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ARCHEOLOGY

PROMOTION OF THE HISTORICAL AND ARCHITECTURAL MONUMENTS OF THE AKTOBE REGION

Pirimjarov M.
PhD
Aktobe Regional University named after K. Zhubanov Aqtobe, Kazakhstan
DOI: 10.5281/zenodo.20737073

Abstract

After the restoration of architectural monuments, preserving and immortalizing them, as well as introducing tourists to the historical monuments of the region and their history, is considered one of the noble initiatives. Making the natural beauty and historical monuments of the region more attractive to tourists is also important. For example, the archaeological monuments and natural reserves of the Aktobe region can be widely promoted. Promoting the natural and historical sites of the Aktobe region plays a significant role in the development of tourism. There are several remarkable places in this area.

The promotion of natural and historical sites is essential for preserving cultural heritage and developing tourism. In this process, the restoration of historical buildings, the protection of natural beauty, and introducing them to the wider public are among the main tasks. In Kazakhstan, a number of measures are being implemented to promote cultural and historical sites. For instance, historical objects such as the Koblandy Batyr Memorial Complex, the Sulukli Residential Complex, and others are being restored, while efforts are being made to create favorable conditions for tourists. In addition, issues of historical reconstruction are also of great importance.

Keywords: Region, archaeological monuments, preservation of cultural heritage, restoration, reconstruction.

Introduction

Through historical reconstruction of ancient periods, it is possible to preserve cultural heritage and restore its authentic appearance. Historical reconstruction of the Middle Ages is considered an important means of preserving and promoting cultural heritage to the public. This process involves not only the restoration of material monuments, but also the deepening of historical knowledge and the strengthening of cultural identity within society. Historical reconstruction is an activity aimed at recreating the lifestyle, architecture, clothing, weapons, and other cultural aspects of a particular historical period [1].

Table 1.

Promotion of historical sites in the Aktobe region through tourism.

№	Direction	Measures	Timeframe	Responsible persons
1	Marketing	Creation of multilingual (Kazakh, Russian, English) websites and mobile applications for tourist sites.	3 months.	Tourism Department, IT companies.
2	Information	Organizing video productions on the theme “History of Aktobe” and arranging tours with bloggers.	Permanent / Ongoing.	PR agencies, media outlets.
3	Infrastructure	Installing road signs to historical sites and information plaques with QR codes.	6 months.	City administration, transport services.
4	Cultural events	“History and Tourism Week”, traditional customs festival, reconstruction demonstrations.	Throughout the year / Year-round.	Department of Culture, museums.
5	Educational direction	Introducing historical excursion courses for schools and universities.	1st semester.	Year-round.
6	International cooperation	Tour packages with neighboring countries, cooperation with TÜRKSOY and UNESCO.	Throughout the year / Year-round.	Department of International Relations.

For example, it serves to preserve cultural heritage, use it for educational purposes, increase tourism potential, and strengthen national pride and historical consciousness.

Methods of reconstructing the medieval period are carried out through archaeology and scientific research, including the restoration of architecture and traditions based on data obtained from archaeological excavations, as well as 3D visualization and digital technologies for modeling historical buildings in 3D format (for example, mosques and various complexes) [2].

Through VR/AR technologies, virtual tours are created (for example, XR Museum and simulations

based on Unreal Engine), while ethnographic and applied arts are revived by presenting medieval clothing, handicrafts, and customs in a modern form, as well as organizing reconstruction events. Their importance in preserving cultural heritage lies mainly in restoring monuments, collecting information about them, shaping historical consciousness among the younger generation, creating attractive cultural sites for international tourists, and designing recreational areas near these sites. They also contribute to strengthening national branding and are used in the fields of education and museums.

Practical examples of institutions and technologies include: ICOMOS and UNESCO - organizations engaged in the protection of historical heritage at the international level. Technologies they support include GIS (Geographic Information Systems) for mapping historical objects, as well as Omeka, SketchUp, and Blender for creating visualizations, archives, and databases [3].

"Mapping historical objects through GIS geoinformation systems" is a method of using modern technologies for the digitization and visualization of historical and cultural heritage sites. GIS (Geographic Information Systems) refers to a set of technologies that make it possible to analyze, store, and visually present data linked to geographic coordinates [4, 5, 6].

1.Advantages of GIS systems:

the exact location of historical objects can be identified;

it helps in the protection and development of cultural heritage;

it serves as a convenient source of information for users (tourists and researchers);

it is useful in urban planning, archaeological, and restoration studies.

2.Activities carried out through GIS:

entering historical buildings, monuments, and archaeological sites into digital maps;

placing information about the object (name, history, condition, photographs) into the system;

analyzing the condition of objects and developing measures for their protection.

3.Examples of application:

In Kazakhstan, objects such as the Mausoleum of Khoja Ahmed Yasawi, Arystan Bab Mausoleum, and Beket Ata Underground Mosque are managed through GIS technologies.

Digitization of sites included in the UNESCO World Heritage List; identification of historical sites for archaeological research through satellite imagery.

GIS technologies are considered an important tool in the preservation of historical objects and in introducing them to the public. Through these technologies, it becomes possible to preserve cultural heritage and communicate its significance to a wider audience.

The importance of mapping historical objects through GIS geoinformation systems and protecting cultural heritage lies in the fact that cultural heritage represents the historical, national, and spiritual wealth of a people. These objects may be damaged over time by various natural factors and human activities. Therefore, their protection, accurate documentation, and digitization have become urgent tasks. At present, GIS (Geographic Information Systems) plays an important role in this process. Through GIS, historical objects can be mapped using precise coordinates, while information can be collected, analyzed, and managed.

GIS is a set of computer-based technologies that allows the collection, storage, analysis, and visualization of geographically referenced data. Its main functions include:

creating maps based on the exact coordinates of objects;

linking data with environmental information;

monitoring the condition of cultural heritage sites;

serving as a basis for scientific research and decision-making processes [7].

The process of mapping historical objects is carried out in several stages, including:

Data collection: gathering archival documents, historical sources, photographs, and expedition results, as well as compiling a list of historical monuments in the region.

Geolocation identification: determining the exact coordinates of an object using GPS or satellite data; using drones or satellite imagery.

Entering data into the GIS database: creating a database for each object (name, history, type, condition, photographs, etc.); classifying objects into clusters according to their types (architectural, archaeological, natural, religious).

Visualization and analysis: presenting the objects visually through maps; conducting additional analyses (for example, risk level, tourism value, transport routes, etc.).

The importance of GIS technologies in the protection of cultural heritage includes:

A. Protection of vulnerable objects

any changes can be monitored in real time;

enables assessment of the impact of natural disasters, urban development, or construction activities.

B. Scientific research and education

serves as a convenient source of information for researchers, students, and scholars;

allows chronological and geographical analyses based on GIS in the study of cultural heritage.

C. Tourism development

creation of tourist maps;

providing online information about historical objects.

Conclusion

Historical objects in Kazakhstan are being documented through GIS technologies, for example the Mausoleum of Khoja Ahmed Yasawi in Turkistan, the Beket Ata Underground Mosque near Aktau, and the Arystan Bab Mausoleum near Shymkent.

In cooperation with UNESCO, digitization and documentation processes are being carried out according to international standards.

One of the global projects in this field is the Arches Project, which is aimed at documenting cultural heritage objects based on GIS technologies. However, our scientific research focuses on the restoration and graphical reconstruction of historical architectural monuments in the Aktobe region of Western Kazakhstan.

GIS geoinformation systems are considered modern and effective tools for accurately documenting, protecting, and presenting cultural heritage objects to society. With the help of these technologies, historical objects are preserved not only on paper, but also on digital platforms, where they can be analyzed and transmitted to future generations [8].

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ASTRONOMY

A NEW LOOK AT THE VORTEX DYNAMICS OF MATTER IN THE UNIVERSE

Milyuvene V.,
Milyus A.,
IRG "LITAVEM-3",
Milyute E.
IRG "LITAVEM-3", Vilnius, Lithuania
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Abstract

Modern science, at the present stage of civilization's development, describes the origin of the Universe (time and space) as the result of the Big Bang from some super-dense "point" (as a "primeval atom" [1]) approximately 13.7 billion years ago. It is believed that from the moment of this explosion the Universe began to expand, and that later stars, galaxies, nebulae, and planets formed from enormous clouds of intergalactic gas produced by the explosion as a result of their gravitational collapse; all this is considered to be sufficiently well explained by observational facts. Over the past 40 years, more advanced telescopes with greatly enhanced capabilities, as well as other observational instruments placed beyond the Earth's atmosphere, have made it possible to obtain clearer high-resolution images of cosmic objects in various regions of the electromagnetic spectrum. This makes it possible to reconsider the accumulated observational material from a new perspective. Based on the hypothesis proposed and developed by us - that the principal form of existence of matter in the Universe is a liquid, rotating, self-contained spherical vortex, whose internal dynamics are responsible for all types of electromagnetic radiation across different spectral regions [2–4] - we analyzed the accumulated observational material concerning various manifestations of the state of matter in the cosmic space surrounding us. Observational data for 7,835 objects included in the New General Catalogue (NGC), presented on various Internet sites, were reanalyzed.

Keywords: vortex, radiation, vortical state, astrophysics.

1. WHAT DO OBSERVATIONAL FACTS SHOW US?

All observational facts in astronomy are based on the detection of radiation fluxes of different wavelengths emitted by the objects under study. As is well known, the atoms that make up these objects emit light only in an excited state; in a cold state they are incapable of emitting it. Therefore, matter whose atoms are in a cold state - for example, in the form of planets and their satellites - is visible to us only due to reflected or scattered light emitted by other objects. This fact indicates that all the magnificent observable structures of matter in the Universe - such as galaxies, nebulae, stars, and comets - are formed by matter concentrated in compact structures, a portion of whose atoms are in an excited state. At the same time, the luminosity of an object depends on the degree of its excitation, i.e., on its energetic state. Another interesting fact is that all objects in the Universe emit their radiation radially and uniformly in all directions, just as our Sun does. However, even in the case of the Sun, we do not see the rays emitted in planes perpendicular to our line of sight. As a result, we perceive it not as a "hedgehog" radiating light in all directions, but simply as a luminous disk. Its radial emissions can be observed only during an eclipse by the Moon or with the aid of a coronagraph. Likewise, we do not directly observe the radial radiation emitted by other objects in the Universe.

