⁴ The paper then went on to detail which officials were under investigation and which charges were brought up against them. On 28 August, another public assembly was called, the agenda of which included the Interior Minister's document, which was followed with great interest not only by the public in Debreczen but also in the capital.⁵⁵ Rumors circulated that the Minister of Interior was not only suspending Vásáry but also pressuring him to retire.⁵⁶

The next day, the *Debreczen* daily reported on the extraordinary general assembly, including a statement by Baron Vay, the lord-lieutenant, regarding the investigation: "Some of the irregularities that have occurred in connection with property and consumption taxes are subject to judicial proceedings... I intend to act in the most calm manner in all cases, with the aim of achieving the greatest harmony among the public of the city."⁵⁷ In addition to the lord-lieutenant, other speakers included Bishop Dezső Baltazár, Professor István Rugonfalvi Kiss and Pál Hegymegi Kiss. According to Pálffy, at a given signal, Hegymegi jumped up from his seat, opened the door wide, and the suspended mayor entered. Vásáry was greeted by a huge cheer from the left and they began to sing the national anthem together.⁵⁸ Hegymegi stated that Vásáry was being driven to his death, a sentiment echoed in the press, and warned that if this continued, those responsible would be guilty of manslaughter.⁵⁹ The speeches were followed by voting, where only a slim majority, 73 out of 159 present, voted in favour of the official proposal, thus accepting the ministerial transcript.⁶⁰ Meanwhile, not only the newspapers of Debreczen – especially *Debreczen* – but also major press outlets in the capital voiced their support for Mayor Vásáry. The *Pesti Hírlap* [Daily Journal of Pest], *Az Est* [The Evening]

⁴⁴ Debreczen, 1 May 1934. 2.

⁴⁵ Debreczen, 24 May 1934. 3.

⁴⁶ Debreczen, 29 May 1934. 1-2.

⁴⁷ Veress 1999. 80.

⁴⁸ The investigation was based on Article 78, paragraph 1 of Act XXX of 1929, while the suspension of István Vásáry was based on Article 80, paragraph 1 of the same Act. Debreczen, 25 August 1934. 1-6.

⁴⁹ Veress 1999. 82-83.

⁵⁰ The primary accusations against Town Clerk József Zöld included irregularities in the construction of the Homokkert Street tramway and his failure to uphold the city's contractual rights. In the cases brought by Attorney General Dr. Károly Miszt, on behalf of the city, he charged the city a total of approximately 43,000 pengos in costs on about 800 occasions. In addition, Councillor Dr. Géza Veress concealed the fact that the statements showed that there was a capital debt in the account of the accounting office. Veress 1999. 84-85.

⁵¹ Veress 1999. 85.

⁵² "By my decree issued on 23 May 1934 under the number 128.045-1934 B.M. ... I hereby inform the public of the city

about the following: the investigation carried out has revealed a deficit of approximately 3 million pengos in the city's budget management." Debreczen, 25 August 1934. 1-6.

⁵³ Debreczen, 25 August 1934. 1-6.

⁵⁴ Debreczen, 25 August 1934. 1-6.

⁵⁵ The general assembly attracted significant public interest, with ticket offices overwhelmed by people eager to secure gallery seats. Some of Vásáry's supporters sought to organize a march in his defense, but he personally intervened, insisting that the town hall dispute should not escalate into street demonstrations. Debreczen, 28 August 1934. 1-2.

⁵⁶ Debreczen, 26 August 1934. 1.

⁵⁷ Debreczen, 29 August 1934. 1-4.

⁵⁸ Pálffy documents – The first ten years. 75.

⁵⁹ Debreczen, 29 August 1934. 1-4.

⁶⁰ György Magoss, who would have sacrificed everything for Vásáry in mid-April, now turned against him. In 1938, the administrative court subsequently ruled his decision illegal, since he had been involved as an officer prosecutor general in the contract containing the lease guarantee. Veress 1999. 97.

and *Magyarság* [Hungarianness] also commented on the events in leading articles.⁶¹ In general, they spoke with the highest praise of Mayor Vásáry's outstanding personality and values, and emphasized that many cultural and other achievements of the city were attributed to his name.

At that moment, the true motives of the racist groups became unmistakably clear. Through propaganda leaflets, they denounced the liberal movement that had been gaining traction in Debrecen, arguing that the city must be purged of these so-called "*parasitic groups*" as soon as possible. All this was intended to lay the groundwork for the forthcoming elections to the city council, and not without good reason, since some members of the Debrecen Municipal Association had defected from Vásáry and sided with groups supporting Gömbös and the lord-lieutenant.⁶²

The following months were devoted to the investigation of the accusations, and the *Debreczen* daily paper continuously covered the events of the case. In mid-October, the Debrecen Municipal Association sent an open letter to Baron Vay, whose reply was published in the 16 October issue. The lord-lieutenant claimed that the vociferous opposition group was led by the Independent Smallholders Party and that it was therefore necessary for the authorities to put an end to a system that was causing public harm. Vay said the following: "*(Gömbös determined) to organize the Hungarian society and make it strong, combative and resistant to the tasks and great problems of the future... (the Party of National Unity) has shown that it not only proclaims but really feels the importance of the power of unity and organization and... it is only through a common understanding of the common difficulty, and by subordinating private interests above all to the public interest, that this unhappy, broken country can be put on the road to a better future.*"⁶³ It is also important to note that the lord-lieutenant was now openly opposing Vásáry. However, a month later, Minister of Interior Keresztes-Fischer was still saying that the mayor was only temporarily out of office, and his hearing was held on 15 November before a disciplinary board.⁶⁴ According to the chairman of the board, Deputy-Lieutenant Sándor Virányi, Vásáry's interrogation is still ongoing, it is not known when it will be completed, and this will depend on what the mayor has to say.⁶⁵ Notably, the mayor had

much to say, which led to the interrogation being finished only on 24 November. Meanwhile, on 22 November, the *Debreczen* published a one-page editorial entitled "*Put on Index.*" This decision stemmed from the Party of National Unity's issuance of a circular prohibiting its members from reading the *Debreczen* and forbidding any form of collaboration with the newspaper. According to the paper, the reason is that "*we refuse to write the Debreczen with the pen of Mihály Kolosváry-Borcsa.*" According to István Pálffy, the editor-in-chief, the editors of *Debreczen* had repeatedly refused to publish Kolosváry-Borcsa's reports, leaving this task to *Hajdúföld*, which was already engaged in the propaganda of Gömbös. The leaders of *Debreczen* compared this role to that of the ancient inhabitants who fought against the immigrant foreigners.^{66 67}

Meanwhile, Vásáry's support was diminishing on a daily basis – not due to a lack of sympathy or compassion, but because of fear and intimidation. Those who expressed support for Vásáry faced fines imposed by the tax authorities a few days later.⁶⁸ *Debreczen* was also not spared by the inquisition. The publishing company of the newspaper was subjected to an audit by three financial inspectors, who spent two weeks scrutinizing its records. The results were reported every day by telephone, where it was easy to listen in on the conversations, so that it was clear that the instructions had come from the lord-lieutenant. Following the inspections, legal proceedings were initiated against the owner, Gyula Szigethy, and the editor-in-chief, József Pálffy. The true aim was to intimidate and pressure the newspaper's leadership into submission – though ultimately without success.⁶⁹

No progress was made on the case for months, but *Debreczen* wrote about it frequently. In early December, an official reassessment of the Vásáry siblings' debt was conducted. The final conclusion revealed that the siblings had not received any special privileges and, in fact, had been granted proportionally fewer concessions than others. A front-page headline urged voters to "*stick with István Vásáry despite all the deceptions and cunning tricks.*"

At the end of 1934, the municipal elections took place in multiple stages: a limited election on 5 December and a general election on 16 December. Vásáry ran as a representative of District XII, facing fierce opposition from racist groups. *Debreczen* reported the event

⁶¹ *Debreczen*, 31 August 1934. 1.

⁶² Tóth, Gábor: Debrecen a második világháború előtti évtizedben 1931–1941 [Debrecen in the decade before the Second World War 1931–1941]. In: Tokody, Gyula (ed.), *Debrecen története* [The History of Debrecen], 1986. 252.

⁶³ *Debreczen*, 16 October 1934. 6.

⁶⁴ At the same time, Pál Hegymegi Kiss gave a speech in which he said that the Vásáry family had already had their leases when he became mayor. He himself was against Vásáry, but now he thinks that instead of an investigation, there is a manhunt. Pálffy documents – The first ten years. 85.

⁶⁵ *Debreczen*, 16 November 1934. 3.

⁶⁶ Pálffy documents – The first ten years. 85.

⁶⁷ The interrogation of Vásáry's brother, József Vásáry, in Egyek, in the case of the "wormy bacon", took place in parallel with the interrogation of István Vásáry. The accusation was that the brothers had given their workers wormy bacon.

The accusation was soon dropped, as the whistleblower, Péter Kovács, contradicted himself during the first interrogation. A piece of the bacon in question was examined in court and the Vásáry brothers were acquitted. However, the case did not stop there, and the capital's newspapers took advantage of the situation. The case of the bacon was identified with the struggle of social classes, where the poor have to be protected from their attackers. *Debreczen*, 25 November 1934. 13. Pálffy documents – The first ten years. 85.

⁶⁸ The incident was reported by Vásáry himself in an editorial in *Debreczen* on 27 November, as an anonymous writer, under the title "*What is happening in Debrecen?*" Pálffy documents – The first ten years. 87.

⁶⁹ The charges were dropped years later and the imposed tax increase was cancelled. Pálffy documents – The first ten years. 88.

as follows: despite the terror on the day of the municipal elections, Mayor István Vásáry was elected with a large majority, despite the fact that some protest groups tried to intimidate any voter they thought would support Vásáry's victory. They assaulted voters with whips and brass knuckles until police intervened. The protesters were unsuccessful: in district XII, out of 1,225 valid votes cast, Vásáry won 721 votes.⁷⁰ The next day, it was also reported that Vásáry had been unanimously re-elected as the General Superintendent of the Reformed Church in Debrecen: *"The 70,000-strong Reformed society of Debrecen showed yesterday that it continues to cling to its current mayor, István Vásáry, with unbroken trust and love."*⁷¹ On the whole, however, the Municipal Association was defeated in the fight, which gave new strength to the groups of the Party of National Unity, who celebrated the beginning of a new era, replacing the old regime.⁷²

By the end of February 1935, the disciplinary proceedings had concluded, including the interrogation of city officials and witnesses, as well as the collection and review of documents. The case file spanned approximately 1,400 to 1,500 pages, with the indictment drafted by Sándor Virányi. The investigating commissioner deemed Vásáry's claim of non-involvement in his family members' rental property to be false and misleading. The investigators cited Vásáry's managerial conduct, his failure to fulfil his supervisory and control duties, and accused his fellow officials of being influenced by their tension with the mayor. However, several interviewed city leaders, including József Zöld, Károly Miszti, and Géza Veress, dismissed these allegations.

Domestic political changes also had a negative impact on the development of the Vásáry case. The political struggle between Bethlen and Gömbös intensified, and the departure of Ferenc Keresztes-Fischer further aggravated Vásáry's position, who had tried to remain objective throughout the investigation. On 11 May, the final day of the disciplinary hearing, István Vásáry delivered his concluding speech, which the *Debrecen* published the following day. A large audience had gathered in the state-room of the county hall, where Vásáry made the following statement: *"For more than a year now I have been silently enduring, reading and listening to the barrage of attacks that have been directed against me... If the (Attorney General) thought that I was lamenting the dead, I am calling on the living... If this city is in disgrace, this disgrace will cease one day and fall on the heads of those who have brought this disgrace upon the city of Debrecen. And rest assured, it will not be on my head... I have the dignity to believe that to hold the post of mayor of Debrecen at a time such as the one when I was destined to be there*

*was not a dignity, not an honour, but a terrible spiritual and even, I would say, physical burden."*⁷³

At the conclusion of the week-long disciplinary hearing, Ödön Mikecz, the lord-lieutenant of Szabolcs County, stated that the verdict would be announced later, requiring a week's delay. Vásáry's memoirs indicate that the Minister of Agriculture had privately informed him that Gömbös had personally reprimanded the lord-lieutenant for postponing the verdict announcement.⁷⁴ In the disciplinary decision, several charges were dropped, but Vásáry was found guilty of some charges that were not sufficiently substantiated. Among other things, he was found guilty of: allowing his family to receive improper benefits; failing to hold accountable officials who acted contrary to the interests of the city or in an improper or negligent manner; and making false reports about his non-interference in disputes between the city and his relatives. In mitigation, the mayor's long-standing commitment to the development of the city and his generally good reputation were assessed. In view of this, the most serious penalty was waived, and a fine was imposed instead. In addition, the salary withheld during his suspension was not paid and he was ordered to pay one third of the costs of the disciplinary proceedings. However, after the decision became final, the important decision was taken to reinstate him.⁷⁵ Vásáry was informed of the decision by telephone. News of the judgment spread quickly, and praise for Vásáry was not confined to the city; numerous public figures and city representatives also extended their congratulations. Dezső Baltazár was pleased to announce that the mayor had been reinstated and hoped that neither side would appeal. His hopes were dashed, as the Steering Committee of the Party of National Unity and Lord-Lieutenant Vay filed an appeal that evening.⁷⁶ *"We waited with faith in justice and we were not disappointed"* was the title of the *Debrecen* newspaper's report on the details of the verdict, celebrating Vásáry's return.⁷⁷

Less than a week later, an assembly consisting solely of the members of the Party of National Unity convened and voted in favor of the appeal. Before the vote, some members of the assembly called for a reconciliation between Vay and Vásáry, saying *"two strong men confronted each other here, and the old Hungarian proverb is definitely true, no castle can have two kings."*⁷⁸ After the vote, Vásáry himself launched an appeal, arguing that the decision contained a number of factual errors and unfair conclusions. He argued that in all his activities he was guided only by the interests of the city. Lord-Lieutenant Vay was disappointed with the first instance decision and could not envisage success at the second instance. Anticipating

⁷⁰ Vásáry won in his own district, but the general election was an absolute victory for the Party of National Unity, with 30 out of 36 seats. Tóth 1986. 254.

⁷¹ *Debrecen*, 12, 15, 18, 19 December 1934.

⁷² Tóth 1986. 254.

⁷³ *Debrecen*, 12 May 1935. 1.

⁷⁴ Veress 1999. 137.

⁷⁵ Károly Miszti, who was also under disciplinary proceedings, was sentenced to loss of his job, while Elemér Vargha, deputy mayor, and József Zöld were fined. Veress 1999. 139.

⁷⁶ Veress 1999. 139.

⁷⁷ Despite its claims of political neutrality, *Debrecen* consistently supported Vásáry, dedicating its columns to his defense and struggle for justice. *"The flower-beds are in white, as if to proclaim that in this ancient city hall, with István Vásáry at its head, worked a group of officers whose souls were pure, bright white, and innocent."* *Debrecen*, 19 May 1935. 1.

⁷⁸ Pálffy documents – The first ten years. 142.

another unfavorable outcome, he simultaneously pursued a separate action against Vásáry on a different front. On 4 June, the Legislative Council considered a motion by Gábor Bakóczy and three other committee members, invoking the so-called 'executioner's paragraph' of Act I of 1934 to order Vásáry's forced retirement. The purpose of the appeal, specifically to find Vásáry guilty and in breach of his duties, was considered so serious that he was found to be unfit to hold the office of mayor, in their opinion lacking the essential requisites for the proper performance of his duties. The decision reached the Minister of Interior, Miklós Kozma, the following day, who informed the committee by his decision of 6 June that István Vásáry had been ordered to retire under the above-mentioned Act. According to the law: *"In addition to the cases provided for in the legislation in force, a person who fails to perform his duties to the required extent, because of lack of the qualifications, diligence or other important requisites necessary for the proper performance of his duties, may be subject to regular treatment. For the purpose of conducting such proceedings... the Minister... shall constitute a standing committee of three members."*⁷⁹ The committee, chaired by László Vay, included members Vásáry could have challenged on grounds of bias, yet he chose not to do so. The following day, Vásáry received the committee's decision ordering his compulsory retirement. The decision outlined reasons that had not been previously communicated to him. In his response on 20 June, he argued that the committee had acted improperly and that he had not been adequately informed of the grounds for the proceedings. The outcome of the committee's hearing finally produced unexpected results: on 9 July, Vásáry's previous fine was halved, while 19 of the original 23 charges were dropped. Although the disciplinary court of the Ministry of Interior officially lifted Vásáry's suspension and reinstated him as mayor, he chose to resign, recognizing that forced retirement was inevitable.⁸⁰ *"I am very happy for the moral satisfaction, which is worth more than anything to me. I am especially glad to be able to pass on to my dear son the honour which I have received in a pure way from my father. This is the one thing that comforts and lifts me up after the mental agonies I have unjustly suffered."*⁸¹ However, a complete exoneration was truly unattainable. On 1 November, he was officially ordered into compulsory retirement, with a preceding period of paid leave. The reasons for the decision were as follows: *"I had to decide this way because higher civil servant ethics require that an official who has been disciplined should not hold a leadership position, where a good example must be set..."*⁸² Although the *Debreczen* paper initially expressed disappointment at the news of Vásáry's retirement, it eventually concluded that the move could

have positive long-term effects. According to the newspaper, Vásáry had long since *"outgrown Debrecen"*, and his talents should not be confined to serving just one city. Instead, he should fight with all his strength and stand up for the interests of the whole country. *"We do not therefore bid farewell to István Vásáry, whom we believe we shall soon see at the forum where he will be free to work for the economic reconstruction of the country and the resurrection of Great Hungary, free from all constraints."*⁸³ This is how Vásáry himself bid farewell to the city of Debrecen: *"In my mayoral seat, I felt that I was among my fellow citizens, not above them, and I will remain among them."*⁸⁴

Summary

The retirement of Vásáry marked the end of an era in Debrecen that his successors could not surpass. During his tenure as mayor, he allocated between 2.5 and 3 million forints to public health and social services, and 4.5 million forints to cultural activities. He focused on unemployment and improved the gas and electricity networks, the tramway and the industrial railway. Other significant achievements of the period included the construction of the National Defence Cemetery Mausoleum and the new National Bank building. Additionally, in May 1932, the central building of the University of Debrecen was completed and inaugurated, where Vásáry was awarded an honoris causa doctorate degree in March 1933.⁸⁵ The *Debreczen* newspaper, a key player in Debrecen's press scene during the 1930s, was an outspoken supporter and defender of Mayor István Vásáry. The paper used every means at its disposal to preserve Vásáry's reputation and to refute the political attacks launched against him. *Debreczen* consistently emphasized the personal and professional integrity of Vásáry, as well as his dedication to the city, while methodically refuting accusations against him. *Debreczen's* stance became symbolic not only of Vásáry's character but also of the city's autonomy and moral values. Despite its cautious approach to open conflict, the paper actively confronted radical right-wing groups and their supporters, who led the charge against Vásáry.

Vásáry frequently voiced his opinions on economic, social, and political issues, often initiating reforms. In his view, the growing social inequalities were a pressing problem: while a few people had enormous wealth, poverty and misery were on the increase. However, it was his loyalty to István Bethlen that played a decisive role in sealing his fate when Gyula Gömbös came to power. Vásáry's political loyalty also stood out: he was always on the side of István Bethlen, yet Bethlen never directly intervened in his litigation, although he followed the events closely and exchanged several letters with Vásáry during this period.⁸⁶ In his speech on 5 November, 1935, he reflected on the forced retirement of Vásáry, stating: *"When they tried to find*

⁷⁹ <https://net.jogtar.hu/ezer-ev-torvenyei> (Accessed: 02.01.2025).

⁸⁰ Veress 1999. 150-152.

⁸¹ *Debreczen*, 10 July 1935. 1-3.

⁸² Statement by Miklós Kozma. *Debreczen*, 13 July 1935. 3.

⁸³ *Debreczen*, 13 July 1935. 3.

⁸⁴ *ibid.*

⁸⁵ Veress 1999. 40-45.

⁸⁶ István Bethlen and István Vásáry met several times, one of these memorable occasions was when Bethlen attended a luncheon in Debrecen with György Magoss, and Vásáry was present. From Vásáry's memoirs we know that during the lunch the disciplinary investigation was discussed. Another such incident was reported in *Debreczen*: Bethlen had a meeting with the Minister of Interior, where, according to leaked

him guilty of disciplinary offences under all kinds of titles, and when they could not find any other way of convicting him... they immediately resorted to this law (Act I of 1934) and sent him into retirement, although he was such a mayor of the town of Debrecen that today Americans come to Debrecen to admire the progress he has made in the last few years.”⁸⁷

Vásáry was ultimately defeated in a fight the outcome of which seemed almost inevitable, but his political career was not broken. Thanks to the unity of his supporters, he was elected to the Legislative Committee in 1934 and then to the Parliament in 1939, albeit with an opposition programme, as a member of the Independent Smallholders Party. Thus, while his mayoralty – and, to some extent, his career in Debrecen – fell victim to political power struggles, the influence of Vásáry endured. He continued to be an active and prominent figure in public life.

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⁸⁷ Cited by Veress 1999. 158.

MATHEMATICAL SCIENCES

NUMBER SPIRALS

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ЧИСЛОВЫЕ СПИРАЛИ

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Abstract

The proposed variants of number spirals are a representation of natural numbers on a spiral in units of measurement of angles. Following certain rules for placing numbers allows you to get an infinite spiral multiplication table for any natural number $a > 1$. The appearance and structure of a specific a -spiral will be the same for any units of measurement of angles in any number systems of natural numbers.

Аннотация

Предлагаемые варианты числовых спиралей – это представление натуральных чисел на спирали в единицах измерения углов. Соблюдение определенных правил размещения чисел позволяет получить бесконечную спиральную таблицу умножения для любого натурального числа $a > 1$. Внешний вид и структура конкретной **a -спирали** будут одинаковыми для любых единиц измерения углов в любых системах счисления натуральных чисел.

Keywords: natural numbers, number spirals, units of measurement of numbers, units of measurement of angles, rays, arcs, number systems, multiplication, addition, power of a number, positional number system, prime numbers.

Ключевые слова: натуральные числа, числовые спирали, единицы измерения чисел, единицы измерения углов, лучи, дуги, системы счисления, умножение, сложение, степень числа, позиционная система счисления, простые числа.

Введение

Визуальное изображение натуральных чисел известно давно и имеет вид **числового луча** (рис. 1).

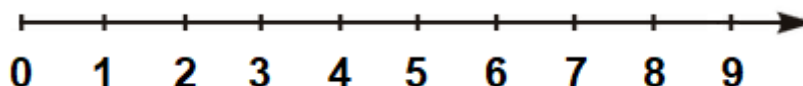


Рис.1 Числовой луч

Для визуализации чисел на числовом луче используются единицы измерения длины. Числовой луч начинается с нуля, поскольку иначе невозможно изобразить единичный отрезок как единицу измерения. Расстояния между числами одинаковые и равны единичному отрезку [1].

В 1963 году Станислав Улам предложил изображение натуральных чисел в виде спирали. Сегодня это визуальное представление натуральных чисел известно как **скатерть (или спираль) Улама** (рис. 2) [2].

37	36	35	34	33	32	31
38	17	16	15	14	13	30
39	18	5	4	3	12	29
40	19	6	1	2	11	28
41	20	7	8	9	10	27
42	21	22	23	24	25	26
43	44	45	46	47	48	49

Рис.2 Скатерть Улама

Двумерная плоскость разбита на квадраты одинакового размера. В центре спирали находится единица, вокруг неё в каждый квадрат вписывается одно натуральное число по спирали. Данная спираль построена без применения каких-либо единиц измерения, ноль отсутствует.

В 1994 году Роберт Сакс расположил натуральные числа по Архимедовой спирали (рис. 3) и получил спираль, известную сегодня как **спираль Сакса** [2].

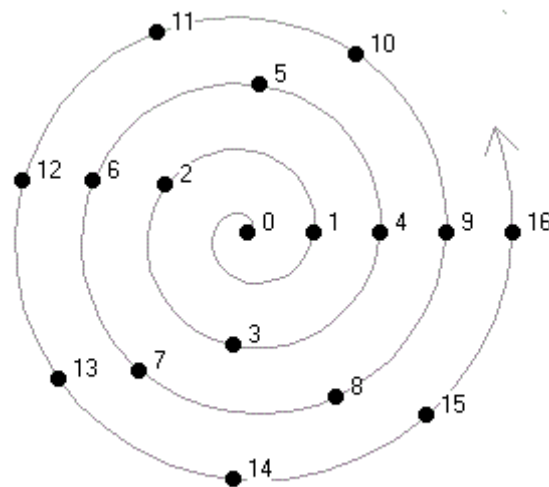


Рис.3 Спираль Сакса

Для построения спирали Сакс использовал единицы измерения углов для поворота и единицы измерения длины для определения расстояния от центра спирали до каждого натурального числа. В центре спирали расположен ноль единиц измерения длины, на нулевом луче единиц измерения углов Сакс расположил квадраты натуральных чисел.

Если для визуального отображения натуральных чисел использовать произвольную спираль и единицы измерения углов, тогда все числа можно упорядочить по следующим правилам:

1. На главной оси **а-спирали** располагаются числа вида a^n в порядке возрастания, где $a > 1$, $n \geq 0$.
2. Главная ось совпадает с нулевым лучом единиц измерения углов и имеет следующий вид (рис.4).

Числовые спирали

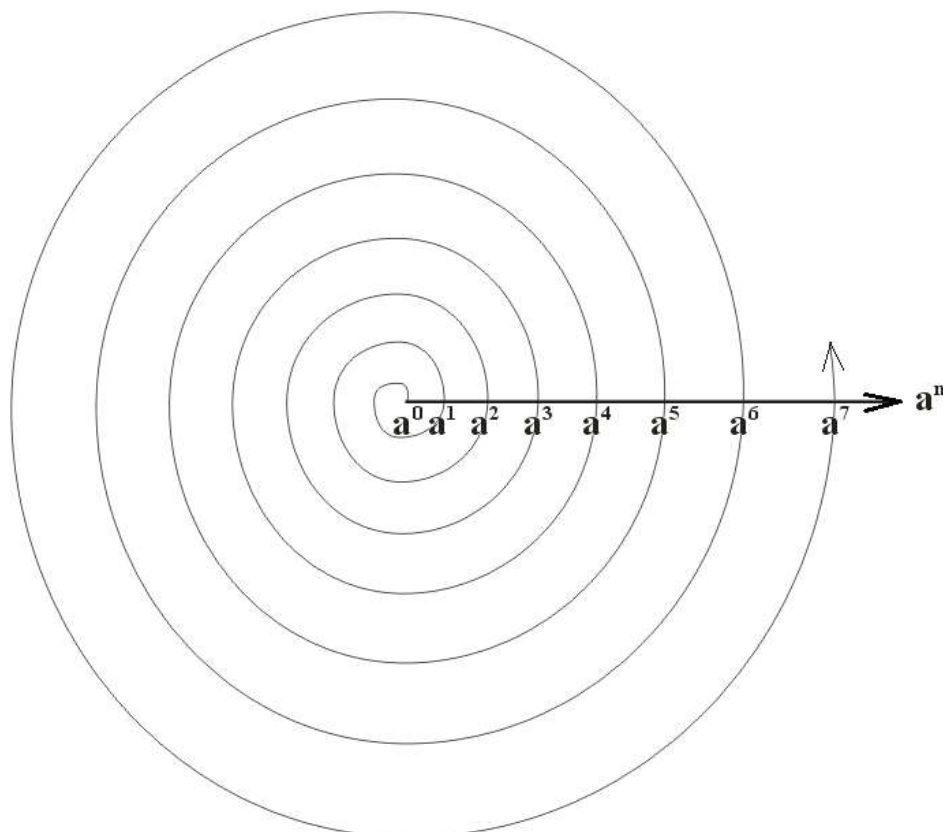


Рис.4 Главная ось числовой спирали

3. Главная ось делит спираль на отдельные витки размером в 360° , которые целесообразно нумеровать по показателю степени числа a , расположенного в начале каждого витка. Например, **а.0-виток**, **а.1-виток**, **а.п-виток**. Расстояние между витками спирали произвольное.

4. Каждый виток **а-спирали** разбивается лучами на равное количество единичных угловых секторов, которые делят виток на единичные дуги. Каждая единичная дуга имеет произвольную длину и соответствует одной числовой единице. Единичные дуги разделяют два соседних натуральных числа, которые располагаются на пересечениях лучей и витков спирали.

5. Количество единичных секторов и количество натуральных чисел m_n для каждого **а.п-витка** определяется по формуле:

$$m_n = a^{n+1} - a^n = a^n(a-1) \quad (1)$$

6. Для нулевых витков всех **а-спиралей** количество единичных секторов и натуральных чисел имеет вид:

$$m_0 = a^0(a-1) = a-1 \quad (2)$$

7. Каждая единичная дуга из витка m_n на следующем витке m_{n+1} делится на a единичных дуг новыми лучами.

8. В начале каждого луча (**Н-луч**), на пересечении с витком, расположено натуральное число **N** вида P_a , простое по отношению к числу a .

9. На продолжении **Н-лучей**, в точках пересечения с последующими витками, располагаются натуральные числа, кратные числу a , образующему главную ось **а-спирали**.

Описание числовых спиралей

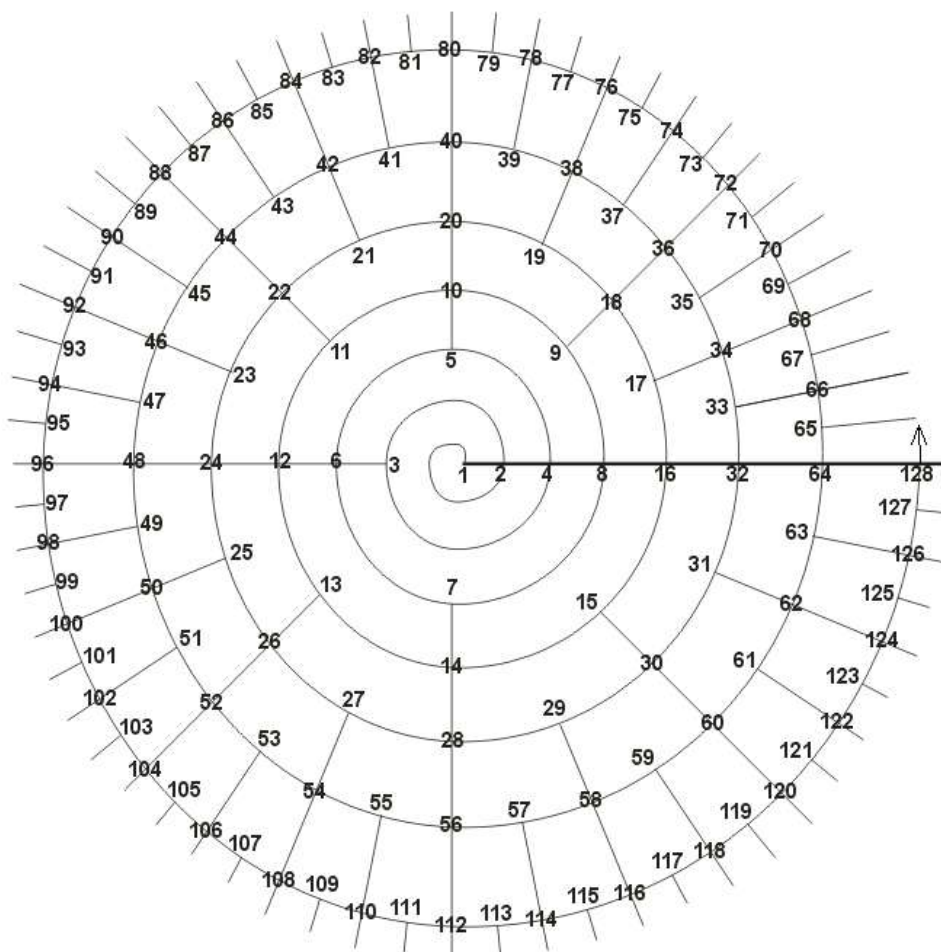


Рис.4 2-спираль

На **2-спирали** (рис. 4) главная ось образуется последовательными степенями числа 2. Все нечетные числа располагаются в начале числовых **Н-лучей**, все четные числа расположены на **Н-лучах** спирали.

На **2.0-витке** находится одна единичная дуга размером 360° , в начале этого витка находится число 1. Это единственная числовая спираль, у которой на нулевом витке нет других чисел, кроме единицы. Количество чисел и единичных дуг определяется по формуле (2):

$$m_0 = a - 1 = 2 - 1 = 1$$

2.1-виток разбивается на две единичные дуги размером 180° и на нем расположено два числа – 2

и 3. Здесь и на остальных витках количество чисел и единичных дуг определяется по формуле (1):

$$m_1 = a^1(a-1) = 2(2-1) = 2$$

2.2-виток образуют четыре единичные дуги размером 90° , на котором располагаются числа 4, 5, 6, 7.

$$m_2 = a^2(a-1) = 4(2-1) = 4$$

2.3-виток образуют 8 единичных дуг размером 45° .

$$m_3 = a^3(a-1) = 8(2-1) = 8$$

На этом витке расположены числа с 8 по 15 включительно. Числа 10, 12 и 14 расположены на продолжении 5-луча, 3-луча и 7-луча соответственно.

Дальнейшее расположение натуральных чисел на **2-спирали** можно проследить на рисунке.

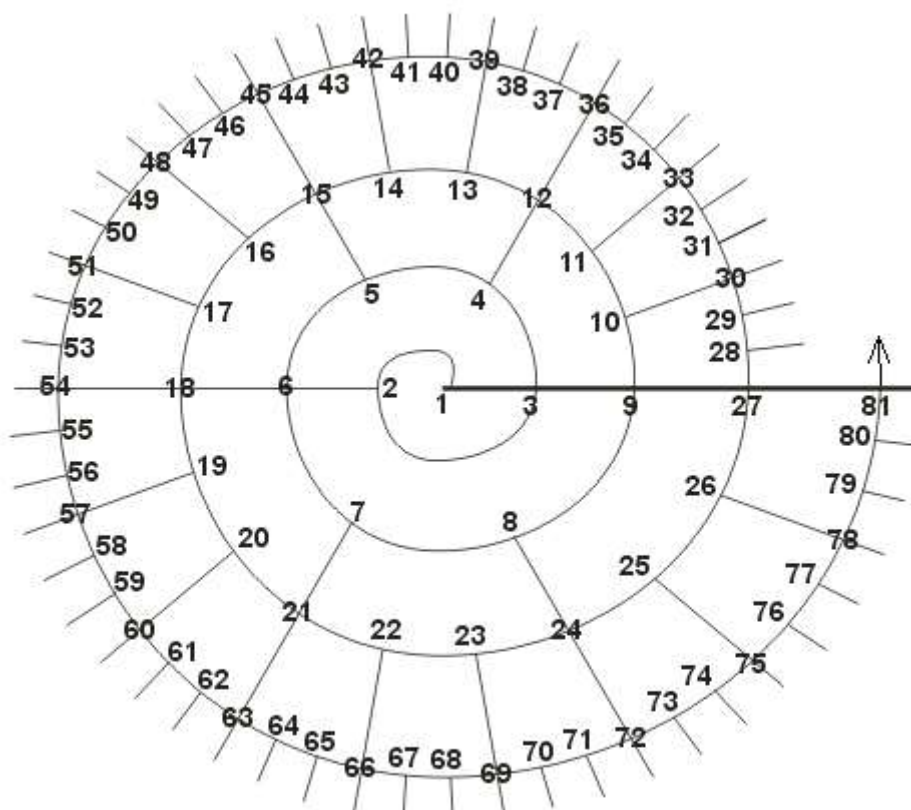


Рис.5 3-спираль

Главную ось **3-спирали** (рис. 5) образуют последовательные степени числа 3. На **3.0-витке** находится две единичные дуги размером 180° и на нем расположено два числа – 1 и 2. Формула (2) имеет следующий вид:

$$m_0 = a - 1 = 3 - 1 = 2$$

3.1-виток разбивается на шесть единичных дуг размером 60° , на нем располагаются числа 3, 4, 5, 6, 7 и 8. Формула (1) выглядит так:

$$m_1 = a^1(a-1) = 3(3-1) = 6$$

Число 6 находится на продолжении **2-луча** и является результатом умножения числа 2 на число 3.