On the other hand, the fact that light from sources located billions of light-years away reaches us indicates that the region of the Universe through which the light from the observed object travels to us is essentially empty; that is, there is no matter capable of absorbing the light. In other words, the deep vacuum between individual objects that concentrate matter is relatively empty and transparent. The best evidence for this comes from data obtained with the Hubble Space Telescope. Orbiting the Earth through outer space, the telescope observes and studies objects that cannot be detected from Earth because of the interfering effects of the atmosphere. During its 19 years of operation, "Hubble" discovered so many new phenomena in the Universe that several thousand scientific articles have already been required merely to describe its observations. One of the most important discoveries is the enormous, almost completely empty region in the constellation Eridanus, detected by the Wilkinson Microwave Anisotropy Probe (WMAP). This "void" contains nothing - not even the relic microwave radiation that is believed to have originated during the earliest stage of the Universe and still exists today, revealing itself through a temperature of approximately 2.7 K [5]. Yet here there is complete zero. Moreover, this "nothingness" extends across a billion light-years. Researchers were astonished, since nothing like this had ever been observed before. These observations challenge many modern concepts concerning the structure of the Universe

Observations show that the bulk of the matter we observe in nature is concentrated in stars, which differ in mass and luminosity and which, in turn, are grouped into galaxies — giant systems of enormous size, mass, and luminosity that also differ significantly from one another. More than two-thirds of the visible mass of the Universe is contained in galaxies, more than 70% of which are spiral galaxies.

However, it is precisely the spiral arms of galaxies that contain an enhanced concentration of diffuse matter composed of ionized and molecular gas filling the interstellar space within them, although the total mass of this diffuse substance is small compared with

the total mass of the stars. At the same time, the galaxies themselves are isolated, compact, and closed systems. The concentration of diffuse matter in the spiral arms of galaxies exceeds the concentration of the cosmic background surrounding the galaxies by several times. Therefore, there are no grounds for claiming that galaxies actively consume the surrounding gas flowing along their arms toward the nucleus and use it as building material. This conclusion coincides with the conclusion reached by Viktor Ambartsumian as early as 1958 in his report on the evolution of galaxies [6–10], presented at the Solvay Conference.

Fig. 1. Appearance of Comet 17P/Holmes, October 2007 [11].

All cosmic objects are isolated from one another. However, luminosity variations are often observed in some cosmic objects (short- and long-period variable stars, Cepheids, novae and supernovae, and comets). The causes that give rise to these variations, as well as the changes occurring in the external appearance of the radiating object, have not yet been sufficiently studied.

On October 23–24, 2007, an astonishing and unprecedented cosmic event occurred in space. **Comet 17P/Holmes**, normally visible only through a telescope and moving quietly along its orbit, suddenly flared up (exploded). Within just a few hours, its brightness first increased by 400,000 times and then by a million times. The causes of this phenomenon remain a mystery.

Another remarkable mystery associated with the comet's explosion is the perfectly symmetrical, spherical shape of the cloud (Fig. 1), which is clearly visible in the image obtained by the Hubble Space Telescope [11]. Astronomers calculated that material was ejected from the comet at a speed of about 2,000 kilometers per hour. According to A. Fitzsimmons, the total volume of material expelled during this outburst reached about 1% of the comet's mass, comparable to a situation in which the Earth suddenly ejected its entire crust into space [12]. At the same time, the expelled matter did not disperse but remained within the comet's gravitational field. The nature of such a highly symmetrical explosion has likewise not yet received an explanation.

The observational data presented above for the comet indicate the nonlocal nature of the process that led to the explosion - the entire nucleus of the comet exploded as a single whole. Contemporary models of cometary nuclei as conglomerates of ice and rock do not provide convincing explanations for the processes that could have caused the explosion of the cometary nucleus.

Even more mysterious is the fact that 17P/Holmes has exploded more than once. It was originally discovered in 1892 by Edwin Holmes following a similar outburst. In December 1892, the comet faded considerably and became observable only through a telescope. By mid-December, its brightness was estimated at about 11m, while the diameter of its coma was 3–4 arcminutes. On January 16, 1893, a powerful flare-up was recorded: the comet again became visible to the naked eye, reaching a reaching an apparent magnitude of 5–6. A bright nucleus of magnitude 7–8m was observed in the comet. In the final days of January, the comet again faded to 11–12m. The comet continued to be observed until April, when it was visible only through large telescopes. However, in February, the Austrian astronomer Johann Holetschek recorded another smaller outburst, during which the comet became visible through a 15-centimeter telescope (9–10m).

The above-mentioned changes in cometary brightness are not isolated cases. The brightness of the short-period **Comet Tuttle-Giacobini-Kresák** suddenly increased by nearly 10 stellar magnitudes (about 10,000 times!) two days before its perihelion passage in 1973. It then gradually decreased over the course of a month, but on July 6, 1973, another powerful outburst occurred. Significant abrupt increases in brightness (approximately 250 times) were also observed for **29P/Schwassmann-Wachmann**. These data indicate not some local process, but rather that the entire nucleus of the comet responded as a single whole. Other phenomena are also observed that are difficult to reconcile with the generally accepted view of cometary nuclei as primordial Solar System material in the form of frozen conglomerates of ice and dust.

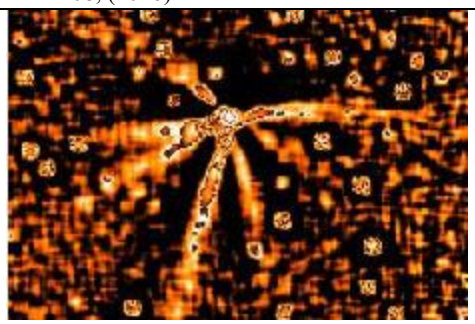

Fig. 2. Comet Hale-Bopp

On the picture it is shown not less 7 jets, owing out from the coma of Comet Hale-Bopp [12].

Thus, **Comet Hale–Bopp** exhibited intense activity even at a great distance from the Sun in the form of numerous jets (or streamers). In the image of the comet (Fig. 2), no fewer than seven jets can be seen being ejected from the comet's coma, and no preferred direction of the eruptive emissions is observed [13].

The nucleus of **Halley**'s Comet, during its perihelion passage in 1986, ejected a dust cloud extending over hundreds of thousands of kilometers.

On March 27, 1996, the X-ray satellite ROSAT unexpectedly detected X-ray radiation emitted by **Comet Hyakutake**.

Images of cometary surfaces obtained in recent years with the aid of spacecraft also do not correspond to the presumed conglomerate of ice and rock. Of the 111.5 square kilometers of the surface area of **Tempel 1**, according to data from Peter Schultz of Brown University, only three regions, with a total area of merely 2.8 hectares, are covered with frozen water mixed with dirt. All the remaining surface is covered by a layer of dust. At the same time, numerous small craters are visible on the comet's surface.

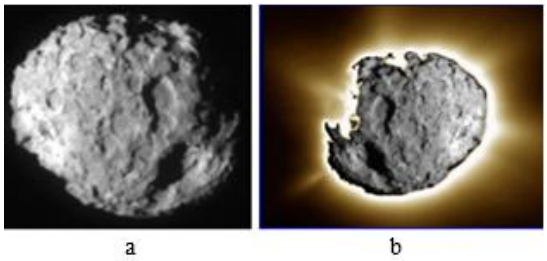

*Fig.3. a) The nucleus of comet **Wild 2** [14]; b) Intense streams of gas and dust surround the nucleus of **81P/Wild 2**, one of the most active bodies in the Solar System [15].*

The first photographs of the surface of **81P/Wild** transmitted by the Stardust reveal an even greater diversity of landscape, showing peaks, depressions, craters of various sizes, and active jets streaming from the surface in different directions [14–16].

Particularly unusual is the fact that the comet possesses virtually none of the small craters observed on **Tempel 1**, while only large craters are present, whose age, according to Donald Brownlee, amounts to several billion years [17].

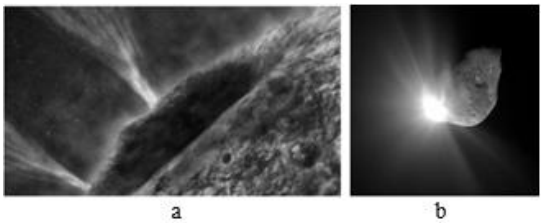

Fig. 4. a) This is an artist's concept depicting a view of comet Wild 2 as seen from NASA's Stardust spacecraft during its flyby of the comet on Jan. 2, 2004 [16]; b) Comet Tempel 1's Electrifying Impact [17].

By examining approximately two dozen dust particles (out of about one million) captured from the comet [18–20], scientists discovered minerals such as olivine, pyroxene, and spinel, which normally form at temperatures exceeding 1000°C and are quite commonly found on Earth among crystals of deep mantle origin.

Changes in the luminosity of comets and supernova explosions, the appearance of expanding spherical shells in planetary nebulae (Figs. 5–6), and the emergence of zones of different luminosity similar to those observed when

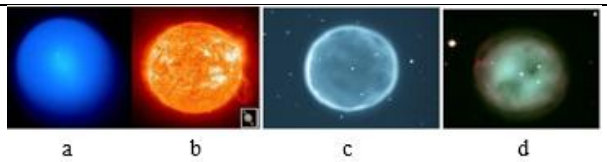

Fig.5. Spherical shapes of outer shells:
a) Comet Holmes [21], b) Sun [22], c) Abell Nebula 39 [23],
d) NGC 3587 M97 Owl Nebula [24].

the potential of a central body changes, leading to the formation of spherical strata of spherical shape (Figs. 7b, c, d), suggest changes in the charge state of the object. As was shown in our works [2–4], the cause of this is a change in the object's rotational velocity about its own axis.

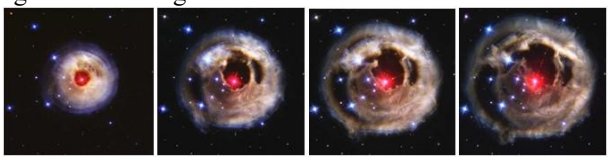

Fig. 6. V838 Monocerotis [25]

The abrupt change in the luminosity of **Comet 17P/Holmes** and the formation around it of spherical zones resembling equipotential surfaces formed around charged bodies indicate the existence of common properties between the matter of the cometary nucleus and the atoms constituting charged bodies at the centers of spherical strata. The observed phenomena make it possible to assume that the basis of the volume of cometary nuclei — as well as of any cosmic objects, including atoms of chemical elements and

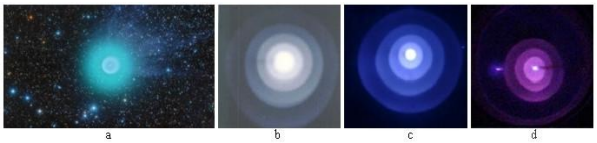

Fig. 7. Spherical forms of shells:
a – Comet Holmes [26], b – d – spherical striations at the central charged body [27]

elementary particles - is a unified liquid, viscous, dense matter forming a self-contained isolated vortex capable of responding sensitively to changes in external conditions created by various cosmic objects. This conclusion corresponds more closely to the observed phenomena than the conventional concept of cometary nuclei as conglomerates of ice and rock.

2. EVOLUTION OF GALAXIES

Fluctuations in luminosity have been observed only in relatively small objects of the Universe. Galaxies are undoubtedly also subject to similar luminosity variations. However, given the billions of years over which galaxies exist, we are unable to detect such changes directly in objects of this scale. Nevertheless, the presence of diffuse envelopes in elliptical galaxies (spherical envelopes in elliptical galaxies of type E) surrounding the central galactic nucleus - which, as studies of various kinds of galaxies show, are present in all galaxy types — indicates that at some time in the past the galactic nucleus underwent strong excitation and, similarly to 17P/Holmes, ejected part of its mass. The excited galactic nucleus, like 17P/Holmes, continued its motion and left the region where

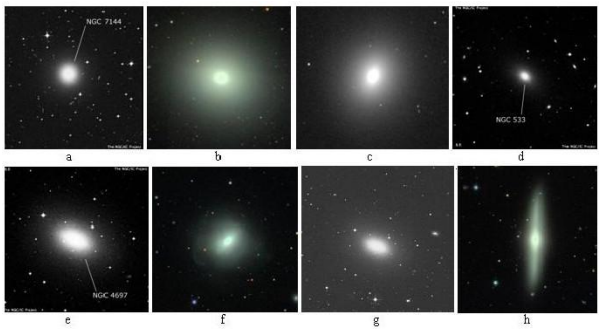

Fig. 8. Stages in the transformation of elliptical galaxies during their evolution from E to S0:
a - NGC 7144 [28]; b - NGC 3379 E1 [29]; c - NGC 221 E2 [30]; d - NGC 533 E3 [31]; e - NGC 4697 E4 [32];
f - NGC 584 E5 [33]; g - NGC 3610 E6 [34]; h - NGC 4026 S0 [35].

the excitation had occurred. Subsequently, lacking an external energy supply to maintain its excited state, the galaxy began to evolve, which was reflected primarily in changes in its external appearance. In order to conserve its acquired angular momentum, the galaxy

began to elongate along its axis of rotation while simultaneously increasing its rotational velocity about its own axis. Gradually, it transformed from a spherical form into an elliptical one rotating around its major axis.

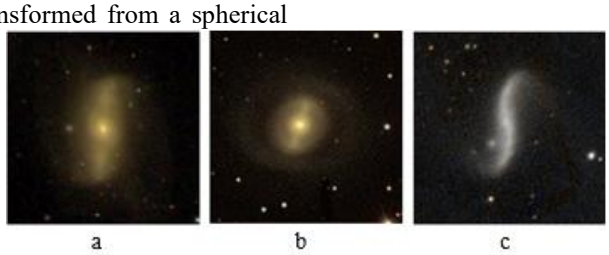

Fig. 9. Formation of polar bars in galactic nuclei: a - NGC 3867 [36]; b - NGC 108 [37]; c - NGC 4572 [38].

Further elongation led, through the stages of morphological transformation noted by Edwin Hubble, from E1 to S0 galaxies (Fig. 8), to the formation of elongated bars at the poles of the rotating central spherical mass (Fig. 9). These bars, as we assume, are continuations of the poles from whose ends the outflow of matter from the nucleus began, creating streams of opposite polarity, similar to the model presented in [3, 39–40] (Fig. 10).

The matter flowing out from the elongated polar bars (Fig. 10b) represents a continuation of two internal axial vortices that form not only the poles but also the central core of the rotating mass of matter, and which possess opposite directions of not only translational but also rotational motion of the matter within them.

In accordance with Helmholtz's second law, these ends of the vortex tend to reconnect with the nucleus that emitted them (Figs. 11, 12). The figures show different stages of the outflow of matter from the polar bars.

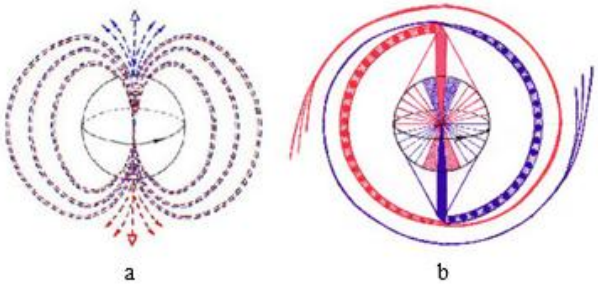

Fig. 10. a) A model of formation of streams of liquid in rotating liquid spherical vortex, stipulated the appearance of poles and magnetic force lines [3]; b) A model of appearance of bulge, bars - poles and arms with different directions of rotation. (Milyuvene, etc, the given work, 2008 [3, 39, 40, 91]).

The appearance of bars in the central nuclei of galaxies, in turn, indicates the high viscosity of the matter composing galactic nuclei, as a result of which they are unable to rapidly shed matter in the equatorial region in order to slow their increasingly rapid rotation. This, in turn, casts doubt on the

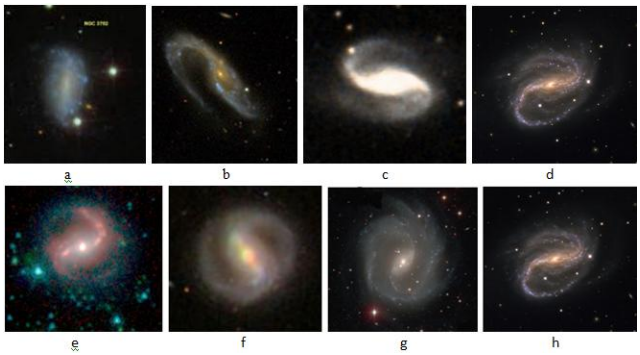

Fig. 11. Different stages of matter ejection from the polar bars of galactic nuclei: a - NGC 3782 SBcd [41]; b - NGC 3509 SBbc [42]; c - NGC 1720 SBab [43]; d - NGC 7479 SBc [44]; e - NGC 6701 SBa [45]; f - NGC 762 SBa [46]; g - NGC 2935 SBb [47]; h - NGC 6782 SBa [48].

possibility of the instantaneous dispersion (within 10-33 seconds) of the matter of the Universe from a single initial point, as proposed by the Big Bang hypothesis [53]. The differing degrees of spread of the spiral arms are apparently related to the rotational velocity of the galactic nucleus itself about its axis.

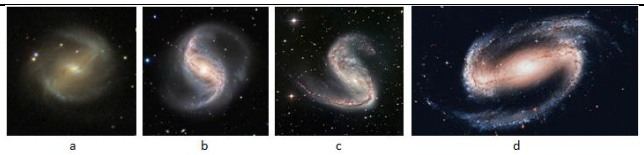

Fig. 12. Patterns of different types of spiral arm development in galaxies:
*a - **NGC 5383 SBb** [49]; b - **NGC 986** [50]; c - **NGC 2442 SBbc** [51]; d - **NGC 1300 SBbc** [52].*

Sometimes the outflowing matter succeeds in reconnecting with the opposite pole. This leads to the formation of ellipsoidal galaxies similar to those shown in Fig. 13.

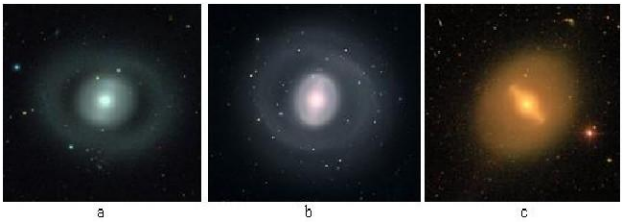

Fig. 13. Closed polar outflows in elliptical galaxies:
a - NGC 2859 SB0-a [54]; b - NGC 1269 SB0-a [55]; c - NGC 4643 SB0-a [56].

In other cases, however, the terminal vortices, due to the high velocities of the matter at their ends, are unable to approach the opposite pole and pass by it. In this way, structures with complex systems of twisted spiral arms are formed in galaxies (Fig. 14).

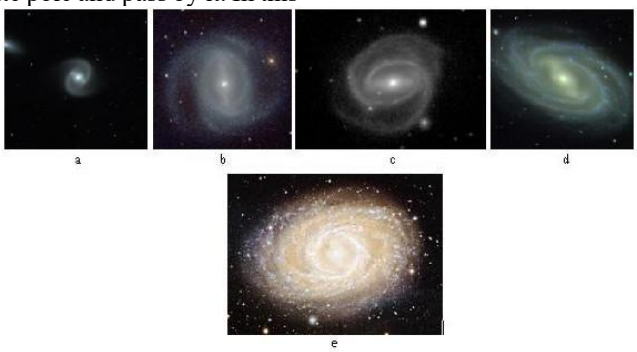

Fig. 14. Different patterns of spiral arm twisting in galaxies:
a - NGC 4440 SBa [57]; b - NGC 1433 SBa [58]; c - NGC 266 SBab [59]; d - NGC 3992 SBbc [60]; e - NGC 3351 M95 SBb [61].

The differing lengths of the spiral arms are apparently determined by the length of time the galaxy remains in such a state. An ellipsoidal region is always observed in the central parts of galaxies.