3.2-виток образуют восемнадцать единичных дуг размером 20° , на нем располагаются числа с 9 по 26.

$$m_2 = a^2(a-1) = 9(3-1) = 18$$

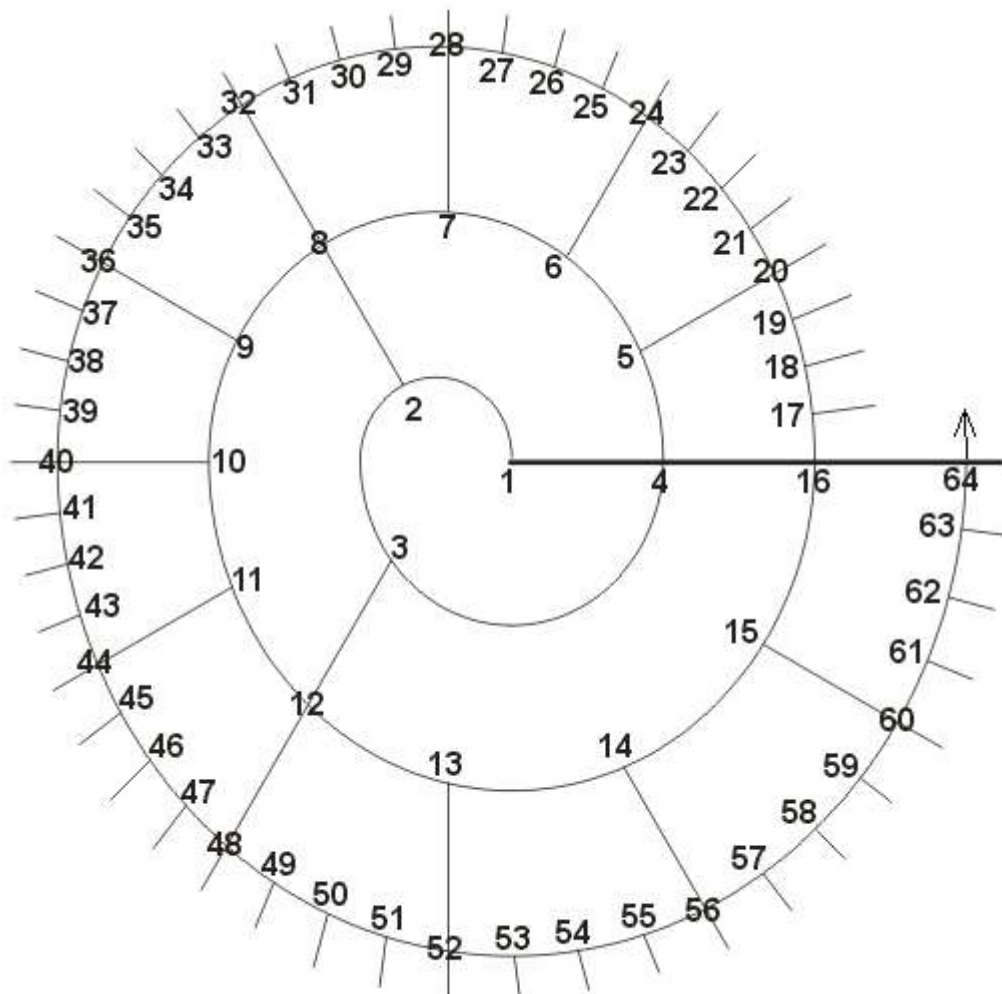


Рис.6 4-спираль

Главную ось **4-спирали** (рис. 6) образуют последовательные степени числа **4**. На **4.0-витке** находится три единичные дуги размером 120° и на нем расположено три числа – **1, 2 и 3**:

$$m_0 = a - 1 = 4 - 1 = 3$$

4.1-виток разбивается на двенадцать единичных дуг размером 30° :

$$m_1 = a^1(a-1) = 4(4-1) = 12$$

4.2-виток разбивается на сорок восемь единичных дуг размером $7,5^\circ$:

$$m_2 = a^2(a-1) = 16(4-1) = 48$$

Каждый виток **4-спирали** содержит в себе два сжатых витка **2-спирали**. Сжатие происходит неравномерно и задается структурой нулевого витка

4-спирали. Нулевой и четные витки **2-спирали** сжимаются до $1/3$ витка **4-спирали**, первый и нечетные витки – до $2/3$. Такое неравномерное сжатие обеспечивает равенство единичных угловых сегментов всех витков в структуре **4-спирали**.

Подобное неравномерное сжатие происходит и на остальных спиралях, построенных на числах, равных степени числа **a**, больше первой степени. Так, для **8-спирали** ($a=2^3$), каждый виток которой содержит три витка **2-спирали**, пропорции равны: $1/7, 2/7, 4/7$.

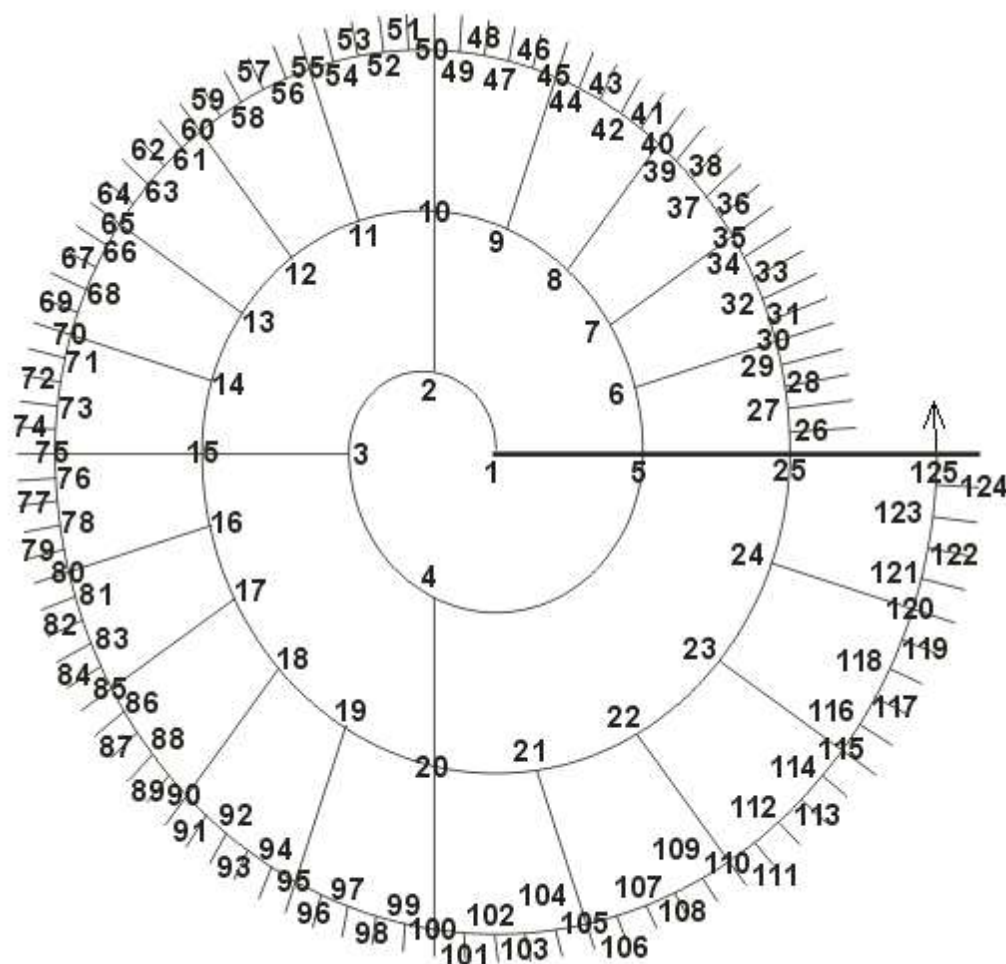


Рис. 7 5-спираль

Главную ось 5-спирали (рис. 7) образуют последовательные степени числа 5. На 5.0-витке находится четыре единичные дуги размером 90° и на нем расположено четыре числа – 1, 2, 3 и 4:

$$m_0 = a - 1 = 5 - 1 = 4$$

5.1-виток разбивается на двадцать единичных дуг размером 18° :

$$m_1 = a^1(a-1) = 5(5-1) = 20$$

5.2-виток разбивается на сто единичных дуг размером $3,6^\circ$:

$$m_2 = a^2(a-1) = 25(5-1) = 100$$

Подобным образом можно построить числовую спираль для любого натурального числа.

Анализ числовых спиралей

Движение вдоль витков любой **а-спирали** является таблицей сложения с последовательным добавлением одной единицы к предыдущему числу, начиная с единицы. Движение вдоль лучей любой **а-спирали** является таблицей умножения с последовательным умножением числа, расположенного

в начале луча, на число **а**. Если двигаться от меньших чисел к большим вдоль витков спирали, мы получим направление движения при математической операции сложения. Если двигаться от меньших чисел к большим вдоль лучей, мы получим направление движения при умножении. Эти два движения перпендикулярны, что свидетельствует о принципиальном различии сложения и умножения [3, стр.36]. Сложение и умножение являются перпендикулярными математическими действиями.

Если провести ось симметрии через главную ось любой **а-спирали**, тогда симметричные числа на витках образуют суммы разложения [4, стр. 24]. Для любого **а.п-витка** эта сумма разложения равна $a^n + a^{n+1}$. Для примера суммы разложения показаны на 4.1-витке (рис.8). Количество таких сумм, учитывая сумму чисел a^n и a^{n+1} на главной оси, равно $m_0/2$.

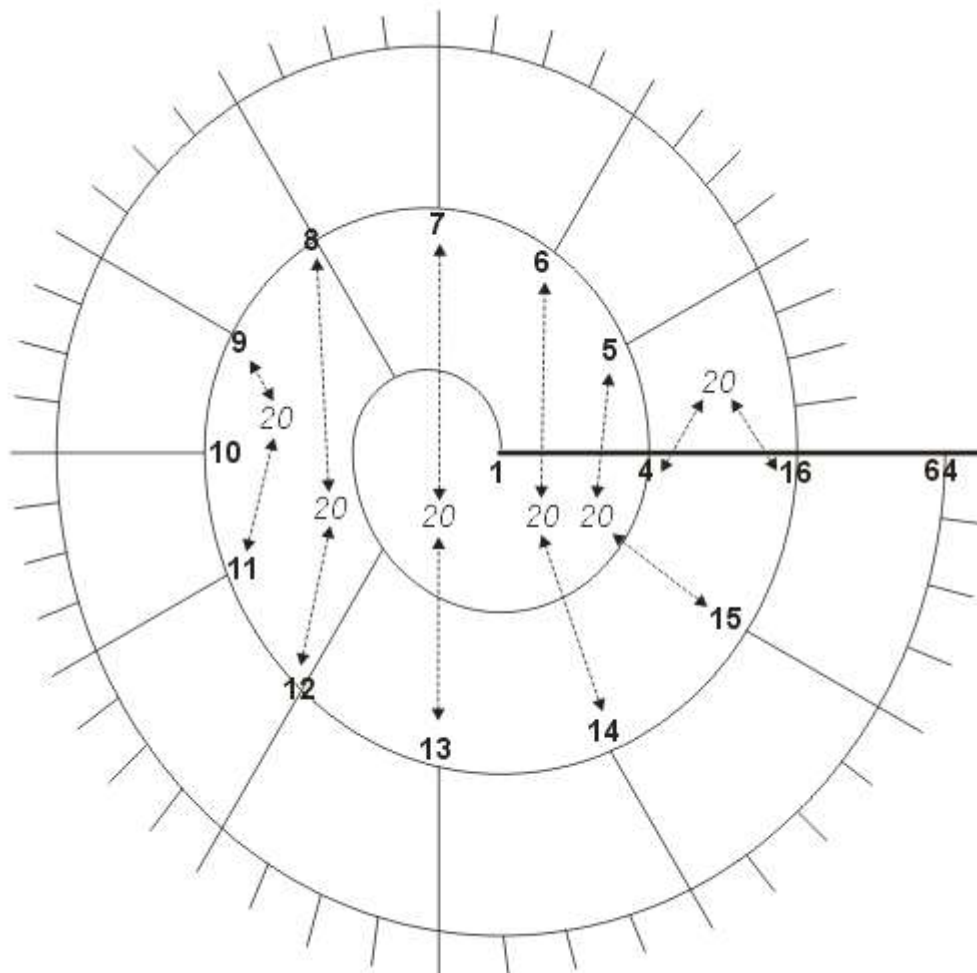


Рис.8 Суммы разложения

Данное свойство числовых спиралей позволяет вычислить сумму натуральных чисел, расположенных на одном **а.п-витке**. Для этого необходимо сумму разложения умножить на количество

таких сумм, используя формулу (1), добавить число, расположенное на оси симметрии, которое равно половине суммы разложения и вычесть число a^{n+1} , которое относится к следующему витку:

$$(a^n + a^{n+1}) \frac{a^{n+1} - a^n}{2} + \frac{a^n + a^{n+1}}{2} - a^{n+1} = \frac{a^{n+1}(a^{n+1} - 1) - a^n(a^n - 1)}{2} \quad (3)$$

Формула (3) позволяет вывести уже давно известную формулу [5] для определения суммы всех натуральных чисел от единицы до любого числа a .

Для этого необходимо определить сумму чисел на нулевом витке **а-спирали** и добавить само число a :

$$\frac{a^{0+1}(a^{0+1} - 1) - a^0(a^0 - 1)}{2} + a = \frac{a(a+1)}{2}$$

Если построить числовую спираль для бесконечно большого числа (∞ -спираль), начало этой спирали будет отличаться от числового луча (рис. 1) только отсутствием нуля. Нулевой виток будет состоять из бесконечно большого количества единичных дуг, каждая единичная дуга будет ограничена лучами с бесконечно малым значением угла. Кривизна витка станет проявляться в районе очень больших чисел от начала спирали.

Числовые спирали и системы счисления

Числа на числовых спиралях могут быть представлены в разных системах счисления. Для примера рассмотрим числа на главной оси некоторых спиралей в разных системах счисления. *Таблица 1* показывает числа на главной оси **2-спирали** в двоичной, десятичной и шестнадцатеричной системах счисления.

Табл. 1

Степень числа 2	Основание системы счисления		
	2	10	16
0	1	1	1
1	10	2	2
2	100	4	4
3	1000	8	8
4	10000	16	10
5	100000	32	20
6	1000000	64	40
7	10000000	128	80
8	100000000	256	100
9	1000000000	512	200
10	10000000000	1024	400
11	100000000000	2048	800
12	1000000000000	4096	1000
13	10000000000000	8192	2000
14	100000000000000	16384	4000
15	1000000000000000	32768	8000
16	10000000000000000	65536	10000
17	100000000000000000	131072	20000
18	1000000000000000000	262144	40000
19	10000000000000000000	524288	80000
20	100000000000000000000	1048576	100000

В таблице 2 представлены числа на главной
оси **10-спирали** в тех же системах счисления.

Табл. 2

Степень числа 10	Основание системы счисления		
	2	10	16
0	1	1	1
1	1010	10	A
2	1100100	100	64
3	1111101000	1000	3E8
4	10011100010000	10000	2710
5	11000011010100000	100000	186A0
6	11110100001001000000	1000000	F4240
7	100110001001011010000000	10000000	989680
8	101111101011110000100000000	100000000	5F5E100
9	111011100110101100101000000000	1000000000	3B9ACA00
10	1001010100000010111110010000000000	10000000000	2540BE400

Аналогично, в таблице 3 представлены числа
на главной оси **16-спирали**.

Табл. 3

Степень числа 16	Основание системы счисления		
	2	10	16
0	1	1	1
1	10000	16	10
2	100000000	256	100
3	1000000000000	4096	1000
4	10000000000000000	65536	10000
5	10000000000000000000	1048576	100000
6	10000000000000000000000	16777216	1000000

Как видно из таблиц выше, каждая **а-спираль** в системе счисления с основанием **а** будет состоять из отдельных витков с числами, имеющими одинаковое количество разрядов в позиционной системе счисления. Каждый следующий виток числовой спирали для числа **а** в системе счисления с основанием **а** добавляет один разряд в позиционной системе записи чисел. Каждый **п-виток** состоит из чисел, записываемых при помощи **п+1** количества разрядов.

Если ввести правило, что единичные дуги на одном витке должны быть одинаковой длины, тогда числовая спираль превратится в набор концентрических окружностей. Каждая окружность будет содержать числа с одинаковым количеством разрядов. Введение подобного правила нарушает визуальную непрерывность натуральных чисел.

Таким образом, каждая **а-спираль** является графическим отображением натуральных чисел в системе счисления с основанием **а**, которая записана в выбранной нами системе счисления. По умолчанию мы применяем десятичную систему счисления.

Числовые спирали и простые числа

Все простые числа вида **Р** находятся в начале числовых лучей на всех числовых спиралях, за исключением простого числа **а**, расположенного на главной оси **а-спирали**. Взаимное расположение простых чисел будет меняться в зависимости от числа **а**, которое лежит в основе построения спирали (рис. 9 - 12).

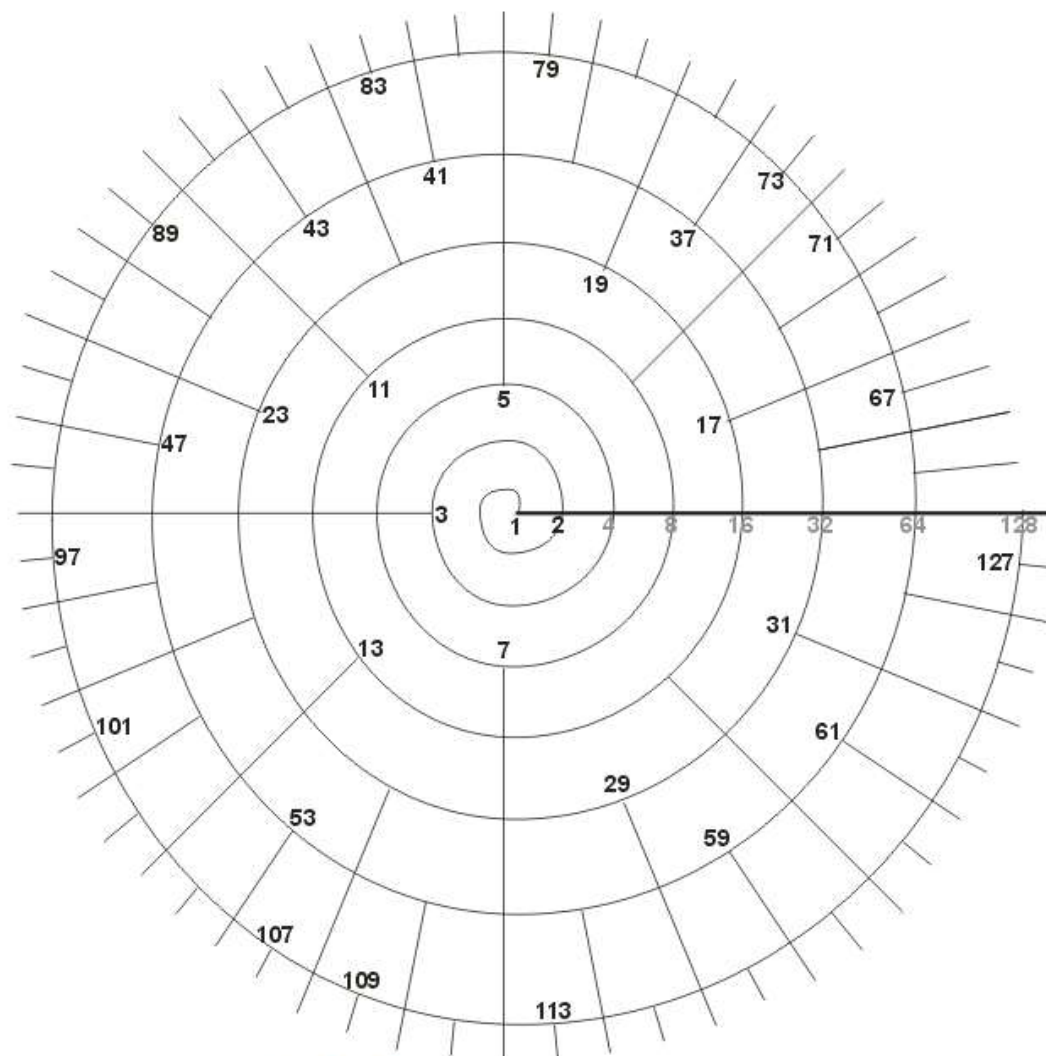


Рис.9 Простые числа на 2-спирали

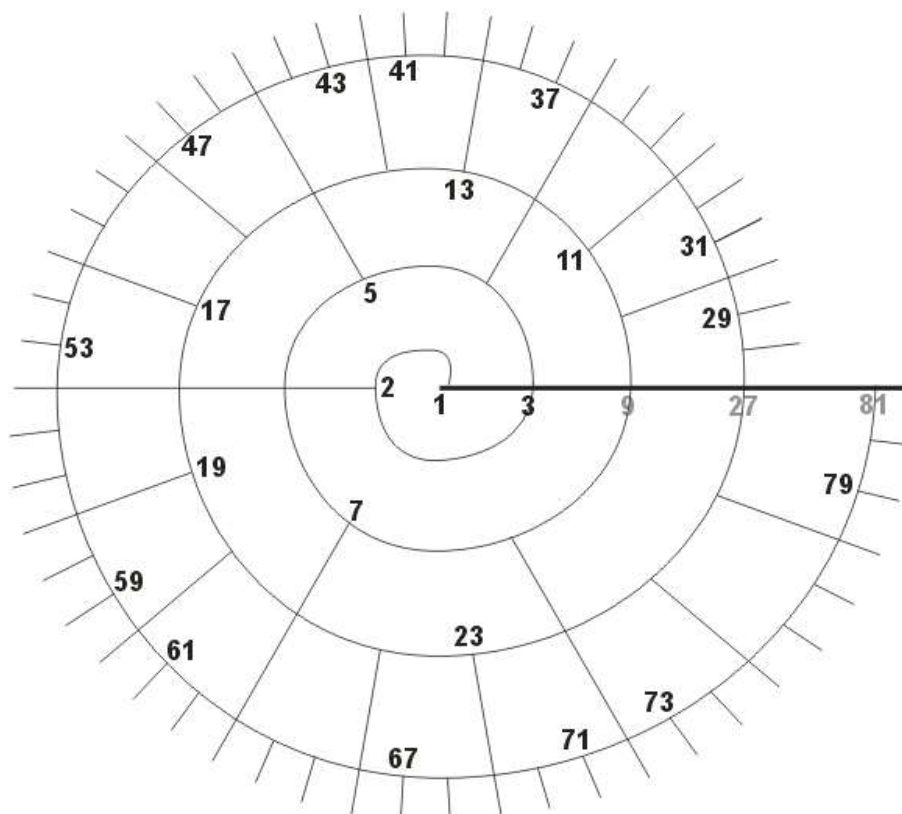


Рис.10 Простые числа на 3-спирали

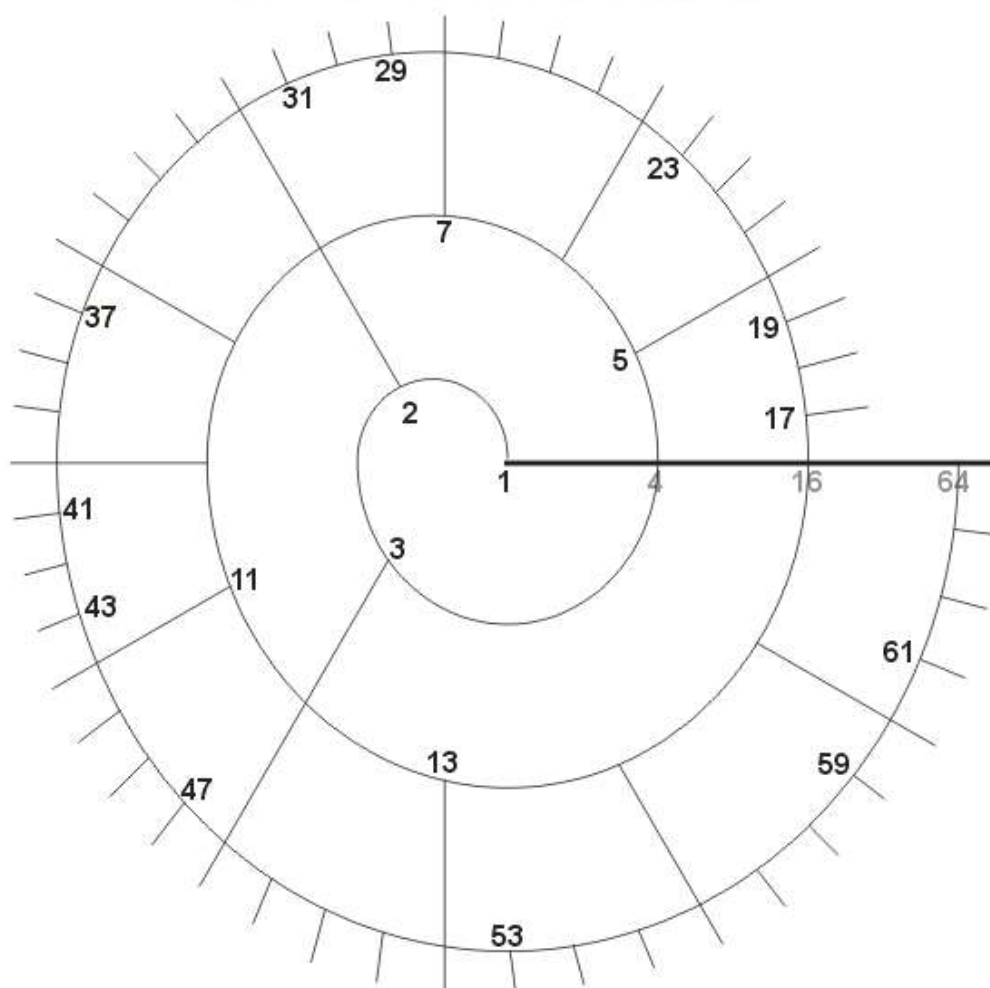


Рис.11 Простые числа на 4-спирали

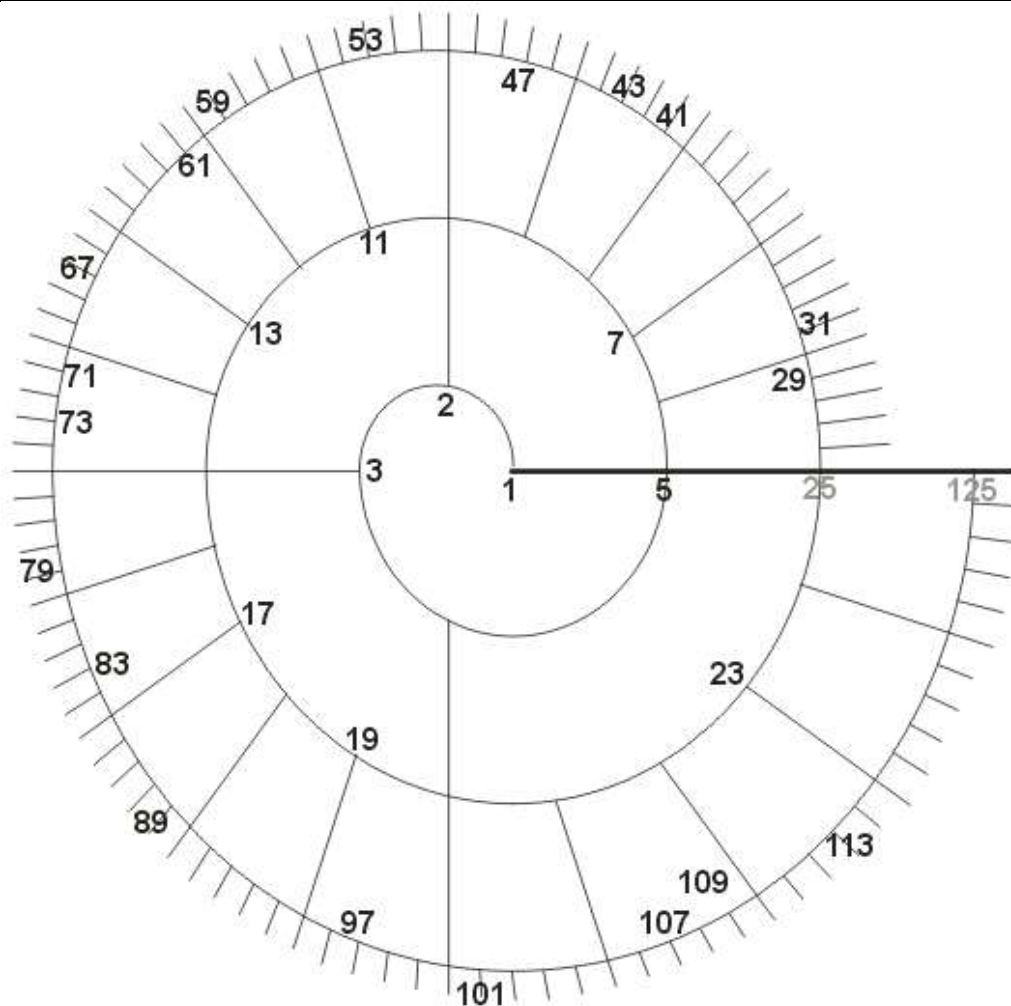


Рис.12 Простые числа на 5-спирали

Составные числа находятся на лучах спиралей, построенных на числах, являющихся делителями этих чисел. На остальных спиралях они расположены в начале числовых лучей. Например, число 6 находится на продолжении 3-луча 2-спирали (рис. 4) и является результатом умножения числа 3 на число 2. Это же число 6 находится на продолжении 2-луча 3-спирали (рис. 5) и является результатом умножения числа 2 на число 3.

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MEDICAL SCIENCES

VITAMIN D AND AUTOIMMUNITY

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Abstract

Historically, vitamin D has been associated with the regulation of bone metabolism. However, increasing evidence demonstrates a strong association between vitamin D signaling and many biological processes that regulate immune responses. The discovery of the vitamin D receptor in multiple immune cell lineages, such as monocytes, dendritic cells, and activated T cells credits vitamin D with a novel role in modulating immunological functions and its subsequent role in the development or prevention of autoimmune diseases. In this review we, discuss five major areas in vitamin D biology of high immunological significance: (1) the metabolism of vitamin D; (2) the significance of vitamin D receptor polymorphisms in autoimmune diseases, such as multiple sclerosis, type 1 diabetes mellitus, and systemic lupus erythematosus; (3) vitamin D receptor transcriptional regulation of immune cell lineages, including Th1, Th17, Th2, regulatory T, and natural killer T cells; (4) the prevalence of vitamin D insufficiency/deficiency in patients with multiple sclerosis, type 1 diabetes mellitus, and systemic lupus erythematosus; and finally, (5) the therapeutic effects of vitamin D supplementation on disease severity and progression.

Keywords: Vitamin D, Autoimmunity, Multiple sclerosis, Type 1 diabetes mellitus, Systemic lupus erythematosus

Introduction

Vitamin D deficiency is an increasingly described phenomenon worldwide (1). Compelling evidence from human disease associations and basic physiological studies demonstrated the significance of vitamin D deficiency in various physiological disorders including neuropathy (2), malignancy (3, 4), infertility (5), cardiovascular diseases (6,7), kidney diseases (8), glucose metabolism (9), and immunological dysfunctions (10-13). Vitamin D was first identified as a nutritional regimen for rickets in the early twentieth century and was broadly defined as a compound with curative effects on rickets. Chemically, vitamin D is the derivative of a steroid, 7-dehydrocholesterol, derived from cholesterol and is found in the sebaceous glands of the skin of animals. Upon exposure to sunlight, 7-dehydrocholesterol will absorb UVB light (~280 to 315 nm) and convert to precalciferol (also called previtamin D₃) in the skin. Much of the precalciferol eventually is isomerized into cholecalciferol (also called vitamin D₃) through thermal conversion (14). Since sunlight is necessary for photosynthesis of previtamin D₃ in human skin, vitamin D is also commonly called “sunshine vitamin”. In addition to 7-dehydrocholesterol in animals, ergosterol is another commonly occurring steroid in plants that can be activated by irradiation to produce ergocalciferol (also called vitamin D₂).

Both vitamin D₃ formed in the skin and vitamin D₃ absorbed from the digestive tract, travel to the liver, where they are hydroxylated at carbon 25 to form calcidiol (also called 25-hydroxy vitamin D₃, abbreviated as 25(OH)D) by liver 25-hydroxylase, CYP2R1 and CYP27A1. 25(OH)D is the major circulating vitamin D metabolite and a reliable indicator of vitamin D status. Following the hydroxylation in liver, calcidiol is further hydroxylated by 1- α -hydroxylase, CYP27B1, in the proximal convoluted tubule cells of kidney, forming calcitriol (also called 1,25-dihydroxy vitamin D₃, abbreviated as 1,25(OH)₂D) which is considered the active form of vitamin D (15).

At the cellular level, 1,25(OH)₂D interacts with nuclear vitamin D₃ receptor (VDR), which belongs to the superfamily of nuclear hormone receptors, to modulate gene transcription. Ligand binding initiates a conformational change that increases the receptor's affinity to the retinoid X receptor (RXR). Once the VDR-1,25(OH)₂D complex is heterodimerized with RXR, this complex will bind to vitamin D₃ response elements (VDREs) and recruit a number of nuclear coactivator or corepressor proteins. The transcription of genes for specific mRNA may be ultimately either enhanced or inhibited by this ligand-activated transcription factor (16).

Immunomodulatory Effect of Vitamin D

Although historically vitamin D has been associated with the regulation of bone metabolism, it is now evident that vitamin D is involved in many biological processes that regulate immune responses (17-20). There has been increasing interest in possible immunomodulatory effects of vitamin D since VDR was first discovered in monocytes (21, 22) and subsequently in dendritic cells and activated T cells (23, 24). In vitro studies showed that vitamin D inhibits pro-inflammatory activity of CD4⁺ Th1 cells and their production of cytokines such as IL-2, interferon (IFN)- γ , and tumor necrosis factor- α (25-27). 1,25(OH)₂D exerts an inhibitory effect on T cell proliferation, the expression of IL-2 (28, 29) and IFN- γ mRNA and protein in T cells (30), which could be caused by binding of the VDR-RXR heterodimer to the VDREs in the promoter regions of genes encoding IL-2 and IFN- γ . In addition to its anti-inflammatory effects, vitamin D also promotes Th2 responses by enhancing IL-4, IL-5, and IL-10 production, thus skewing the T cell compartment from an inflammatory Th1 state to a more anti-inflammatory and regulated Th2 state. Some studies reported that vitamin D could increase regulatory T (Treg) activity and suppress Th17 responses. Interestingly, vitamin D is not only required for the development of natural killer T (NKT) cells, but also increased IL-4 and IFN- γ production of NKT cells. Logically, these extensive effects of vitamin D on multiple immune cell lineages strongly suggest that vitamin D could play important roles in immune-mediated disorders in autoimmunity.

Vitamin D and Autoimmune Diseases

Multiple Sclerosis (MS)

MS is a chronic inflammatory disease characterized by immune-mediated damage of central nervous system (31). The etiology of MS is not well understood but, like other autoimmune diseases, could be attributed to genetic predisposition and/or environmental factors. Epidemiologic evidence showed that MS has a geographical distribution: the prevalence of the disease is lower in equatorial regions and becomes higher with increasing latitudes (32). This phenomenon could be caused by the lack of sunshine in high-latitude regions that is required for the cutaneous synthesis of vitamin D and suggests that vitamin D insufficiency could be a potential risk factor for MS.

Soilu-Hanninen et al. and Correale et al. demonstrated that the serum concentration of 25(OH)D and 1,25(OH)₂D were lower in MS patients than those in controls (33, 34). Seasonal variation of serum 25(OH)D levels were similar in MS patients and controls, but 25(OH)D levels were lower during MS relapses than in remission, suggesting that vitamin D could be involved in the regulation of the clinical disease progress and severity of MS. Multiple studies also demonstrated that most of the MS patients were deficient in vitamin D. In particular, low serum 25(OH)D levels were associated with high disability and relapse rate in MS patients; however, serum 1,25(OH)₂D, which is the biologically active form of vitamin D, was not directly associated with both disability and relapse rate. Munger et al. and Kragt et al. reported that there was a strong inverse correlation between the level of serum 25(OH)D and MS risk; however, the correlation was only evident among whites but not blacks and Hispanics. The reason why

MS patients generally have lower serum 25(OH)D levels than healthy controls could be a combination of insufficient vitamin D intakes and decreased outdoor activities caused by lifestyle changes associated with increasing disability. However, it is unknown whether the high prevalence of vitamin D deficiency found in MS patients is the cause or effect of the disease.

Recent studies showed that vitamin D deficiency might increase the risk of MS. As a result, detection of vitamin D deficiency and restoring vitamin D status to adequate levels may be considered as part of the clinical treatment of MS. In fact, vitamin D intervention has been implemented in several studies. However, these clinical trials were unable to provide definitive evidence to support the therapeutic effects of vitamin D intervention, mostly due to an extremely small number of MS patients recruited. Due to the lack of a double-blind, placebo-controlled, and randomized study with a large number of patients, the beneficial effects of oral vitamin D supplementation on MS progression need to be further investigated. In addition to clinical effectiveness, the optimal dose and duration of vitamin D supplementation are not well defined and may vary between patients.

Type 1 Diabetes Mellitus (T1DM)

T1DM is an immune-mediated disease that is caused by autoimmune destruction of pancreatic β cells that produce insulin, leading to insulin deficiency. Similar to other autoimmune diseases, environmental factors and/or genetic susceptibility could play roles in the onset and progression of T1DM. Epidemiologic studies also showed that the incidence rate of T1DM was higher in geographical regions with lower UV exposure that resulted in less spontaneous vitamin D synthesis. This inverse association of T1DM prevalence with UV radiation is consistent with that reported for MS, suggesting that the environmental UV exposure correlating with cutaneous synthesis of vitamin D could influence the development of multiple autoimmune disorders.

A birth-cohort study by Hyponen et al. demonstrated that dietary vitamin D supplementation is associated with reduced risk of T1DM. The possibility that ensuring sufficient vitamin D could decrease the frequency of T1DM has raised an interest of further investigating nutritional vitamin D levels in T1DM patients. It has been reported that the plasma 25(OH)D levels were lower in T1DM patients than in control subjects among young adults and children. Moreover, the prevalence of vitamin D deficiency/insufficiency was higher in T1DM children compared to controls. Interestingly, 25(OH)D levels were lower in male compared to female patients, suggesting that the gender difference in plasma vitamin D status might contribute to the high incidence of T1DM in males. In addition to plasma 25(OH)D, circulating 1,25(OH)₂D levels were also lower in T1DM patients than in controls. The low serum 1,25(OH)₂D levels were indicative of tubulo-interstitial dysfunction in T1DM before persistent microalbuminuria. Interestingly, low concentrations of circulating 1,25(OH)₂D were not associated with increased risk of microalbuminuria in T1DM. However, the circulating 1,25(OH)₂D levels may not be equal to the local conversion of 25(OH)D into 1,25(OH)₂D that results in beneficial effects.