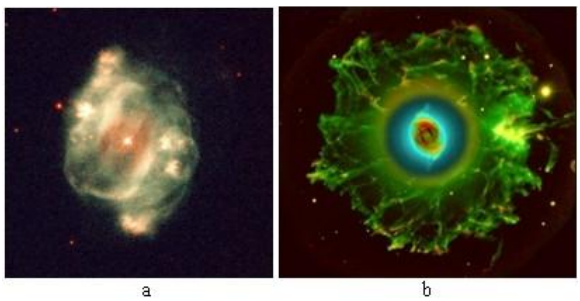

Fig. 15. Polar ejections of matter in planetary nebulae:
*a - **NGC 5307** [62]; b - **NGC 6543** [63].*

An ellipsoidal region with arms from which matter is expelled is observed not only in galaxies but also in planetary nebulae (Fig. 15). This indicates the existence of common laws governing the dynamics of matter in different objects throughout the Universe.

Sometimes the velocities of matter outflow from the polar regions are so high that the spiral arms are unable to reconnect with the nucleus of the galaxy that emitted them. In such cases, they are expelled far into cosmic space (Fig.16). Their superposition with similar outflows from other galaxies forms peculiar streams that become sources of excitation for other objects encountered along their paths — stars, comets, supernovae, variable stars, and even galaxies themselves.

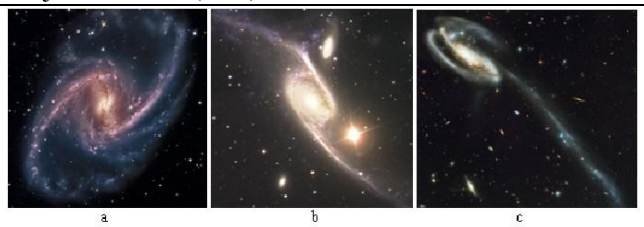

Fig. 16. Formation of elongated outflow arms in galaxies:
a - NGC 1365 [64]; b - NGC 6872 SBb/P [65]; c - UGC 10214 [66].

The outflow of matter from the polar regions is simultaneously accompanied by its dissipation, beginning at the ends of the bars, into smaller individual masses that give rise to all classes of stars observed within the spiral arms (Fig.17).

Fig. 17. Dissipation (decay) of expelled matter into individual stars:
a - NGC 1300 [67]; b - NGC 5194 M51 [68].

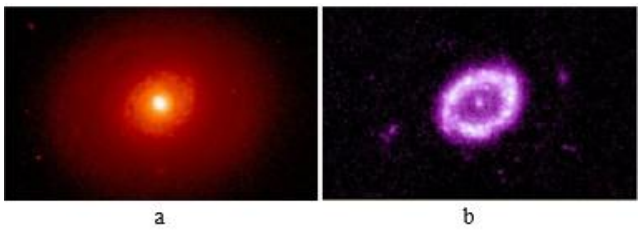

Fig. 18. Patterns of luminosity of matter expelled from galaxies: NGC 4736:
a - NGC 4736 visible region; b - NGC 4736 ultraviolet region [69]

Since the polar outflows simultaneously serve as sources of magnetic field lines [39–40, 91], the penetration of the expelled matter forming stars within the spiral arms by these fields, which carry angular momentum, leads to a greater spin-up of the stars, i.e., to a higher degree of excitation than that observed in the vicinity of the galactic bulge (Fig. 18).

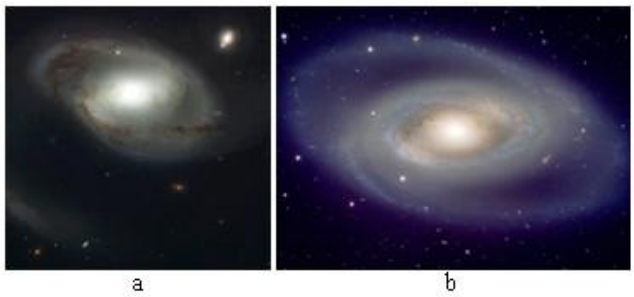

Fig. 19. Appearance of fine diffuse dispersed matter in the spiral arms of galaxies:
a - NGC 4319 SBab [70]: b - NGC 1350 SBab [71].

This, in turn, serves as the cause not only of the enhanced luminosity of stars in the spiral arms and in certain regions of spiral galaxies (Figs. 17, 18), but also of the ejection of matter by these stars, leading to the appearance of diffuse dark dusty matter in these regions of the arms. The expelled mass of the spiral arms expands, forming peculiar “wings” within which the central ellipsoidal bulge appears to be immersed (Fig. 19).

3. MOTION OF MATTER IN THE CENTRAL REGIONS OF GALAXIES AND NEBULAE

The pattern of matter motion within the central ellipsoidal component of massive galaxies is not directly observable. However, an understanding of the mechanism of matter motion within it can be obtained from observations of objects smaller than galaxies – namely, planetary nebulae - that are at similar stages of development. Figures 20 and 21 present examples of elongated planetary nebulae that demonstrate the character of the dispersal of matter ejected by the central excited star during similar stages of evolution. The pattern of

luminosity reflects the distribution of the expelled matter. In turn, the luminous matter, excited by magnetic field lines, reveals the distribution and intensity of the magnetic field lines capable of exciting the expelled matter.

Figure 21 shows the planetary nebulae **NGC 4361** and **Henize 3-1475**, whose polar outflows, similarly to those in spiral galaxies, begin to curve at their ends in order to reconnect with the opposite pole.

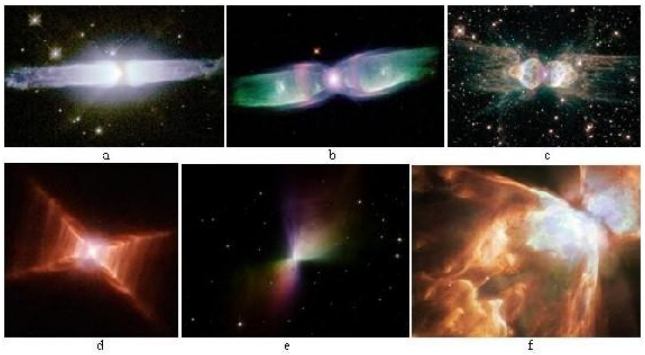

Fig. 20. Patterns of distribution of expelled matter corresponding to the stages of formation of polar bars and cones in various planetary nebulae: a - Henize 3-401 [72]; b - M2-9 Buttery Nebula [73]; c – Mz3 Ant Nebula [74]; d - HD 44179 Red Rectangle [75]; e - Boomerang [76]; f - NGC 6302 [77].

The patterns of matter distribution within the bulge of the ellipsoidal part of galaxies are well illustrated by the structures of expelled matter observed in spherical planetary nebulae. As can be seen in Fig. 22, which presents the

Fig. 21. Patterns of the initial bending of polar outflows in planetary nebulae: a - NGC 4361 [78]; b - Henize 3-1475 [79].

planetary nebulae **NGC 3242, NGC 3918**, and **NGC 7009,** in addition to polar outflows, a spherical component of the bulge is also observed, similar to that seen in elliptical galaxies. The internal structure of the bulge in these images is difficult to interpret because of the presence of dense outer shells; however, it may be assumed that the spherical shape of the central region of the nebula is caused by radial outflows from the nebula's central star.

Radial filaments are also observed in the peripheral regions of most elliptical galaxies. They create a kind of "fluffiness" in their outer zones. The radial component of the bulge is seen much more clearly in spherical planetary nebulae. In most spherical planetary nebulae, the patterns of filament distribution within them are highly complex; however, there are a number of planetary nebulae in which the radial filaments formed by the emitted matter are visible very distinctly.

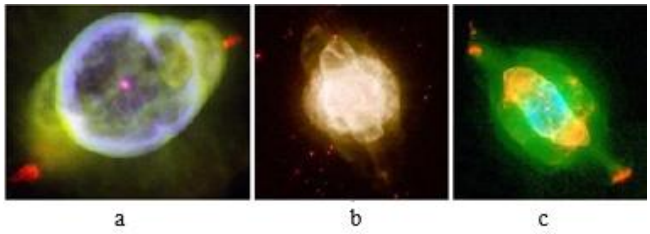

Fig. 22. Spherical component of the bulge in planetary nebulae: a - NGC 3242 Призрак Юпитера [80]; b - NGC 3918 Blue Planetary [81]; c - NGC 7009 Saturn Nebula [82].

Figure 23 presents a series of planetary nebulae in which the presence of radial emission filaments originating from the central star can be clearly observed. In the image of the nebula **NGC 6853**, whose axis of rotation lies in a plane perpendicular to the line of sight, the filaments of radial emissions are visible throughout almost the entire volume except for the polar regions. In the nebula **NGC 6751**, the radial emissions are uniformly distributed throughout the nebular volume, which is probably related to the fact that we observe this nebula from the polar direction. The nebula **NGC 2392** presents a more complex structure; nevertheless, radial emissions can also be observed within it, forming distinct spherical zones.

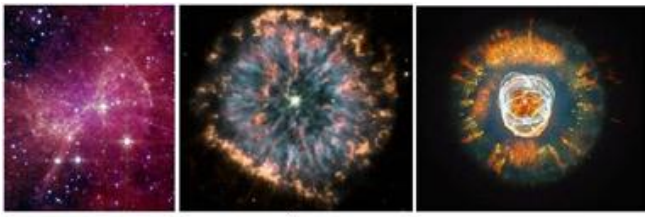

Fig. 23. Patterns of radial emissions in planetary nebulae:
a - NGC 6853 Dumbbell [83]; b - NGC 6751 [84]; c - NGC 2392 Eskimo [85].

The spherical zones and the radial emissions penetrating them are most clearly observed in the nebula **NGC 6543**, commonly known as the **Cat's Eye Nebula** (Fig. 24).

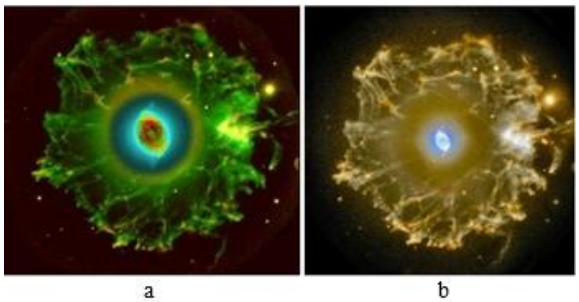

Fig. 24. Halo, spherical zones, and radial emissions in the Cat's Eye Nebula (NGC 6543):
a - NGC 6543 [63]; b - Cat's Eye [86].

The **Cat's Eye Nebula** (**NGC 6543**) is one of the best-known planetary planetary nebulae in the sky. Located at a distance of approximately 3,000 light-years from Earth in the constellation Draco in the northern hemisphere, it was among the first planetary nebulae discovered by astronomers. Its remarkable symmetrical forms are visible in the central region of this remarkable artificially colored image, specially processed to reveal the enormous but very faint halo of gaseous matter, about three light-years in diameter, surrounding the bright planetary nebula at the center. In this composite image (Fig. 24a), radiation from nitrogen atoms is shown in red, while radiation from oxygen atoms is represented by shades of green and blue. In Fig. 24b, the fibrous radial structure of the matter ejected by the star can be seen more clearly.

For a long time, planetary nebulae have for some reason been regarded as the final stage in the life of Sun-like stars. However, only recently have halos been discovered around some planetary nebulae, similar to the one shown above (Fig. 24), which are believed to have formed from matter ejected during earlier active stages of stellar evolution. Whereas the planetary nebula stage lasts about 10,000 years, astronomers have estimated the age of the outer fibrous part of this halo to be between 50,000 and 90,000 years [87].

Fig. 25. System of ring-shaped and radial structures in the halo of a planetary nebula NGC 6543, Cat's Eye Planetary Nebula [88].

As early as 1994, the Hubble Space Telescope revealed that Cat's Eye Nebula (NGC 6543) contains remarkable structures, including concentric gaseous shells and radial jets of rapidly moving gas. The central region of the nebula, which in this high-resolution image obtained by the Hubble Space Telescope is visible with such fine detail, measures more than half a light-year across. The image from **Hubble's Advanced**

Camera for Surveys (ACS) reveals eleven or even more concentric rings or shells surrounding the central ellipsoidal region. Each such "ring" is in fact a projection of a thicker portion of the edge region of a sphere projected onto the observational plane — which is precisely why they appear so bright along their outer edge (Fig. 25).

It is believed that the **Cat's Eye Nebula** (**NGC 6543**), like other planetary nebulae, represents the final, short-lived, but extremely bright stage in the life of a dying star. According to the prevailing view, the dying star located at the center of the nebula, after exhausting its thermonuclear fuel in the core, periodically expelled its outer layers, thereby creating a structure of concentric dust-rich shells. On the basis of observations, astronomers concluded that these stellar "eruptions" - an entire series of matter ejections - occurred at intervals of approximately 1,500 years. These "stellar convulsions" formed the dust shells, each of which contains a mass comparable to that of all the planets in our Solar System (or about 1% of the Sun's mass). Astronomers were surprised by the fact that episodes of matter ejection near the end of a star's life could recur every 1,500 years. Several explanations for this phenomenon have been proposed:

- the action of cycles of magnetic activity similar to the activity cycles of our own Sun;
- the possible influence of a stellar companion (or companions) orbiting the dying star;
- stellar pulsations;
- the possibility that the matter was expelled only once, while the "ring system" formed later due to the development of waves within the already ejected material [89, 90].

However, if one compares images of this nebula obtained by the Hubble Space Telescope in 1994, 1997, 2000, and 2002, one can notice their continuing expansion. This indicates that the formation of these rings is most likely caused by a different mechanism and represents a regular phenomenon rather than an exception, and that the process is still continuing at the present time.

The mechanism responsible for the formation of this beautiful and complex pattern has not yet been examined in sufficient detail.

We believe that the appearance of distinct zones of differing luminosity is more likely caused by the separation of matter ejected radially from the excited center of a galaxy or star. The heavier expelled components form the zones closest to the nucleus, while the lighter components form the more distant concentric zones.

4. ANOTHER REMARK ON THE STRUCTURE OF STARS AND COMETS

The existence of stars with variable luminosity, the periodic explosions of supernovae and novae, as well as the repeated outburst of 17P/Holmes on October 23–24, 2007, cast doubt on the validity of the conclusion that such pulsations are caused solely by thermonuclear reactions in the cores of these objects coming to an end. Rather, these phenomena seem to indicate interactions with invisible periodic energy flows in cosmic space that a star encounters during its motion. We assume that such exciting flows are streams of magnetic field lines emitted by various objects in the Universe (The role of magnetic flows [39, 40, 91]).

5. CONCLUSION

It is impossible to discuss all the accumulated unique observational facts within the scope of a short article; however, the analysis carried out allows the following principal conclusions to be drawn:

- Nature has provided us with a unique microscope of cosmic scale, within which phenomena inaccessible to investigation at the microscopic level can be studied;
- All dense matter in the Universe is accumulated in the form of spherical vortices and exists within halos generated by the electromagnetic fields of the vortices themselves;
- The various observable patterns of the vortex state of matter in space reflect the evolutionary stages of the object under investigation at the particular moment in time at which we observe (or record) it;
- The observed patterns of matter motion in individual accumulations indicate the absence of a dense medium in the regions where these processes occur, even in the centers of the accumulations;
- Cosmic space is permeated by streams of magnetic field lines generated by objects of various scales in the Universe (both by the Universe itself and by its individual objects), interactions with which are manifested in the outbursts of variable stars, supernovae, and comets (in particular, the outburst of 17P/Holmes that occurred on October 24, 2007);
- The recorded vortex patterns of distributed matter in space reflect the stage of the pulsational character of the observed object's life that has reached us;
- All observed facts indicate the existence of a pulsational character in the existence of the Universe itself, similar to that observed in the Sun, whose pulsation period, as discovered by Academician Andrei Severny in 1974, is 160 minutes. In this case, the observed expansion of the Universe is caused namely by this stage of the pulsation expansion, but not from a "single point"; rather, it proceeds from a particular state of the system.

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CHEMISTRY

CATALYTIC SOLUTION FOR THE ECOLOGICAL NEUTRALIZATION OF CHLORINE-CONTAINING AROMATIC COMPOUNDS

Altay A.
Azerbaijan State Oil and Industry University
Master's student
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Abstract
A challenging milestone for modern green chemistry and environmental remediation is the deep ecological neutralization of dangerous, persistent chlorine-containing aromatic compounds, such as chlorobenzenes (CBs), polychlorinated biphenyls (PCBs), and polychlorinated dibenzo-p-dioxins/furans (PCDD/Fs). The structural rearrangement of incomplete combustion pieces is an inherent risk of traditional high-temperature thermal incineration, which also has substantial energy penalties. This frequently causes the *de novo* creation of extremely deadly dioxins during cool-down phases (200°C to 400°C), usually facilitated by transition metal chlorides found in residual fly ash.
Keywords: ecological neutralization, chlorine-containing aromatic compounds, incomplete combustion pieces, *de novo* creation.

INTRODUCTION

Aromatic compounds containing chlorine make up a large class of anthropogenic contaminants with strong carcinogenicity, bioaccumulation, and exceptional chemical stability. Streams containing chlorinated volatile organic compounds (CVOCs) such as chlorobenzene and trace but deadly levels of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) are frequently produced by industrial processes ranging from pesticide synthesis and plastic manufacturing to municipal waste incineration. In the past, the main method of disposal was direct heat burning. However, using a lot of fossil fuels is necessary to operate at such high temperatures. More importantly, combustion fragments undergo *de novo* synthesis routes in the post-combustion zone (200°C to 400°C), creating dioxins and furans at concentrations significantly higher than starting levels if gas cooling is not quickly quenched. An elegant solution to these environmental and thermodynamic risks is provided by heterogeneous catalysis. Catalysts allow very effective, environmentally friendly neutralization at fractions of conventional operating temperatures by reducing the activation energy of destruction or transformation. The two main concepts in contemporary catalytic engineering are described in this paper: resource-recovering valorization through catalytic hydrodechlorination (HDC) and destructive mineralization through deep catalytic oxidation.

METHODOLOGY

This work thoroughly examines low-temperature heterogeneous catalytic technologies to get over these toxicological restrictions, distinguishing between two mechanistic frameworks tailored for different matrix phases:

1. Catalytic Deep Oxidation (Destructive Mineralization): Designed for industrial gas-phase flue streams, catalytic deep oxidation (destructive mineralization) reduces the activation barrier for total combustion to between 160°C and 350°C. The pathway uses surface-modulated mixed metal oxides (such as Nb-Ca/MnO_2) or titanium-supported vanadia-tungsten complexes (V_2O_5 – WO_3 / TiO_2). It functions through a Mars-van Krevelen redox cycle. Before dangerous radical recombination can take place, the aromatic core is chemisorbed by surface acid sites, oxidatively cleaved by lattice oxygen, and mineralized into CO_2, H_2O and HCl.

2. Catalytic Hydrodechlorination (Reductive Valorization): This method maintains the economic value of the underlying carbon skeleton and is specifically designed for liquid effluents and chemical solvent recycling. On noble metal substrates (mostly carbon-supported Palladium, Pd/C), dissolved hydrogen gas (H_2) dissociates into active atomic hydrogen (H*) through a Langmuir-Hinshelwood mechanism. Under moderate circumstances (20°C-130°C), the chlorinated reactant simultaneously adsorbs parallel to the catalyst surface, enabling nearby H* species to preferentially sever the stable aromatic *C-Cl* bond. Current developments use bimetallic designs (Pd-Ni, Pd-Cu), where the secondary base metal shifts the palladium d-band center to accelerate the desorptive release of chloride species, to reduce noble metal costs and prevent irreversible chlorine deactivation.

Water and benign industrial brine (NaCl) are produced when downstream linkage with alkaline absorption systems guarantees the quantitative capture of volatile HCl byproducts. In the end, achieving complete industrial deployment of these systems depends on resolving engineering trade-offs between long-term catalytic resilience against halide poisoning and coke deposition and surface acidity, which promotes initial *C - Cl* bond breakage.

1 Catalytic Deep Oxidation (Destructive Mineralization): Catalytic deep oxidation is the leading technological standard for gas-phase mitigation, such as cleansing municipal incinerator flue gas and industrial off-gases.