Because of the strong correlation between vitamin D and T1DM, it has been suggested that vitamin D could prevent the damage, rescue the function of pancreatic β cells, and reduce the incidence of T1DM. Pitocco et al. and Li et al. both demonstrated that vitamin D had a protective effect on preserving β -cell function, although the effect was not evident in the former study and vitamin D supplementation could only temporarily reduce the clinical insulin dose, which might be attributed to the low 1,25(OH) $_2$ D dose (0.25 μ g on alternate days) administered in T1DM. In Li's study, the insulin plus vitamin D treatment (1- α -hydroxy vitamin D $_3$; 0.5 μ g per day) group developed no β -cell failure, while 27.8 % in the control group developed β -cell failure; however, the number of patients in this randomized controlled study is very limited. Similar to MS, further clinical studies are necessary to determine the therapeutic value of vitamin D supplementation in T1DM.

Systemic Lupus Erythematosus (SLE)

SLE is a systemic autoimmune disease that can cause chronic inflammation and damage in multiple tissues and organs. Environmental factors and genetic susceptibility are both responsible for the pathogenesis of SLE. One of such factors is vitamin D deficiency. SLE patients tend to have inadequate vitamin D since most of them are photosensitive to UV radiation and unable to expose themselves to sunlight. The correlation between vitamin D deficiency/insufficiency and SLE has been documented in multiple studies. Ruiz-Irastorza et al. observed a high frequency of inadequate vitamin D status in SLE patients (75 % of them had insufficient vitamin D levels, serum 25 (OH)D<30 ng/ml, and 15 % of them had deficient vitamin D levels, serum 25(OH)D<10 ng/ml). Borba et al. reported the similar high prevalence of vitamin D insufficiency/deficiency in SLE; however, serum 25(OH)D levels were lower only in SLE patients with high disease activity, but not mild activity, than in controls. In another study by Kim et al., serum 25(OH)D titers were significantly lower in SLE than in controls. Although only 16.3 % of SLE patients had vitamin D insufficiency (serum 25(OH)D <30 ng/ml), the risk of vitamin D insufficiency was 4.6-fold increased in SLE.

Several observational studies yield inconsistent results on the correlation between vitamin D levels and disease severity. Some studies suggested that vitamin D concentrations were inversely related to SLE activity, while others claimed that no such relation was observed. In addition to 25(OH)D, 1,25(OH) $_2$ D was also lower in SLE patients and the vitamin D deficiency was particularly associated with overweight SLE patients. Similar to other autoimmune diseases, seasonal variation of vitamin D status has been observed in SLE patients. In Bogaczewicz's study, the serum 25(OH)D levels in both SLE patients and controls during the cold season were lower compared to the warm season. Interestingly, serum 25(OH)D concentrations were lower in SLE patients than in controls only during the warm season but not the cold season. Furthermore, the cold season was found to be a risk factor for vitamin D deficiency, mainly due to the lack of sunlight exposure and/or the decrease in outdoor activities during the cold season of the year. In addition, there was no connection between serum concentrations of IL-17 and vitamin D status, whereas serum IL-23 was lower in SLE patients with vitamin D deficiency.

Ruiz-Irastorza et al. evaluated the therapeutic effects of oral vitamin D supplementation on SLE in an observational study. After around 2 years of oral vitamin D treatment, mean 25(OH)D levels in all treated patients were increased. However, the majority (71 %) of the SLE patients still had insufficient levels of vitamin D. Although it appears that there was no improvement of SLE severity after oral vitamin D supplementation in this study, the effect of vitamin D intervention in SLE has not been extensively investigated, probably because there are too many confounding factors that could affect vitamin D metabolism in clinical medications used to treat SLE.

Conclusion

Vitamin D, in addition to its crucial role in bone metabolism, has been associated with multiple autoimmune diseases in several epidemiological studies. Due to its unique capability to bind to VDR and serve as a transcriptional factor, vitamin D can regulate gene expression and further exert its immunomodulatory effects on immune cells. It has been shown to inhibit Th17 cytokine production, enhance Treg activity, induce NKT cell functions, suppress Th1, and promote Th2 cytokine production, and thus skew T cells toward Th2 polarization. Furthermore, accumulating evidence suggest that VDR polymorphisms and serum vitamin D status are both closely associated with disease risk of MS, T1DM, and SLE. Therefore, impaired vitamin D signaling and/or inadequate vitamin D intake caused by genetic predisposition (e.g. VDR polymorphisms) and/or environmental factors (e.g. insufficient sunlight exposure in high-latitude regions or during the cold season) may contribute to the onset and progression of autoimmunity. Because of the high prevalence of vitamin D insufficiency/deficiency in patients with MS, T1DM, and SLE, vitamin D supplementation has been considered a prospective candidate for the treatment of such autoimmune diseases. However, due to the lack of larger randomized trials, more well-organized studies with methodological design are essential in order to further confirm the potential of vitamin D to prevent and ameliorate autoimmunity.

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VITAMIN D AND THE IMMUNE SYSTEM**Shkiryak A.***CEO and chief medical officer "Shkiryak Clinic"*

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ORCID: <https://orcid.org/0009-0000-4237-1158><https://doi.org/10.5281/zenodo.15024979>**Abstract**

It is now clear that vitamin D has important roles in addition to its classic effects on calcium and bone homeostasis. As the vitamin D receptor is expressed on immune cells (B cells, T cells and antigen presenting cells) and these immunologic cells are all capable of synthesizing the active vitamin D metabolite, vitamin D has the capability of acting in an autocrine manner in a local immunologic milieu. Vitamin D can modulate the innate and adaptive immune responses. Deficiency in vitamin D is associated with increased autoimmunity as well as an increased susceptibility to infection. As immune cells in autoimmune diseases are responsive to the ameliorative effects of vitamin D, the beneficial effects of supplementing vitamin D deficient individuals with autoimmune disease may extend beyond the effects on bone and calcium homeostasis.

The immune system defends the body from foreign, invading organisms, promoting protective immunity while maintaining tolerance to self. The implications of vitamin D deficiency on the immune system have become clearer in recent years and in the context of vitamin D deficiency, there appears to be an increased susceptibility to infection and a diathesis, in a genetically susceptible host to autoimmunity.

The classical actions of vitamin D are to promote calcium homeostasis and to promote bone health. Vitamin D enhances absorption of calcium in the small intestine and stimulates osteoclast differentiation and calcium reabsorption of bone. Vitamin D additionally promotes mineralization of the collagen matrix in bone. In humans, vitamin D is obtained from the diet or it is synthesized in the skin (reviewed in (1)). As vitamin D is cutaneously produced after exposure to UV B light, its synthesis is influenced by latitude, season, use of sunblock and skin pigmentation. Melanin absorbs UVB radiation inhibiting the synthesis of vitamin D from 7-dihydrocholesterol. This initial vitamin D compound is inactive and it is next hydroxylated in the liver to form 25 OH vitamin D₃ (25 D). 25 D is also an inactive compound, but is the most reliable measurement of an individual's vitamin D status. It is converted in the kidney to the active compound 1,25 dihydroxy vitamin D (1,25 D) or calcitriol by 1- α -hydroxylase (CYP27B1), an enzyme which is stimulated by PTH. 1,25 D may be further metabolized to the inactive 1,24,25 vitamin D by 24-hydroxylase (CYP24). 1,25 D levels are tightly regulated in a negative feedback loop. 1,25 D both inhibits renal 1- α -hydroxylase and stimulates the 24-hydroxylase enzymes, thus maintaining circulating levels within limited boundaries and preventing excessive vitamin D activity/signaling.

1,25 D acts on the intestine where it stimulates calcium reabsorption, and upon bone, where it promotes osteoblast differentiation and matrix calcification. The active hormone exerts its effects on these tissues by binding to the vitamin D receptor (VDR). This complex dimerizes with the retinoid X receptor (RXR) and the 1,25D-VDR-RXR heterodimer translocates to the nucleus where it binds vitamin D responsive elements (VDRE) in the promoter regions of vitamin D responsive genes and induces expression of these vitamin D responsive genes.

Many tissues other than the skeletal and intestine express the VDR including cells in the bone marrow, brain, colon, breast and malignant cells and immune cells suggesting that vitamin D may have functions other than calcium and bone homeostasis (2). Additionally, tissues other than the kidney express 1- α -hydroxylase and are capable of converting 25 D to 1,25 D, in non-renal compartments (1, 3, 4). Therefore, in addition to its endocrine functions, vitamin D may act in a paracrine or autocrine manner. Some of the more recently recognized non-classical actions of vitamin D include effects upon cell proliferation and differentiation as well immunologic effects resulting in an ability to maintain tolerance and to promote protective immunity. As antigen presenting cells (macrophages and dendritic cells), T cells and B cells have the necessary machinery to synthesize and respond to 1,25 D, vitamin D may act in a paracrine or autocrine manner in an immune environment. Moreover, local levels of 1,25 D may differ from systemic, circulating levels as local regulation of the enzymes synthesizing and inactivating vitamin D are different from the controls originating in the kidney. The extrarenal 1- α -hydroxylase enzyme in macrophages differs from the renal hydroxylase as it is not regulated by PTH (5). Instead, it is dependent upon circulating levels of 25 D or it may be induced by cytokines such as IFN- γ , IL-1 or TNF- α (6). Furthermore, the macrophage 24 hydroxylase enzyme is a non-functional splice variant, so there is no negative feedback of local 1,25 D production by 1,25 D.

Keywords: vitamin D, immunity, infections

VITAMIN D AND PROTECTIVE IMMUNITY

Vitamin D has been used (unknowingly) to treat infections such as tuberculosis before the advent of effective antibiotics. Tuberculosis patients were sent to sanatoriums where treatment included exposure to sunlight which was thought to directly kill the tuberculosis. Cod liver oil, a rich source of vitamin D has also been employed as a treatment for tuberculosis as well as for general increased protection from infections (7).

There have been multiple cross-sectional studies associating lower levels of vitamin D with increased infection. One report studied almost 19,000 subjects between 1988 and 1994. Individuals with lower vitamin D levels (<30 ng/ml) were more likely to self-report a recent upper respiratory tract infection than those with sufficient levels, even after adjusting for variables including season, age, gender, body mass and race. (8). Vitamin D levels fluctuate over the year. Although rates of seasonal infections varied, and were lowest in the summer and highest in the winter, the association of lower serum vitamin D levels and infection held during each season. Another cross-sectional study of 800 military recruits in Finland stratified men by serum vitamin D levels (9). Those recruits with lower vitamin D levels lost significantly more days from active duty secondary to upper respiratory infections than recruits with higher vitamin D levels (above 40nmol). There have been a number of other cross-sectional studies looking at vitamin D levels and rates of influenza (10) as well as other infections including bacterial vaginosis (11) and HIV (12, 13). All have reported an association of lower vitamin D levels and increased rates of infection.

Results of studies looking at potential benefits of administering vitamin D to decrease infection have not been consistent, most likely secondary to a number of methodologic concerns (14). One recent well-designed prospective, double blind placebo study using an objective outcome, nasopharyngeal swab culture (and not self report), and a therapeutic dose of vitamin D showed that vitamin D administration resulted in a statistically significant (42%) decrease in the incidence of influenza infection (15).

The beneficial effects of vitamin D on protective immunity are due in part to its effects on the innate immune system. It is known that macrophages recognize lipopolysaccharide LPS, a surrogate for bacterial infection, through toll like receptors (TLR). Engagement of TLRs leads to a cascade of events that produce peptides with potent bacteriocidal activity such as cathelicidin and beta defensin 4 (16). These peptides colocalize within phagosomes with injected bacteria where they disrupt bacterial cell membranes and have potent antimicrobial activity (17).

Vitamin D plays an important part in the innate antimicrobial response. TLR binding leads to increased expression of both the 1- α -hydroxylase and the VDR (17, 18). This results in binding of the 1,25 D-VDR-RXR heterodimer to the VDREs of the genes for cathelicidin and beta defensin 4 and subsequent transcription of these proteins. Transcription of cathelicidin is absolutely dependent on sufficient 25 D (17). It is now clear that transcription of beta defensin 4 requires binding of NFkB to appropriate response elements on

the beta defensin 4 RNA (19). TLR 2-1 signaling facilitates IL-1 receptor engagement which results in translocation of NFkB to its binding site (19).

CONCLUSIONS

Vitamin D has important functions beyond those of calcium and bone homeostasis which include modulation of the innate and adaptive immune responses.

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ANALYSIS OF RISK FACTORS AFFECTING THE FORMATION OF INTESTINAL MICROFLORA IN INFANTS BORN FROM ALLERGIC MOTHERS

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Abstract

The intestinal microbiota plays a key role in maintaining the physiology and homeostasis of the human body. It has already been established that the formation of the intestinal microflora begins in utero, and the child receives the microflora from the mother throughout pregnancy, childbirth and breastfeeding. The most intensive colonization of the child with maternal and environmental microorganisms occurs in the intranatal and postnatal periods. The composition of the microbiota formed at this time usually depends on the gestational age of the child and the route of delivery, as well as on such factors as the type of nutrition, sanitary and hygienic conditions, medications, etc. In this article, we present the results of our research aimed at investigating the factors affecting the formation of the intestinal microflora in infants born to mothers prone to allergies. We found that allergic diseases of the mother and medications taken during pregnancy, as well as intrauterine infections, premature birth, early transfer of the baby to artificial feeding, etc. Such factors negatively affect the colonization of normal bacteria in the intestine, in other words, the formation of intestinal microflora. As a result, even the most insignificant changes in the intestinal microbiota can trigger sensitization and ultimately the development of allergic conditions in the newborn baby.

Keywords: Atopy, newborns, sensitization, allergy, intestinal microbiota

Introduction. The formation of the gastrointestinal tract (GIT) microbiota is a long and difficult process that begins in utero and continues after birth. The vaginal microflora of the mother surrounding the fetus is considered an important factor in the successful completion of gestation, as well as in the development of the immune system in the newborn. The GI tract of a physiologically born child is partially populated by the mother's microflora, which not only protects the child's body from pathogenic and opportunistic microorganisms, but also reduces the risk of developing chronic diseases [1,2]. On the other hand, breast milk, which contains antibodies against bacteria and viruses and has a high absorbability, is closely involved in the formation of a healthy microbiota of the baby [3,7]. The dynamics of the formation and composition of the intestinal microbiota in a newborn child, which depends on various factors, increases the risk of developing many pathological conditions, including atopy [3,6]. Atopic dermatitis occupies a significant place among the urgent problems of pediatrics as one of the earliest and most frequent factors affecting the constitution and reactivity of the child's body. In atopic infants, the intestinal microbiota undergoes some changes even before the development of allergies. Such microbiological changes that occur lead to the development of sensitization, which causes the activation of opportunistic microorganisms in the intestinal microbiota of the newborn, which can ultimately trigger the development of allergic reactions [1,4,5].

Goal of the work. The aim was to investigate the factors affecting the formation of intestinal microflora in infants born to allergic mothers.

Materials and methods. The study was conducted on 28 (16 boys, 12 girls) infants born to

allergic mothers hospitalized in the neonatal department. In addition to general clinical and laboratory examinations, microbiological analysis of feces was also performed in all patients. Diagnosis of atopic dermatitis was based on anamnestic data, clinical picture of the disease and microbiological analysis of feces.

Results. Anamnesis data revealed that allergy manifested itself in 21 (75%) patients as food allergy, in 4 (14.3%) as nettle rash, and in 3 (10.7%) as Quincke edema. It was determined that the main cause of allergy was sweets and chocolate in 11 (39.3%) mothers, eggs in 8 (28.6%), and antibacterial drugs taken during pregnancy due to exacerbation of acute and chronic diseases in 9 (32.1%). Birth was physiological in 22 (78.6%) cases, surgical (Caesarean) in 5 (17.9%), 19 (67.9%) children were born on time, and 9 (32.1%) were born prematurely. Of the newborns, 10 (35.7%) children were on natural feeding, and 18 (64.3%) were on artificial feeding. In the examined children, allergy symptoms were clinically manifested in the form of strophulus and scaly rash in 18 (64.3%) cases, gneiss on the hairy part of the head in 17 (60.1%) cases, vesiculopustulosis and moist eczema in 11 (39.3%). Among the patients, 6 (21.4%) newborns received antibacterial therapy due to intrauterine infections. Along with signs of atopic dermatitis, 9 (32.1%) patients had signs of acute bronchoobstruction and perinatal damage to the central nervous system (CNS). Mothers complained of causeless crying and periodic anxiety in 16 (57.1%) cases, and 8 (28.6%) of convulsions during feeding. It was found that allergy symptoms among infants are more common in children on mixed and artificial feeding. Microbiological examination of feces revealed significant changes in the quantitative and qualitative indicators of intestinal

microflora in all patients. Thus, bifidobacteria, which are normal inhabitants of the intestine, were detected in only 21 (75%) patients, Escherichia coli in 15 (53.6%), and enterococci in 10 (36.1%) patients.

Conclusion. Thus, it was once again established that allergic diseases of the mother and medications taken during pregnancy, as well as intrauterine infections, premature birth, early transfer of the baby to artificial feeding, etc. such factors can create a risk of developing allergies in a newborn child. Thus, the listed factors negatively affect the colonization of normal bacteria in the intestines of the newborn, in other words, the formation of intestinal biocenosis, leading to certain changes in the intestinal microbiota. As a result, even insignificant changes can trigger sensitization and subsequently the development of an allergic component. Therefore, prevention and correction of changes in the intestinal microbiota of babies born to mothers prone to allergies requires a more serious and effective approach.

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THE IMPACT OF KARATE TRAINING ON THE PHYSICAL AND MENTAL HEALTH OF SCHOOL-AGE CHILDREN (ON THE EXAMPLE OF CONTACT KARATE IN GEORGIA)**Margvelashvili M.***PhD, Professor, Georgian State University of Sport***Mchedlishvili G.***Graduate student, Georgian State University of Sport*<https://doi.org/10.5281/zenodo.15024985>**Abstract**

Karate is one of the most widespread and popular Japanese martial arts worldwide. It is considered a system of physical defense or fighting skills, consisting mainly of striking techniques. Its name refers to the emphasis on techniques that do not require weapons. Traditional karate, as practiced today, is an art, a sport, and a proven method of self-defense. It is practiced by over 130 million enthusiasts worldwide. The Georgian history of karate began in 1967.

According to numerous foreign literature, karate is more than a martial art. It is a discipline that instills valuable life skills in all people, including children and contributes to their overall development. In addition to the physical aspects of training, karate brings other benefits to children's mental and social well-being. The health benefits of martial arts are numerous. In addition, karate is not just movements - it is a philosophy. It instills values such as perseverance, respect, and discipline. Karate training offers numerous benefits for the physical, mental, and social development of children. In addition to physical training and self-defense skills, children gain valuable life skills such as self-discipline, focus, respect, and teamwork. Karate instills self-confidence, promotes emotional balance, and provides a positive outlet for stress. There are also a lot of studies that have examined the effects of karate on physical and brain development and function.

Used by most of the authors the recognized and widely used the Eurofit Physical Fitness Test Battery and the Total Motor Development Test (TGMD-2) to study the impact of karate on children's physical health appear unknown to our country. Thus we surveyed it through specially developed questionnaires and interviews, in which the children themselves and their parents were involved. In total 88 children and their parents were interviewed. The results of our study confirm the significant positive impact of karate training on the physical health and mental development of school-age children. Based on our research, several recommendations were composed.

Keywords: Contact karate, children's training, physical and mental development.

Introduction

Karate is a martial art that is said to have originated in the Ryukyu Islands, now Okinawa, Japan. As interest in karate grew, masters moved to Europe and America to popularize the art. Karate became even more popular in the West in the 1960s with the release of martial arts films.

It is one of the most widespread and popular Japanese martial arts. It is considered a system of physical defense or fighting skills, consisting mainly of striking techniques. Its name refers to the emphasis on techniques that do not require weapons. In Japanese, karate is known as *heiwa no bu*, 'the martial art of peace', and is practiced by over 130 million enthusiasts worldwide.

Traditional karate, as practiced today, is an art, a sport, and a proven method of self-defense.

'Karate is not a game. It is not a sport. It is not a system of self-defense. Karate is half physical training and half spiritual. A karateka who has devoted the necessary years to training and meditation is a calm person. He is not afraid. He can remain calm even in a burning building' [Masutatsu Oyama, Quote].

The Georgian history of karate began in 1967. At that time, there was not a single karate specialist nor full-fledged literature, but a group of enthusiasts laid the foundation for the development of karate. The government persecuted everyone passionate about this oriental combat sport. A similar situation existed in other republics of the Soviet Union. But by 1979, the number of people practicing this sport had grown so much that the government was forced to recognize karate as a

sport. Georgian karateka already had ten years of training experience and were prepared for this. Their successful performances in tournaments and championships of various ranks began.

The Georgian Karate Federation was founded in 1980, and the first Georgian Championship was held in the same year. Karate was banned, and its teaching was declared a criminal offense in 1983, by the USSR Council of Ministers decree.

During the collapse of the Soviet Union in the late 80s, after karate was legalized again, the second stage of karate development began in Georgia. In 1989, the opportunity arose to establish contacts with foreign specialists and invite them. Famous Japanese karateka came to Georgia: Kanazawa, Higaona, Suzuki, Nanbu, Ikata, Hishataka, Kasuya, etc. The result was not long in coming - Georgian athletes achieved notable success on the international stage [Georgian Sports].

Currently, many karate organizations operate in Georgia: the Georgian National Shotokan Federation, the Georgian National Sports Karate Federation, the Georgian National Contact Karate Federation, the Georgian Karate Federation, the Tbilisi Karate Federation, the Karate Federation, etc.

According to numerous foreign literature, karate is more than a martial art. It is a discipline that instills valuable life skills in all people, including children and contributes to their overall development. In addition to the physical aspects of training, karate brings other benefits to children's mental and social well-being. The

health benefits of martial arts are numerous. In addition, karate is not just movements - it is a philosophy. It instills values such as perseverance, respect, and discipline. These values form the foundation of life and guide a person's choices and actions. Karate is a discipline that instills valuable life skills in children of all ages and promotes their overall development.

Karate training offers numerous benefits for children's physical, mental, and social development. In addition to physical training and self-defense skills, children gain valuable life skills such as self-discipline, focus, respect, and teamwork. Karate instills self-confidence, promotes emotional balance, and provides a positive outlet for stress. Moreover, the social interaction and friendships formed in the dojo contribute to the overall well-being of children. Karate enables them to develop holistically and equips them with the skills necessary for a successful future [Emplify, Empowering Achievement].

The benefits of karate in children have been studied by Turkish researchers (Gazi University, Turkey). This study investigated the effect of a 10-week karate training program on motor skills development in 5-7 year-old children. A total of 28 participants were included in the study: 18 in the karate group and 10 in the control group. The karate group was exposed to a fundamental karate training program (*kihon*), consisting of 90-minute sessions four days a week for ten weeks, in addition to physical education classes at their schools. In contrast, the control group did not participate in any sports activities except for physical education classes at their schools. Data were collected using the Eurofit test battery and the TGMD-2 test. When comparing the pre-test anthropometric measurements of the karate group with the control group - no significant differences were observed.

In contrast, significant differences were obtained in height, body mass index, and body fat percentage. In the post-test analysis of the two independent groups, there were statistically significant differences in favor of the karate group regarding height and body fat percentage ($p < 0.005$). In the pre-post-test analysis of the Eurofit test and TGMD-2, all parameters for the karate group showed statistically significant improvements ($p < 0.001$), while the control group showed no statistical difference. After comparing the karate and control groups, the post-test results of the Eurofit test and TGMD-2 showed significantly higher scores (statistically significant differences) in all parameters for the karate group. In conclusion, the study showed that a 10-week karate training program had a positive effect on the motor development of the participating children [Yasin Arslan, Belma Yavaşoglu, et al., 2024].

There are a lot of studies that have examined the effects of karate and other forms of martial arts on brain development and function. Karate and other forms of martial arts require significant training and the mastery of complex movements. These types of movements have been shown to improve cognitive abilities such as attention, memory, and learning. Research has also shown that martial arts training can lead to neural plasticity, which refers to the brain's ability to adapt and change over time. Neural plasticity is essential for the development and functioning of cognitive processes.

Exercise and other forms of physical activity have been shown to have beneficial effects on both cognitive performance and overall brain health. In addition, incorporating mindfulness practices into martial arts training improves stress management. Research suggests that karate and other forms of martial arts have the potential to enhance cognitive performance, particularly in the areas of executive function and attention. That may also impact people who already have cognitive impairments or who are at risk for cognitive decline. The findings also indicate that training in karate and other forms of martial arts can benefit a person's overall physical and mental well-being. The findings also indicate that training in karate and other forms of martial arts can benefit a person's overall physical and mental well-being [Venkateswar Pujari, 2022].

An interesting study has been published using virtual reality technology to study changes in mental health and cognitive function levels in karate athletes. It is known that the use of virtual reality technology in sports generally is increasing. This study concluded that virtual reality-based physical activity improves the mental health and cognitive function of karate athletes [Ferry Fendrian, Amung Ma'mun, Yudy Hendrayana et al., 2024].

As we have seen, most authors used the recognized and widely used Eurofit Physical Fitness Test Battery and Total Motor Development Test (TGMD-2) to study the impact of karate on children's physical health. To study the influence on children's mental development, various testing methods, including the use of virtual reality technology, were used.

Unfortunately, the abovementioned tests and their methodology appear unknown to our country.

Based on the above, it became necessary to conduct our research by collecting subjective data - by studying data available on the Internet about existing Georgian karate organizations and clubs and through specially developed questionnaires and interviews, in which the children themselves and their parents were involved.

The study was conducted by surveying the current situation in the clubs affiliated with the Georgian Contact (Shinkyokushinkai) National Karate Federation (President Avtandil Shengelia). Among them: Kokai (Tbilisi), Spaeri (Tbilisi), Shin (Tbilisi), Mebrzoli (Tbilisi), Gorgasali (Telavi) and Champions Academy (Adjara).

88 children and their parents were interviewed using the developed questionnaire. Among them, by club: 18 children in the Champions Academy; 16 children in Spare; 15 children in Kokai; 9 children in Gorgasali; 11 children in Mebrzoli, and 19 children in Shin.

The age of the children surveyed ranges from 6 to 17 years. Among the respondents, 57 are boys (64.7%), and 32 are girls (35.3%).

Among the motivations for starting karate training, 5 children (5.6%) mention bullying, 17 (19.3%) - media (movies, advertising), 31 (35.2%) - friends, 36 (40.9%) - parents.

The duration of karate training varies from 2 months to 11 years.

The frequency and duration of training is mostly three times a week, with each training session lasting 1-1.5 hours.

65 children (73.8%) are happy with the coach, 23 (26.2%) are moderately satisfied, and none of the respondents expressed dissatisfaction.

Of the external effects of exercise, 25 children (28.4%) reported improved concentration and learning abilities, 61 children (69.3%) reported improved self-defense abilities and 47 children (53.4%) reported improved behavior (discipline).

Conclusion

The results of our study are interesting and confirm the significant positive impact of karate training on the physical health and mental development of school-age children.

The study found that children start practicing karate as early as 6. In addition, the number of girls is 35.3%, which is quite a high figure for this type of sport. Among the motivations for starting karate training, 72% indicate friends and parents. Only 19.3% mention the media (movies, advertising), which is low and suggests the need to strengthen activities in advertising. The comfortable training situation in the clubs and the qualifications of the coaches confirmed that 73.8% of children were happy with the training, and none of the respondents expressed dissatisfaction.

The respondents' answers on the external effects of training on physical and mental development were significant. 28.4% of children noted concentration and learning improvement, 69.3% improved self-defense skills, and 53.4% improved behavior (discipline). These data indicate the positive impact of karate on children's physical and mental development.

The results of our research on the physical and mental development of children coincide with the results of studies conducted by foreign researchers. Our research is indeed largely subjective, since instead of the Eurofit Physical Fitness Test Battery and the Total Motor Development Test (TGMD-2), which are generally accepted abroad, and provide objective and reliable data, we used a survey method, which is less accurate and objective. However, we believe that this research has great prospects and needs to be continued in the conditions of the introduction and use of the abovementioned tests.

Based on our research, the following recommendations composed:

1. To inform the general population, including school-age children and adolescents, as well as their parents, about the positive impact of contact karate on physical and mental development, karate organizations and clubs operating in Georgia should create appropriate websites, which, along with achievements in this sport, will provide the history of karate, its spread

throughout the world, and its benefits for the physical health and mental development of the younger generation.

2. To study and monitor the physical and mental development of school-age children and adolescents, the Eurofit Physical Fitness Test Battery or the Total Motor Development Test (TGMD-2), which is widely accepted abroad, should be introduced in Georgia, which provides objective and reliable data on physical development. In addition, the education and healthcare sectors should be involved in this process.

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PEDAGOGICAL SCIENCES

THE IEP AS AN ANTHROPOLOGICAL TOOL: IDENTITY, NARRATIVE, AND WELL-BEING IN INCLUSIVE EDUCATION

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IL PEI COME STRUMENTO ANTROPOLOGICO: IDENTITÀ, NARRAZIONE E BENESSERE NELL'EDUCAZIONE INCLUSIVA

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Abstract

The Individualized Education Plan (IEP) is not merely an administrative tool but a cultural device that reflects anthropological conceptions of learning, diversity, and inclusion. Through an analysis based on the anthropology of education, this study explores the IEP as a space for identity construction and mediation between the individual and the school context. Following the theories of Geertz (1973), Levinson & Holland (1996), and Ricoeur (1983), the IEP emerges as an institutional narrative that shapes the perception of disability and influences educational practices. Its value lies not only in the personalization of learning objectives but also in its ability to integrate emotional and relational dimensions into the student's educational journey.

A comparative analysis of different educational models highlights how more structured and flexible approaches, such as co-teaching and Universal Design for Learning, enhance both academic outcomes and the psychological well-being of students with Special Educational Needs (SEN).

Rethinking the IEP from an anthropological perspective means transforming it into a tool of agency and inclusion, capable of valuing diversity as a resource and promoting a truly participatory school environment.

Sinossi

Il Piano Educativo Individualizzato (PEI) non è semplicemente uno strumento amministrativo, ma un dispositivo culturale che riflette concezioni antropologiche dell'apprendimento, della diversità e dell'inclusione. Attraverso un'analisi basata sull'antropologia dell'educazione, questo studio esplora il PEI come spazio di costruzione identitaria e mediazione tra individuo e contesto scolastico. Seguendo le teorie di Geertz (1973), Levinson & Holland (1996) e Ricoeur (1983), il PEI emerge come una narrazione istituzionale che modella la percezione della disabilità e incide sulle pratiche educative. Il suo valore non risiede unicamente nella personalizzazione degli obiettivi didattici, ma nella capacità di integrare le dimensioni emotive e relazionali nel percorso formativo dello studente.

L'analisi comparativa di diversi modelli educativi evidenzia come approcci più strutturati e flessibili quali il co-teaching e l'Universal Design for Learning, migliorino sia i risultati accademici sia il benessere psicologico degli studenti con BES.

Ripensare il PEI in una prospettiva antropologica significa trasformarlo in un dispositivo di agency e inclusione, capace di valorizzare la diversità come risorsa e di promuovere una scuola realmente partecipativa.

Keywords: inclusion, identity, narrative, well-being, agency.

Parole chiave: inclusione, identità, narrazione, benessere, agency.

Introduction

The Individualized Educational Plan (IEP) is designed to address the specific needs of students with disabilities and special educational needs (SEN). However, beyond its administrative function, it can be interpreted as an epistemological and narrative device that

reflects anthropological conceptions of the person, diversity, and learning. From an epistemological perspective, the IEP is not merely a tool for organizing knowledge and operational strategies; rather, it functions as an instrument through which a specific pedagogical and social understanding of disability and related educational practices is produced, transmitted,

and legitimized. In this sense, the IEP actively contributes to the social construction of the categories of normality and difference, acting as a device that establishes classification criteria, operational definitions, and shared interpretative frameworks within the school community (Berger & Luckmann, 1966, pp. 61-125). Through the IEP, situated forms of knowledge are consolidated, responding not only to individual needs but also to cultural and institutional visions of educability and inclusion (Geertz, 1973, pp. 3-30).

Similarly, from a narrative perspective, the IEP can be read as a text that organizes and narrates the student's educational experience, outlining a storyline in which school biography, educational expectations, personalized goals, and teaching strategies intertwine. Following Paul Ricoeur's perspective, the IEP participates in the construction of a narrative identity, as it allows for the configuration of the student's journey into a coherent narrative that connects past, present, and future, providing a sense of continuity and projectuality to their experience (Ricoeur, 1983, pp. 235-297). The identity emerging through the IEP is never fixed or definitive but results from the continuous interpretative work of those who write, read, and implement the document, with concrete effects on how the student is perceived and perceives themselves within the school (Levinson & Holland, 1996, pp. 1-54).

In this sense, the IEP is configured not only as a technical tool for educational planning but also as a symbolic and cultural device that contributes to producing shared meanings regarding diversity and the ways in which the school welcomes, recognizes, and values each student (Geertz, 1973, pp. 13-32).

This perspective is grounded in various theories of the anthropology of education. Clifford Geertz (1973), with his interpretative approach to cultural anthropology, suggests that educational documents such as the IEP can be read as "thick descriptions," that is, texts that do not merely report objective data but encapsulate and layer cultural, social, and symbolic meanings, resulting from shared practices and worldviews rooted in the educational context (Geertz, 1973, pp. 3-30). "Thick description" allows for an understanding of not only what is formally stated or written but also the value systems and implicit conceptions of personhood, learning, and disability that underlie the drafting of the IEP. In this perspective, the IEP functions as a device through which the school narrates and, at the same time, culturally constructs diversity, attributing meaning to specific educational needs and defining the ways in which they are accommodated and valued (Geertz, 1973, pp. 13-32).

Similarly, Paul Ricoeur (1983), through his *Theory of Narration*, highlights how identity construction is a process mediated by biographical narratives, which organize personal experience in the form of a story, giving coherence and continuity to one's self-history (Ricoeur, 1983, pp. 235-297). Applied to the IEP, this perspective allows for interpreting the educational plan not merely as a list of objectives and strategies but as a true narrative device that documents, orders, and conveys the student's educational journey. Through the drafting and updating of the IEP, a dynamic and dialogic representation of the student is constructed, highlighting

their skills, difficulties, aspirations, and significant relationships, concretely influencing both their self-perception and the perception developed by the school environment (Ricoeur, 1983, pp. 240-285).

Thanks to the contributions of Geertz and Ricoeur, the IEP can be understood not only as a technical-administrative tool but as a textual and symbolic space in which cultural practices, identity narratives, and educational conceptions intertwine, profoundly impacting the construction of the meaning of inclusion and the valorization of diversity within the school.

Likewise, perspectives from the anthropology of education (Levinson & Holland, 1996) show that educational documents are not merely technical instruments but social acts that shape and are shaped by collective representations of diversity and inclusion.

Thus, inclusion cannot be limited to curriculum adaptation but must entail a profound redefinition of learning modalities, relational dynamics, and identity construction, both individual and collective. In this context, the IEP acts as a bridge between the student's personal experience and the educational and social environment, contributing to the construction of meanings, values, and cultural practices within inclusive education.

Theoretical Foundation

The Individualized Educational Plan (IEP) can be interpreted as a tool that promotes the active participation of the student within the learning community, in line with the Situated Learning Theory by Jean Lave and Etienne Wenger (1991). This theory argues that learning is not an abstract or decontextualized process but takes place within specific social practices through the progressive participation of the individual in a community of practice (Lave & Wenger, 1991, pp. 29-34). Knowledge is not an entity that can be passively transmitted; rather, it is a social construction that develops through interaction with other community members and the cultural context in which it is situated. The IEP, therefore, can be understood as a tool that facilitates the gradual integration of the student into a collaborative learning environment, promoting participation that evolves from peripheral to increasingly central in a process of legitimate peripheral participation (Lave & Wenger, 1991, p. 37).

Similarly, analyzing the IEP through the lens of the anthropology of emotions highlights how affective and relational dimensions influence the educational process. According to Catherine Lutz (1988), emotions are not universal and biologically determined phenomena but rather cultural constructions that reflect the values, norms, and social practices of a given community (Lutz, 1988, pp. 5-7). Emotions play a fundamental role in the educational process as they influence motivation, self-efficacy, and the student's sense of belonging. In this sense, the IEP can be considered a tool that addresses not only the student's educational needs but also their emotional and relational needs, contributing to the creation of a more inclusive educational environment that is responsive to students' affective requirements.

The IEP is not merely a technical document but a pedagogical device that embodies a vision of learning as a situated and relational process. The integration of

the Situated Learning perspective and the anthropology of emotions allows for a better understanding of the fundamental role of social and affective dynamics in knowledge construction and students' educational success.

The Individualized Educational Plan (IEP) can be interpreted as a device that promotes the overall well-being of the student, in line with the approach of medical anthropology. This discipline analyzes health and illness not only in biomedical terms but also as social and cultural phenomena, recognizing the interconnection between the socio-cultural context, individual experiences, and caregiving practices (Kleinman, 1980, pp. 24-30).

According to Arthur Kleinman (1980), health cannot be understood solely as a biological condition but must be analyzed through three fundamental dimensions: disease (illness as a biological dysfunction), illness (subjective experience of illness), and sickness (social construction of the health condition) (Kleinman, 1980, pp. 72-78). Inclusive education, of which the IEP is a central element, aligns with this perspective by considering the student not only based on their diagnosed difficulties (disease) but also in relation to their subjective perception of educational challenges (illness) and the way in which the school and social environment interpret and respond to their needs (sickness). This vision is closely linked to the idea that education is an experience situated within a specific cultural context, where factors such as social representations of disability, educational expectations, and relational support play a crucial role in determining the student's academic success and overall well-being (Kleinman, 1980, pp. 103-110). The IEP becomes a device that not only provides personalized teaching strategies but also acts as a bridge between the educational system and the student's psycho-physical well-being, ensuring a holistic approach that considers cognitive, emotional, and social aspects.