1.1 Chemistry and Kinetics of Reactions

Deep oxidation's worldwide goal is to completely transform the chlorinated hydrocarbon backbone into safe mineral gases and controllable inorganic acids

while preventing the production of carbon monoxide or partially chlorinated intermediates:

$$C_6H_{6-X}Cl_x + \left(6 + \frac{6-x}{4}\right) O_2 \rightarrow 6CO_2 + \left(\frac{6-x}{2}\right) H_2O + xHCl$$

1.2 The Mars-van Krevelen Redox Mechanism

The traditional Mars-van Krevelen method, which goes through three crucial synchronized steps, is used to destroy chlorinated aromatics over metal-oxide catalysts:

Adsorption and Activation: Lewis or Brønsted acid sites, which polarize the aromatic ring, are the main locations where the chlorinated aromatic molecule is chemisorbed onto the catalyst surface.

Lattice Oxygen Consumption: By directly consuming highly reactive lattice oxygen (O^{2-}) from the catalyst's crystalline structure, the polarized reactant is oxidatively broken down. The catalyst surface's metal centers are momentarily reduced as a result of the cleavage of the carbon-chlorine and carbon-carbon bonds, producing CO_2, H_2O and adsorbed chlorine species.

Reoxidation: The catalytic cycle is completed when gas-phase molecular oxygen (O_2) from the surrounding flue stream adsorbs onto the empty oxygen sites, reoxidizing the reduced metal catalyst to its initial valence state.

1.3 Modern Catalyst Architectures

- **Vanadia-Titania Formulation (V_2O_5 – WO_3 / TiO_2):** This framework, which is based on Selective Catalytic Reduction (SCR) NOx systems, has outstanding commercial resilience to halogen deactivation. Tungsten stabilizes thermal characteristics, vanadium supplies the main active redox sites, and the titanium support keeps chlorine from building up strongly on the surface, enabling quick desorptive discharge of HCl (Chen, 2026).
- **Transition Metal Oxides (CeO_2, MnO_2):** Highly valued due to their exceptional ability to store oxygen. For instance, tailored surface acid sites are used in contemporary manganese dioxide catalysts modified with niobium and calcium (Nb-Ca/MnO_2) to greatly improve low-temperature conversion while retaining exceptional resistance to chlorine poisoning (Wu, 2026).
- **Carbon-Nanotube Enhancement:** By utilizing noncovalent π-π stack interactions between the aromatic ring and the CNT surface, advanced carbon scaffolds such as carbon nanotubes (CNTs) with V_2O_5/TiO_2 matrices can produce a localized enrichment effect that can destroy up to 95% of chlorobenzene at temperatures as low as 300°C (Nie, 2011).

2 Catalytic Hydrodechlorination (Reductive Valorization)

Destructive oxidation is frequently less appropriate when handling liquid waste, toxic industrial chemical solvents, or concentrated soil extracts because of the enormous energy needed to evaporate liquid matrices. Catalytic hydrodechlorination (HDC) offers a sustainable and resource-recovering substitute in these situations (Leal-Duaso, 2025).

2.1 Upgrading Pathways and Reaction Chemistry

HDC converts toxic waste into useful chemical building blocks like benzene, which can alternatively be fully hydrogenated into cyclohexane, by removing the halogens with a reducing agent rather than burning the hydrocarbon skeleton:

$$Ar - Cl + H_2 \rightarrow Ar - H + HCl$$

2.2 The mechanism of Langmuir-Hinshelwood

A Langmuir-Hinshelwood process that only takes place on the active catalyst surface controls the kinetics of HDC:

Competitive Co-Adsorption: The liquid-phase chlorinated aromatic and gas-phase molecular hydrogen (H_2) vie for active sites on the catalytic substrate.

Dissociative Chemisorption: The noble metal divides H_2 into mobile, extremely reactive atomic hydrogen radicals (H*).

Nucleophilic Substitution: Along the catalytic surface's d-electron bands, the co-adsorbed chlorinated aromatic is flat. The polarized carbon-chlorine bond is attacked by adjacent H* radicals, which successively replace the chlorine atom with hydrogen, release the dehalogenated aromatic ring, and assemble HCl.

2.3 Advanced Catalytic Engineering and Selectivity Control

Monometallics of Palladium (Pd/C): Because of its remarkable ability to dissolve and split hydrogen gas, palladium continues to be the most active single metal for *C - Cl* bond cleavage at moderate temperatures. By precisely controlling the spatial loading of zero-valent palladium (Pd^0) nanoparticles on hydrogen-transfer membranes, researchers have shown that operations can produce up to 99% fully saturated cyclohexanone or over 98% pure phenol directly from chlorinated phenols under ambient conditions (Luo et al., 2022).

Bimetallic and Biosupported Innovations: Although pure palladium is very effective, its byproduct HCl strongly adsorbs onto active sites and coordinates into inactive species, making it vulnerable to quick poisoning. Bimetallic configurations such as Pd-Ni, Pd-Cu, or biosupported Pd-Au nanoparticles made by specific bacterial reductions are used by engineers to get around this (De Corte, 2011). By changing the electronic d-band center of the palladium clusters, the secondary transition metal reduces the adsorption energy of the produced chloride ions and speeds up their desorptive removal.

Comparative Industrial Performance

Engineering Parameter	Catalytic Deep Oxidation	Catalytic Hydrodechlorination
Primary Target Matrix	Flue gas streams / Gaseous off-gases	Liquid chemical waste / Concentrated solvents
Operational Window	160℃ to 400℃	20℃ to 130℃
Primary Mechanical Path	Mars-van Krevelen (Lattice Oxygen Redox)	Langmuir-Hinshelwood (Surface H* Substitution)
Standard Catalyst Systems	V_2O_5 – WO_3 / TiO_2	Pd-Ni, Pd-Cu
Dominant Waste Products	CO_2, H_2O, HCl	Ar-H and HCl
Core Ecological Advantage	Completely inhibits *de novo* dioxin synthesis	Eliminates carbon emissions; recycles hydrocarbons
Primary Deactivation Threat	Volatile sulfur/halogen metal-caking	Irreversible halide surface binding

Post-Treatment Integration Downstream

Both catalytic pathways inevitably result in the production of volatile hydrochloric acid (HCl), regardless of whether destruction or valorization is chosen. Untreated HCl would result in secondary acid rain pollution and severe corrosion to downstream industrial plant components. Both systems need to be directly linked with wet or dry alkaline gas scrubbers in order to achieve genuine ecological neutralization. To ensure quantitative chemical capture, the gaseous effluent is sent via a spray tower loaded with either lime ($Ca(OH)_2$) or sodium hydroxide (NaOH):

$$HCl + NaOH \rightarrow NaCl + H_2O$$

This effectively completes the green decontamination process by converting a highly corrosive halogenated waste into safe, industrial-grade brine (NaCl) and water.

Conclusions and Future Research Trajectories

Crude, high-temperature burning is no longer the paradigm for mitigating chlorinated aromatic waste thanks to catalytic devices. While catalytic hydrodechlorination transforms liquid chemical liabilities into valuable hydrocarbon assets, catalytic deep oxidation effectively suppresses the environmental threat of de novo dioxin formation inside gas streams.

The following goals must be given top priority in future heterogeneous catalyst research in order to hasten widespread commercial implementation:

- Creating intricate multi-element structures that stop halide ions from persistently coordinating with active transition or precious metal sites is known as **"doping for halogen resilience."**
- **Acid-Site Optimization:** Accelerating the cleavage of the stable aromatic *C - Cl* bond without causing carbon coking by carefully adjusting the surface Brønsted and Lewis acidity balance.
- **Low-Energy Synthesis Scaling:** To effectively scale catalyst manufacturing for large-scale industrial cleanup facilities, green, economical bio-reduction or magnetic nanoparticle core-shell frameworks are used.

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COMPUTER SCIENCES

IT SECTOR BUSINESS TRENDS AND SPECIFIC IT PROJECTS

Denić N.
Faculty of Sciences and Mathematics
University of Priština, Kosovska Mitrovica,
https://orcid.org/0000-0003-2584-259X
Bogdanić D.
Faculty of Information Technologies,
Alfa BK University, Belgrade, Serbia,
https://orcid.org/0009-0008-1152-159
Glogorijević M.
Faculty of Information Technologies,
Alfa BK University, Belgrade, Serbia,
https://orcid.org/0000-0001-7581-148X
Jokić S.
Faculty of Information Technologies,
Alfa BK University, Belgrade, Serbia,
https://orcid.org/0000-0003-4432-0172
Milić S.
Faculty of Information Technologies,
Alfa BK University, Belgrade, Serbia,
https://orcid.org/0009-0005-1491-263X
Jakovljević J.
Faculty of Information Technologies,
Alfa BK University, Belgrade, Serbia,
https://orcid.org/0009-0005-8133-8648
DOI: 10.5281/zenodo.20737115

Abstract

In this research paper, based on a studious review of the relevant scientific literature and conducted research in practice, the results of the state of IT business and development trends in the Republic of Serbia will be presented. At the beginning of the work, the latest scientific literature in the field of digital transformations, information technologies and project management of the implementation of IT projects will be developed. In the theoretical part, in addition to the above, the specifics of IT projects will be analyzed, the division of IT projects will be defined. In this context, the paradox of the lack of qualified workforce in the field of IT on the one hand, and the appearance of mass layoffs of IT experts and the demand for employment on the other hand, will be evolved. The paper will present the theoretical foundations of IT project management through the concept of the project triangle, that is, the identification of key success factors for the introduction of these projects in companies. Also, the paper will investigate possible current trends and future perspectives of the situation on the labor market of IT experts from the aspect of personal income in the conditions of the current economic crisis in the world caused by increased energy prices. In this context, the paper will present the results of research into the state of business results of companies in the Republic of Serbia, then the state of the workforce in the field of IT, with a comparison of the state in EU member states, where the results and different levels of development of individual countries in the field of the IT sector and digital transformation will be presented. In the final part of the work, the perspective will be analyzed and the possible impacts of new technologies will be examined with a special emphasis on the impact of artificial intelligence on the reduction of jobs, changes in the way of doing business and the emergence of new professions.

Keywords: IT sector, Management project, IT project.

INTRODUCTION

In the turbulent economic conditions of business caused by wars, the economic and energy crisis and contradictions, the lack of quality and trained workforce is increasingly pronounced[6]. In this regard, according to Eurostat data for 2024, as many as 57.5% of companies in the EU fail to find enough qualified IT experts. Data for the Republic of Serbia show that the domestic industry currently lacks more than 30,000 trained experts, so that in the long term this can significantly slow down the growth of the economy. In terms of economic activities, the IT sector remained one of the most important exporters of services from Serbia in 2025, with a continuation of the growth trend, a stable inflow of foreign currency and a realized foreign trade deficit. However, like others, this industry is also facing a series of structural problems that are increasingly openly questioning its medium-term development potential. In this context, according to research, large companies have the biggest problems with the lack of qualified IT experts - 68% of them cannot fill all IT positions, while challenges are also present in medium-sized (59.2%) and small companies (53.4%). In the education system of the Republic of Serbia, in the state

and private sector, there are quite a number of study programs for educating personnel in the field of IT, however, there is still a demand for this type of personnel on the labor market[7]. Another problem that occurs in the sphere of the IT sector is the shutdown of several large IT companies in Serbia, which left hundreds of people without work in a short period of time and opened some new questions about the impact of new technologies and artificial intelligence, the stability of the business environment and the long-term sustainability of the domestic IT model. The state of the IT sector in the world is such that, according to the data of the TrueUp platform, during 2025, around 245,000 layoffs were recorded in the technology sector worldwide, while in the first months of 2026, around 94,000 employees in almost 240 companies remained without work. This is also indicated by the fact that the co-founder of the global IT company "Block" Jack Dorsey explained the dismissal of 40 percent of employees by claiming that AI tools can work more, better and faster because it is the most transformative technology we have seen since the Internet. The aforementioned trend in the world has not bypassed Serbia either, the wave of layoffs that has affected the global IT industry has also reached Serbia, but experts warn that it is not a crisis, but a deep transformation of the labor market in which artificial intelligence, changed business models and increasingly fierce competition are changing the existing and setting new rules of the game. The latest research and estimates by the Serbian IT Association (SITA) show that between 70,000 and 80,000 workers are employed in key IT activities in Serbia. In this context, the latest layoffs in the IT sector do not sound like a good indicator for this year and the development of the domestic IT industry, which has definitely been one of the more potent export-oriented branches of the Republic of Serbia's economy for years. Many companies and business systems in Serbia were affected by the lack of work on the global market or problems in specific industries, which resulted in a decrease in income and in some cases led to the decision to lay off a large number of employees[8]. However, in spite of the mentioned problems, the office for information technologies and electronic administration announced that at the end of the third quarter of 2025 in the entire ICT sector. 115,933 people worked, which is 3,678 or 3.3 percent more compared to the same quarter of the previous year. Regarding the situation in the environment, the greatest demand for IT personnel is in Germany, the Czech Republic, Malta, Austria and Luxembourg, where more than 65% of companies fail to find adequate candidates. However, on the other hand, in support of the lack of IT personnel in large companies, the numbers speak for themselves - for example, in Malta as many as 84% of large companies have a problem with hiring IT experts, in Germany 80%, while similar trends apply to the Czech Republic (79%), Slovenia (78%), Austria (76%) and Luxembourg (75%). In contrast, the results show that in the Republic of Serbia last year, the number of people who lost their jobs in the IT sector is estimated between 450 and 550, which is one of the most pronounced waves of layoffs in the domestic IT sector in the last few years. In addition to the fact that the salaries of IT experts are high according to the data of the Republic Institute of Statistics for the year 2024, the sector of computer programming and related services records an average net salary of RSD 282,510 (about €2,400 per month). In practice, there are noticeable contradictions, i.e. the paradox that despite the obvious demand for personnel in the IT profession, some employers from this branch state that as many as 2,500 applications are received for one job advertisement in the IT industry in Serbia.

2.SPECIFIC IT PROJECTS

Poslovanje u IT sektoru je usko povezano sa IT projektima stim u vezi u nastavku su date neke od specifičnosti projekata sa akcentom na IT projektima. U literaturi se navodi model tkz. projektnog trougla koji naglašava tri fundamentalna ograničenja koja oblikuju svaki pa i IT projekat: obim posla, vremenski okvir i raspoloživi resursi [14].

Fig. 1. Project triangle [14]

In the context of IT project management, the constraints are often illustrated by the aforementioned "project management triangle" concept. As explained by (Nizhebetskyi, 2022), the essence of the project triangle is to balance these constraints in order to achieve the best possible result or quality [14]. Practice shows that all projects have a beginning and an end. In addition, they have a team, a budget, a schedule, and a set of expectations that the team must meet. According to the well-known institute, each project is unique and differs from routine operations (current activities of the organization) because projects end when the goal is achieved [16]. In general, it can be said that all projects are temporary endeavors to create value through a unique product, service or result.

According to the relevant literature, IT projects can be divided into the following eight categories [2]:

1. Software development
2. Web development
3. Application of technology
4. Cloud computing
5. Maintenance and support
7. Cyber security
8. Training

3. IT PROJECT MANAGEMENT

IT project management is the application of processes, methods, skills, knowledge and experience to achieve specific project goals in accordance with project acceptance criteria within agreed parameters. A well-known author states that the use of IT project management provides companies with benefits such as [17]: better control of financial, physical and human resources; improved customer relations; shorter development time; lower costs; higher quality and higher reliability; higher profit margins; improved productivity; better internal coordination and greater employee motivation. IT project management has end results that are limited by time frame and budget [1]. According to well-known authors, IT project management is used in

all areas of activity and business processes, including companies with a process-oriented production system [13]. It is known that IT project management is defined as the process of project management from the beginning through its life cycle. The primary goal of IT project management is to complete the project within the established time, budget and quality objectives[12].

IT project management is the discipline of applying established principles, procedures and policies for successful project management from conception to completion. The literature states that IT project management requires the application of these principles and procedures, as well as tools and technologies, to ensure that the project can be completed in a way that meets all articulated outcomes - from cost constraints to ultimate goals[15]. For an IT project to be successful, it must effectively meet certain criteria. In this context, some authors point out that it is quite possible for the project to be completed on time and within the budget, but still fail if it does not meet the client's expectations [18]. While other authors emphasize that the implementation of a realistic analysis of costs and benefits additionally increases the probability of achieving customer satisfaction and providing measurable business benefits [10]. Also very important is the understanding of customer requirements, which includes two key components: examining the customer's needs and validating the team's understanding[4]. In theory and practice, various frameworks, methods and practices have developed over time to support agile project management. In this regard, the renowned institution PMI lists Scrum, Kanban, Scrumban, Extreme Programming (XP), Crystal, Feature-Driven Development (FDD), DSDM, SAFe® and LeSS among the most common[16]. According to the report on the state of agile development, Scrum remains the dominant approach, used by 87% of respondents, followed by Kanban (56%), Scrumban (27%), iterative methods (20%) and Scrum/XP hybrids (13%) [9].

In this sense, with regard to the success of the introduction of IT projects, the well-known authors Irijarte and Bayona (2020) based on the results of their research identify the following factors as key to the success of an IT project[11]: customer satisfaction, user satisfaction, compliance with the budget, compliance with the schedule, quality of information, efficiency of the process, quality of the system, understanding of needs, creation of business value, competitive advantages, satisfaction of contractors, duration, efficient performance of tasks, financial budget, functionality, achievement of goals, individual influence, effectiveness of leadership, fulfillment of functional requirements, fulfillment of non-functional requirements, operational quality, organizational impact, final product utilization, productivity improvement, project stakeholder satisfaction, quality, quality of project management process, development team accepts requirements as realistic/achievable, resource savings, scope, quality of service, system utilization, team satisfaction, ability to achieve project goals, expected scope of work performed, project well planned, quality of work performed, project plan exists, and specifications. In addition to the above, the literature states that other important factors include supporting broader, implicit project goals, achieving a satisfactory internal rate of return, and ensuring that each IT initiative contributes significantly to the organization's success [3].

4. RESEARCH METHODOLOGY

For the research purposes of this paper, a combined qualitative-quantitative research method will be applied, which includes all modern methods and techniques of scientific research. At the beginning of the research, we first briefly defined the basic problem that we are researching or dealing with in the research. In this sense, a methodological research framework is proposed that combines different research methods, including quantitative and qualitative research methods. In the theoretical discussion, an overview or presentation of the contents researched by well-known authors in the country and abroad in the context of this topic is given. The research instruments used in the research process and procedure are: different types of questionnaires, there are tables, reviews, checks of individual and team abilities and knowledge; numerical chart and scale; special and Internet search questionnaires, etc.

5. RESULTS

The results show that in 2024, the total export of IT services in the Republic of Serbia amounted to 4.1 billion euros. Regarding the type of software services in Serbia, outsourcing is one of the dominant business models in the IT industry, which means that most software companies work on projects for foreign clients, most often from the USA, Great Britain, Germany and the EU, developing software or providing other IT services for them. In this context, when the entire domestic IT industry is observed, its total revenues amounted to 5,498,403,477 euros in 2024. This represents a growth of 13.5 percent compared to 4,843,484,596 euros recorded a year earlier. Also, the total profit in 2024 amounted to 319,390,317 euros, with an annual growth of 19.3 percent (267,496,512 euros in 2023). Taking all this into account, the results in practice indicate that companies are facing many challenges, but also new opportunities for business improvement. Regarding the location of workplaces, the research results show that the percentage of companies that work entirely from the office is on the rise compared to last year (from 7% to 13%). At the same time, in this sense, the share of the structured hybrid model is also growing (from 21% to 27%), whereby the arrangement of three days in the office per week is currently the most common. One of the key problems of the IT sector in Serbia is the strong cooling of the global IT market, especially in the segments of custom software development and outsourcing, on which the Serbian industry relies to a great extent. That's why Serbia is vulnerable because a large part of the IT sector is related to outsourcing and work for foreign clients, and this means that the consequences could "spill over" to Serbia if a client in the US or EU decides to optimize costs with the help of AI. It is notable that the global slowdown in investments has already left negative consequences[19]. For the abovementioned reasons, in Serbia, this applies especially to the part of outsourcing services. It is this sector that is dependent on Western clients, primarily from the USA and the European Union, where the reduction of IT budgets has led to a drop in demand for these services. The results of the research indicate that as many as 74%

of respondents would leave or consider leaving the company, if mandatory attendance at the office was introduced, and that percentage is highest among millennials (29-44) and senior profiles. Also devastating is the fact that even 62% of companies did not change their salaries in the past 12 months, which also represents the most common drop in employee satisfaction.