Through the lens of medical anthropology, the IEP can be seen as a tool that goes beyond mere educational planning to become a means of promoting student health and overall well-being, fostering greater integration between education, culture, and care.

The anthropology of education analyzes the IEP as a dynamic process that not only reflects but also shapes cultural conceptions of disability, learning, and inclusion.

From Clifford Geertz's (1973) perspective, the IEP can be interpreted as a space of interaction between the student's individual dimension and educational structures, where meanings and practices related to diversity are constantly redefined. Levinson and Holland (1996) emphasize that educational documents are not merely administrative tools but actual cultural texts that incorporate ideologies and social values. From this perspective, the IEP goes beyond adapting instruction to the student's needs and actively contributes to constructing their academic and social identity. Through the IEP, the recognition of the student's abilities is negotiated, structuring educational paths that move beyond mere compensation for difficulties and fostering active and meaningful participation in the learning environment.

Rethinking the IEP from an anthropological perspective means considering it as a system that not only responds to the student's needs but also values their uniqueness, fostering an environment where diversity becomes a resource and the school a place of shared growth.

Comparison of Educational Approaches to Inclusion and Academic Outcomes

The evolution of the concept of disability has led to a shift in the educational models adopted by different school systems. In this context, the Individualized Educational Plan (IEP) can be analyzed not only as a tool to support learning but also as a cultural device that reflects and shapes how a society interprets diversity. The adoption of a specific educational model is never neutral: it profoundly influences the construction of the student's identity, their opportunities for participation, and the recognition of their abilities.

Medical Model vs. Biopsychosocial Model

The approach to disability has undergone a significant transformation, shifting from a purely clinical view to a more integrated and inclusive model. This transition is not only pedagogical but also reflects a change in cultural paradigms that define the concept of "normality" and "educational needs."

The medical model of disability interprets disability as an individual deficit of a biological or functional nature, to be diagnosed and corrected through specialized interventions. This historically dominant perspective tends to focus on the individual's limitations rather than the environmental and social context in which they manifest (Shakespeare, 2006, pp. 28-35). In the educational field, the application of this model often results in a rigid categorization of students, where support strategies are predominantly oriented towards rehabilitative treatments rather than a true personalization of the educational path (Barnes & Mercer, 2010, pp. 45-50).

From an anthropological perspective, the medical model can reinforce an identity based on pathological difference, framing the student primarily in terms of deficits rather than resources and potential. This process can negatively impact students' self-perception, limiting their sense of self-determination and reducing opportunities for active participation in the school community (Goodley, 2016, pp. 97-102). In particular, the anthropology of disability highlights how the emphasis on diagnostic classifications can lead to the social construction of disability as a static and stigmatizing condition rather than a fluid experience influenced by cultural and relational contexts (Ingstad & Whyte, 2007, pp. 12-18).

Consequently, the exclusive application of the medical model in schools' risks reducing the educational process to a series of interventions aimed at normalizing the student rather than valuing their uniqueness and promoting real inclusion. A more integrated approach, which also considers the social model of disability, would shift the focus from individual limita-

tions to systemic barriers that hinder the full participation of students with disabilities in the educational environment (Oliver, 1990, pp. 22-29).

The biopsychosocial model conceives disability as the result of the dynamic interaction between biological, psychological, and social factors, overcoming the dichotomy between the medical and social models (Engel, 1977, pp. 130-136). This approach recognizes that disability is not only an individual condition but also a construct influenced by the physical environment, social structures, and personal experiences (WHO, 2001, pp. 3-7). In the educational field, the biopsychosocial model promotes flexible teaching strategies aimed at enhancing the student's abilities and reducing barriers to active participation, thereby fostering more inclusive learning environments (Shakespeare, 2014, pp. 56-63).

From an anthropological perspective, this model allows for a redefinition of the student's identity within a school community that recognizes diversity as a resource rather than a limitation (Goodley, 2016, pp. 110-115). The anthropology of disability highlights how the meaning of disability varies culturally and is profoundly influenced by the social and institutional contexts in which the individual is embedded (Ingstad & Whyte, 2007, pp. 20-26). Adopting this perspective, the school is no longer seen merely as a place of therapeutic intervention but as a space where students with disabilities can develop a sense of belonging and self-determination, contributing to a more positive narrative of their individual abilities (Barnes & Mercer, 2010, pp. 78-84).

The biopsychosocial model represents a more balanced and inclusive paradigm as it acknowledges the complexity of disability and promotes interventions that do not merely aim to correct deficits but seek to modify the context to make it more accessible and conducive to the development of each student (Oliver, 2013, pp. 40-45).

According to the World Health Organization (WHO, 2020, pp. 45-50), school systems that adopt an approach based on the biopsychosocial model report a 25% increase in the active participation of students with disabilities compared to systems that rely solely on a medical model. This data highlights how inclusive education, attentive to the interactions between individual and environmental factors, fosters greater integration of students into the school context, improving their engagement and sense of belonging.

Furthermore, a study conducted by UNESCO (2021, pp. 62-68) emphasizes that an Individualized Educational Plan (IEP) oriented towards enhancing the student's competencies, rather than merely compensating for difficulties, leads to an 18% improvement in academic performance. This approach aims to strengthen the student's abilities and promote personalized teaching based on strengths and flexible strategies rather

than focusing solely on limitations. The same study also highlights that such an educational approach contributes to a 30% reduction in school dropout rates, demonstrating the positive impact of an inclusive and personalized educational model.

These data confirm that adopting the biopsychosocial model not only improves the learning experiences of students with disabilities but also helps create a more equitable and accessible school environment, where diversity is recognized as an added value rather than an obstacle (Shakespeare, 2014, pp. 80-85).

Inclusive Education in Italy and Other Countries: Impact on Outcomes

Inclusive schooling in Italy is based on an integration model, which entails the presence of students with disabilities in regular classrooms with the support of specialized teachers (D'Alessio, 2011, pp. 55-62). This approach has helped overcome educational segregation by promoting the participation of students with special educational needs in the general school context. However, the quality of inclusion does not depend solely on available resources, such as the number of specialized teachers or compensatory tools, but is strongly influenced by the cultural beliefs that guide educational practices and the ways in which schools implement the Individualized Educational Plan (IEP) (Canevaro, 2006, pp. 29-34).

At the international level, the approach to the IEP varies significantly across different countries, directly affecting student autonomy, school engagement, and the way in which they construct their identity (UNESCO, 2020, pp. 40-46). In contexts where the IEP is conceived as a dynamic and participatory tool, the educational process becomes more student-centered, fostering a greater sense of self-efficacy and belonging to the school community (Ainscow, 2015, pp. 67-72). Conversely, in systems where the IEP is applied in a rigid or bureaucratic manner, there is a risk of limiting the personalization of the educational pathway, thereby reducing opportunities for inclusive and participatory learning (Florian, 2014, pp. 90-95).

The way the IEP is designed and implemented not only influences the academic success of students with disabilities but also affects their self-perception and the possibility of developing a positive and self-determined identity within the educational environment (Shakespeare, 2014, pp. 102-108). For this reason, inclusion cannot be limited to mere presence in the classroom but must translate into teaching practices that recognize and value diversity as a collective resource.

The comparison between different educational systems highlights significant differences in inclusion models and their respective academic and social outcomes.

Country	Inclusive Educational Approach	Academic Outcomes and Well-being
Italy	Integration model with support teachers	Benefits in socialization, but heterogeneous academic results. Poor coordination between general education and support teachers. According to ISTAT (2022), 40% of students with disabilities do not achieve adequate levels in mathematics and reading.
Finland	Co-teaching and individualized support with early interventions	According to the Finnish National Agency for Education (2021), students with SEN achieve academic results 20% higher than the EU average.
Canada	Model based on Universal Design for Learning (UDL), with assistive technologies and highly flexible plans	Inclusion with personalized strategies has reduced the learning gap by 35% over ten years (data from the Canadian Ministry of Education, 2022).
Germany	Mixed system with specialized schools and optional inclusive classes	Good academic results for those attending specialized classes, but lower socialization with neurotypical peers. The OECD (2021) reports an effective inclusion rate of 50%.
United States	Individualized Education Program (IEP) with strong family involvement	Studies by the American Institutes for Research (2021) show a 22% improvement in school engagement for students with SEN.

International data show that school systems that adopt a structured and flexible approach to inclusion, such as those in Finland and Canada, achieve significantly better results both in terms of academic performance and in the psychological and social well-being of students with special educational needs (SEN) (Ainscow, 2015, pp. 45-52).

In particular:

An OECD report (2022, pp. 78-84) highlights that students with SEN placed in inclusive settings with adequate support score, on average, 15% higher on standardized tests compared to those educated in segregated environments. This data confirms that access to inclusive teaching methodologies and personalized support strategies can lead to better academic outcomes.

According to a PISA survey (2021, pp. 102-108), in countries that adopt co-teaching models and Universal Design for Learning (UDL), the level of school satisfaction among students with disabilities is 28% higher than the EU average. This suggests that teacher collaboration and the use of flexible teaching strategies not only enhance learning but also contribute to a greater sense of belonging within the school community.

A longitudinal analysis of the Finnish education system (2018–2023, pp. 55-61) showed that the introduction of early support strategies led to a 40% reduction in the need for intensive specialist interventions in later years, demonstrating the importance of preventive and personalized education.

The IEP does not merely identify strategies to address the student's educational needs but plays a broader role in redefining the very concept of inclusion within the school community (Florian, 2014, pp. 72-78). If conceived as a tool for cultural mediation, it can

foster the development of a stronger identity and greater self-determination in students with SEN (Goodley, 2016, pp. 88-94).

An inclusive IEP not only improves access to learning but also contributes to building an educational environment where diversity is recognized and valued as a resource, promoting a fairer school system that is attentive to the well-being of all students (Shakespeare, 2014, pp. 115-120).

Conclusions

This study highlights how the Individualized Education Plan (IEP) should not be seen as a mere bureaucratic requirement but rather as a flexible and dynamic tool capable of adapting to the continuously evolving needs of students with disabilities, ensuring a personalized and targeted educational path (Rossi, 2020, pp. 45-50). Its effectiveness depends on the quality of collaboration among the various stakeholders involved, including teachers, families, specialists, and the student, within a co-design framework (Bianchi, 2018, pp. 112-120).

The personalization of interventions and the active participation of all figures involved—including teachers, families, and specialists—are essential to ensuring truly inclusive and meaningful education (Verdi, 2019, pp. 75-80). Furthermore, the need for continuous training for school staff emerges as crucial, allowing them to acquire up-to-date skills and innovative tools for planning and developing more effective teaching methodologies that are sensitive to the needs of students with disabilities (Neri, 2021, pp. 98-105).

Another key aspect to consider is the importance of regular monitoring and evaluation of the IEP to ensure that the established objectives are effectively met

and, if necessary, reformulated based on the student's emerging needs (Moretti, 2023, pp. 55-60). The integration of new technologies and inclusive teaching methodologies, such as digital-mediated learning and cooperative learning strategies, can serve as valuable support in making the IEP an increasingly effective tool that truly meets the students' needs (Colombo, 2022, pp. 80-85).

In conclusion, the IEP must be conceived as a continuously evolving process—an open system that thrives on feedback and new educational strategies to best address students' needs. Only through shared commitment and an inclusive vision can the effective realization of the right to education for all be ensured, promoting a school model that is truly accessible and oriented toward the personal and social growth of each student (Ferrari, 2022, pp. 130-138).

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Dashdemirova Ay.

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Due to the Cold War era, research and development budgets were significantly reduced, so Russian-language texts could not be translated into English using artificial intelligence. Since the 1980s, countries such as Japan, the United Kingdom and the United States of America began to work with expert systems that imitate human actions in the field of artificial intelligence in order to further develop in terms of industry. Since these systems were programmed by human hands, artificial intelligence could not acquire new functions without the touch of a “human hand”. For artificial intelligence programmers, it was a very time-consuming and difficult task to code all the rules for artificial intelligence. After a while, it turned out that expert systems coded by human hands did not produce the expected results. Since the 1990s, interest in artificial intelligence has decreased sharply. Later, with the discovery of the “deep learning” technique by Andrew Ng, Yann LeCun and Geoffrey Hinton, a period of revival in artificial intelligence began. Thus, solving some algorithms that were previously considered very difficult has now become possible through deep learning. What are the other benefits of the “deep learning” technique? This technique has a number of applications that approach and sometimes exceed human performance. For example, in medicine, the “deep learning” technique is used to diagnose skin cancer, in self-driving cars it is used to determine the direction and speed of the car, and in social media it is used to evaluate the originality of texts on the “Face-book” platform.

Keywords: artificial intelligence, development, modernity, technology, human intelligence

Since the early years of the 21st century, the level of development of artificial intelligence had increased so much that in 2001, robots called “Kismet” were created that used human facial expressions to repeat human voices and movements (turning their heads, etc.) exactly. These robots improved themselves by establishing social relationships just like humans.

In our modern era, the most common forms of artificial intelligence include Siri, which most of us know from our iPhones, driverless cars, translation programs, automatic face and voice recognition programs. If we summarize what we have discussed above, we can outline the stages of development of artificial intelligence as follows: Henry Ford has a quote: “If I asked people what they wanted, they would say a faster horse.” If we evaluate the answer given from this perspective, it can be said that schools have turned into “fast classes” in a short period of time. But is it enough for such “fast classes” to continue operating in the 21st century, or should new systems that were never thought of before be created as we move towards the 22nd century? It is thought that these topics will be on the agenda again in the near future. Can artificial intelligence really replace teachers or not? According to some authors, developments in the field of artificial intelligence will “usually make people more human.” According to their opinion, the use of artificial intelligence in education will further personalize learning, help students discover their talents, improve their creativity, and also reduce the workload of teachers. They also believe that the application of artificial intelligence will be beneficial for people who are isolated from society and do not go to school, the disabled, and refugees. However, there are researchers who think the opposite. Thus, they assess the transfer of the role of the teacher to the computer as a risk for the future.

Among the first contributors to the application of artificial intelligence in the education system, we can mention Sidney Pressey. Thus, according to Pressey,

these mechanisms not only immediately showed the test results of students, but also created conditions for providing them with the necessary knowledge. Pressey stated that the mechanism that enabled the application of artificial intelligence in education was convenient not only for students, but also for teachers. Because teachers would now be able to spend more time with their students in the time they used to spend checking their students' exam results.

The next discovery regarding the development of educational interests was made by Burrhus Skinner in 1958. Skinner developed the concept of operant learning by working on operant behavior. He developed a project to control aircraft fire using pigeons during World War II. According to the learning mechanism discovered by Skinner, students would write and turn the answer on a rotating system, and then see the correct answer.

In my opinion, the answer to the question of how and when to use artificial intelligence in the classroom should be given to teachers. Because the application of artificial intelligence in education should reduce the work of teachers, not their importance. Thus, the application of artificial intelligence The application of the entity is to be made. In order to make these effects more positive, the application of the application of the application of the application of the application of the application of the entity is expected to help the teachers to communicate with the students in a more positive way. For example, thanks to the artificial intelligence used by Google, our searches are now shaped according to our geographical location and previous searches. In addition, students can do personalized homework according to their academic skills and learning levels (the Alloproof application will come to their aid at this time). Another example is the application of artificial intelligence in the education system, which creates the opportunity for students to travel to virtual reality. That is, through this

application, some aspects of the real world (for example, geographical locations, historical and inaccessible environments, places where a person cannot actually go, etc.) are presented in a simulated form.

With the use of artificial intelligence applications in the classroom, teachers:

- They had to correctly evaluate and make correct judgments about the already developing artificial intelligence applications;
- They had to analyze the data provided by artificial intelligence technologies in order to guide students correctly, and develop their research skills;
- They had to effectively assess this situation, since artificial intelligence technology would also help them during the teaching of lessons.

Considering the benefits of artificial intelligence technologies, some countries are investing in the further development of artificial intelligence. It is expected that investments in this direction will reach \$6 billion by 2025. China and the United States are very famous in this field. It should be noted that more than half of the expenses related to artificial intelligence in the world belong to these two countries. SquirrelAI, located in China, aims to provide each student with an artificial intelligence teacher. Similarly, ALEKS, developed by McGraw-Hill in the United States, and WATSON, produced by IBM, are popular. Another example is the program called "third space learning", implemented in England, which creates online teaching opportunities for students and teachers. In addition, as a result of the feedback received from the program, the level of comprehension and mastery of each student's lesson can be determined and the lessons that the teacher will teach next time can be determined according to the level of comprehension of each student. More precisely, the learning system is built according to the knowledge and skills of the individual. Studies show

that as a result of the personalized learning method, students show better results.

Another country where personalized teaching methods are applied is Sweden. Thus, the company Sana Labs, located in Sweden, unlike other companies, is working on teaching programs that cover several areas of education (mathematics, specialized subjects, etc.). Thanks to these programs, the "knowledge table" of students is constantly updated.

Let's touch on the experience of Turkey in the application of artificial intelligence in education. Thus, many conferences and events are being held in Turkey regarding this field. According to the decision of the Institute of Educational Industry and Technology, the implementation of the "Smart Classroom Behavior Management" (Smart Classroom Behavior Management) system was discussed. Thanks to this system, cameras will be placed in classrooms and it will be possible to determine from the facial expressions of students during the lesson how much they understand the lesson, which part of the lesson is easier for them and which part is uninteresting for them. This will help teachers determine the best teaching method for the next lessons. At the same time, these cameras are planned to be installed at the entrance and exit of the school.

However, the Turkish Ministry of Education, together with Istanbul Technical University, has launched a project to establish and implement a personalized learning system and is negotiating a number of projects. Within this framework, a project to teach the subject of "Artificial Intelligence for Children" has been launched, and it is currently being clarified whether related books will be written within this project. Among those supporting the project are the Cambridge Professional Education Academy in England, CCS in Ireland, and IBM Watson.

ENSURING EQUALITY AND BALANCE OF INTERESTS IN PARTNERSHIPS IN ONLINE EDUCATION**Galetskyi S.***Ph.D in Pedagogy, Associate Professor
Department of Language Mediation
The National University of Ostroh Academy, Ostroh***ЗАБЕЗПЕЧЕННЯ РІВНОПРАВНОСТІ ТА БАЛАНСУ ІНТЕРЕСІВ У ПАРТНЕРСЬКИХ ВІДНОСИНАХ В ОНЛАЙН-ОСВІТІ****Галецький С.М.***кандидат педагогічних наук, доцент
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The development of online education has become one of the key areas of transformation of the modern education system, providing wide access to educational resources regardless of geographical location, social status or professional experience of education seekers. At the same time, the active implementation of digital technologies has posed new challenges, in particular the need to ensure equality and balance of interests of all participants in the educational process. In the traditional education system, partnership relations between teachers, students, administration and external stakeholders are regulated by official mechanisms of interaction, while in the distance format there are risks of blurring of responsibility, uneven distribution of opportunities and limited feedback. Global trends in the development of online learning demonstrate that the effective functioning of the digital educational environment is possible only if all participants are ensured equal rights, a clear division of responsibilities and the creation of quality control mechanisms.

Purpose. The purpose of the study is to analyze the principles of equal partnership in online education, identify key barriers in ensuring a balance of interests of teachers, students and other stakeholders, as well as develop practical recommendations for improving partnership cooperation mechanisms in the digital educational space.

Methods. The study used a comparative analysis of international experience in implementing partnership approaches in the field of education, content analysis of scientific works on the problem of interaction between participants in the educational process.

Results. Analysis of the data obtained showed that one of the main challenges in partnership relations in online education is insufficient regulation of feedback mechanisms and joint decision-making. Students often face limited access to teachers and a lack of opportunities for personalized interaction, while teachers emphasize digital overload and lack of administrative support. In addition, it was found that online education platforms have a heterogeneous level of interactivity, which affects the degree of student involvement in the learning process.

Conclusions. The results of the study confirm the need to improve partnerships in online education by creating effective communication mechanisms, implementing the principles of co-management and personalization of the learning process. Important steps to achieve equality are expanding feedback opportunities, developing adaptive learning tools and creating a regulatory framework for regulating partnerships in the digital educational environment.

Анотація

Розвиток онлайн-освіти став одним із ключових напрямів трансформації сучасної системи навчання, що забезпечує широкий доступ до освітніх ресурсів незалежно від географічного розташування, соціального статусу чи професійного досвіду здобувачів освіти. Водночас активне впровадження цифрових технологій поставило нові виклики, зокрема необхідність забезпечення рівноправності та балансу інтересів усіх учасників освітнього процесу. У традиційній системі освіти партнерські відносини між викладачами, студентами, адміністрацією та зовнішніми стейкхолдерами регулюються офіційними механізмами взаємодії, тоді як у дистанційному форматі існують ризики розмивання відповідальності, нерівномірного розподілу можливостей та обмеженого зворотного зв'язку. Глобальні тенденції розвитку онлайн-навчання демонструють, що ефективне функціонування цифрового освітнього середовища можливе лише за умови забезпечення рівноправності всіх учасників, чіткого розподілу обов'язків і створення механізмів контролю якості.

Мета. Метою дослідження є аналіз принципів рівноправної партнерської взаємодії в онлайн-освіті, виявлення ключових бар'єрів у забезпеченні балансу інтересів викладачів, студентів та інших зацікавлених сторін, а також розробка практичних рекомендацій щодо удосконалення механізмів партнерської співпраці в цифровому освітньому просторі.

Методи. У процесі дослідження використано, порівняльний аналіз міжнародного досвіду реалізації партнерських підходів у сфері освіти, контент-аналіз наукових праць з проблеми взаємодії учасників освітнього процесу.

Результати. Аналіз отриманих даних засвідчив, що одним із головних викликів у партнерських відносинах онлайн-освіти є недостатня регламентація механізмів зворотного зв'язку та ухвалення спільних рішень. Студенти часто стикаються з обмеженим доступом до викладачів і відсутністю можливостей для персоналізованої взаємодії, тоді як викладачі наголошують на перевантаженості цифровими запитами та браку адміністративної підтримки. Крім того, виявлено, що платформи онлайн-освіти мають неоднорідний рівень інтерактивності, що впливає на ступінь залученості студентів у навчальний процес.

Висновки. Результати дослідження підтверджують необхідність удосконалення партнерських відносин в онлайн-освіті через створення ефективних механізмів комунікації, впровадження принципів співуправління та персоналізації навчального процесу. Важливими кроками для досягнення рівноправності є розширення можливостей зворотного зв'язку, розвиток інструментів адаптивного навчання та створення нормативної бази для регулювання партнерських відносин у цифровому освітньому середовищі.

Keywords: personality development, participants in the educational process, social presence, level of involvement, virtual environment.

Ключові слова: розвиток особистості, учасники освітнього процесу, соціальна присутність, рівень залученості, віртуальне середовище.

Постановка проблеми

Для виконання замовлення суспільства на освіту і запити замовників щодо генерування нових знань, розвитку компетентностей, наскрізних навичок і ціннісних орієнтацій, які необхідні сучасним здобувачам освіти для роботи і життя у XXI ст., навчання та виховання має проводитися із упровадженням системи методів та прийомів на засадах демократизму, гуманізму і творчого підходу до розвитку особистості у партнерській взаємодії між викладачами, студентами, батьками, закладами освіти та іншими стейкхолдерами. Однією з ключових передумов ефективності такої взаємодії є забезпечення рівноправності та балансу інтересів усіх учасників освітнього процесу.

У сучасних умовах цифрової трансформації освіти онлайн-навчання стало не лише інструментом розширення доступу до знань, а й платформою для формування нових партнерських відносин. Водночас, ефективність цих відносин значною мірою залежить від рівномірного розподілу активності, відповідальності та ресурсів між усіма учасниками освітнього процесу. Однією з проблем, що виникають у цьому контексті, є нерівномірність участі студентів у навчальних групах, що може призводити до їхньої ізоляції або, навпаки, до домінування окремих учасників у комунікації. Важливим аспектом є також довіра, підтримка та соціальна присутність у віртуальному середовищі, які суттєво впливають на рівень залученості та якість освіти.

Актуальність проблеми забезпечення рівноправності в онлайн-освіті зумовлена не лише технологічними викликами, а й необхідністю розробки стратегії партнерських взаємодій, що враховують потреби та очікування всіх учасників процесу. Дослідження свідчать, що чітке визначення ролей, створення механізмів підтримки та спільне навчання сприяють підвищенню мотивації студентів, їхньої соціальної інтеграції та ефективності навчального процесу. У даній роботі розглянуто основні виклики забезпечення рівноправності та балансу інтересів у партнерських відносинах в онлайн-освіті, а також запропоновано можливі шляхи їх подолання.

Аналіз останніх досліджень і публікацій

Аналіз останніх досліджень і публікацій свідчить про зростаючу увагу науковців до проблеми рівноправності та балансу інтересів у партнерських відносинах в онлайн-освіті. Значна частина робіт присвячена впливу цифрових технологій на взаємодію між учасниками освітнього процесу, ролі соціальної присутності у формуванні партнерських стосунків та механізмам забезпечення рівноправності між студентами й викладачами.

Дослідження Wang C., Wang Y. [1] акцентує увагу на тому, що ефективне онлайн-навчання можливе лише за умови активної взаємодії між студентами, викладачами та освітніми платформами. Він наголошує, що відсутність рівноправної комунікації може призводити до зниження мотивації студентів та їхньої залученості до навчального процесу. Подібних висновків дійшов Hai-Long S. et. al. [2], який вказує на важливість педагогічного дизайну та організації навчального середовища, яке сприяє рівноправності у доступі до освітніх ресурсів.

Роботи Abusalem A. et. al. [3], Naili L. et. al. [4] демонструють, що рівноправність у партнерських відносинах в онлайн-освіті значною мірою залежить від соціальної присутності студентів та викладачів. Вони зазначають, що інструменти онлайн-комунікації, такі як дискусійні форуми та спільна робота над проектами, можуть знижувати рівень ізоляції та сприяти активнішому залученню студентів. Водночас, дослідження Мура (Moore, 2022) вказує на те, що у багатьох онлайн-курсах спостерігається домінування викладачів у процесі навчання, що може обмежувати можливості студентів для самостійного прийняття рішень та формування автономності у навчанні.

Деякі дослідники, зокрема Tate T., Warschauer M. [5], підкреслюють роль технологічних рішень у забезпеченні рівноправності в онлайн-освіті. Вони вказують, що адаптивні освітні платформи, які враховують індивідуальні потреби студентів, можуть значно покращити їхню залученість та підвищити рівень взаємодії. Водночас, Straub S., Rummel N. [6] вказують на наявність проблеми цифрового розриву, який може створювати бар'єри для рівного доступу до освітніх можливостей, особливо для студентів із соціально вразливих категорій.

Незважаючи на значний прогрес у дослідженнях, існують певні прогалини в знаннях. Зокрема, мало уваги приділяється питанням адаптації партнерських взаємодій до різних освітніх рівнів та дисциплін, а також впливу індивідуальних особливостей студентів на ефективність рівноправної взаємодії. Крім того, бракує комплексних підходів до інтеграції педагогічних стратегій та технологічних рішень, що сприяли б створенню справді інклюзивного онлайн-освітнього середовища.

З урахуванням існуючих прогалин у знаннях, дана робота спрямована на комплексний аналіз механізмів забезпечення рівноправності та балансу інтересів у партнерських відносинах в онлайн-освіті. Запропоновані в дослідженні підходи можуть бути використані для вдосконалення освітніх платформ, розробки методичних рекомендацій щодо організації партнерської взаємодії та підвищення ефективності дистанційного навчання в умовах цифрової трансформації освіти.

Формулювання цілей статті (постановка завдання)

Мета дослідження – проаналізувати механізми забезпечення рівноправності та балансу інтересів у партнерських відносинах в онлайн-освіті, виявити ключові бар'єри та розробити практичні рекомендації щодо удосконалення взаємодії між учасниками освітнього процесу.

Завдання дослідження:

- охарактеризувати теоретичні засади партнерських відносин в освітньому процесі та визначити ключові принципи забезпечення рівноправності в онлайн-освіті;
- проаналізувати міжнародний досвід у сфері партнерської взаємодії між викладачами, студентами та адміністрацією в онлайн-освіті;
- виявити основні виклики та бар'єри у забезпеченні рівноправності та балансу інтересів у цифровому навчальному середовищі;
- запропонувати практичні рекомендації щодо підвищення ефективності партнерської взаємодії в онлайн-освіті, зокрема вдосконалення механізмів зворотного зв'язку, персоналізації навчання та нормативного регулювання партнерських відносин.

Виклад основного матеріалу дослідження

В умовах онлайн-освіти рівноправність та баланс інтересів у партнерських відносинах залежать не лише від організаційних механізмів, а й від того, наскільки студенти відчувають свою залученість та підтримку у цифровому середовищі. Ключовими елементами цього процесу є соціальна присутність, ставлення до цифрового навчання та спільне навчання, які взаємопов'язані та впливають один на одного. Соціальна присутність у цифровому середовищі відображає рівень зв'язку, який студенти відчувають із викладачами та однолітками під час навчання. Вона є визначальним фактором рівноправного партнерства, адже чим сильніше людина відчуває свою залученість у спільноту, тим активніше вона бере участь у навчальному процесі [7].

Формування атмосфери довіри, взаєморозуміння та підтримки сприяє відкритості студентів до обміну знаннями, зміцнює командну взаємодію та допомагає уникати ситуацій нерівномірного розподілу ролей у групових проєктах. Це особливо важливо у спільному навчанні, де кожен учасник має можливість реалізувати свої здібності та отримати рівноцінний досвід.

Не менш важливою складовою рівноправного партнерства є ставлення студентів до цифрового навчання. Якщо студенти відчувають комфорт у використанні онлайн-інструментів, вважають цифрове середовище зручним та мають відчуття приналежності до освітньої спільноти, вони більш охоче залучаються до навчального процесу та сприймають спільне навчання як важливий аспект свого досвіду. Позитивне ставлення до цифрового навчання допомагає подолати бар'єри комунікації, робить взаємодію більш відкритою та підтримує баланс інтересів між усіма учасниками навчального процесу. Відчуття приналежності до віртуальної спільноти мотивує студентів ділитися своїми знаннями, досвідом та ідеями на рівних, не боячись висловлювати власну думку чи конструктивно критикувати.

Заклади освіти відіграють важливу роль у забезпеченні рівних можливостей для участі кожного студента в онлайн-освіті. Розуміння взаємозв'язку між соціальною присутністю, ставленням до цифрового навчання та спільною діяльністю дозволяє закладам освіти створити інклюзивний навчальний простір, де кожен студент має можливість брати активну участь, відчуваючи рівноправність та баланс інтересів у спільній роботі [7]. На рис. 1 схематично зображено заходи що до формування відкритого та підтримуючого онлайн-середовища на базі партнерських відносин між викладачем та студентом.

Формування відкритого та підтримуючого онлайн-середовища є необхідною умовою для досягнення рівноправності в освіті. Соціальна присутність, позитивне ставлення до цифрового навчання та ефективна організація спільного навчального процесу взаємопов'язані та можуть підвищити якість освіти та сприяти продуктивному партнерству між студентами. Для викладачів та навчальних закладів важливо не лише надавати доступ до освітнього контенту, а й створювати сприятливі умови для активного залучення студентів, підтримуючи їхню соціальну взаємодію, забезпечуючи рівномірний розподіл ролей та створюючи атмосферу довіри та взаєморозуміння. Таким чином, баланс інтересів у партнерських відносинах в онлайн-освіті можливий лише за умови комплексного підходу, що поєднує технологічні, соціальні та педагогічні аспекти навчального процесу.

Сучасна онлайн-освіта дедалі більше фокусується на співпраці між учасниками навчального процесу, що вимагає дотримання рівноправності та врахування інтересів усіх

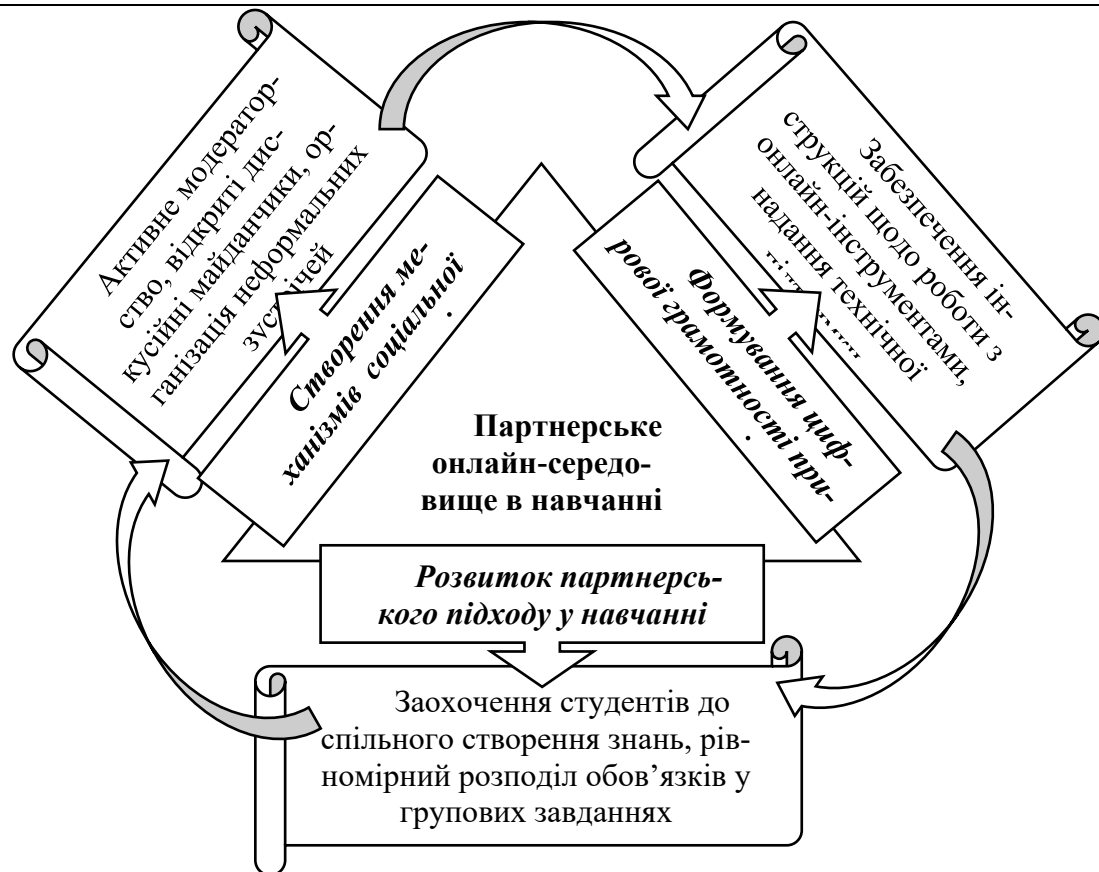


Рис.1. Формування партнерського онлайн-середовища в навчанні

Джерело: складено автором на основі [7]

сторін. Одним із ключових підходів є Online Collaborative Learning (OCL) – система, що передбачає активну взаємодію студентів у навчальних групах. Дослідження, проведене серед студентів Польщі та Португалії, показало неоднозначне ставлення до впровадження OCL у навчальні програми: майже половина опитаних (49,27%) позитивно оцінили цей підхід, визнаючи його потенціал для розвитку навичок співпраці та критичного мислення. Водночас, 19,88% респондентів висловили занепокоєння або негативне ставлення до групової роботи в онлайн-середовищі. Значна частка студентів (38,04%) залишилися нейтральними, що свідчить про потребу в додатковому роз'ясненні переваг такого навчання та адаптації методик його впровадження. 46,73% студентів виявили бажання брати активну участь у колективному онлайн-навчанні, тоді як 15,57% висловили протилежну думку. Цікаво, що рівень підтримки OCL значною мірою залежав від рівня особистісних навичок, зокрема ініціативності та здатності до аргументованої негативної асертивності. Це вказує на те, що ефективна інтеграція спільного онлайн-навчання потребує не лише технічного забезпечення, а й розвитку комунікативних і соціальних компетенцій студентів [8, с. 7]. Таким чином, для досягнення ба-

лансу інтересів у партнерських відносинах в онлайн-освіті важливо створювати умови, що сприятимуть комфортній співпраці, а також підтримувати розвиток особистісних якостей, необхідних для ефективної взаємодії у цифровому середовищі.

Успішна онлайн-освіта базується не лише на технічних аспектах, а й на створенні безпечного середовища для навчання. Дослідження показують, що формування довірчої спільноти є ключовим фактором ефективної співпраці. Основними складовими безпечного середовища є почуття приналежності, коли студенти відчують себе цінними членами групи, соціальна підтримка для обміну ідеями та отримання допомоги, доступність і гнучкість у використанні технологій, а також моделювання взаємоповаги викладачами. Для ефективної співпраці важливо впроваджувати ознайомчі активності для створення довіри, встановлювати чіткі правила взаємодії та проводити синхронні сесії й неформальні майданчики, які сприяють залученню студентів і формуванню соціальних зв'язків [9, с. 420]. Отже партнерські відносини можливі за умови рівноправності в онлайн-освіті та досягаються через створення середовища, основні аспекти якого систематизовані у таблиці 1, де кожен студент має змогу висловити свою думку, отримати підтримку та відчути свою значущість.

Аспекти партнерського середовища в онлайн-освіті

Аспект	Опис	Приклади реалізації
Почуття приналежності	Студенти повинні відчувати себе важливою частиною групи, знати, що їхній внесок має значення та буде почутий. Це формує довіру та мотивацію до активної участі.	Використання командних проєктів, спільних дискусій, підтримки в групах та взаємного навчання.
Соціальна підтримка	Можливість отримувати підтримку від однокурсників та викладачів через форуми, групові чати та особисті консультації. Це допомагає знижувати стрес та підвищує ефективність навчання.	Організація парної та групової роботи, менторських програм, де досвідчені студенти допомагають новачкам.
Доступність та гнучкість	Різний рівень технологічних навичок потребує адаптації матеріалів та доступності альтернативних способів комунікації (наприклад, текстові інструкції, відеоуроки, голосові консультації).	Запровадження покрокових інструкцій з користування платформою, можливість зв'язку з технічною підтримкою.
Моделювання взаємоповаги	Викладачі повинні демонструвати повагу до думок студентів, підтримувати конструктивні дискусії, забезпечувати справедливий розподіл часу та уваги серед учасників.	Викладачі показують приклад етичної взаємодії, моделюють толерантне та конструктивне обговорення.
Ознайомчі активності	Ігрові завдання, представлення учасників, обмін короткими біографіями та досвідом допомагають створити довірчу атмосферу, сприяють відкритості та взаєморозумінню.	Інтерактивні опитування, знайомства через відеопрезентації, обговорення особистих інтересів у неформальній формі.
Чіткі правила взаємодії	Чітко прописані правила взаємодії (наприклад, доброзичливе спілкування, дотримання етикету, конструктивна критика) допомагають уникнути конфліктів та сприяють комфортному навчальному середовищу.	Створення 'кодексу поведінки' для курсу, пояснення правил під час першої зустрічі, модерація дискусій.
Синхронні сесії	Живі онлайн-зустрічі дозволяють студентам краще взаємодіяти, задавати питання в реальному часі, а також формувати соціальні зв'язки, які складніше розвивати в асинхронному навчанні.	Регулярні онлайн-зустрічі в Zoom/Google Meet, сесії запитань-відповідей, групові обговорення тем у реальному часі.
Неформальні майданчики	Створення неформальних просторів для спілкування (курсіві кафе, форуми для вільного обговорення) дає студентам можливість ділитися досвідом, налагоджувати зв'язки та отримувати моральну підтримку.	Форуми для обговорення, Telegram-групи для неформального спілкування, віртуальні зустрічі для обміну ідеями.

Джерело: складено автором на основі [9]

Онлайн-навчання розширює доступ до освіти, але без належної взаємодії може посилювати ізоляцію та нерівність можливостей. Пандемія COVID-19 прискорила цифровізацію, проте виявила проблеми браку соціальної підтримки та залученості студентів. Для збереження балансу інтересів освітні заклади впроваджують спільне онлайн-навчання, що сприяє партнерству, соціальній взаємодії та рівноправному обміну знаннями [10, с. 98]. Спільне навчання ґрунтується на ідеї, що навчальний процес є соціальною взаємодією, під час якої учасники обмінюються знаннями, спільно шукають рішення та створюють нові ідеї. Такий формат сприяє розвитку партнерських відносин, оскільки студенти працюють разом, розподіляючи відповідальність, підтримуючи одне одного та вільно висловлюючи свої думки [10, с. 99]. Завдяки груповій роботі зникає почуття ізоляції, а навчальний процес стає більш залученим і продуктивним.

Учасники не лише краще засвоюють матеріал, а й розвивають навички співпраці та критичного мислення, що підсилює їхню спроможність ефективно працювати в команді. Спільне навчання робить освітній процес цікавішим і змістовнішим, сприяючи рівноправному партнерству, де кожен має можливість долучитися, отримати підтримку та досягти кращих результатів.

Співпраця в освіті створює так званий «третій простір» – гнучке середовище, де учасники спільно формують знання, переосмислюють ідеї та розробляють рішення. Це простір взаємодії, в якому традиційні ієрархічні структури згладжуються, а навчальний процес стає більш рівноправним та відкритим для трансформацій. Яскравий приклад такого підходу – спільна розробка навчальних модулів в Університеті ДеМонтфорд (Велика Британія), де студенти та викладачі разом створили курс про особливі освітні потреби, спираючись на

досвід різноманітних людей та їхніх сімей [11]. Таке середовище сприяє освітньому партнерству, де викладачі й студенти не лише сприймають знання, а й спільно їх конструюють, враховуючи різноманітні точки зору та досвід. Це підхід, що акцентує на соціальній природі навчання, сприяє розвитку критичного мислення та створює умови для справедливої освіти, орієнтованої не лише на ринок, а й на потреби суспільства.

Дослідження підтверджують, що міцний зв'язок між студентом і викладачем позитивно впливає на мотивацію та знижує рівень тривожності. Чим більше студент відчуває підтримку та довіру з боку викладача, тим вища його залученість у навчальний процес. Особливо це важливо для онлайн-навчання, де студенти можуть бути більш схильні до тривожності, що негативно впливає на їхні академічні результати. Якщо рівень тривоги залишається високим протягом курсу, він може знижувати мотивацію та успішність. Щоб створити підтримувальне середовище, викладачі застосовують педагогіку турботи, що передбачає відкритість, емпатію та врахування потреб студентів. Ефективними стратегіями є оперативний зворотний зв'язок, різні форми комунікації (електронна пошта, відеоповідомлення, оголошення) та особистий контакт [12, с. 271]. Встановлення довірчих партнерських відносин між викладачами та студентами є ключовим фактором для підвищення мотивації, зменшення тривожності та створення сприятливого освітнього середовища.

Важливу роль у забезпеченні рівноправності та балансу інтересів партнерських відносин в онлайн-освіті виконують невербальні сигнали, такі як жести, міміка та мова тіла. Вони займають важливе місце у встановленні довіри, емпатії та ефективної взаємодії в навчанні. В очному форматі вони значно покращують комунікацію, сприяючи глибшому розумінню між учасниками освітнього процесу. У віртуальному середовищі їхня роль довгий час вважалася другорядною, однак сучасні платформи, як от Zoom, Microsoft Teams та Google Classroom, дозволяють відтворювати невербальні сигнали через відеозв'язок [13, с. 6]. Проте багато студентів уникають використання відео та аудіо, надаючи перевагу письмовим повідомленням чи записаним матеріалам, що обмежує якість взаємодії. Асинхронні формати навчання також позбавлені багатства невербальної комунікації, що може спричиняти почуття відчуженості та ускладнювати побудову стосунків між студентами та викладачами. Крім того, культурні відмінності у сприйнятті невербальних сигналів можуть викликати непорозуміння, впливаючи на якість взаємодії.

У відповідь на пандемію COVID-19, коли університети та підприємства закрилися, освіта змушена була миттєво перейти на дистанційне навчання. Це створило нові виклики, зокрема щодо якості онлайн-взаємодії та підтримки студентів. Відповідно до моделі SERVQUAL, що визначає ключові аспекти якісного сервісу – довіру, чуйність, доступність та партнерство в освіті, було оновлено платформу Moodle. Новий дизайн став візуально привабливішим, простішим у навігації та

адаптованим до потреб студентів. Сайт підтримує підхід, орієнтований на учня, що базується на концепції партнерства між студентами та викладачами (LPAE). Студентам надається автономія у навчанні, але вони не залишаються без підтримки – доступні інтерактивні інструменти, такі як дискусійні форуми, чати, форми зворотного зв'язку, вікторини та опитування [3, с. 64]. Розширені можливості взаємодії сприяють ефективній комунікації між викладачами та студентами, роблячи онлайн-навчання більш структурованим, доступним і залученим.

Партнерство дослідницької практики (RPP) сприяє рівноправній взаємодії між викладачами та здобувачами освіти, забезпечуючи баланс інтересів у спільному вдосконаленні освітніх підходів. В основі цього підходу лежить не лише доступ до нових знань і ресурсів, а й взаємне навчання, що підсилює якість освітнього процесу та підтримує рівноправний діалог між усіма учасниками. Дослідження онлайн-програми RPP у Китаї, проведене через Tencent Meeting, демонструє, як співпраця між викладачами та здобувачами освіти сприяє впровадженню STEM PjBL – навчальної моделі, що заохочує студентів до проектної роботи в кількох дисциплінах. Такий формат дозволяє учасникам взаємодіяти на рівних, спільно адаптуючи освітні підходи до реальних потреб студентів. Для забезпечення релевантних висновків дослідження використовує аналіз соціальних мереж (SNA), що дозволяє відстежувати зміни у взаємодії та ролях учасників. Це допомагає краще зрозуміти механізми співпраці та зменшити можливі напруження між сторонами, створюючи більш гармонійне та продуктивне освітнє середовище [4]. Таким чином, RPP є ефективним механізмом для досягнення рівноправності в онлайн-освіті, оскільки воно дає змогу всім учасникам відігравати активну роль у формуванні навчального процесу, забезпечуючи баланс між науковими підходами та реальними освітніми потребами.

Партнерська взаємодія у закладах вищої освіти (далі – ЗВО) є основою для побудови ефективного навчального середовища, що об'єднує студентів, викладачів та стейкхолдерів. У контексті онлайн-освіти ця взаємодія набуває нових форм і викликів, зокрема щодо забезпечення рівноправності учасників та балансу їхніх інтересів. В умовах онлайн-навчання важливо розробляти ефективні моделі партнерства, що базуються на взаємній підтримці, доступності технологій та інтерактивних формах взаємодії. Створення стратегій розвитку партнерства у ЗВО допоможе не лише усунути бар'єри у співпраці, а й підвищити якість освіти, забезпечуючи інклюзивність, прозорість і рівноправність для всіх учасників навчального процесу [14, с. 97].

Онлайн-освіта в Україні, як і в багатьох інших країнах, пережила значну трансформацію після початку пандемії COVID-19. Потрібно було оперативно перейти на дистанційне навчання, що стало серйозним викликом для навчальних закладів і студентів. З одного боку, цей процес сприяв розвитку цифрових компетентностей, з іншого – виявив проблеми, пов'язані з недостатньою інфраструктурою

та неготовністю частини вчителів і студентів до використання новітніх технологій [15, с. 389]. Однією з основних проблем є нерівномірний доступ до Інтернету по всій країні, що ускладнює навчальний процес, особливо в сільських та віддалених районах, де часто спостерігається нестабільний Інтернет-зв'язок і відсутність необхідних цифрових пристроїв. Більшість викладачів, хоч і здобули деякі навички роботи в онлайн-форматі, все ж не володіють достатньою кваліфікацією для ефективного використання технологій. Це позначається на якості навчального процесу та взаємодії з учнями, особливо коли йдеться про збереження мотивації та залученості студентів. Онлайн-освіта часто призводить до зниження зацікавленості в навчанні, оскільки віртуальна взаємодія не замінює особисту присутність у класі.

Однак для покращення ситуації існує кілька шляхів. По-перше, важливим кроком є розвиток інфраструктури та забезпечення рівного доступу до Інтернету на всій території України. Це дозволить забезпечити належні умови для навчання навіть у віддалених регіонах. По-друге, необхідно підвищувати кваліфікацію викладачів, створюючи для них програми постійного навчання і підтримки у сфері цифрових технологій. Педагоги повинні отримати не тільки знання з використання різноманітних платформ і онлайн-ресурсів, але й навички управління класом в онлайн-середовищі, адже це суттєво впливає на ефективність процесу. Для підвищення зацікавленості студентів слід активно використовувати інтерактивні методи навчання, такі як відеоконференції, вебінари, онлайн-дискусії, інтерактивні платформи для виконання завдань. Це дозволить не лише зробити навчання більш захоплюючим, але й забезпечить кращу взаємодію між студентами та викладачами. Ще одним важливим аспектом є впровадження гібридних моделей навчання, які поєднують традиційні та онлайн-формати, що дає змогу отримати переваги обох підходів. У таких моделях частина навчальних матеріалів викладається онлайн, а частина – в класі. Важливо також застосовувати різноманітні методи мотивації студентів, наприклад, через гейміфікацію, інтерактивні завдання, конкурси, що допоможе підвищити їхню активність.

Висновки

Забезпечення рівноправності та балансу інтересів у партнерських відносинах в онлайн-освіті є необхідною умовою для створення ефективного та комфортного навчального середовища. Важливо розглядати партнерську взаємодію як динамічний процес, що вимагає постійного удосконалення методів комунікації та розподілу ролей між учасниками. Рівноправність у навчальному процесі може бути досягнута через створення доступного середовища, де кожен студент має можливість висловлювати свою думку, отримувати підтримку та брати активну участь у спільних проектах.

Онлайн-освіта має потенціал для розвитку інклюзивних підходів до партнерства, однак для цього необхідно впроваджувати стратегії, що сприяють зміцненню соціальної взаємодії та мотивації

студентів. Важливу роль відіграє використання інтерактивних платформ, які забезпечують ефективну взаємодію, синхронну та асинхронну комунікацію, а також можливість отримання своєчасного зворотного зв'язку. Крім того, розподіл відповідальності у партнерській роботі має бути прозорим і справедливим, що допоможе уникнути дисбалансу у виконанні завдань та сприятиме розвитку навичок співпраці.

Успішна реалізація партнерських відносин в онлайн-освіті можлива лише за умови інтеграції технологічних, педагогічних та соціальних факторів. Викладачі мають відігравати активну роль у підтримці студентів, створюючи умови для конструктивного діалогу та спільного навчання. Таким чином, ефективне партнерство в онлайн-освіті є запорукою підвищення якості навчального процесу та формування рівноправного і збалансованого середовища для всіх учасників.

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THE STRATEGIES FOR BILINGUAL EDUCATION IN CHINA'S HIGHER EDUCATION

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Nowadays, as an effective way of language acquisition, bilingual education is being attached increasing importance in the educational reform in the world. However, the blind implementation of it in education will inevitably lead to some negative influences. This paper gives a brief introduction of the bilingual education and points out some problems of bilingual teaching existing in higher education in China. Based on this, some main strategies have been put forth so as to make bilingual teaching develop more smoothly and healthily in higher education.

Keywords: bilingual education, successful bilingual teaching, strategies, teaching reform, relationship

1.Introduction

Bilingual education is one of the most essential parts of the educational reform in higher education, as well as in Primary and Secondary education. According to *Beijing Youth Daily*, it is reported that colleges and universities across China will launch bilingual education to meet the need for bilingual talents and that major courses such as information technology, bio-technology, information technology and law etc. will be given both in Chinese and English. Therefore, it's necessary to make it clear what bilingual education is and what factors should be taken into account in order to make the bilingual education develop smoothly and healthily rather than implement it with blindness.

2. The Definition of Bilingual Education**2.1 The definition of "bilingual"**

There are various definitions for "bilingual". However, the definition of it is quite controversial. According to *The Longman Dictionary of Applied Linguistics*, the definition given is: "A person who knows and uses two languages." In *Encyclopedia Dictionary of Applied Linguistics: A handbook for Language Teaching* (Johnson, 2001), "bilingual" refers to "A person who speaks two languages equally well."⁸⁸ Very recently, some scholars in North America have regarded "bilingual" in an even looser meaning. It is pointed out that a person does not have to speak both languages with equal fluency to be bilingual. It is very common for bilinguals, even those have been bilingual since birth, to be somewhat "dominant" in one language.

2.2 The definition of "bilingual education"

A correct understanding of bilingual education is vital for us to carry out this program. According to *Longman Dictionary of Applied Linguistics*, the definition given is "The use of a second or foreign language in school for the teaching of content subjects." Richard, J. C. & Platt, John (2002) stated that bilingual education

is the employing of a second (foreign) language at school for subject teaching."⁸⁹

It is known that in Canada, bilingual education refers to the employing of French for subject teaching in the areas where English is their native language, and in America, it usually means to use Spanish to teach the other science subjects. In China, as English plays a dominating role in the world, the combination use of Chinese and English is one of the primary forms of bilingual education. This places a great emphasis on the improvement of students' English level, which is important for them to learn much from advanced countries and hence help promote their competition in the world. However, in some multiethnic areas, it is the combination of Han Chinese language and ethnic languages. For instant, in Xinjiang, it is the combination of Han and Uygur. Bilingual education in this form can help them equally develop language and culture of each national and also help them learn much of our main culture, which is beneficial for their self-development. "learning a foreign language may reduce conflicts among different racial, ethnic, or religious groups, as well as among nation states".⁹⁰ In a word, bilingual education varies from country to country, from region to region. Therefore, we should pay special attention to the situation and should not follow the others' model blindly.

3. The Models of Bilingual Education

At present, the following three models are often adopted in bilingual education in the world.

3.1 Immersion Model

Immersion Model refers to the use of a single school language which is not the child's home language. This is sometimes called an immersion program. (Cummins and Corson, 1997).

In this model, all the subjects are required in the target language and even in the assignments and exams. It is directed by Krashen's theory of Second Language

⁸⁸ George Yule. *The Study of Language* [M], Beijing: Foreign Language Teaching and Research Press & Cambridge University Press, 2005.

⁸⁹ Zhong Qiquan, My opinion on "Bilingual Education"[J], *Global Education Outlook*, 2003. (2).

⁹⁰ Hu Zhuanglin, *On Bilingual Education in China*[J], *Foreign Languages in China*, 2004. (2).

Acquisition. Students are encouraged to master the target language naturally and unconsciously in the process of learning science subjects. the integration of language and culture learning by using the language as medium for the continuing socialization of students is a process which is not intended to imitate and replicate the socialization of native-speaker teachers but rather to develop student's cultural competence from its existing stage, by changing it into intercultural competence" (Fengping Gao)⁹¹

3.2 Maintenance Model

It is the use of the child's home language when the child enters school but later a gradual change to the use of the school language for teaching some subjects and the home language for teaching others. This is sometimes called maintenance bilingual education. (Cummins and Corson, 1997). This model emphasizes that native language can be used to maintain the comprehension of the content subject while the target language is learned.

3.3 Transitional Bilingual Model

It involves the partial or total use of the child's home language when the child enters school, and a later change to the use of the school language only. This is sometimes called transitional bilingual education. (Cummins and Corson, 1997).

This model is to some extent to ensure students' no sacrifice of subject content learning.

The effectiveness of the first model is eventually turned out to be the best and most successful one. However, it is not as effective as the students in China learning in the Chinese background. And in most cases, the second and the third models are adopted in our current situation due to the nature of bilingual education.

4. The Problems of Bilingual Education

4.1 Lacking of qualified bilingual teachers

As we all known, bilingual education has a high demand for bilingual teachers, who should not only have proficiency in English especially in oral English, but also must be specialized in one of the science subject. The lack of adequate qualified bilingual teachers is our major problems. This is the key factor to successful bilingual teaching. Therefore, we should carry out the program at the right time and under the appropriate circumstances.

4.2 Lacking suitable teaching materials.

The lack of suitable teaching material is another major problem of bilingual education. Given that the differences between Chinese students and oversea students, it is not easy to have access to the right original teaching materials. On the other hand, some original materials may not be quite suitable for our students' level. Then how to select and edit the teaching materials which suit to our students in higher education is also a major concern.

4.3 Weakening the native language learning.

Since our bilingual education must pay much attention to the education localization. That is to say, we

can not waken our native language learning while carrying out bilingual education program. This is also a problem some people are worrying about. Just as Professor Zhang (Zhang Zhendong, 2002) once pointed out that bilingual education can cultivate an intellectual who may speak two languages well, but may not be a qualified translator as a result of his incorrect use of native language.

4.4 Traditional College English teaching

In the traditional College English classroom, more emphasis is laid on vocabularies, grammar, not on lively language. Limited chances are given to students for communicating. Listening and speaking skills are often neglected. This obviously forms an obstacle for the successful bilingual teaching, which to some extent depends much on students' listening and reading skills. And bilingual teaching has a high demand for input as well as output. Apparently, the present teaching model can not meet the need for our bilingual teaching model. In addition, the traditional examination and assessment systems also contribute to this negative influence. How to realize the relationship between College English teaching and bilingual teaching is something important for successful bilingual teaching. As a result, much effort must be made to strengthen the teaching reform of our College English teaching.

4.4 Affecting content subject learning.

In America, bilingual education is to help immigrants learn the mathematics and science subjects, and meanwhile promote their English level. But in our country, as Chinese and English do not belong to one language family. So it seems far more difficult for learning English than other languages. Using English for subject teaching should take both teachers and students' English level into consideration. Otherwise it may affect content subject learning. This is another problem to which we must attach more importance. And the ability of mastering much advanced academic information is so important that it can not be neglected in the competitive modern world.

5. Some strategies

5.1 Dealing with the following relationships appropriately

5.1.1 Native language and target language

It is said, "Language is civilization."⁹² or "Language is the symbol of the nation." Any country pays much attention to its native language learning. So the implementation of bilingual education must be based on the fact that it can not affect the native language education. Namely, we must make sure there's no sacrifice of our native language. As native language is our advantage language, we'd better make full use of its positive transfer while learning English and avoid pursuing the form of using target language only and weakening the learning of our native language.

5.1.2 Language teaching and content subject

Bilingual teaching as an effective way of language acquisition is playing an increasing important role in China as well as abroad. And it is also a special type of

⁹¹ engping Gao, "Japanese: A Heavily Culture-Laden Language"[J] Journal of Intercultural Communication, Issue 10, December 2005

⁹² Du Jingping, Deng Shaoli, On the relationship between ESP, ELE, CBI, bilingual teaching and college English [J]. Crazy English (Teacher Edition). 2012. (3)

teaching which is different from either foreign teaching or the teaching of other content subjects. For this reason, it is vital to deal with the relationship between language teaching and the teaching of content subject appropriately so as to achieve the ideal result of “Killing two birds with one stone”. With this in mind, our bilingual teaching must avoid focusing only on language form, which is our habitual way of foreign language teaching. More attention should be paid to content learning. Culture and language teaching complement each other and are inseparable. Attaching importance to cultural teaching in language teaching not only helps to improve the efficiency and quality of language learning, but also helps to cultivate talents with international vision and cross-cultural communication skills. Sherzer (1987:305) considered discourse “to be the concrete expression of language-culture relationships”⁹³. The author also discusses the Sapir-Whorf hypothesis and reconceptualizes it (p. 296): It is discourse which creates, recreates, modifies, and fine tunes both culture and language and their intersection, and it is especially in verbally artistic discourse such as poetry, magic, verbal dueling, and political rhetoric that the potentials and resources provided by grammar, as well as cultural meanings and symbols, are exploited to the fullest and the essence of language-culture relationships becomes salient. Consequently, the combination of consciously learning of the science subject and unconsciously acquisition the language is an effective way of successful bilingual teaching.

5.1.3 College English teaching reform and bilingual teaching

College English teaching and Bilingual teaching share the same objective of promoting students' English level, but they also have different connotations. In general, College English teaching is language-based teaching, which focuses on language form while bilingual teaching is content-based teaching, which focuses on the content learning, such as, the knowledge learning of physics, mathematics, and so on. In order to meet the high demand of Bilingual teaching, the students' intercultural communicative competence must be improved as soon as possible. Language is a dance to the music of culture. Dance steps and the music they go with convey more than just rhythm and joy – they also help the dancers negotiate a relationship. We must teach language relative to culture⁹⁴. At the time being, how to reform College English teaching seems to be an increasingly important issue for successful bilingual teaching. To our relief, some effective ways are under discussion. For example, Based on the review of ESP (English for Specific Purpose) and ELE (English for Liberation Education), college English may be divided into three levels, namely, core English learning level, which is considered as English for General Purpose, ELE & ESP level, and Bilingual Instruction level. However, much effort need to be made on the reform

of our College English teaching, including teaching curriculum, teaching methodologies, relative examination systems, assessment systems and so on.

5.2 Teacher training

As to teacher training, several practical ways adopted in the present conditions are as following:

Firstly, some national policies can be issued to ensure some universities or colleges to set up practical bilingual training programs. We can not deny the fact that the effective policy assistance can have much positive impact on the successful implementation of bilingual education. One point should be clarified is that the training programs must put emphasis on teachers' ability of oral English and modern educational technology as well as the others.

Secondly, some capable teachers can be selected and sent abroad for further study for a period of time. And meanwhile, some foreign experts, especially those with bilingual teaching background can be recruited to help us for the bilingual courses constructions.

Thirdly, a new major of bilingual education may be set up in some universities, where there are possibilities for doing this to solve the shortage of the qualified teachers for bilingual teaching.

5.3 Teaching materials

To attempt to solve the problem of lacking of the teaching materials for bilingual teaching, the following measures may be taken:

1) Introducing the original textbooks

One of the advantages of bilingual teaching is the access to original textbooks for academic information. Original textbooks are obviously the best choice. However, they should be well selected so as to be suitable for our own situation and our students' English level.⁹⁵

2) Introducing the original audiovisual materials

There are many good original audiovisual materials attached to books. They are also good resources for our bilingual teaching due to their direct and quick way of learning. But they also need to be selected first.

3) Editing, translating and rearranging the teaching materials

In most cases, there are not very suitable textbooks and other teaching materials available. General speaking, most original textbooks must be altered or rearranged according to the actual need of present subject teaching. So another choice is form a bilingual research group, which is constituted of qualified and responsible teachers. That is really hard-demanding work. But it is proved by many universities in China, such as Zhejiang University, this is a very practical way to solve the problems of Bilingual textbooks.⁹⁶

6. Conclusion

In order to meet the great challenges of the new century, bilingual teaching is the trend of our educational reform. This paper attempts to find some strate-

⁹³ SHERZER, Joel, 1987. A discourse centered approach to language and culture.[M] American Anthropologist, New Series, 89 (2):295-309

⁹⁴ CEDAR, Payung, 2006. Thai and American responses to compliments in English. [J]The linguistic journal, 1(2):6-28.

⁹⁵ Yuan Duping, Yu Liming, Research on the Concept and Strategy of Bilingual Teaching in Colleges and Universities[J], Foreign Languages in China, 2005.

⁹⁶ KUBOTA, Ryuko, 2003. Critical teaching of Japanese culture.[M]Japanese Language and Literature, 37(1):67-87.

gies for the main problems which exist in bilingual education programs in China's higher education. Of course, there are others, such as the positive policy assistances, the efficient management, the effective assessment, more powerful research work and so on.

Bilingual education in universities or colleges with the aim of enhancing students' comprehensive language skills at no loss of damaging the language of Chinese and academic attainment is just our strategies of talent cultivation and educational reform. However, it still clarifies in this paper that successful bilingual teaching can be realized only on the condition that it is carried in a suitable model instead of copying the models from others.

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THE USE OF CONTEXTUALIZED TASKS IN CHEMISTRY CLASSES TO PROMOTE FUNCTIONAL EDUCATION IN STUDENTS**Nurekenova A.***candidate of biological Sciences, associate professor,
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of the Department of chemistry and biology,
«Shakarim University of Semey»***ПРИМЕНЕНИЕ КОНТЕКСТНЫХ ЗАДАЧ НА УРОКАХ ХИМИИ ДЛЯ РАЗВИТИЯ ФУНКЦИОНАЛЬНОЙ ГРАМОТНОСТИ ШКОЛЬНИКОВ****Нурекенова А.Н.***кандидат биологических наук,
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<https://doi.org/10.5281/zenodo.15024995>***Abstract**

The article discusses the methodology of using contextual tasks as a tool for the formation of functional literacy of students in chemistry lessons. The main approaches and methods of effectiveness of this approach are analyzed. Examples of contextual tasks and their impact on the educational process are presented. The natural pedagogical experiment of applying contextual tasks is described.

Аннотация

В статье рассматривается методика использования контекстных задач как инструмента формирования функциональной грамотности учащихся на уроках химии. Проанализированы основные подходы, методы эффективности данного подхода. Представлены примеры контекстных задач и их влияние на образовательный процесс. Описан естественный педагогический эксперимент применения контекстных задач.

Keywords: contextual tasks, principles of contextual tasks, functional literacy, types of functional literacy, chemistry, teaching methods.

Ключевые слова: контекстные задачи, принципы контекстных задач, функциональная грамотность, виды функциональной грамотности, химия, методика преподавания.

Целью обучения на уроках химии является целостное формирование системы химических знаний и естественнонаучного представления об окружающем мире, развитие функционально грамотной и творческой личности. В условиях модернизации казахстанского образования возрастает роль функциональной грамотности, позволяющей применять знания в реальных жизненных ситуациях. Контекстные задачи представляют собой эффективный инструмент, способствующий развитию критического мышления, аналитических навыков и способности использовать знаний по химии в повседневной жизни. [1, 94-97] Современное образование направлено на всестороннее развитие учащихся, что включает в себя возможность применять полученные знания в жизненных условиях. Важность этого аспекта особенно велика в естественнонаучных дисциплинах, таких как химия, где применение знаний в качестве альтернативы способствует формированию критического мышления и аналитических навыков решения проблем в реальной жизни. В этом случае использование контекстных задач является эффективным средством, позволяющим учащимся сохранять связь между концептуальными

схемами и реальными ситуациями. [2,83-86] Исследования в области преподавания химии показывают, что контекстные задачи способствуют повышению познавательной активности учащихся и развитию их аналитических способностей. [3,52-56] Однако, несмотря на пристальное внимание к этой методике, остаются нерешенные вопросы, связанные с определением системных задач для разных уровней обучения и оценкой их функциональной грамотности учащихся.

Данная статья направлена на обоснование методики использования контекстных задач в преподавании химии и определение их педагогической эффективности с учетом развития функциональной грамотности учащихся. Для начала разберем что же такое функциональная грамотность и почему ее так важно развивать в условиях школьного образования.

Функциональная грамотность – это способность человека использовать знания и навыки в различных жизненных условиях, анализировать информацию, глубоко ее осмысливать и принимать обоснованные решения. Согласно концепции международного исследования PISA, функциональная

грамотность включает в себя несколько ключевых компонентов [4,17]:

1. **Читательская грамотность** – способность понимать, интерпретировать и анализировать тексты.

2. **Математическая грамотность** – умение применять математические знания для решения повседневных задач.

3. **Естественная научная грамотность** – возможность использовать естественнонаучные знания для объяснения предположений, создания гипотез и аргументированного принятия решений. [4,17]

Из выше изложенных терминов делаем вывод, что научная грамотность является важным фактором функциональной грамотности, так как она формирует у учащихся умение анализировать природные и техногенные процессы, оценивать научные данные и принимать решения на их основе. 21 век — это период стремительного развития науки и технологий, так что функциональная грамотность жизненно необходима в условиях ежедневного соприкосновения с новейшими технологиями. Навыки научного мышления, помогают развивать решение контекстных задач, которые представляют собой задания, основанные на реальных или приближенных к реальности, требующие применения знаний и умений для их решения. В зависимости от характера проблем и требуемых компетенций контекстные задачи подразделяются на [3,53-56]:

• **Практико-ориентированные задачи** – направлены на применение знаний в быту и профессиональной деятельности (например, определение состава воды с использованием химического анализа).

• **Исследовательские задачи** – требования к основам гипотез, планирования эксперимента и анализа полученных данных.

• **Проблемные задачи** – стимулируют учащихся к поиску решений сложных вопросов, например, экологических органических веществ в окружающей среде.

Решение контекстных задач способствует развитию различных когнитивных навыков: через анализ данных, выявление ошибок и обоснование решений, учащиеся формируют критическое мышление, посредством структурирования информации, создания причинно-следственных связей тренируют аналитическое мышление, а также поиск нестандартных решений и моделирование новых ситуаций оказывает сильное влияние на рост и совершенствование творческого мышления учеников. Контекстные задачи позволяют связать абстрактные понятия с реальными ситуациями, что способствует повышению мотивации к изучению предмета и осознанию его возникновения. Для лучшего восприятия принципов контекстных задач, представленных на рисунке 1.



Рисунок 1. Методические принципы контекстных задач

Контекстные задачи представляют собой задания, ориентированные на применение знаний в реальных или приближенных к реальности ситуациях. [5,63-37] Они могут быть классифицированы по различным критериям. Выделим некоторые из них:

1. **По уровню сложности:** уровень воспроизведения, уровень установления связей, уровень рассуждения. [6,125-127]

2. **По содержанию:** эколого-химические, технологические, социально-экономические. [5,63-67]

Все это позволяет нам сделать вывод, что основное отличие контекстных задач от традиционных заключается в том, что они требуют не только

воспроизведения знаний, но и их интерпретации и практического применения.

Методологическая база данного исследования определяется необходимостью выявления эффективности использования контекстных задач в обучении химии для формирования функциональной грамотности учащихся. В основе исследования лежат сравнительный анализ и педагогический эксперимент, позволяющие оценить влияние применения контекстных задач на уровень сформированной функциональной грамотности. Выбор данных методов обусловлен их способностью обеспечивать комплексную оценку педагогических стратегий, а также измерять количественные и качественные изменения в уровне знаний учащихся. Исследование

организовано в соответствии с принципами квази-экспериментального дизайна, который позволяет проводить наблюдения в условиях естественного образовательного процесса, сохраняя при этом возможность сравнительного анализа результатов экспериментальной и контрольной групп. Данный подход позволяет минимизировать влияние внешних факторов и обеспечить прозрачность результатов исследования. В рамках исследования применялись методы сбора данных, обеспечивающие комплексный анализ влияния контекстных задач на учебный процесс такие как:

Анкетирование – используется для изучения отношения учащихся к контекстным задачам, уровня их мотивации и познавательной активности.

Тестирование – проводится на начальном и завершающем этапах исследования для диагностики уровня сформированности функциональной грамотности. В тестовые задания включены элементы, основанные на критериях международных исследований (PISA).

Анализ учебных материалов – направлен на выявление частоты и качества включения контекстных задач в современные школьные учебники и методические пособия.

Наблюдение – осуществляется для фиксации особенностей учебной деятельности, учащихся в процессе решения контекстных задач. Особое внимание уделяется уровню вовлеченности, характеру рассуждений и стилю решения задач.

Для количественного и качественного анализа собранных данных применялись современные методы статистической обработки:

- **t-критерий Стьюдента** – применяется для оценки статистической значимости различий в результатах тестирования между контрольной и экспериментальной группами.[7,38-40]

- **Качественный анализ открытых вопросов анкетирования** – направлен на выявление основных тенденций в восприятии учащимися контекстных задач, их сложности и полезности.

Данные методы обеспечивают комплексную и объективную оценку влияния контекстных задач на развитие функциональной грамотности учащихся. Применение сочетания количественных и качественных методов анализа способствует повышению достоверности и обоснованности полученных результатов, что является важным условием для дальнейшего внедрения эффективных образовательных стратегий в школьную практику. Данное исследование эффективности использования кон-

текстных задач на уроках химии для развития функциональной грамотности опирается на комплексный подход, включающий элементы сравнительного анализа и педагогического эксперимента. Сравнительный анализ позволяет сопоставить традиционные методы обучения с методами, основанными на контекстных задачах, выявляя их влияние на формирование функциональной грамотности учащихся. Педагогический эксперимент направлен на проверку гипотезы о том, что систематическое использование контекстных задач способствует развитию у обучающихся навыков критического мышления, аналитической деятельности и способности применять знания в реальных ситуациях.

В исследовании приняли участие учащиеся 9 класса Интеллектуальной школы физико-математического направления города Семей, разделенные на экспериментальную (ЭГ) и контрольную (КГ) группы. Экспериментальная группа обучалась с применением контекстных задач, ориентированных на развитие функциональной грамотности, тогда как контрольная группа использовала традиционные методы обучения. Количество участников исследования составило 22 человек, из них 11 в ЭГ и 11 в КГ. Перед началом эксперимента были проведены диагностические тестирования, результаты которых показали отсутствие значимых различий в уровне исходных знаний и функциональной грамотности между группами (t-критерий Стьюдента, $p > 0.05$).

Эксперимент проводился в три этапа:

I этап - диагностическое тестирование с целью определения исходного уровня функциональной грамотности учащихся.

II этап - внедрение системы контекстных задач в учебный процесс экспериментальной группы. В течение трех месяцев учащиеся ЭГ решали задачи, основанные на реальных жизненных ситуациях, в то время как в КГ обучение велось по традиционной методике.

III этап - повторное тестирование и анализ изменений уровня функциональной грамотности.

Система контекстных задач была разработана с учетом соответствия школьной программе по химии, использования реальных проблемных ситуаций, требующих применения химических знаний, а так же включения заданий, развивающих критическое мышление и аналитические способности.

Примеры контекстных задач использованные при проведении исследования представлены в таблице 1:

Уровни и примеры контекстных задач.

Уровень воспроизведения: задачи должны быть близки к ситуациям из жизни, знакомы обучающимся. Сюжетная часть не преобладает над химическим содержанием. Цель – проверка знаний и умений из изученных тем и разделов химии.	Контекстная задача	Задача 1. Для проявления черно-белых фотографий необходимо приготовить раствор тиосульфата натрия ($\text{Na}_2\text{S}_2\text{O}_3$). <i>Инструкция к проявителю:</i> Для приготовления рабочего раствора необходимо растворить 250 г тиосульфата натрия в 1 литре воды. <i>Задания:</i> 1. Составьте ионное уравнение реакции растворения тиосульфата серебра ($\text{Ag}_2\text{S}_2\text{O}_3$) в растворе тиосульфата натрия. 2. Объясните, почему тиосульфат серебра растворяется. 3. Опишите последовательность действий по приготовлению раствора. 4. Рассчитайте концентрацию раствора, необходимую для проявления фотографий (используя данные из инструкции к проявителю).
	Описание задания	Задача описывает бытовую ситуацию приготовления раствора и требует применения знаний о ионных реакциях, а также требует применения базовых знаний о приготовлении растворов и расчетах массовой доли.
	Критерии оценивания	– Правильность составления ионного уравнения. – Полнота и обоснованность объяснения растворения тиосульфата серебра. – Точность описания последовательности действий. – Правильность расчета концентрации раствора, с указанием формулы для расчета.
Уровень установления связей: содержание задачи описывает ситуацию, возникающую при изучении других предметов; отражает химические и нехимические проблемы и их взаимную связь; должны проверять знания и умения из изученных тем и разделов химии и других учебных предметов, прикладная часть не должна покрывать химическую сущность.	Контекстная задача	Задача 2. Предприятие сбрасывает в реку сточные воды, содержащие ионы свинца (Pb^{2+}). Местные жители обеспокоены загрязнением реки. <i>Задания:</i> 1. Предложите способ очистки сточных вод от ионов свинца с использованием раствора сульфида натрия (Na_2S). Составьте ионное уравнение реакции. 2. Объясните, почему сульфид свинца (PbS) выпадает в осадок. 3. Оцените, как загрязнение реки ионами свинца влияет на водную экосистему и здоровье человека. 4. Разработайте проект по очистке сточных вод от ионов свинца, используя доступные материалы и оборудование имеющиеся в школьной лаборатории.
	Описание задания	Задача описывает проблему загрязнения сточных вод ионами тяжелых металлов и требует применения знаний о ионных реакциях.
	Критерии оценивания	– Правильность составления ионного уравнения. – Полнота и обоснованность объяснения выпадения осадка. – Обоснованность оценки влияния загрязнения на экосистему и здоровье. – Реалистичность и эффективность проекта.
Уровень рассуждений: задачи описывают ситуацию в реальной действительности, но явно не подсказывают область знаний и метод решения. Содержат большое количество избыточной информации, актуализирует	Контекстная задача	Задача 3. В городе Алматы участились случаи отравления угарным газом. Городская администрация провела анализ воздуха и обнаружила повышенное содержание оксида углерода (II). Основным источником загрязнения являются автомобили, работающие на бензине. <i>Задания:</i> 1. Опишите процесс горения бензина (основной компонент - октан, C_8H_{18}) в условиях недостатка кислорода. Составьте соответствующее химическое уравнение. 2. Предложите меры по снижению выбросов угарного газа в атмосферу. Обоснуйте свой ответ с точки зрения химии.

умения пользоваться и другими источниками информации		3. Оцените, как загрязнение воздуха может повлиять на здоровье жителей города и окружающую среду.
	Описание задания	Задача описывает реальную проблему загрязнения воздуха, требующую анализа причин, последствий и поиска решений.
	Критерии оценивания	– Полнота и обоснованность описания процесса горения – Правильность составления химического уравнения. – Обоснованность предложенных мер по снижению выбросов. – Обоснованность оценки влияния загрязнения на здоровье и окружающую среду.

Для анализа изменений в уровне знаний, учащихся использовались статистические методы,

включая t-критерий Стьюдента. Входные и итоговые результаты оценки работ с применением контекстных задач представлены в таблице 2:

Таблица 2.

Уровень знаний учащихся

Группа	Средний балл (до эксперимента)	Средний балл (после эксперимента)	Прирост (%)
КГ	63.2	68.9	5,7
ЭГ	65.7	79.3	13,6

В контрольной группе наблюдается небольшой прирост уровня знаний – 5,7 %. Это может быть связано с естественным процессом обучения, с влиянием других факторов, не связанных с экспериментом. В экспериментальной группе наблюдается значительный прирост уровня знаний, более чем в два раза превышающий прирост в контрольной группе. Это свидетельствует об эффективности применения контекстных задач на уроках химии для развития функциональной грамотности. Результаты статистического анализа подтверждают, что различия между группами являются статистически значимыми (t-критерий Стьюдента, $p < 0.05$). Это означает, что применение контекстных задач оказало существенное влияние на уровень знаний учащихся. Наблюдения за учебной деятельностью показали, что учащиеся ЭГ продемонстрировали:

- Повышенную мотивацию к изучению химии.
- Более развитые навыки самостоятельного поиска и анализа информации.
- Улучшенные навыки аргументации при объяснении химических явлений.

Подводя итоги, можно отметить что проведенное исследование подтверждает эффективность применения контекстных задач на уроках химии для развития функциональной грамотности учащихся. Данные педагогического эксперимента показали, что систематическое использование контекстных задач способствует значительному повышению уровня знаний учащихся, развитию их критического мышления, аналитических способностей и умений применять химические знания в реальных жизненных ситуациях. В ходе исследования установлено, что контекстные задачи являются эффективным инструментом формирования функциональной грамотности, поскольку они ориентированы на использование знаний в практических и междисциплинарных контекстах. Они позволяют учащимся видеть связь между химией и реальными

жизненными ситуациями, что способствует более глубокому усвоению материала и осознанию его значимости.

Таким образом, внедрение контекстных задач в образовательный процесс целесообразно не только для повышения качества химического образования, но и для формирования ключевых компетенций, необходимых учащимся в современной наукоемкой и технологически развитой среде. Дальнейшие исследования могут быть направлены на разработку системных рекомендаций по интеграции контекстных задач в школьные программы, а также на изучение их влияния на другие аспекты образовательного процесса, включая креативное и проблемно-ориентированное мышление учащихся.

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EXPERIMENTAL PROBLEMS AND THEIR SOLUTION METHODS RECOMMENDED FOR USE IN TEACHING SUBJECTS RELATED TO CHEMICAL KINETICS IN GENERAL SCHOOLS TO STRENGTHEN STUDENTS' PROCEDURAL AND CONCEPTUAL KNOWLEDGE**Nuriyeva M.***Doctoral candidate at Azerbaijan State Pedagogical University (Azerbaijan) <https://orcid.org/0009-0000-7461-9912>***ÜMUMTƏHSİL MƏKTƏBLƏRİNDƏ KİMYƏVİ KİNETİKAYA AİD MÖVZULARIN TƏDRİSİNDƏ ŞAĞİRD LƏRİN PROSEDURAL VƏ KONSEPTUAL BİLİKLƏRİNİN MÖHKƏMLƏNDİRİLMƏSİ ÜÇÜN İSTİFADƏSİ TÖVSIYƏ EDİLƏN EKSPERİMENTAL MƏSƏLƏLƏR VƏ ONLARIN HƏLLİ ÜSULLARI****Nuriyeva M.S.***Doctoral candidate at Azerbaijan State Pedagogical University (Azerbaijan)**<https://orcid.org/0009-0000-7461-9912>**<https://doi.org/10.5281/zenodo.15050892>***Abstract**

Based on our research, we can say that when teaching topics related to chemical kinetics, special attention should be paid by the teacher to properly involving students in the lesson. When we say that students are involved in the lesson, we mean that they are enthusiastic about class activities related to the subject and that they are able to determine the importance of the independent activities they perform in their lives. One of the most important aspects of involving students in the lesson is independent work methods. As a result of implementing independent work methods, students develop procedural, conceptual and metacognitive knowledge. In this case, the student does not give up on the difficulties he encounters when solving the problem set before him and must also explore the aspects of the problem he will solve that are related to his daily life. It is precisely when students understand the importance of topics such as chemical kinetics, which form the basis of chemistry, in daily life, that interest in the subject can be achieved.

Xülasə

Aparadığımız araşdırmalara əsasən deyə bilərik ki, kimyəvi kinetikaya aid mövzuları tədris etdikdə müəllim tərəfindən şagirdlərin dərslə düzgün cəlb olunmasına xüsusi diqqət edilməlidir. Şagirdlərin dərslə cəlb olunması dedikdə, onların mövzu ilə bağlı sinif fəaliyyətlərinə həvəslı olmağı, yerinə yetirdiyi müstəqil fəaliyyətin öz həyatlarında hansı əhəmiyyətə malik olduğunu müəyyənləşdirmək bacarıqlarının formalaşdırılması nəzərdə tutulur. Şagirdlərin dərslə cəlb olunmasının ən mühim istiqamətlərindən biri də müstəqil iş üsullarıdır. Müstəqil iş üsullarının yerinə yetirilməsi nəticəsində şagirdlərdə prosedural, konseptual və metakognitiv biliklərin inkişaf etdirilməsini təmin edən öyrənmə həyata keçirilir. Bu zaman şagird qarşısına qoyulmuş problemi həll edərkən qarşısına çıxan çətinliklərə təslim olmur və həll edəcəyi problemin gündəlik həyatı ilə əlaqəli tərəflərini də araşdırmalı olur. Məhz kimyəvi kinetika kimi kimya fənninin əsasını təşkil edən mövzuların gündəlik həyatda əhəmiyyətini anladıqda şagirdlərdə mövzu ilə bağlı marağın yaranmasına nail olmaq olur.

Keywords: chemical kinetics, chemical equilibrium, procedural knowledge, conceptual knowledge, density, pressure, temperature coefficient

Açar sözlər: kimyəvi kinetika, kimyəvi tarazlıq, prosedural bilik, konseptual bilik, qatılıq, təzyiq, temperatur əmsalı

Kimyəvi kinetikaya aid mövzuların tədrisi prosesində şagirdlərin müstəqil iş üsulları üç qrupa bölünür:

- Kimya eksperimenti
- Dərsləlik və internet resursları üzrə şagirdlərin müstəqil işləri
- Kimyəvi kinetikaya aid məsələ həlli üsulları

Kimyəvi kinetikaya aid eksperimental məsələlərin həlli- problemlı vəziyyətin yaradılması ilə kimyəvi reaksiyaların sürətinə qatılığın, temperaturun təsirini əks etdirən təcrübələrin yerinə yetirilməsi zamanı müəyyən qrafiklərin qurulması və hesablamaların aparılmasını reallaşdıran şagird eksperimentidir. Beləliklə kimyəvi kinetikaya aid məsələləri nəzərdən keçirdikdə aydın olur ki, şagirdlərdə mövzu ilə bağlı tələb olunan bilik, bacarıq və vərdişlərin formalaşdırılması üçün məhz eksperimental məsələlərin həlli üsullarına məktəblərdə

geniş yer verilməlidir. Ümumtəhsil məktəblərində kimyəvi kinetikanın tədrisində istifadəsi tövsiyə edilən məsələlər dörd qrupa bölünür:

- Qarşıya qoyulan suallara cavab tələb edən məsələlər
- Hesablama məsələləri
- Çalışma məsələləri
- Eksperimental məsələlər

Kimyəvi kinetikaya aid mövzuların tədrisində istifadə olunan məsələ suallar və çalışma məsələləri həm sinifdə dərslə zamanı, həm də sinifdən xaric müstəqil tapşırıqların həlli istiqamətində şagirdlərə verilə bilər. Şagirdlərin kimyəvi kinetika ilə bağlı prosedural və konseptual biliklərinin müəyyən edilməsi üçün tətbiqi tövsiyə edilən eksperimental məsələlər iki qrupa bölünür:

- Sırf təcrübə xarakterli eksperimental məsələlər

➤ Hesablama xarakterli eksperimental məsələlər.

Şagirdlərinin kimyəvi reaksiyanın sürəti və kimyəvi tarazlıq mövzusunə aid biliklərinin qiymətləndirilməsi üçün istifadə edilən test nümunələri və onların həlli üsulları

Şagirdlərin biliklərinin kimyəvi reaksiyaların sürəti və kimyəvi tarazlıq mövzusu üzrə qiymətləndirilməsi üçün Dövlət İmtahan Mərkəzi üç tip testdən (sadə; orta; çətin) istifadə edir. Bu tiplərin hər biri relevantlıq dərəcəsinə görə, faktiki material, izahat, ümumiləşdirmə, hesablama, proqnozlaşdırma əsasında tərtib edilir. Biz bu mövzuda sadə test nümunələrindən deyil, orta və çətin test nümunələri verəcəyik.

Məsələ 1. $N_2 + 3H_2 \xrightarrow{t} 2NH_3$ reaksiyasında 2 dəqiqədə 16 mol N_2 sərf olunarsa, reaksiyanın azota, hidrogenə və ammoniyakə görə sürətlərini (mol/l·dəq ilə) hesablayın. Reaksiya gedən qabın həcmi 10 l-dir.

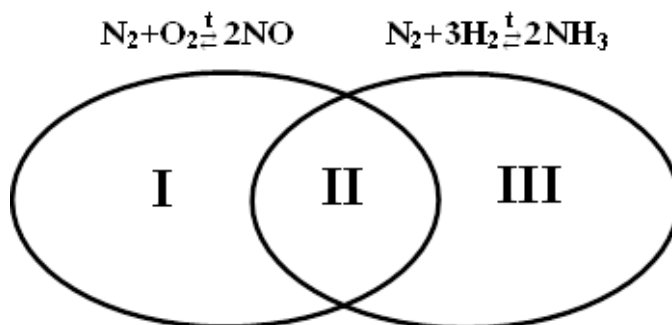
Həlli: Bu test nümunəsi orta dərəcəli, hesablama tiplidir.

$$\vartheta_{N_2} = \frac{v_{N_2}}{V_{qab} \cdot \Delta \tau} = \frac{16}{10 \cdot 2} = 0,8 \text{ mol/l} \cdot \text{dəq}$$

$$\vartheta_{H_2} = 3\vartheta_{N_2} = 0,8 \cdot 3 = 2,4 \text{ mol/l} \cdot \text{dəq}$$

$$\vartheta_{NH_3} = 2\vartheta_{N_2} = 0,8 \cdot 2 = 1,6 \text{ mol/l} \cdot \text{dəq}$$

Məsələ 2. Uyğun olanları Eyler –Venn diaqramında müəyyən edin.



a) Azotun qatılığını 2 dəfə artırıqda reaksiya 2 dəfə sürətlənir.

b) Təzyiqin dəyişməsi tarazlığın yerdəyişməsinə təsir etmir.

c) Təzyiqin 2 dəfə artırılması reaksiyanı 16 dəfə sürətləndirir.

d) Azotun qatılığının artırılması tarazlığı sağa yönəldir.

Həlli: Orta çətinlikli testdir, izahat tələb edir.

a) Azotun qatılığını 2 dəfə artırıqda hər iki reaksiyanın sürəti 2 dəfə artır, çünki hər iki reaksiyada azotun əmsalı 1-dir.

b) $N_2 + O_2 \leftrightarrow 2NO$ reaksiyasında təzyiq tarazlığa təsir etmir, çünki, reaksiyaya daxil olan və alınan qazların molları eynidir.

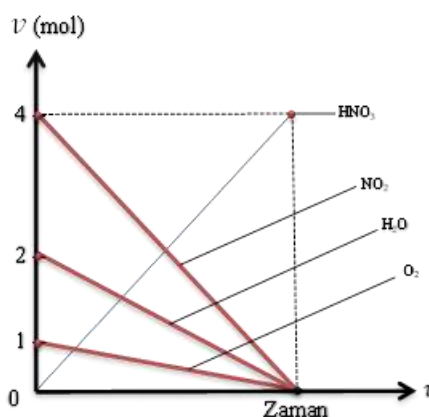
c) Təzyiqi 2 dəfə artırıqda $N_2 + 3H_2 \leftrightarrow 2NH_3$ reaksiyasının sürətini $2 \cdot 2^3 = 16$ dəfə artırır.

d) Hər iki reaksiyada azotun qatılığını artırıqda tarazlıq sağa yerini dəyişir.

I – b; II – a, d; III – c

Məsələ 3

Reaksiyanın kinetik ayrılırlarına əsasən nə doğrudur?



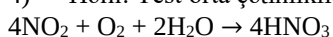
$Ar(H)=1$; $Ar(O)=16$; $Ar(N)=14$

1) Reaksiya axıra qədər getmişdir.

2) Reaksiyaya daxil olan maddələrdə oksigen atomlarının ümumi sayı $12N_A$ -dır.

3) Reaksiyaya daxil olan maddələrin ümumi kütləsi 284 qramdır.

4) Həlli: Test orta çətinliklidir, izahat tiplidir.

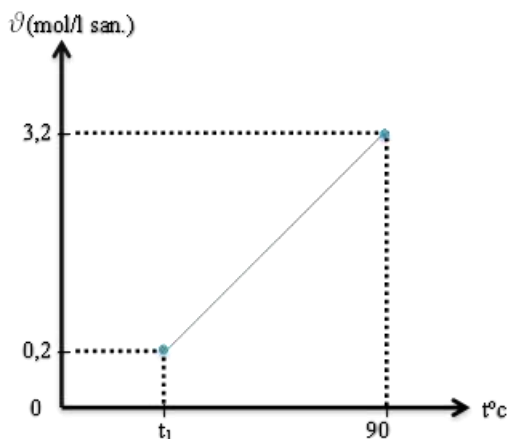


$$4 \cdot 63 = 252 \text{ qr}$$

$$N(O) = 12N_A$$

Başlanğıc maddələrin qatılığı sıfıradək azaldığı üçün reaksiya sonadək getmişdir. Reaksiyaya daxil olan oksigen atomlarının ümumi sayı məhsulda oksigen atomlarının sayına ($12N_A$) bərabərdir. Maddə kütləsinin saxlanması qanununa görə başlanğıc maddələrin kütlələri cəmi, məhsulun kütləsinə (252qr) bərabərdir.

Onda cavab: 1; 2 olur.



Məsələ 4.

Qrafikə əsasən reaksiya sürətinin temperatur əmsalı (γ) 2-yə bərabər olarsa, reaksiyanın ilkin temperaturunu (t_1) hesablayın.

Həlli: Test orta çətinlikli olub hesablama tiplidir.

$$\frac{90-t_1}{10}$$

$$\frac{v_{t_2}}{v_{t_1}} = \frac{3,2}{0,2} = 16 = 2^4$$

$$\text{Onda: } 2^4 = 2^{\frac{90-t_1}{10}}; 4 = \frac{90-t_1}{10}; 40 = 90-t_1; t_1=50$$

Cavab: 50

Məsələ 5.

Reaksiyalar	Reaksiya sürətinin temperatur əmsalı (γ)
I. $X_{(qaz)} + Y_{(qaz)} \leftrightarrow Z_{(qaz)}$	2
II. $T_{(bark)} + 2Y_{(qaz)} \leftrightarrow E_{(bark)}$	4

Hansı hallarda hər iki reaksiya eyni dəfə sürətlənər?

1) Hər iki reaksiyada temperaturu 10°C artırıqda

2) Y-in qatılığını 2 dəfə artırıqda

3) Təzyiqi 2 dəfə artırıqda

4) I reaksiyanın temperaturunu 40°C , II reaksiyanın temperaturunu 20°C artırıqda.

Həlli: Test çətin və ümumiləşdirmə tiplidir.

1) I reaksiya: $\gamma_{10}^{\Delta t} = 2^{\frac{10}{10}} = 2$ dəfə sürətlənir

II reaksiya: $\gamma_{10}^{\Delta t} = 4^{\frac{10}{10}} = 4^1 = 4$ dəfə sürətlənir

2) I reaksiya: Y-in qatılığını 2 dəfə artırıqda reaksiyanın sürəti $2^1 = 2$ dəfə artır.

II reaksiya: Y-in qatılığını 2 dəfə artırıqda reaksiyanın sürəti $2^2 = 4$ dəfə artır.

3) I reaksiya: təzyiqi 2 dəfə artırıqda X və Y-in qatılığı 2 dəfə artır sürət $2 \cdot 2 = 4$ dəfə artır.

II reaksiya: təzyiqi 2 dəfə artırıqda Y-in qatılığı 2 dəfə artır, sürət 4 dəfə artır.

4) I reaksiya: $2^{\frac{40}{10}} = 2^4 = 16$ dəfə artır;

II reaksiya: $4^{\frac{20}{10}} = 4^2 = 16$ dəfə artır

Onda,

Cavab: 3; 4 olur

Məsələ 6.

$N_2 + 3H_2 \xrightarrow{t} 2NH_3$ reaksiyası üçün uyğunluğu müəyyən edin.

1) Hidrogenin qatılığını 2 dəfə artırıqda a) 8 dəfə artar

2) Azotun qatılığını 2 dəfə azaltdıqda b) 2 dəfə artar

3) Azotun qatılığını 8 dəfə artırıb, c) dəyişməz hidrogenin qatılığını 2 dəfə azaltdıqda d) 8 dəfə azalar

e) 2 dəfə azalar

Həlli: Çətin tipli izahat və proqnoz tələb edən testdir

1) Hidrogenin qatılığını 2 dəfə artırıqda reaksiyanın sürəti $2^3 = 8$ dəfə artır

2) Azotun qatılığını 2 dəfə azaltdıqda reaksiyanın sürəti $\frac{1}{2}$; yəni 2 dəfə artır

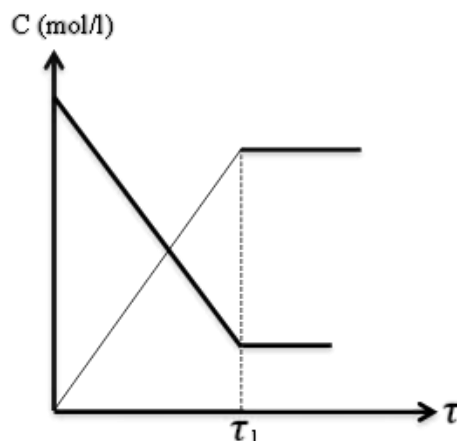
3) Azotun qatılığını 8 dəfə artırıqda sürət 8 dəfə artır, hidrogenin qatılığını isə 2 dəfə azaltdıqda sürət $\frac{1}{2^3} = \frac{1}{8}$; yəni 8 dəfə azalır. Sonda reaksiyanın sürəti

$8 \cdot \frac{1}{2^3} = 1$ olur, yəni dəyişmir.

Onda,

Cavab: 1-a; 2-e; 3-c olur

Məsələ 7.



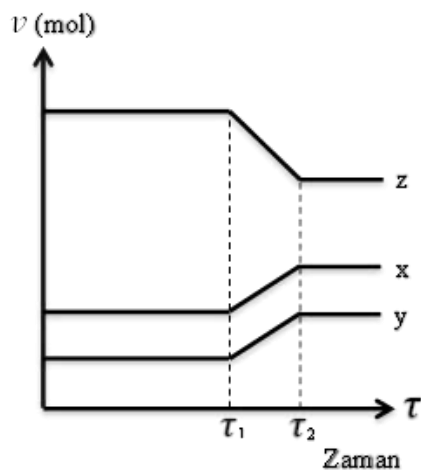
Reaksiyaya daxil olan və alınan maddələrin qatılığının zamandan asılılıq qrafikinə əsasən hansı ifadələr doğrudur?

- 1) Reaksiya axıra qədər gedir
- 2) Dönən reaksiyadır
- 3) τ_1 anından etibarən düzünə və əksinə gedən reaksiyaların sürətləri bərabərdir.

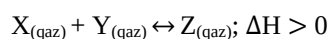
Həlli: Orta çətinlikli, izahat tipli testdir.

Əgər başlanğıc maddənin qatılığı sıfıradək azalmırsa, onda reaksiya dönəndir, sistem tarazlıqdadır ifadəsi doğrudur. Sistem tarazlıqda olduqda düzünə və əksinə reaksiyaların sürətləri bərabər olur.

Onda,
Cavab: 2;3 olur.



Məsələ 8.



Reaksiyasına aid qrafikə əsasən τ_1 zamanınadək reaksiya tarazlıqdadır.

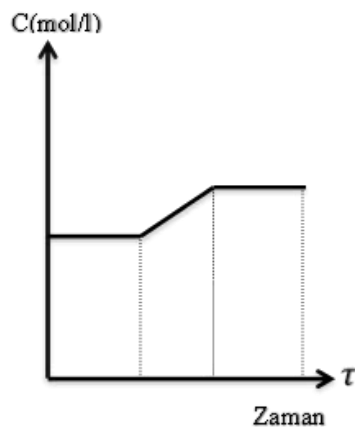
Hansı dəyişiklikləri aparmaq lazımdır ki, τ_2 zamanındakı tarazlıq halı yaransın.

- 1) Sistemin həcmi azaltmaq
 - 2) Temperaturu azaltmaq
 - 3) Sistemə X maddəsini əlavə etmək.
- Həlli: Orta çətinlikli, izahat tipli testdir. $\Delta H > 0$

olduğu üçün reaksiya endotermikdir ($Q < 0$) sistemin həcmi azaldılsa X və Y-in mol miqdarı azalmalı, Z-in mol miqdarı artmalıdır, çünki tarazlıq sağa yönəlir.

Reaksiya endotermik olduğundan temperaturu azaltdıqda tarazlıq sola yönəldiyindən X və Y-in mol miqdarı artır, Z-in mol miqdarı azalır. Sistemə X maddəsi əlavə etdikdə tarazlıq sağa yönəldiyindən Y-in mol miqdarı azalmalıdır.

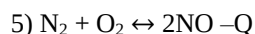
Onda,
Cavab: yalnız 2 olur



Məsələ 9.

Tarazlıqda olan hansı reaksiyalarda eyni zamanda temperaturun azaldılması və təzyiqin artırılması ilə reaksiya məhsullarının qatılığı qrafikdəki kimi dəyişər?

- 1) $2\text{NO} + \text{O}_2 \leftrightarrow 2\text{NO}_2 + \text{Q}$ 2) $\text{H}_2 + \text{Cl}_2 \leftrightarrow 2\text{HCl} + \text{Q}$
 3) $2\text{SO}_3(\text{qaz}) \leftrightarrow 2\text{SO}_2 + \text{O}_2 + \text{Q}$ 4) $\text{N}_2 + 3\text{H}_2 \leftrightarrow 2\text{NH}_3 + \text{Q}$



Həlli: Orta çətinlikli faktiki materiala əsaslanan testdir.

Temperatur azaldıqca, tarazlıq sağa məhsula doğru yerini dəyişirsə, deməli ekzotermik reaksiyadır. Təzyiq artanda tarazlıq sağa yerini dəyişirsə deməli, tənliyin sol tərəfindəki qazların mollar cəmi, sağ tərəfindəkindən çox olmalıdır. Onda,

Cavab: 1; 4 olur.

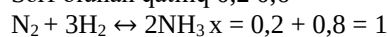
Məsələ 10.

Reaksiya $\text{N}_2 + 3\text{H}_2 \leftrightarrow 2\text{NH}_3$			
Maddələr	N_2	H_2	NH_3
Tarazlıq qatılıqları (mol/l)	0,8	0,4	0,4
Başlanğıc qatılıqları (mol/l)	X	Y	0

X və Y-i müəyyən edin.

Həlli: Çətin hesablama tipli testdir. Aşağıdakı formada sxem qurulur, məhsulun tarazlıq qatılığı formulunun üzərində yazılır və bunun əsasında başlanğıc maddələrin sərf olunan qatılığı müəyyən edilir. Hər bir maddənin sərf olunan qatılığı ilə tarazlıq qatılığının cəmi başlanğıc qatılığına bərabərdir.

Sərf olunan qatılıq 0,2 0,6 0,4



Başlanğıc qatılıq x y 0 y = 0,6 + 0,4 = 1

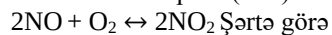
Tarazlıq qatılığı 0,8 0,4 0,4

Məsələ 11. Qapalı qabda 0,6 mol NO və 0,4 mol O_2 qarışdırılaraq reaksiya aparılır. Tarazlıq anında başlanğıc maddələrin molekullarının sayları cəmi reaksiya məhsulunun molekulları sayına bərabər olur. Reaksiyanın tarazlıq sabiti 8-ə bərabərdirsə, reaksiya gedən qabın həcmi hesablayın (litrə).

Həlli: Çətin hesablama tipli testdir.

Məsələ 10-dakı kimi sxem quraq. O_2 -nin sərf olunan mol miqdarını X qəbul edək.

Sərf olunan miqdarı (mol) $2x \times 2x$



Başlanğıc miqdarı (mol) 0,6 0,4 0 0,6 – $2x$ +0,4 – $x = 2x$

Tarazlıq anında (mol) 0,6– $2x$ 0,4– x $2x$ $1 = 5x$;
 $x = 0,2$

Reaksiya gedən qabın həcmində y qəbul edək.

Onda: $2\text{NO} + \text{O}_2 \leftrightarrow 2\text{NO}_2$ Şərtə görə $k = 8$ olduğuna Tarazlıq anında (mol) 0,2 0,2 0,4 görə,

$$\text{Tarazlıq qatılığı (mol/l)} \quad \frac{0,2}{y} \cdot \frac{0,2}{y} \cdot \frac{0,4}{y} \cdot 8 = \frac{\left(\frac{0,4}{y}\right)^2}{\left(\frac{0,2}{y}\right)^2 \cdot \left(\frac{0,2}{y}\right)^2} =$$

$$\frac{0,4^2 \cdot y}{0,2^2 \cdot 0,2} \quad y = 0,4$$

Məsələ 12.

Reaksiya $2\text{SO}_2 + \text{O}_2 \leftrightarrow 2\text{SO}_3$		Tarazlıq sabiti (K)
Maddələr	Tarazlıq qatılıqları (mol/l)	0,5
SO_2	2a	
O_2	A	
SO_3	2a	

Həlli: Çətin hesablama tipli testdir.

Yenə məsələ 10-dakı kimi sxem quraq.

Sərf olunan qatılıq $2\text{SO}_2 + \text{O}_2 \leftrightarrow 2\text{SO}_3$	4	2	4	Şərtə görə $k=0,5$ olduğundan $0,5 = \frac{(2a)^2}{(2a)^2 \cdot a}$; $0,5a = 1$; $a=2$
Başlanğıc qatılıq	x	y	0	a-nın qiymətini yerinə yazaq.
Tarazlıq qatılığı	2a	a	2a	Onda, SO_2 -nin başlanğıc qatılığı
Tarazlıq qatılığı	4	2	4	$x = 8$, O_2 -nin başlanğıc qatılığı $y=4$ olur.

Məsələ 13.

Reaksiya $2\text{CO} + \text{O}_2 \leftrightarrow 2\text{CO}_2$		
Maddələr	Başlanğıc qatılığı (<i>mol/l</i>)	Tarazlıq qatılığı (<i>mol/l</i>)
CO	A	X
O ₂	A	Y
CO ₂	–	Z

Reaksiyada dəm qazının yarısı sərf olunarsa, onda hansı münasibətlər doğrudur?

- 1) $x > y$; 2) $a > z$; 3) $y > z$
4) $y > x$; 5) $n=2y$

Başlanğıc qatılıq a a 0 y =
 $a - 0,25a = 0,75a$
Tarazlıq qatılığı x y z $z = 0,5a$
Cavab: 2) $a > z$; 3) $y > z$; 4) $y > x$

Həlli: Orta çətinlikli hesablama tipli testdir.
Şərtə görə CO-nun sərf olunma qatılığı $a/2 = 0,5a$ olur. Onda;

Sərf olunan qatılıq $0,5a$ $0,25a$ $0,5a$
 $2\text{CO} + \text{O}_2 \leftrightarrow 2\text{CO}_2$ $x = a - 0,5a = 0,5a$

Məsələ 14.

$2\text{X}_2\text{Y}_{(q)} \leftrightarrow 2\text{X}_{2(q)} + \text{Y}_{2(q)}$ reaksiyasında X_2Y -in başlanğıc qatılığı 6mol/l , tarazlıq anında isə qazların ümumi mol miqdarı 8 mol, reaksiya gedən qabın həcmi 1 l olarsa, reaksiyanın tarazlıq sabitini hesablayın.

Həlli: Çətin hesablama tipli testdir.

Sərf olunan qatılıq	2a	2a	a	Şərtə görə, $6 - 2a + 2a + a = 8$
	$2\text{X}_2\text{Y}_{(q)} \leftrightarrow 2\text{X}_{2(q)} + \text{Y}_{2(q)}$			
Başlanğıc qatılıq	6	0	0	$a=2$
Tarazlıq qatılığı	$6 - 2a$	2a	a	$k = \frac{4^2 \cdot 2}{2^2} = 8$
Tarazlıq qatılığı	2	4	2	

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PSYCHOLOGICAL SCIENCES

SOCIAL AND PROFESSIONAL SKILLS: THE HEART OF SUCCESS IN THE WORKPLACE

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COMPETENZE SOCIALI E PROFESSIONALI: IL CUORE DEL SUCCESSO NEL MONDO DEL LAVORO

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Abstract

The evolution of educational and training practices requires a rethinking of didactic and methodological strategies to meet learning needs in the contemporary context. This study explores the integration of active and participatory approaches, enhancing experiential learning and the laboratory dimension. Through an interdisciplinary perspective, innovative pedagogical models are analyzed to foster the development of critical, collaborative, and adaptive skills, which are essential in the knowledge society. A reflection is proposed on the interaction between cognitive processes, transversal skills, and digital tools, emphasizing the role of metacognition and situated learning. The study also considers the impact of emerging technologies and inclusive methodologies to personalize educational pathways and promote the academic success of all students. From a lifelong learning perspective, the importance of continuity between initial training, professional development, and the enhancement of soft skills is highlighted. The findings contribute to the debate on the transformations of teaching, suggesting new trajectories for a more dynamic, effective, and meaningful knowledge-oriented education.

Sinossi

L'evoluzione delle pratiche educative e formative impone un ripensamento delle strategie didattiche e metodologiche per rispondere alle esigenze di apprendimento nel contesto contemporaneo. Questo studio esplora l'integrazione di approcci attivi e partecipativi, valorizzando l'apprendimento esperienziale e la dimensione laboratoriale. Attraverso una prospettiva interdisciplinare, si analizzano modelli pedagogici innovativi che favoriscono lo sviluppo di competenze critiche, collaborative e adattive, essenziali nella società della conoscenza. Viene proposta una riflessione sull'interazione tra processi cognitivi, competenze trasversali e strumenti digitali, sottolineando il ruolo della metacognizione e dell'apprendimento situato. L'indagine considera inoltre l'impatto delle tecnologie emergenti e delle metodologie inclusive per personalizzare i percorsi educativi e promuovere il successo formativo di tutti gli studenti. In un'ottica di lifelong learning, si evidenzia l'importanza della continuità tra formazione iniziale, aggiornamento professionale e sviluppo delle soft skills. I risultati contribuiscono al dibattito sulle trasformazioni della didattica, suggerendo nuove traiettorie per un'educazione più dinamica, efficace e orientata alla costruzione di saperi significativi.

Keywords: professional skills, continuous learning, soft skills, educational innovation, adaptability

Parole chiave: competenze professionali, apprendimento continuo, soft skills, innovazione didattica, adattabilità.

Introduzione

Nel contesto socio-economico contemporaneo, caratterizzato da rapidi mutamenti e crescente complessità organizzativa, il successo professionale non dipende esclusivamente dal possesso di competenze tecniche. La capacità di interagire efficacemente con gli altri, adattarsi a nuovi contesti e risolvere problemi in maniera collaborativa rappresenta un fattore determinante per la crescita individuale e collettiva [Capelli & Tavis, 2016].

Le competenze sociali comprendono la capacità di comunicare, collaborare e interagire con gli altri in diversi contesti. Abilità come l'intelligenza emotiva, la gestione dei conflitti e la leadership consentono di instaurare relazioni positive e produttive [Goleman et al., 2013]. Secondo Boyatzis [1982], la competenza professionale si configura come una combinazione di conoscenze, capacità e atteggiamenti che determinano la performance di un individuo nel proprio ruolo lavorativo.

L'integrazione tra competenze sociali e professionali rappresenta un elemento cruciale per il successo nel mondo del lavoro contemporaneo, caratterizzato da un'elevata complessità organizzativa e dalla necessità di interazioni efficaci tra individui con background e competenze eterogenee. Studi recenti hanno evidenziato che una solida preparazione tecnica, se non accompagnata da un adeguato sviluppo delle competenze socio-relazionali, può risultare insufficiente per affrontare le sfide tipiche dei contesti lavorativi, soprattutto in termini di collaborazione, risoluzione dei conflitti e adattabilità [Robbins & Judge, 2021].

Le competenze sociali, comprendenti abilità quali la comunicazione interpersonale, la leadership, l'empatia e la gestione delle dinamiche di gruppo, giocano un ruolo determinante nella capacità di un individuo di operare efficacemente all'interno di un'organizzazione [Goleman, 1998; Spencer & Spencer, 1993]. La letteratura in ambito psicologico e manageriale sottolinea, infatti, che le competenze tecniche, pur essendo fondamentali per l'esecuzione delle mansioni specifiche, tendono a perdere rilevanza in assenza di capacità trasversali quali il problem solving collaborativo e la negoziazione [Salas, Tannenbaum, Kraiger, & Smith-Jentsch, 2012].

Questa consapevolezza ha radici lontane. Già negli anni '20, gli studi di Elton Mayo condotti presso la Western Electric Company di Hawthorne evidenziarono come fattori sociali e relazionali influenzassero significativamente la produttività e la soddisfazione dei lavoratori [Mayo, 1933]. Negli anni successivi, il concetto di intelligenza sociale, sviluppato da autori come Goleman [2006], ha enfatizzato il ruolo delle competenze emotive e relazionali nella gestione efficace dei rapporti interpersonali. Più recentemente, Mark Granovetter [1973] ha dimostrato l'importanza delle reti sociali e della "forza dei legami deboli" nel facilitare l'accesso a nuove opportunità professionali e nel favorire la crescita della carriera.

Robbins e Judge [2021] evidenziano che una scarsa padronanza delle competenze sociali può limitare significativamente l'efficacia delle competenze tecniche, incidendo negativamente non solo sulle dinamiche di gruppo, ma anche sulla leadership, sulla gestione del cambiamento e sulla capacità di affrontare situazioni complesse e impreviste. Questo aspetto è particolarmente rilevante nei contesti professionali attuali, caratterizzati da team multidisciplinari, modalità di lavoro ibride e una crescente richiesta di flessibilità e intelligenza emotiva [Ashkanasy & Daus, 2005].

In tale prospettiva, la crescente complessità del mercato del lavoro rende essenziale una combinazione equilibrata di competenze tecniche e sociali. Le organizzazioni che promuovono un ambiente di lavoro collaborativo e investono nello sviluppo delle soft skills dei propri dipendenti tendono a registrare livelli più elevati di produttività e innovazione [Salas et al., 2012]. Di conseguenza, lo sviluppo di strategie formative che promuovano l'integrazione tra competenze professionali e sociali diventa una priorità per le istituzioni educative e per le aziende. Approcci basati sull'apprendimento esperienziale, sulla formazione collaborativa e sullo sviluppo della metacognizione sociale si sono dimostrati particolarmente efficaci nel potenziare le

competenze trasversali dei lavoratori, contribuendo a una maggiore produttività e a un miglior clima organizzativo [Kolb, 1984; Bandura, 1977].

Heckman e Kautz (2012) hanno evidenziato come le competenze tecniche, per quanto avanzate e specifiche, non siano di per sé sufficienti a garantire una performance lavorativa efficace e sostenibile nel tempo. Questo concetto è stato ulteriormente approfondito dalla letteratura recente, che sottolinea il ruolo cruciale delle competenze trasversali (soft skills) nel determinare il successo professionale [Deming, 2017; World Economic Forum, 2023].

Le soft skills, tra cui la comunicazione efficace, la capacità di lavorare in team, la gestione del tempo e la risoluzione dei problemi, sono sempre più riconosciute come fattori determinanti per l'occupabilità e la progressione di carriera [Robles, 2012; Carnevale et al., 2020]. L'autoregolazione emotiva e le capacità di leadership sono elementi essenziali per adattarsi ai cambiamenti del mercato del lavoro, caratterizzato da digitalizzazione e automazione [OECD, 2021].

Il valore delle competenze sociali è in costante crescita, Deming [2017] poiché i ruoli lavorativi più richiesti non solo richiedono conoscenze tecniche avanzate, ma anche un'interazione efficace con colleghi e clienti. Un'indagine del World Economic Forum [2023] ha sottolineato che entro il 2025 le competenze cognitive avanzate, la collaborazione e l'intelligenza emotiva saranno tra le qualità più ricercate dai datori di lavoro, accanto alle competenze digitali.

Di conseguenza, la formazione professionale e accademica non può limitarsi a un trasferimento di conoscenze tecniche, ma deve integrare strategie per sviluppare abilità relazionali, incentivando l'apprendimento collaborativo, la comunicazione assertiva e la capacità di adattamento ai contesti lavorativi complessi e in continua evoluzione [Cedefop, 2020].

L'importanza di una formazione equilibrata tra competenze sociali e professionali è confermata dai programmi educativi e formativi a livello internazionale, che pongono sempre più enfasi sullo sviluppo integrato di queste competenze [OECD, 2022].

Competenze Sociali: fondamento delle relazioni efficaci

Le competenze sociali rappresentano un insieme di abilità fondamentali per la gestione delle interazioni interpersonali nei contesti lavorativi e sociali. Esse comprendono la capacità di comunicare in modo efficace, di gestire le emozioni, di collaborare in team e di risolvere i conflitti in maniera costruttiva [Goleman et al., 2013]. La rilevanza di tali competenze, è considerata determinante non solo per il benessere individuale, ma anche per l'efficacia organizzativa e la coesione sociale [Robbins & Judge, 2021].

La comunicazione rappresenta il fondamento delle relazioni interpersonali ed è riconosciuta come una competenza trasversale indispensabile in tutti i settori lavorativi. McCornack e Morrison [2023] evidenziano come una comunicazione efficace vada oltre la semplice trasmissione di informazioni, richiedendo strategie mirate per garantire chiarezza, adattabilità al contesto e ascolto attivo. Questo approccio è particolarmente rilevante nell'attuale panorama professionale,

caratterizzato da interazioni sempre più mediate dalla tecnologia e dalla necessità di coordinamento tra team eterogenei e interculturali [Glick et al., 2022].

La comunicazione non verbale gioca un ruolo altrettanto significativo. Secondo Knapp, Hall e Horgan [2021], il linguaggio del corpo, il contatto visivo, la postura, il tono di voce e l'intonazione influenzano profondamente la percezione del messaggio e le dinamiche relazionali. Un'efficace gestione della comunicazione non verbale può migliorare la fiducia, la persuasione e la cooperazione nei contesti professionali [Burgoon, Guerrero & Floyd, 2022].

In particolare, l'ascolto attivo è emerso come un elemento chiave nella costruzione di relazioni lavorative efficaci. Secondo Weger et al. [2019], l'ascolto attivo non solo favorisce una migliore comprensione del messaggio, ma contribuisce anche a rafforzare il senso di appartenenza e la collaborazione nei team di lavoro. Questo è rilevante in ambienti ad alta complessità comunicativa, come quelli caratterizzati da interazioni virtuali e multiculturali [Derks, Fischer & Bos, 2021].

La crescente digitalizzazione del lavoro ha portato all'emergere di nuove sfide legate alla comunicazione mediata dalla tecnologia, e la mancanza di segnali non verbali nei contesti digitali può compromettere la qualità dell'interazione e aumentare il rischio di incomprensioni [Walther, 2022]. Per questo motivo, sviluppare competenze comunicative efficaci, sia in presenza che a distanza, è diventato un requisito essenziale per i professionisti di qualsiasi settore [World Economic Forum, 2023].

Alla luce di queste evidenze, è fondamentale che i percorsi formativi includano lo sviluppo di competenze comunicative avanzate, promuovendo non solo la capacità di espressione verbale, ma anche l'intelligenza emotiva, l'empatia e la consapevolezza del linguaggio non verbale [Goleman, 2020]. In un mercato del lavoro sempre più dinamico e interconnesso, la capacità di comunicare in modo efficace rappresenta un fattore determinante per il successo professionale e la costruzione di relazioni solide e produttive.

La capacità di integrare e modulare questi elementi riduce il rischio di incomprensioni e migliora l'efficacia comunicativa nei contesti organizzativi.

L'empatia, definita come la capacità di comprendere e condividere le emozioni altrui, è una componente chiave delle competenze sociali. L'empatia gioca un ruolo centrale nelle dinamiche di leadership, nella gestione del personale e nelle interazioni con i clienti [Clark et al., 2022]. In questo contesto, l'intelligenza emotiva, concettualizzata da Salovey e Mayer [1990] e approfondita da Goleman [2013], comprende la consapevolezza e la regolazione delle proprie emozioni, nonché la capacità di interpretare e influenzare quelle degli altri. Un' elevato livello di intelligenza emotiva correlato a una maggiore resilienza, a una leadership più efficace migliora i risultati nei contesti di lavoro collaborativi [Ashkanasy & Dorris, 2017].

Il lavoro di squadra è un elemento imprescindibile nelle organizzazioni moderne, in quanto permette di integrare competenze individuali e di ottimizzare le prestazioni collettive [West, 2021]. Katzenbach e Smith [2020] definiscono il team come un gruppo di individui con obiettivi condivisi, responsabilità

reciproche e un forte senso di appartenenza. I team eterogenei, grazie alla diversità di prospettive e competenze, tendono a raggiungere risultati migliori rispetto ai gruppi omogenei, purché siano presenti meccanismi di coordinazione e fiducia reciproca [Edmondson, 2019]. Affinché la collaborazione risulti efficace, è fondamentale sviluppare competenze quali la gestione delle dinamiche di gruppo, la comunicazione chiara e la costruzione di un clima di fiducia [Salas, Reyes & McDaniel, 2020].

I conflitti sono una componente inevitabile della vita organizzativa e la loro gestione efficace è determinante per il mantenimento di un ambiente lavorativo positivo. Secondo Rahim [2011], le strategie di gestione dei conflitti si articolano in cinque modalità principali: evitamento, accomodamento, competizione, compromesso e collaborazione. Tra queste, la collaborazione è considerata la strategia più efficace, in quanto consente di individuare soluzioni vantaggiose per tutte le parti coinvolte, riducendo il rischio di tensioni future [De Dreu, 2022]. Una gestione efficace dei conflitti si basa sull'ascolto attivo, sulla negoziazione e sulla capacità di mediazione, competenze ritenute essenziali per i leader e per i professionisti che operano in ambienti caratterizzati da elevata complessità relazionale [Jehn & Bendersky, 2020].

Alla luce delle evidenze scientifiche, emerge che lo sviluppo delle competenze sociali è un fattore chiave per il successo individuale e organizzativo. Investire nella formazione e nel potenziamento di queste abilità rappresenta una strategia essenziale per rispondere alle sfide del mondo del lavoro contemporaneo e promuovere relazioni interpersonali più efficaci e costruttive.

Competenze Professionali: il valore aggiunto nel lavoro

Le competenze professionali rappresentano un pilastro essenziale per la performance individuale e collettiva nei contesti lavorativi, poiché combinano abilità tecniche, cognitive e comportamentali necessarie per rispondere alle sfide del mercato del lavoro contemporaneo [Toner, 2011, p. 34]. Lo sviluppo di tali competenze è un processo dinamico che implica sia l'acquisizione di conoscenze specialistiche sia la capacità di adattarsi alle trasformazioni del contesto produttivo e tecnologico [Billett, 2014, p. 217]. In un'economia sempre più globalizzata e digitalizzata, le competenze professionali non solo determinano la produttività individuale, ma rappresentano un vantaggio competitivo per le organizzazioni e per i lavoratori stessi [OECD, 2021, p. 57].

Le competenze tecniche e specialistiche sono fondamentali per operare efficacemente in un determinato settore. Esse vengono acquisite attraverso percorsi formativi formali, esperienze pratiche e aggiornamenti continui [Eraut, 2004, p. 251]. La rapida evoluzione tecnologica ha reso necessaria una costante riqualificazione professionale per far fronte alle nuove richieste del mercato del lavoro [Frey & Osborne, 2017, p. 265]. In particolare, la diffusione dell'intelligenza artificiale e dell'automazione ha evidenziato l'importanza della complementarità tra competenze digitali e capacità di

problem solving avanzato [Brynjolfsson & McAfee, 2014, p. 134].

Tuttavia, le sole competenze tecniche non sono sufficienti: il loro impatto è amplificato dall'integrazione con competenze trasversali come la comunicazione, la gestione del tempo e la capacità di lavorare in team [Tynjälä, 2008, p. 142], la sinergia tra competenze hard e soft aumenta la capacità di innovazione e adattamento nelle organizzazioni [World Economic Forum, 2020, p. 45]. In particolare, la comunicazione efficace risulta cruciale per la condivisione di conoscenze e per il coordinamento delle attività lavorative [Gibson et al., 2019, p. 219].

Il problem solving e il pensiero critico emergono come due delle competenze più richieste nel panorama occupazionale attuale [OECD, 2022, p. 83]. Il problem solving implica la capacità di analizzare problemi complessi e di individuare soluzioni efficaci, mentre il pensiero critico permette di valutare informazioni e processi decisionali in modo sistematico e razionale [Facione, 2011, p. 4]. La ricerca sottolinea come l'adozione di un approccio basato sul problem solving collaborativo migliori la produttività e favorisca l'innovazione nei contesti organizzativi [Jonassen, 2014, p. 78].

L'adattabilità e l'apprendimento continuo costituiscono elementi chiave per la crescita professionale in un mercato del lavoro in continua evoluzione [Illeris, 2018, p. 173]. L'adattabilità si riferisce alla capacità di riorientare strategie e competenze in risposta ai cambiamenti, mentre il lifelong learning implica un impegno costante nello sviluppo professionale e nella riqualificazione [Marsick & Watkins, 2015, p. 142]. Secondo l'UNESCO [2021, p. 19], le società che investono nell'apprendimento continuo migliorano la resilienza del capitale umano e stimolano la crescita economica sostenibile.

Le organizzazioni che promuovono una cultura dell'apprendimento permanente ottengono vantaggi significativi in termini di innovazione e competitività [Senge, 2006, p. 58]. Il modello delle learning organizations, teorizzato da Argyris e Schön [1996, p. 19], sottolinea come la riflessione critica e la sperimentazione pratica favoriscano l'acquisizione di nuove competenze e il miglioramento continuo. In questo contesto, la capacità di adattarsi e di sviluppare nuove competenze rappresenta un fattore chiave per la sostenibilità della carriera professionale e per il successo nel mondo del lavoro contemporaneo [Billett, 2021, p. 102].

L'Equilibrio tra Competenze Sociali e Professionali

Nel contesto lavorativo contemporaneo, l'interazione tra competenze sociali e professionali rappresenta un elemento determinante per la performance individuale e collettiva. Le competenze professionali, intese come il complesso di conoscenze tecniche, metodologiche e operative proprie di una specifica disciplina, costituiscono la base dell'efficacia lavorativa [Eraut, 2004, p. 247]. Tuttavia, le sole competenze tecniche non sono più sufficienti per rispondere alle sfide del mercato globale, caratterizzato da crescente complessità e interconnessione tra le professionalità [OECD,

2021, p. 34]. Parallelamente, le competenze sociali – che includono la capacità di comunicazione, la gestione delle emozioni, il lavoro in team e la risoluzione dei conflitti – si rivelano cruciali per garantire il coordinamento efficace tra individui e gruppi di lavoro [Robbins & Judge, 2019, p. 198].

La letteratura ha evidenziato come l'integrazione tra competenze tecniche e sociali sia un fattore determinante per il successo professionale. Spencer e Spencer [1993, p. 12] sottolineano che le soft skills, lungi dall'essere accessorie, costituiscono un valore aggiunto per i professionisti, influenzando la capacità di adattamento e di innovazione. Heckman e Kautz [2012, p. 451] affermano che queste competenze non sono mutualmente esclusive, ma si rafforzano reciprocamente, creando un profilo professionale più completo e resiliente. Goleman [1995, p. 43], attraverso la teoria dell'intelligenza emotiva, evidenzia come la capacità di comprendere e gestire le proprie emozioni, unitamente alla capacità di interpretare quelle altrui, abbia un impatto diretto sulla produttività e sulla leadership, l'equilibrio tra competenze tecniche e relazionali è essenziale per il benessere organizzativo e la sostenibilità dei modelli di lavoro [Deloitte, 2020, p. 29].

L'importanza di questo equilibrio emerge con particolare evidenza in diversi ambiti professionali. In medicina, ad esempio, la padronanza delle conoscenze cliniche deve essere affiancata da elevate capacità comunicative, fondamentali per la relazione con i pazienti e per la collaborazione interdisciplinare [Salas et al., 2017, p. 30]. Studi empirici dimostrano che medici con scarse competenze relazionali tendono a compromettere il rapporto di fiducia con i pazienti, riducendo l'aderenza alle terapie e, di conseguenza, l'efficacia del trattamento [Travaline et al., 2005, p. 38]. Analogamente, nel settore della leadership e del management, la capacità di elaborare strategie efficaci non può prescindere dalla gestione delle dinamiche di gruppo e dalla motivazione dei collaboratori [Kotter, 1996, p. 112]. Leader capaci di combinare visione strategica e intelligenza emotiva risultano più efficaci nel risolvere conflitti, stimolare l'innovazione e promuovere il coinvolgimento dei dipendenti [Goleman, Boyatzis & McKee, 2013, p. 67].

Anche in ambito educativo, la qualità dell'insegnamento dipende non solo dalla conoscenza disciplinare, ma anche dalla capacità di costruire ambienti di apprendimento motivanti e inclusivi [Hattie, 2009, p. 109]. Darling-Hammond [2000, p. 167] sottolinea che docenti dotati di elevate competenze sociali riescono a migliorare significativamente il rendimento degli studenti, facilitando processi di apprendimento collaborativo e personalizzato. Inoltre, la crescente digitalizzazione e il rapido sviluppo tecnologico hanno trasformato il mondo del lavoro, rendendo necessarie competenze trasversali anche nei settori più tecnici. Ingegneri e informatici, tradizionalmente valutati sulla base delle loro conoscenze specialistiche, devono oggi dimostrare capacità di problem solving, gestione del tempo e collaborazione interdisciplinare per rispondere alle esigenze di un mercato sempre più orientato all'innovazione e all'integrazione tra competenze diverse [OECD, 2019, p. 85].

Alla luce di queste considerazioni, emerge con chiarezza che la valorizzazione congiunta delle competenze sociali e professionali rappresenta un elemento chiave per la competitività individuale e collettiva. L'apprendimento continuo e l'adattabilità diventano dunque fattori imprescindibili per affrontare la complessità del mondo del lavoro contemporaneo, favorendo la crescita professionale e il miglioramento della qualità delle interazioni organizzative [Marsick & Watkins, 2003, p. 134].

Conclusioni

L'integrazione tra competenze sociali e professionali rappresenta un elemento imprescindibile per affrontare le sfide del mondo del lavoro contemporaneo, caratterizzato da trasformazioni tecnologiche e organizzative sempre più rapide [World Economic Forum, 2023, p. 14]. Se da un lato le competenze professionali costituiscono il fondamento della specializzazione tecnica e dell'efficacia operativa, dall'altro le competenze sociali favoriscono la collaborazione, l'adattabilità e la gestione efficace delle dinamiche interpersonali, aspetti essenziali per il successo individuale e collettivo [Robles, 2012, p. 458]. Il valore delle competenze tecniche la combinazione di abilità relazionali e cognitive, favoriscono non solo la produttività, ma anche il benessere organizzativo e la capacità di innovazione [OECD, 2021, p. 63]. In questo scenario, l'apprendimento continuo e l'aggiornamento costante assumono un ruolo centrale, non solo come strumento per mantenere la propria competitività professionale, ma anche come strategia per adattarsi ai cambiamenti strutturali del mercato del lavoro [Cedefop, 2020, p. 32]. Le organizzazioni, pertanto, sono chiamate a promuovere ambienti formativi che incentivino lo sviluppo delle competenze in modo integrato, attraverso programmi di mentoring, pratiche riflessive e percorsi di apprendimento esperienziale [Billett, 2021, p. 78]. Parallelamente, i professionisti devono adottare un approccio proattivo nella costruzione del proprio percorso di crescita, sfruttando le opportunità offerte dalla formazione continua e dal confronto interdisciplinare [Kolb, 2015, p. 95].

Questa prospettiva non solo permette di rispondere in modo efficace alle esigenze del mondo del lavoro, ma contribuisce anche alla creazione di contesti professionali più dinamici, resilienti e orientati all'innovazione, in cui il valore delle competenze risiede non solo nella loro applicazione pratica, ma nella capacità di evolvere e adattarsi alle sfide emergenti [Schwab, 2020, p. 51].

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TECHNICAL SCIENCES

AN INTELLIGENT WEB APPLICATION FOR DRUG INFORMATION RETRIEVAL USING OPTICAL CHARACTER RECOGNITION AND DEEP LEARNING

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Abstract

In a period of swift technological progress, access to accurate pharmaceutical information is similarly significant for healthcare professionals and patients. This paper explores the development of a web application that leverages machine learning, particularly optical character recognition (henceforth, OCR) and deep learning, to provide rapid, reliable access to drug information by scanning medication packaging. The application uses neural network models, which include Convolutional Recurrent Neural Networks (hereafter, CRNN) and ResNet architectures, to improve text recognition accuracy under various conditions, such as different lighting and font styles. Python-based frameworks, namely EasyOCR and PaddleOCR, enabled efficient and thorough text extraction and processing. This system streamlines the typically lengthy process of searching for medications, supporting informed decision-making, and mitigating the risk of errors. Additionally, integrated databases and Flask web development tools ensure a simplified and user-friendly interface. This innovative approach to pharmaceutical information retrieval can greatly improve medication management, patient safety, and the overall efficiency of healthcare delivery.

Keywords: Medicine Information, Optical Character Recognition (OCR), ResNet Model, Convolutional Recurrent Neural Network (CRNN), PaddleOCR / KerasOCR, EasyOCR

Introduction

In today's world, where technology is developing rapidly and the requirements for efficient solutions are constantly increasing, the need for quick and convenient access to pharmaceutical information is also growing. Technological advances, particularly in machine learning and healthcare integration, offer new opportunities to improve access to this information. Applying neural networks to recognize text in images is at the forefront of machine learning. It provides more accurate and reliable identification of drug information, even under different lighting conditions and font styles.

Developing applications that meet the needs of modern society is the key requirement of this era. The development of a web application that allows users to search for information about drugs through photos of their packaging greatly simplifies and speeds up the search process. Healthcare systems around the world are facing the challenge of streamlining increasingly pressured processes and improving patient care, which is why the need for innovative solutions that enhance medication management and safety is becoming increasingly apparent. Traditional methods of accessing

drug information - printed drug instructions or consultations with healthcare professionals - are often time-consuming and burdensome. In this context, the development of a user-friendly application that enables users to get comprehensive details about their medication quickly and accurately through scanning is an important advancement of the times. It is particularly beneficial for those who need rapid identification of pharmaceutical products. In the healthcare context, drug information must be accurate and reliable. The development of robust text recognition models and their integration into the web application following quality standards ensures the reliability of the information provided. Creating a web application that allows users to interact with the system through photos increases user-friendliness, which is particularly relevant in situations where users may have limited medical knowledge, providing a more accessible way to access information.

Furthermore, quick access to drug information through a photo-based web application reduces the need for manual searches, facilitating decision-making for healthcare professionals, pharmacists, and patients.

The work aims to develop a web application to search for information about medicines using a photo of the packaging. The search should be performed using the name recognized from the drug directory photo. To complete the task, it is necessary to use neural networks to recognize the drug's name, analyze the measurements, evaluate the results of the detection and text recognition models, and improve these indicators for both models. The information will be retrieved from the drug directory. For the implementation of the mentioned goal, the following tasks were outlined:

- study existing approaches to solve the problem of text recognition from photos, and conduct comparative analysis;
- search for pre-prepared models for solving a given problem, study their working principles, review articles and scientific publications;
- collecting data to test neural networks, and conducting experiments to identify the best models;
- conducting experiments, developing, finalizing, and improving models.

Literature review

In recent years, rapid advancements in information technology have made significant impacts on healthcare, particularly regarding access to reliable data. Digital platforms have become essential for managing vast volumes of information in healthcare. Studies show that these platforms increase accuracy in diagnosis and treatment, allowing healthcare providers and patients alike to access medical information promptly. The manuscript indicates that machine learning-enabled applications are crucial to improving service efficiency and reducing human error, particularly in medication management.

In "Information and Access to Health Care: Is There a Role for Trust?" Michael Thiede examines the crucial role trust plays in healthcare access and the exchange of information between patients and providers (Thiede, 2005). Thiede argues that trust in healthcare institutions and professionals is fundamental for ensuring that patients seek care and adhere to medical guidance. He discusses how trust affects not only patient behavior but also healthcare outcomes, as individuals are more likely to disclose important health information when assured of confidentiality and competence. The paper highlights disparities in healthcare access, noting that communities with higher trust in healthcare systems generally experience better health outcomes. Thiede ultimately suggests that building trust within healthcare systems may mitigate inequalities in access and enhance the overall effectiveness of healthcare services.

In *Digital Transformation in Healthcare: Technology Acceptance and Its Applications*, authors (Stoumpos et al., 2020) explore how digital transformation is reshaping healthcare through new technologies and changing patient and provider interactions. The authors emphasize the importance of technology acceptance in healthcare settings, noting that user acceptance is critical for successful implementation and patient satisfaction. The study reviews various digital tools, such as electronic health records, telemedicine, and mobile health applications, which have improved accessibility

and efficiency in healthcare delivery. By analyzing factors influencing technology acceptance, including perceived ease of use and trust in digital tools, the authors provide insights into how healthcare providers can encourage digital tool adoption. The editors also highlight the potential for digital transformation to reduce healthcare costs and improve patient outcomes through data-driven, efficient healthcare practices.

Based on Kayethri, Dharunya, and Harini's study on "Recognition Holic - Medicine Detection Using Deep Learning Techniques" highlights the advancement of deep learning applications in healthcare, particularly in medicine detection (Kayethri et al., 2022). Recent developments in neural network architecture have shown promising results in accurately recognizing pharmaceuticals through image data, which the authors leverage by training their model on a wide array of medication images. Previous studies have underscored the limitations of traditional detection methods, such as barcode scanning and manual checking, which can be both time-consuming and prone to error. This paper contributes to the field by proposing a model capable of adapting to various types of medication, ensuring a high level of accuracy and robustness in diverse pharmacy and healthcare settings. The research paper ultimately emphasizes the potential for deep learning to revolutionize medicine recognition, supporting safer and more efficient pharmaceutical management practices.

In the healthcare industry, especially within pharmacies, ensuring accurate prescription dispensing is essential for patient safety. Previous studies have noted that human errors in medication dispensing can lead to severe health complications, emphasizing the need for automated systems to support pharmacists in verifying prescriptions accurately. Advances in deep learning techniques, particularly in image and text recognition, have paved the way for automated verification systems that reduce these errors. Convolutional Neural Networks (henceforward, CNN) are widely used in image classification tasks, as they can learn intricate patterns within image data, making them suitable for recognizing visual features of medication blister packs. Combining CNNs with Histogram of Oriented Gradients (HOG) for feature extraction has shown promising results in pattern recognition, with high accuracy in image classification models. In addition to visual identification, text extraction techniques such as OCR are applied to read imprints on medication packages. Studies have demonstrated that methods like Character Region Awareness for Text Detection (CRAFT) and Keras-OCR improve text recognition accuracy, particularly when combined with text correction algorithms. By integrating both image and text classification models, an automatic system can leverage majority voting mechanisms to achieve a balanced, high-confidence outcome in prescription verification. Recent work, including the work by Maitrichit and Hnoohom (2020), indicates that this dual-model approach can achieve over 90% accuracy, effectively identifying and verifying medications. These systems have great potential to enhance patient safety and improve

pharmacy operations by minimizing errors in the prescription dispensing process

According to another study (N. Maitrichit and N. Hnoohom, 2020) in the healthcare industry, especially within pharmacies, ensuring accurate prescription dispensing is essential for patient safety. Previous studies have noted that human errors in medication dispensing can lead to severe health complications, emphasizing the need for automated systems to support pharmacists in verifying prescriptions accurately. Advances in deep learning techniques, particularly in image and text recognition, have paved the way for automated verification systems that reduce these errors. CNN is widely used in image classification tasks, as they can learn intricate patterns within image data, making them suitable for recognizing visual features of medication blister packs. Combining CNNs with HOG for feature extraction has shown promising results in pattern recognition, with high accuracy in image classification models. Besides, text extraction techniques such as OCR are applied to read imprints on medication packages. Studies have demonstrated that methods like CRAFT and Keras-OCR improve text recognition accuracy, particularly when combined with text correction algorithms. By integrating both image and text classification models, an automatic system can leverage majority voting mechanisms to achieve a balanced, high-confidence outcome in prescription verification. Recent research, including the work by Maitrichit and Hnoohom (2020), indicates that this dual-model approach can achieve over 90% accuracy, effectively identifying and verifying medications. These systems have great potential to enhance patient safety and improve pharmacy operations by minimizing errors in the prescription dispensing process.

Automating data-filling processes in web systems has gained traction due to the inefficiency and error-prone nature of manual data entry, particularly when dealing with complex form images. Traditional data uploading methods that require manually inputting form data are not only time-intensive but also increase the risk of inaccuracies, especially when handling similar-looking fields or irrelevant edge content. OCR has become an essential technology for converting images into text, allowing web systems to process and digitize form images more effectively. Nonetheless, OCR alone often struggles to accurately parse complex images due to issues such as overlapping fields or low-quality image components. Recent advancements, like the method proposed by Su, Kang, and Fan (2024), combine OCR with multi-text similarity measures to improve data extraction accuracy in complex forms. Techniques such as the Levenshtein distance metric provide a reliable approach for detecting and correcting OCR output by measuring text similarity, enabling better alignment with intended data fields. Studies indicate that integrating OCR with these text similarity measures can significantly enhance the accuracy of data extraction and field mapping. Practical applications of such hybrid methods in web systems have demonstrated data-filling accuracies exceeding 90% in complex forms. These improvements underscore the potential of combining OCR and advanced text-match-

ing methods to automate data-filling processes efficiently. This research area continues to evolve, providing promising solutions for streamlining data processing in web applications.

With the growing complexity of medication regimens, especially for cancer patients and individuals with multiple comorbidities, the risk of drug-drug interactions (DDIs) has become a critical concern. Traditional methods of identifying contraindications are often manual, time-intensive, and prone to human error. Advances in AI and natural language processing have led to innovative tools designed to automate this process and improve medication safety. OCR is a key technology for reading and digitizing text on medication packaging, enabling automated systems to extract necessary information. Nevertheless, OCR alone may not be sufficient for accurately extracting data from complex images, which is where multi-text similarity techniques, as discussed by Su, Kang, and Fan (2024), provide enhanced precision in identifying relevant text fields. Integrating OCR with multi-text similarity and language models offers a promising solution for accurate data extraction in medication management systems. The MEDIC chatbot, as presented by Kim et al. (2024), uses OCR alongside ChatGPT to identify DDIs, employing the Langchain framework to structure and deliver contextually relevant information. This combination allows MEDIC to recognize drug names from packaging images and provide real-time, concise information on potential contraindications, contributing to safer medication practices. Early studies demonstrate that AI-driven systems like MEDIC are highly accurate and user-friendly, making them valuable tools in clinical and home care settings. These advancements underscore the potential of AI to transform medication management, providing healthcare providers and patients with an efficient means of preventing adverse drug interactions.

To conclude, the reviewed literature underscores the transformative potential of digital technologies in healthcare, particularly in medication management and data processing. The integration of machine learning, OCR, and AI-driven applications has led to significant advancements in error reduction, efficiency, and accessibility. Trust and user acceptance remain fundamental to the success of these systems, as patient engagement and adherence are essential for effective healthcare delivery. Studies consistently show that machine learning, especially deep learning techniques like CNNs combined with OCR and text similarity measures, offers reliable solutions for automated data extraction and medication identification. Recent innovations, such as hybrid systems that integrate image recognition, OCR, and NLP (e.g., the MEDIC chatbot), demonstrate promising results in improving patient safety through efficient drug-drug interaction detection. Collectively, these advancements highlight the growing importance of AI in supporting healthcare providers and patients by ensuring safe, accurate, and accessible medication management, with ongoing analysis aimed at further enhancing these outcomes in clinical and home settings.

In summary, it can be said that currently, machine learning allows us to solve many problems that seemed

unattainable to humanity not so long ago. Solving complex problems thanks to well-known algorithms and models opens many doors to human society, offering people to make their lives easier. Experience shows that in this rapidly developing period, it is necessary to adapt to new technologies as quickly as possible, so as not to lag behind the rhythm of life and not be afraid of new challenges of science, but to accept challenges with honor and diligently develop with the times. If new technologies are used, considering them as an integral part of our lives, we will obtain unlimited new and useful knowledge from science, and by applying them, we will become more competitive and will not give up our place in technology.

Research Methodology

The research methodology for this study is structured around the design, development, and evaluation of a web application that retrieves drug information using EasyOCR and deep learning techniques. The application consists of three main modules: image acquisition, OCR processing, and deep learning-based information retrieval. Users upload or capture images of drug labels, packaging, or prescriptions, which are then processed through EasyOCR for text extraction. To support this system, a comprehensive dataset of high-quality images of drug packaging and labels was compiled from various sources, including publicly available pharmaceutical databases. Each image was preprocessed to optimize OCR performance, including steps like grayscale conversion, noise reduction, and resizing to meet OCR model requirements.

The EasyOCR tool was selected due to its capacity to handle multiple languages and fonts, which is crucial for recognizing text on diverse drug packaging. For optimal performance, EasyOCR was fine-tuned to recognize specific terms in pharmaceutical labeling, helping improve accuracy in challenging cases like blurry or low-resolution images. After text extraction, the data underwent post-processing, applying regular expressions to correct misrecognized characters and ensure text consistency. The next stage involved designing a deep learning model based on a CNN to analyze and classify the extracted text data. The CNN was trained on a labeled dataset that included relevant drug information, such as drug names, dosages, and usage instructions.

To ensure the model's reliability, the dataset was split into an 80/20 ratio for training and validation. Evaluation metrics, including accuracy, precision, recall, and F1-score, were calculated to measure the

model's performance on validation data. Several hyperparameter tuning techniques were applied, adjusting learning rates, batch sizes, and regularization methods to refine model performance. The application was designed as a microservices architecture, with the OCR and deep learning components deployed as separate services for improved scalability. The front end was built to offer users an intuitive interface where they can easily upload images and view retrieved drug information in real time.

For enhanced usability, error handling mechanisms were implemented to log OCR and classification errors, providing users with options to refine or correct search results. Testing was conducted in multiple phases, starting with functional testing to ensure all core features operated as intended. Performance testing evaluated response times and load handling, especially critical for an application designed for quick information retrieval. A usability test phase was conducted with a small group of users to gather feedback on the interface, ease of use, and system response accuracy. The user feedback was analyzed, and iterative improvements were made to enhance the application's functionality and user experience. Moreover, an accuracy test compared the application's retrieval success rate against existing drug information retrieval systems, demonstrating the efficacy of the OCR and deep learning approach. To support error resolution, logs were maintained to monitor OCR extraction and classification accuracy continually. Regular updates were applied to the OCR and deep learning model as new drug information became available, ensuring the system remained up-to-date with current pharmaceutical data.

EasyOCR is an open-source OCR library that aims to provide an easy-to-use interface for text detection and recognition tasks. EasyOCR is designed to recognize text in images and convert it into machine-readable text. EasyOCR typically uses deep learning models, such as CNN or RNN, to perform text detection and recognition tasks. These models are trained on large datasets of annotated images to learn to accurately detect and recognize text in different environments and languages. EasyOCR, as the name suggests, is a Python package that allows for effortless optical character recognition⁹⁷.

A diverse set of text images is fundamental to getting started with EasyOCR. It helps the OCR system handle a wide range of text styles, fonts, and orientations, increasing the system's overall performance.

⁹⁷ <https://pyimagesearch.com/2020/09/14/getting-started-with-easyocr-for-optical-character-recognition>

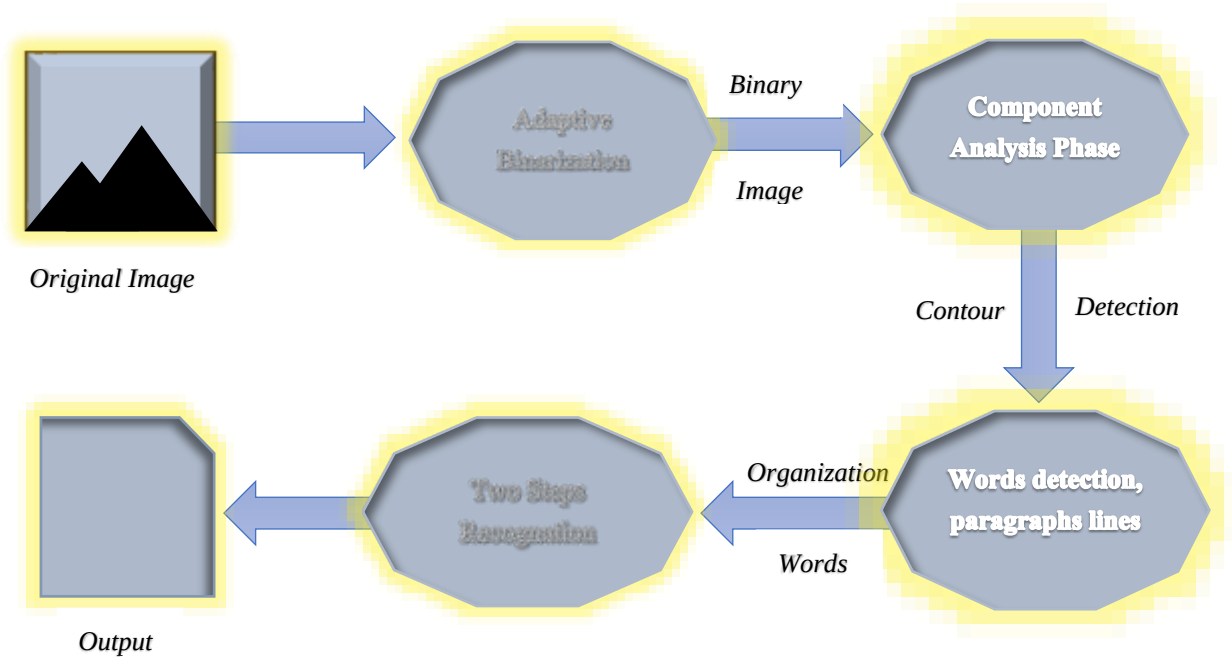


Figure 1: Steps of EasyOCR

Email validation is a method that determines whether an email address is available and valid. This implements a quick process that detects typos, whether they are "accidental" errors or deliberate misdirection. This tool checks email addresses at the point of database entry.

In a nutshell, the research methodology employed in this study successfully integrated image processing, OCR, and deep learning to create an innovative web application for drug information retrieval. The system leveraged EasyOCR for robust text extraction across a diverse range of drug packaging, augmented by preprocessing techniques that optimized OCR accuracy. By training a CNN on a well-curated dataset, the application achieved reliable classification of essential drug information, such as drug names and dosages. Careful dataset splitting, model evaluation, and hyperparameter tuning contributed to a refined, high-performing deep-learning model.

The modular design, encapsulated within a micro-services architecture, allowed for scalable deployment and seamless interaction between OCR and classification components. A user-friendly front end, complemented by thorough error handling and logging mechanisms, provided a reliable and accessible platform for users. Rigorous testing phases, including functional,

performance, and usability assessments, further validated the application's robustness and responsiveness.

Comparative accuracy tests demonstrated the application's efficacy relative to existing drug information retrieval systems, showcasing the potential of integrating OCR and deep learning in the pharmaceutical domain. The methodology also emphasized continual improvement through user feedback analysis and model updates, ensuring long-term relevance and alignment with evolving drug data. Overall, this methodology lays a strong foundation for further advancements in digital health applications and drug information retrieval.

Analysis

In practical scenarios, predefined form templates are frequently used to streamline data collection processes. For instance, standardized templates are commonly employed in activities such as opening a bank account, processing insurance claims, or administering school examinations. These templates maintain consistent field positions and dimensions, enabling predefined formats to guide the data input and recognition process⁹⁸. Since the layout remains uniform, the form structure can be defined beforehand, allowing for direct mapping and recognition of specific fields using the template. The procedure for identifying and matching these fields typically involves the following steps:

⁹⁸ Kumar, P.; Revathy, S. An Automated Invoice Handling Method Using OCR. In Proceedings of the Data Intelligence

and Cognitive Informatics: Proceedings of ICDICI 2020, Tirunelveli, India, 8–9 July 2020; pp. 243–254

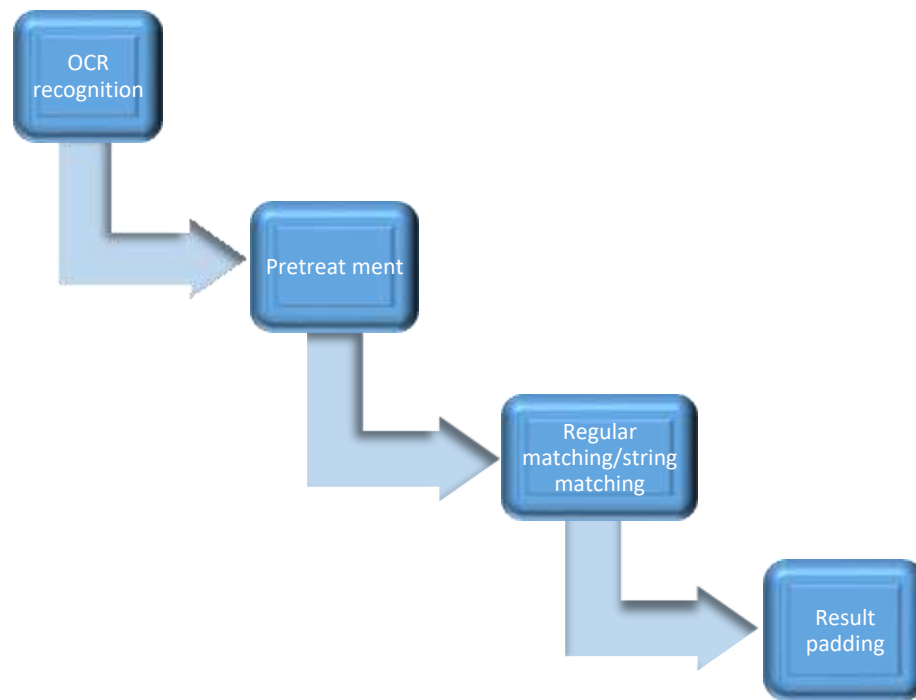


Figure 2. Field matching step diagram

After performing OCR-based image recognition, a set of extracted text data is generated, which includes both task-relevant information and extraneous characters such as spaces and line breaks. To enhance usability, this text data must undergo preprocessing. The preprocessing involves eliminating unnecessary elements like spaces and line breaks, as well as reformatting specially structured data. Importantly, the preprocessing step also preserves the positional information of the corresponding fields, which represents their relative arrangement within the form. This positional data is crucial for understanding the form's structure and context. For tasks involving predefined templates, this approach significantly simplifies the complexity of field matching. By utilizing the predefined field positions, the matching process can be confined to a narrower scope. Since predefined templates often contain fields with

similar structures and attributes, field matching can be efficiently executed on a smaller scale. This process relies on field names defined within the template and employs filtering techniques, such as regular expressions or string-matching algorithms, to locate relevant data.

Experimental Results and Analysis

Based on the existing web system development framework, integrating OCR technology and text similarity algorithms, and improving the similarity comparison process of corresponding fields according to the actual functional needs of the system, we can achieve our proposed goal of automatically filling in images for different frames of data forms on corresponding web pages containing data content. As shown in Figure 4 below, this is the overall structure of the system functions.

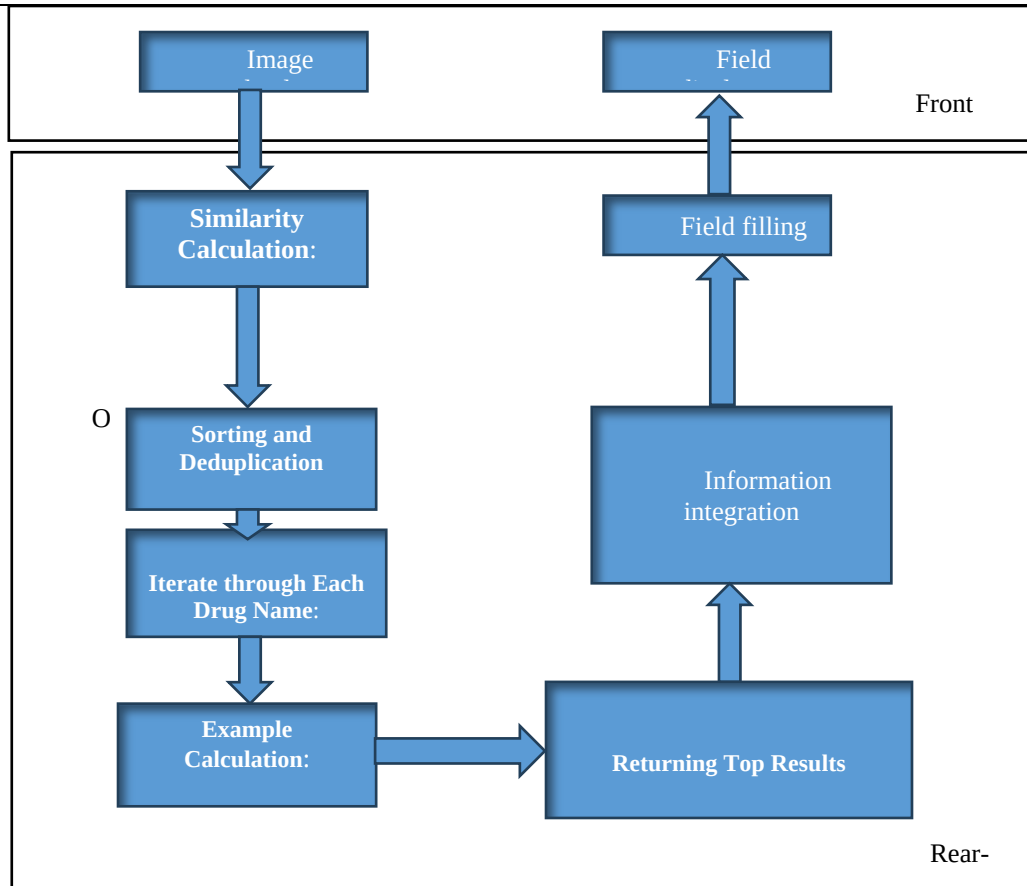


Figure 3. Functional structure diagram.

Let the input image I contain visual information about a drug label (name of the drug, active

1. Similarity Calculation:

For each substring found in the drug_text (e.g., the drug name "**Ibuprofen**", converted to lowercase), the similarity score is calculated as:

$$\text{Similarity Score} = \frac{\text{len}(\text{substring})}{\text{len}(\text{drugname})} \quad (1)$$

This formula gives a ratio of how much of the drug name matches the search text. A longer matching substring relative to the drug name's length will result in a higher similarity score, indicating a closer match.

2. Sorting and Deduplication:

- After calculating similarity scores, the code sorts the matches in descending order based on the similarity score, prioritizing matches with longer substrings within the drug name.

- The code then removes duplicate drug names to avoid listing the same drug multiple times with different substring matches.

Walkthrough

• Iterate through Each Drug Name:

- For the drug name "**Ibuprofen**" in the dataset, all possible substrings are generated and checked against the search text to see if they are present.

- If a substring is found, the similarity score is calculated for that substring using the formula:

$$\text{Similarity Score} = \frac{\text{len}(\text{substring})}{\text{len}(\text{drugname})} \quad (2)$$

• Example Calculation:

- Let's assume the drug name is "**Ibuprofen**" and the search text is "**pro**".

- Substrings of "**Ibuprofen**":

"I", "Ib", "Ibu", "Ibup", "pro", ..., "Ibuprofen"

- When the substring "**pro**" is found in the search text, its similarity score is calculated as:

$$\text{Similarity Score} = \frac{\text{len}(\text{"pro"})}{\text{len}(\text{Ibuprofen})} = \frac{3}{9} = 0.3333(3)$$

• Returning Top Results:

- The code sorts the results by similarity and returns the top 5 unique matches, ensuring the most relevant matches appear at the top.

Summary

The formula:

$$\text{Similarity Score} = \frac{\text{len}(\text{substring})}{\text{len}(\text{drugname})} \quad (4)$$

is used as a similarity measure, making it a proportional score of how much of the drug name matches the search text. In this case, the substring "**pro**" within "**Ibuprofen**" achieves a score of **0.3333**, indicating a partial match. This technique ensures the search effectively identifies relevant drug names using substring matching.

EasyOCR applies image processing and text extraction steps to identify text elements T from I . The extracted text T can be expressed as:

$$T = OCR(I) = CNN(I) \quad (5)$$

where $CNN(I)$ represents the convolutional neural network-based feature extraction within EasyOCR to identify individual characters and sequences in multiple languages and fonts. Let's assume the input image I contains the following details.

The main part of the web application is the section for scanning the medicine box. You need to click the "Open Camera" button and in the opened window, take

a picture of the medicine box by clicking the "Take a photo of the medicine box" button.

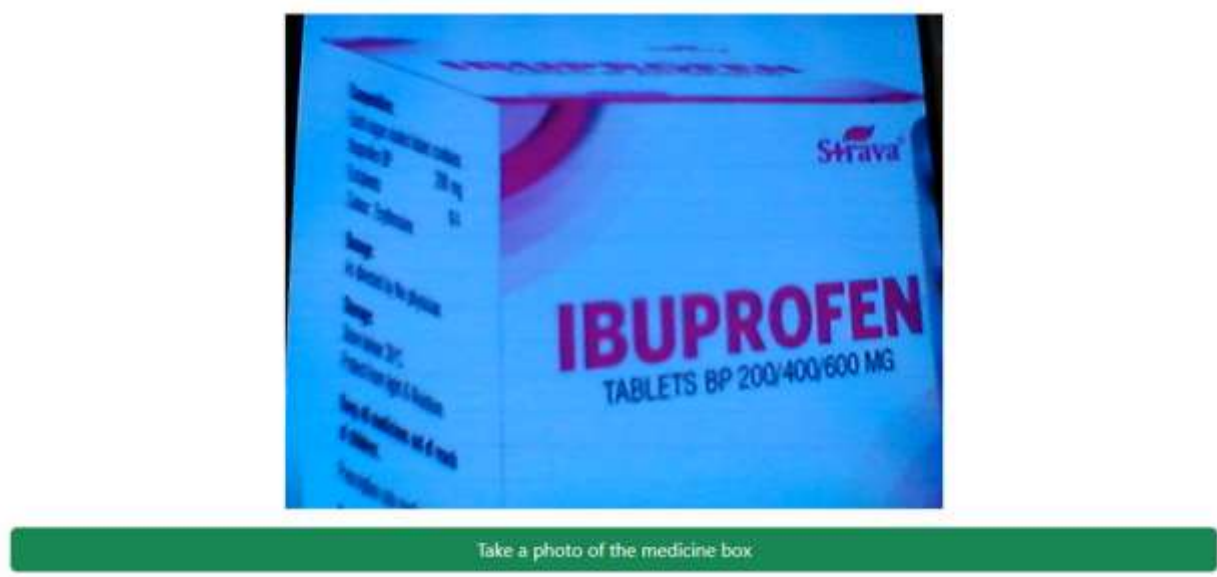


Image1. The scanning of the medicine box

The image I represents the drug label, which EasyOCR will process to extract the necessary text

It contains the following details:

- Name of the drug: Ibuprofen
- Active ingredient of the drug: Ibuprofen
- Form of the drug: Capsule

This process would result in structured data that can be stored or used in an application to display information to the user.

EasyOCR applies its OCR function to identify and extract text elements T from I . Here is how the text extraction process can be expressed:

$$T = OCR(I) = CNN(I) \quad (6)$$

where:

- T is the extracted text, containing the relevant information about the drug label.
- $CNN(I)$ is the convolutional neural network (CNN) model in EasyOCR, which identifies and processes individual characters and text sequences in the image.

Example output T for ibuprofen Label

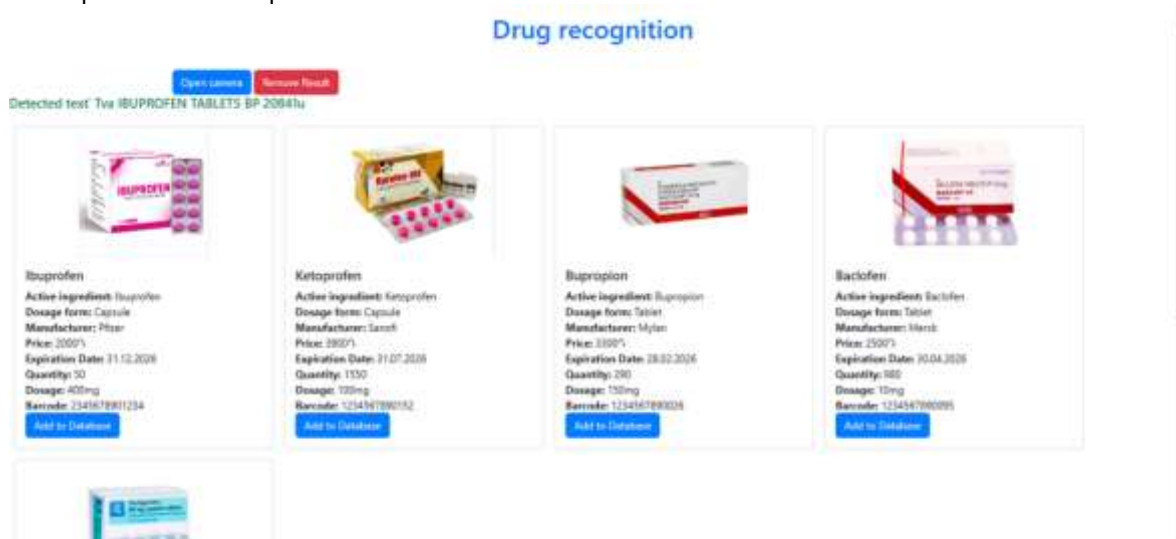


Image2. The scanning of the medicine box

Assuming EasyOCR processes the input image correctly, the output T could be:

$T = \{\text{ibuprofen, capsule, Pfizer, 2000mg, 31.12.2026, 50, 4000G, 2345678901234}\}$

This extracted text can then be further analyzed to categorize details:

Image Preprocessing for Enhanced OCR Accu-

To enhance the OCR accuracy for extracting text from the input image I containing drug information, we apply a series of image preprocessing steps.

The goal is to prepare the image for optimal OCR extraction of specific text elements T from I .

Given the image containing the following text elements:

T
= {ibuprofen , capsule, Pfizer, 2000mg. , 31.12.2026, 50, 4

1. **Grayscale Conversion:** Convert the image to grayscale to improve text contrast by removing color, making it easier to distinguish characters.

$$I_{gray} = \text{Grayscale}(I)$$

2. **Noise Reduction:** Apply filters to reduce background noise, such as shadows or textures, which can interfere with text recognition.

$$I_{clean} = \text{Denoise}(I_{gray})$$

3. **Image Binarization:** Convert the cleaned image to black and white, isolating text from the background by enhancing the contrast between text and non-text areas.

$$I_{binary} = \text{Threshold}(I_{clean})$$

4. **Resizing:** Scale the image to the optimal resolution for OCR processing, ensuring that text size meets OCR model requirements

$$I' = \text{Resize}(I_{binary}, d_w, d_h)$$

Where d_w and d_h are the target dimensions for best OCR results.

5. **Rotation Correction:** If the text is not horizontally aligned, apply a rotation transformation to align it horizontally.

$$I' = \text{Rotate}(I')$$

Segmentation of Text Areas: Isolate each section of text (e.g., "ibuprofen," "capsule," "Pfizer," "2000 AMD/mg," etc.) to help the OCR engine read each part individually and avoid misinterpretation of adjacent text areas. The information content in self-made images includes useful information and irrelevant information. The useful information is further divided into similar field information and dissimilar field information. Our testing dataset contains 203 images.

The evaluation criteria for the sim mentioned above are the final results obtained through multiple experiments. For the evaluation indicators of results, we use the following accuracy formula:

$$P = \frac{TP}{TP+FP} \quad (7)$$

For the accuracy of the final filling of an image, we divide the number of correctly filled fields (TP) by the number of fields it fills (TP + FP).

$$\text{Top-1 Accuracy} = \frac{\text{Number of correct Top-1 predictions}}{\text{Total number of predictions}} \quad (8)$$

The Top-1 Accuracy calculated on our testing dataset is 94.1%, while the Top-5 Accuracy is 98%. Top-1 accuracy is a metric commonly used to evaluate the performance of classification models. It measures the proportion of instances where the highest probability prediction made by the model (i.e., the top prediction) matches the actual label of the data point. In simpler terms, it's the percentage of times the model's most confident guess is correct.

Top-5 accuracy is another metric used to evaluate the performance of classification models, especially when there are a large number of classes. It measures the proportion of instances where the true label of a data point is among the top five most probable predictions made by the model.

This article focuses on the problem of data uploading and filling in web systems. Based on the existing advanced OCR technology and text similarity algorithms, combined and improved, the goal of filling fields in complex form images was effectively achieved. According to the test results, it was found that the accuracy of image recognition and filling in practical applications can reach over 90%. However, this method also has some limitations, as its proposal is based on practical engineering problems, so the field information considered is also related to this project. If fields need to be changed, they may need to be readjusted. In the future, further optimization can be based on this method, such as considering real-time updates

of database tables corresponding to fields, in order to better adapt to different image forms.

Discussion

Our study highlights how effective OCR and deep learning techniques, especially CNNs, can be in creating a reliable web application for retrieving drug information. The system depicted impressive accuracy, with a Top-1 score of 94.1% and a Top-5 score of 98%. These results underscore how advanced technology can tackle challenges in managing medications and facilitating access to pharmaceutical details. Our research builds on the work of other researchers and moves the field forward. For instance, Maitrichit and Hnoohom (2020) also achieved over 90% accuracy with CNNs and OCR; however, we have taken it a step further. By adding advanced text-matching algorithms, we have made data extraction and field mapping even more precise. Our system also stands out due to the use of Easy-OCR, fine-tuned specifically for pharmaceutical labels, which performs better than traditional methods like manual data entry or barcode scanning.

Comparing our work to the "Recognition Holistic" study by Kayethri et al. (2022), it can be seen that their approach focused on accuracy in medicine detection. We have built on that by ensuring our system works well with a variety of packaging styles, even low-resolution images. This adaptability is thanks to preprocessing steps like noise reduction, grayscale conversion, and rotation correction, which align with Su,

Kang, and Fan's (2024) recommendations on optimizing OCR accuracy for complex tasks. Our web application brings real and unique value. It is simple: take a photo of a drug package, and the app retrieves detailed information in seconds. For users, this means less time searching and fewer chances of medication mistakes. It is a win for patients and healthcare professionals alike. Whether it is verifying prescriptions in a pharmacy or reconciling medications in a hospital, this system streamlines the process and makes it safer.

The app's design also ensures it is scalable and adaptable, which means it can be integrated into various healthcare environments. Besides, since the database can be updated, the system will remain current and reliable over time. Undoubtedly, no system is perfect. One of the main challenges is the need for high-quality images. Blurry or poorly lit photos might not work as well, which could limit the app's usability in some situations. Another hurdle is processing multilingual or heavily stylized fonts, which can be tricky for OCR. And then there is the need to keep the database updated—a critical task to ensure users always receive accurate information. Eventually, the computational demands of the deep learning models may be a barrier for users with less powerful devices.

Enhancing the OCR model to handle multiple languages and improving its ability to process more challenging images are top priorities. Expanding the training dataset to include more packaging styles and resolutions will make the system even more versatile. We are also thrilled about the potential of incorporating Natural Language Processing (NLP) tools. Imagine the app not only identifying medications but also flagging potential drug interactions or contraindications. Collaborations with pharmaceutical companies could help us build an even more comprehensive and reliable database. And by optimizing the app for mobile use, we can make it more accessible to people everywhere.

This work is part of a larger movement to bring digital innovation to healthcare. By using OCR and deep learning, we are making medication management safer, faster, and easier. The app streamlines workflows, reduces errors, and, most importantly, helps protect patients. By continuing to refine and expand this technology, we can make a lasting impact on global health, improving lives and transforming how we manage medications.

Conclusion

In summary, the development of a web application for obtaining drug information represents a significant advancement in pharmaceutical technology with the potential to improve medication management. In this research, various innovative solution frameworks were explored, examining their advantages and challenges. The primary objective of this web application is to provide comprehensive yet accurate and reliable information to every user. Following this, it is equally important to ensure easy access to the process of obtaining information, enabling users to make informed decisions regarding their health.

To organize the smooth operation of the web application, the attachment of the necessary databases plays an important role in the application design. Almost every operation performed in the application is

recorded in tables in the database. Examples include registering, logging in, and adding medications to the web application. An administrator is registered in the application, who can add medicines to the home page of the web application by attaching certain information to them. The information contains comprehensive characteristics of the drug. They are: the name of the drug, the active ingredient contained in the drug, the pharmaceutical company that produces the drug, the average price of the drug in the market, its expiry date, dosage, the barcode of the drug, and the most important point is the description of the drug, what kind of drug it is, for what purpose it is used, with a prescription or without a prescription. is achieved. The information also indicates what diseases it is used for.

After adding this drug in the case of an admin account, he can attach the drug to the base linked to the web application. To have a regular user account, individuals must first register in the web application. Following the sequence of filling in the necessary data, the user can register and then log in. The user can see some medicines on the site. However, if he cannot find the information about the drug from the drug list presented in the web application, he can find the information by using the drug recognition functionality. For this, he merely needs to take a picture of the drug box in the appropriate section, namely "Medicine recognition", in addition to pressing the camera, the "Open camera" button, and then wait for the result. By scanning the medicine box, the system will find the necessary information from the database and display it on the user's device. The user can add the drug he is looking for to the basket in order not to "lose" the drug. If the drug is no longer needed, the user can delete the drug from his cart.

All the mentioned actions, including adding the drug to the cart and later deleting it from there, are recorded in the database in the corresponding table. Those tables, in turn, have key values and are connected by appropriate links. It ensures the smooth operation of the web application.

One of the main goals of this research is to contribute to having an informed society. By providing users with the knowledge, they need to understand and correctly take the medication they are about to use, the web application reduces the risk of medication errors, adverse reactions, and non-adherence. All of this can lead to improved health outcomes, reduced healthcare costs, and a higher quality of life for users. Moreover, the integration of additional features in terms of information, such as touching on the topics most important to users in a web application, is primarily in the interests of the users themselves. By including reliable information and details about sensitive topics, the web application helps increase user awareness and enrich the knowledge base.

While this app offers several benefits to users, it poses just as many challenges from a developer's perspective. One of the primary challenges is the need to ensure the accuracy and reliability of drug information to users. Accepting this challenge with dignity and looking for ways to solve it, reliable sources were the best solution. Examples of reliable sources are pharmaceutical and pharmaceutical companies. After researching and identifying the necessary information, efforts

were made to include it in the drug information retrieval web application. In addition to its innovative functionality, the web application provides ample information.

Considering the needs, wishes, and interests of society, different sections of the website contain equally valuable information. Surveys conducted to understand the public's expectations of the web application were instrumental in the development and design of the web application. Targeting the wants and needs of each survey participant, the web application included several sections containing very different, yet important information. Seeing the need to present such a format, it was considered important to include information from the simplest information to the most sensitive topics.

The public always needs a reliable source of information. Even though, they always tend to take the easy way out and choose shortcuts to achieve their goals. That is why the web application has been designed to be simple enough and easy to use for the user, and at the same time

Comparing the traditional methods of obtaining information about medicines and the advanced solution offered by the web application, we can say that the public, striving to make their daily life even easier, will appreciate this innovative solution and include it in their daily life.

As a result of this research, the set problems were solved and the corresponding expected results were obtained. Therefore, the development of a web application for obtaining information about a drug by scanning its box holds great promise in the process of changing medication management. A web application can have a significant impact on the delivery of health care and improve the well-being of individuals worldwide. Due to further updates of the web application, it is planned to include several more features to diversify and further improve the application.

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MODELS FOR AUTOMATING CI/CD PROCESSES IN RUBY WEB APPLICATION DEVELOPMENT

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Abstract

This paper explores the automation of Continuous Integration/Continuous Delivery (CI/CD) processes in Ruby web application development and its impact on software reliability and delivery speed. It examines modern automation tools such as GitHub Actions, Jenkins, and GitLab CI, focusing on their architectural characteristics, operational principles, and integration capabilities within the Ruby ecosystem. Deployment strategies, including blue-green deployment, rolling deployment, and canary deployment, are analyzed alongside approaches for optimizing CI pipelines, dependency management, and testing. Special attention is given to methods for enhancing fault tolerance, enabling automatic scaling, implementing monitoring solutions, and managing application environments effectively.

Keywords: automation, Continuous Integration/Continuous Delivery (CI/CD), web applications, Ruby, deployment, testing.

Introduction

In modern software development, the rapid evolution of technology has established Continuous Integration and Delivery (CI/CD) automation as an essential component of an efficient and reliable development pipeline. Automated approaches save considerable time-to-market, promote high-quality code, and minimize software failure occurrences. Because of its inherent malleability and versatility, web programs developed with Ruby require a tailor-made model for CI/CD; therefore, it is important for developers to explore relevant automation tools specifically for such programs.

A key field of inquiry in such a model is a comparative evaluation of CI/CD tools, such as GitHub Actions, Jenkins, and GitLab CI, each with its specific integration, testing, and delivery-related features. Comparison of these tools enables a critical evaluation of individual strengths and weaknesses, determination of best use cases, and development of integration approaches for enhancing web application delivery efficiency and dependability. The aim of this article is to conduct a comparative assessment of automation tools, such as GitHub Actions, Jenkins, and GitLab CI, focusing on the development and evaluation of integration and deployment models for Ruby-based web applications.

Main part. The concept of automation of CI/CD processes in web application development and comparative analysis of automation tools

Modern software development practices focus on improving team efficiency, accelerating release cycles, and ensuring software stability. A crucial aspect of this process is the automation of Continuous Integration

(CI) and Continuous Delivery (CD), or in some cases, Continuous Deployment. These methodologies minimize risks associated with code integration, expedite testing, and guarantee seamless application deployment into production environments [1].

The process of automatically validating new changes before merging them into the main branch of a project is a fundamental aspect of **CI**. This is achieved through automated testing, static code analysis, and other verification steps that help detect errors early and prevent regressions. CI also reduces merge conflicts, simplifies project maintenance, and ensures adherence to quality standards. A crucial aspect of CI is its integration with version control systems, which streamlines validation processes and enhances collaboration.

The automation of software releases into production environments is a fundamental aspect of CD. **Continuous Delivery** ensures that software is always in a deployable state, allowing it to be released on demand, while **Continuous Deployment** removes manual intervention by automatically deploying updates after successful testing. These approaches significantly shorten the time between code development and deployment, making them particularly beneficial for web applications requiring frequent updates.

The automation of CI/CD processes in web application development necessitates the selection of an appropriate tool capable of meeting project-specific requirements. Among the most widely adopted solutions are GitHub Actions, Jenkins, and GitLab CI, which provide robust capabilities for automating build, testing, and deployment workflows (fig.1).

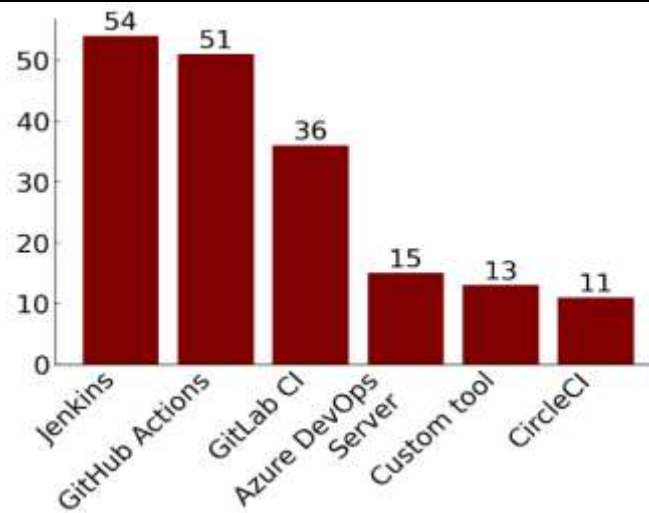


Figure 1. Distribution of regularly used CI systems among worldwide developers in 2023, % [2]

These tools differ in their architecture, functionality, workflow configuration approaches, and integration with various ecosystems, making their comparative evaluation essential for determining the most suitable option for a given development environment. Understanding the characteristics of these technologies enables the identification of their strengths and weaknesses, as well as the determination of the most effective use cases in Ruby web application development.

GitHub Actions is a native automation system integrated into GitHub, allowing developers to create and configure workflows directly within their repositories. Workflows are defined using YAML files, specifying execution triggers, job sequences, and associated actions. One of the primary advantages of GitHub Actions is its deep integration with GitHub, which enables

seamless CI/CD setup without the need for additional servers or complex configurations [3].

GitLab CI is a built-in component of the GitLab platform, providing seamless integration with repositories, task management, and deployment environments. Workflows are defined in a `.gitlab-ci.yml` file, following a structure similar to that of GitHub Actions [4]. However, GitLab CI distinguishes itself through its robust runner management system, which enables efficient allocation of computing resources for executing CI/CD tasks. This feature makes it a highly versatile solution, particularly in enterprise environments where load balancing across multiple deployment environments is essential. In GitLab CI/CD workflow, stages include branch creation, automated testing, review and approval, and deployment to production (fig. 2).

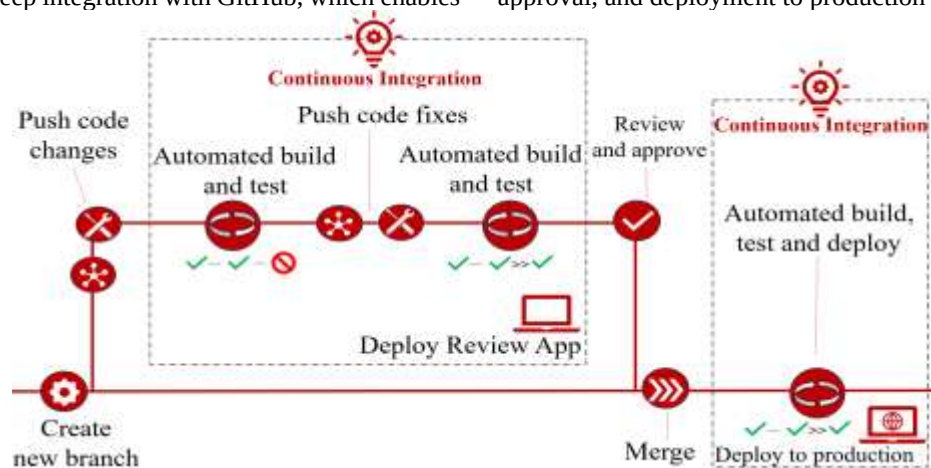


Figure 2. GitLab CI/CD pipeline structure [5]

The image illustrates a GitLab CI/CD pipeline structure, demonstrating the flow of code from development to production. It begins with creating a new branch and pushing code changes, which triggers an automated build and test process as part of continuous integration. If issues are detected, developers push fixes, and after successful testing and approval, the code is merged, leading to automated deployment to production.

Jenkins, in contrast, is a standalone automation server that requires installation and configuration on a

dedicated machine or within a cloud environment. Unlike GitHub Actions, which is tightly integrated with GitHub, Jenkins is version control-agnostic, supporting Git, Subversion, Mercurial, and other repositories. This makes it a highly flexible CI/CD tool, particularly for projects requiring integration with multiple source control systems and deployment environments. However, its setup and maintenance demand considerable effort, particularly in managing dependencies and ensuring server reliability and fault tolerance.

Selecting an appropriate CI/CD tool for Ruby web application development requires careful consideration

of specific requirements related to testing, building, and deployment (table 1).

Table 1.

Analysis of CI/CD tools and supported features [6, 7]

Criterion	GitHub Actions	Jenkins	GitLab CI
Architecture	Integrated into GitHub, serverless.	Self-hosted automation server.	Integrated into GitLab, supports cloud and self-hosted runners.
Configuration approach	YAML-based workflow files stored in the repository.	Declarative and scripted pipelines requiring manual setup.	YAML-based configuration managed within GitLab.
Flexibility	Limited by GitHub's ecosystem, but extensible through actions.	Highly flexible with extensive plugin support	Flexible but tightly coupled with GitLab infrastructure
Scalability	Limited to GitHub-hosted or self-hosted runners.	Scalable with dedicated infrastructure, requires manual optimization.	Scalable with built-in runner management and custom allocation.
Automatic event-based triggering	Yes	Yes (requires webhook configuration)	Yes
Cloud integration	Seamless integration with GitHub Cloud, third-party services supported via actions.	Cloud-agnostic but requires plugins for cloud deployment.	Deep integration with GitLab Cloud and third-party cloud providers.
Prebuilt templates for Ruby applications	Yes (Ruby setup action)	No	Yes

For Ruby web applications, it is pivotal to consider testing requirements, dependency management, and deployment strategies. In smaller projects hosted on GitHub, GitHub Actions can serve as an optimal solution due to its seamless integration and ease of use. For large-scale enterprise projects requiring complex CI/CD workflows, Jenkins remains a powerful tool, offering extensive configurability and scalability. In teams operating within the GitLab ecosystem, GitLab CI provides the most streamlined pipeline management experience. The selection of a CI/CD tool should be based on the specific needs of the project, the availability of administrative resources, and scalability requirements.

Integration and deployment approaches: enhancing reliability and accelerating delivery of Ruby applications

Efficient automation of CI/CD processes in Ruby web application development requires not only selecting the right tools but also implementing effective integration and deployment strategies. With frequent updates, the need for fault tolerance, and the demand for minimal downtime, it is crucial to adopt approaches that ensure stability while streamlining the delivery pipeline.

In Ruby web development, continuous testing and seamless integration of code changes play a pivotal role. Automated testing enables early detection of errors, preventing defects from reaching the production environment. By incorporating robust testing pipelines

into CI/CD workflows, development teams can maintain high code quality, reduce deployment risks, and ensure stable application performance.

A widely adopted approach involves the separate execution of unit tests (RSpec, Minitest), integration tests, and static code analysis (RuboCop, Brakeman). Segmenting tests into independent stages reduces the computational load on the CI system and accelerates error detection. Additionally, dependency caching (Bundler, Yarn, Node.js) is employed to minimize pipeline execution time during subsequent runs.

Efficient CI pipeline performance also necessitates database optimization in the testing environment. Parallel test execution, using the **database_cleaner** gem and multiple worker processes, reduces testing duration. For projects utilizing PostgreSQL or MySQL, employing **database snapshots** instead of executing migrations before each test run is recommended to enhance efficiency and reduce setup time.

Deploying Ruby applications presents obstacles related to dependency management, database migrations, and interactions with web servers like Puma, Unicorn, and Passenger. To mitigate these challenges, several deployment strategies are commonly used: **Blue-Green Deployment**, which maintains two identical environments, applying updates to a standby instance before switching traffic to minimize downtime and simplify rollbacks; **Rolling Deployment**, where updates are gradually distributed across servers to reduce the risk of system-wide failures; and **Canary Deployment**, which initially releases new versions to a small subset

of servers or users to assess potential issues before full-scale deployment [8].

A significant aspect of deployment is database migration management. When using relational databases in Ruby on Rails, it is recommended to separate migration execution from the deployment process to prevent schema inconsistencies during code updates. A common practice involves running migrations as a distinct stage before the primary deployment or leveraging zero-downtime migration techniques, such as those provided by the **strong_migrations** gem. These techniques prevent schema inconsistencies by ensuring that database changes are backward-compatible, avoiding downtime during deployments.

To minimize downtime during the deployment of Ruby web applications, the preboot strategy is widely employed. This approach involves launching a new server process in advance, followed by a smooth traffic switchover, ensuring minimal disruption to users.

The reliability of CI/CD pipelines depends not only on the correctness of automated processes but also on environment management, logging, and production monitoring. For Ruby applications, it is crucial to maintain distinct environments (development, test, staging, production) with isolated configurations. The use of environment variables, like "**dotenv**", Rails credentials, AWS Parameter Store) enables centralized management of sensitive data without exposing it in the codebase, thereby enhancing security and maintainability.

Effective monitoring and logging are critical for failure prevention and rapid incident response. Modern CI/CD pipelines utilize tools such as Prometheus, Grafana, New Relic, and Datadog to enable real-time tracking of performance metrics, server health, and error rates. Centralized logging solutions like Logstash, Fluentd, Loki, and Papertrail enable real-time event analysis for identifying system failures, while automated alerting tools such as PagerDuty, Slack, and OpsGenie provide instant notifications to development and operations teams in the event of critical failures. To ensure high availability, autoscaling and load balancing mechanisms (e.g., NGINX, HAProxy, AWS Elastic Load Balancer) are widely used in Ruby web applications. These techniques allow for dynamic allocation of active servers based on workload fluctuations, which is particularly crucial in cloud environments.

Optimizing CI/CD workflows for Ruby web applications requires a comprehensive approach that includes test acceleration, deployment strategy selection, and effective production environment management [9]. Implementing separate test stages, dependency caching, and parallel task execution reduces pipeline execution time, while deployment strategies such as blue-green, rolling, and canary deployment enhance release reliability and minimize downtime.

Conclusion

Efficient automation of CI/CD processes in Ruby web application development accelerates the release

cycle, enhances software reliability, and minimizes deployment-related risks. Leveraging tools such as GitHub Actions, Jenkins, and GitLab CI enables flexible management of integration and delivery workflows while accounting for project architecture and scalability requirements. The implementation of optimized testing, deployment, and monitoring strategies plays a crucial role in ensuring application stability, reducing the likelihood of errors, and minimizing downtime. Advanced techniques, including parallel task execution, automated scaling, and continuous monitoring, contribute to high fault tolerance and maintain a consistently high standard of software quality throughout the entire development lifecycle.

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