5. DISCUSSION OF RESULTS

The results of the research show the difference in the level of development of individual countries in the area of the IT sector and digital transformation. The European Commission published indicators of the progress of member states in the field of digital transformation as part of the Report on the State of the Digital Decade 2024. The comparison below is based on official data for 2024 published in national profiles for Serbia and the EU [5].

DESI 2024 KEY INDICATORS – SERBIA COMPARED TO THE EU

Indicator (DESI 2024)	Serbia	EU Average	EU 2030 Target
Very high capacity network (VHCN) coverage	72.0 %	78.8 %	100 %
FTTP (fibre to the premises) coverage	66.5 %	64.0 %	100 %
5G coverage	58.0 %	89.3 %	100 %
SMEs with at least basic digital intensity	43.0 %	57.7 %	90 %
Use of cloud services	31.0 %	38.9 %	75 %
Use of artificial intelligence	6.5 %	8.0 %	75 %
Use of data analytics	18.0 %	33.2 %	75 %
Individuals with basic digital skills	51.0 %	55.6 %	80 %
ICT specialists as a percentage of total employment	4.0 %	4.8 %	~10 %
Digital public services for citizens	70.0 %	79.4 %	100 %
Digital public services for businesses	74.0 %	85.4 %	100 %
Access to electronic health records	81.0 %	79.1 %	100 %

Source: Western Balkans DESI 2024 (European Commission) and Digital Agenda Serbia – 2024

Fig. 2:Comparison of the state of IT in Serbia and the EU [5]

The data shows that the number of active companies in the IT sector of the Republic of Serbia with annual revenues of at least one million dinars is over 5,000. In the last eight years, the IT sector in the Republic of Serbia has recorded a real growth of an incredible 193 percent, and the next sector in terms of growth is professional and scientific services with 93.5 percent. Research shows that Serbia has a share of 5G coverage in rural areas (58%) compared to the EU average of 89%. Serbia also stands out with over 66.5% FTTP coverage in urban centers, enabling a higher quality of service in commercial centers and industrial zones. An important indicator according to the report is the use of cloud solutions in small and medium-sized enterprises. Compared to the EU average with 38.9%, Serbia is below the average with 31%, which indicates a more cautious approach to data transfer in the cloud. As for the companies themselves, 32,362 companies and entrepreneurs are registered in Serbia under the code Computer programming, of which 12,955 are active, and 7,722 are temporarily suspended. According to the report, companies in Serbia have a digital intensity (51.7%), the use of data analytics (18%), while the use of artificial intelligence (6.5%), which is below the European average of 8.0%. In terms of the type of IT activity, computer programming is the most represented, with as many as 22,411 economic entities, while consulting services are in second place, with 4,901 economic entities. The data also indicate that Serbia achieves 70% of digital public services for citizens and 74% for businesses, which is below the EU value. In addition, Serbia exceeds the EU average in electronic health services (81.0% versus 79.1% in the EU). The analysis of the IT sector in the environment showed that this is one of the fastest growing fields of the economy with a total growth of 72% in the last five years. In addition to the above, Serbia has a smaller share of the population with basic digital skills (51%) than the EU (55.6%). This remains one of Serbia's greatest comparative weaknesses — despite evident technological progress, its population lags behind in the knowledge and use of digital tools. When looking at the structure of companies that operate under the computer programming activity code, micro-enterprises are overwhelmingly dominant - as much as 87%. Small enterprises occupy 11%, medium enterprises 1.3%, while only 0.25% belong to large enterprises. In terms of the region, Belgrade absolutely dominates in terms of the number of registered IT companies and entrepreneurs, with 17,224, i.e. 47.8 percent of the entire market in the Republic of Serbia. Also based on the previous geographical observation, the largest number of IT companies is from the Belgrade area (49.06%), and within the capital, Novi Beograd (12.25%), Stari Grad (9.10%) and Vračar (4.60%) are leading the way. The share of ICT experts in Serbia (4.0%) is also lower than the European average (4.8%). Among other things, the aforementioned research shows that Serbia lags behind in the use of advanced technologies such as artificial intelligence with (6.5%) compared to the EU average of 8.0%.

6. CONCLUSIONS

The research results show that technologies such as artificial intelligence (AI), machine learning (ML) and data analytics are gaining momentum in the IT sector as well, where companies from Serbia are increasingly collaborating with global partners. Based on the research, the conclusion is that the strategic plan of each individual company should serve as the primary guide for the selection of IT projects. Research shows that aligning IT projects with explicit business goals is a key reason why companies decide to invest in them. The results in practice show that considering that the starting salaries of junior programmers in Serbia reach €1,000-1,500, while experienced experts earn up to €5,000, investing in IT education can be one of the most profitable decisions for people looking for a well-paid job. The education system still represents one of the key obstacles for the further development of the IT sector,

because it is not fully aligned with the needs of the market. According to data reported by Business Insider, about 41 percent of companies plan to reduce the number of employees due to the application of AI technologies. In this context, according to the research, the most affected will be employees at junior and "mid" levels. However, despite the above, the data shows that between 65,000 and 75,000 specialists are currently working in the IT sector of Serbia, and there are no official data on layoffs due to AI yet. The growth in the export of software solutions and IT services shows that the IT sector still has the potential to be a key driver of economic development in the country. It can be concluded that the IT market in Serbia has a certain resilience because labor costs in Serbia are lower than in in the West, so the economic calculation of layoffs is less aggressive than, for example, in more developed Western countries. Based on the above, it can be concluded that the rapid development of technology creates an increasing need for experts, and that the education system must fully follow these changes. In this regard, the conclusion is that the state of the IT sector in Serbia will go in the direction of gradual consolidation and the pressure on salaries and the growth of the demand for AI skills, and those who do not adapt will be at the greatest risk, we emphasize this because the IT sector in Serbia has a structural advantage - relatively is young, flexible and used to quick adaptations. Despite the challenges, the IT sector is one of the few that shows resilience and adaptability, even in periods of economic instability. The application of artificial intelligence and machine learning is becoming more pronounced, and domestic companies are increasingly working on projects that use these technologies to improve business processes, data analysis and interaction with users. Some less positive predictions indicate that in the coming years, manual programmers will eventually and exclusively be hired for some critical software, of which there is not even 2%, for everything else, AI will write 95% of the code in a maximum of 3 years... of course still with human supervision. In other words, it boils down to the fact that AI will do 90+% of IT things, and the rest will be narrowly specialized companies for dedicated solutions and problems. The forecast is that the application of AI in programming and its implication with which it will be possible to reproduce or make a better system with much less human resources, and therefore significantly reduce the need for human resources. In this context, in the future it will no longer be important the number of programmers a country has, but how many of them know how to work with the help of artificial intelligence

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HISTORY

СРЕДНЕВЕКОВЫЙ ТАРАЗ КАК ЦЕНТР РЕМЕСЛА И ТОРГОВЛИ: ИСТОРИЯ И ФАКТОЛОГИЧЕСКОЕ ОСМЫСЛЕНИЕ

Бақторазов С.У.
Профессор, главный научный сотрудник
«Государственного историко–культурного заповедника – музея «Ежелгі Тараз ескерткіштері»

MEDIEVAL TARAZ AS A CENTER OF CRAFT AND TRADE: HISTORY AND FACTUAL UNDERSTANDING

Baktarazov S.
Professor, Senior Researcher at the State Historical and Cultural Reserve-Museum «Ежелгі Тараз ескерткіштері»
DOI: 10.5281/zenodo.20737131

Аннотация

В X-XII вв. в условиях феодального уклада происходило быстрое развитие Тараза. Города, не вмещавшиеся в прежние границы шахристана, стали разрастаться, и центр городской жизни переместился в торгово-ремесленные рабады. Развитие феодальных отношений и начавшийся в степи распад родоплеменных отношений привели к большому притоку в город как кочевого, так и сельского населения, изменили топографический облик городов округи, а также к быстро развивавшемуся в это время горному промыслу на юге-востоке округи. В результате этого Тараз и города его округи стали не только торгово-ремесленными центрами, но и центрами сосредоточения в их пригородах сельских поселений и вновь образовавшихся рудников. Развитие производительных сил, происходившее в условиях новой социально-экономической формации, явилось главной причиной дальнейшего роста различного рода ремесел.

Abstract

During the 10th–12th centuries, Taraz underwent rapid development within the context of the feudal system. Cities that had outgrown the former boundaries of the shahristan began to expand, and the center of urban life shifted to the commercial and artisanal quarters. The development of feudal relations and the disintegration of tribal ties that began in the steppe led to a large influx of both nomadic and rural populations into the city, altered the topographical appearance of the surrounding towns, and contributed to the rapidly developing mountain mining industry in the southeastern part of the region. As a result, Taraz and the cities of its district became not only centers of trade and crafts but also hubs around which rural settlements and newly established mines clustered in their suburbs. The development of productive forces, taking place under the conditions of a new socio-economic formation, was the main reason for the further growth of various types of crafts.

Ключевые слова: Средняя Азия, Казахстан, Тараз, интенсивное развитие городской жизни, торгово-ремесленные центры, хозяйственные предметы.

Keywords: Central Asia, Kazakhstan, Taraz, intensive development of city life, trade and craft centers, economic items.

В X-XII вв. в Средней Азии и Казахстане шел быстрый рост городов и городских поселений. "Старые" развивались, новые возникали на базе земледельческих оазисов и в районах взаимодействия с кочевым и полукочевым скотоводческим хозяйством степи. Крупнейший из казахстанских городов того времени Отрар занимал площадь в 200 га, X-XII вв. были периодом наибольшего его территориального расширения. Переживал подъем и древний Тараз, наибольшего расцвета он достиг при Караханидах, с завоеванием края, которыми (в 999 г.), династия Саманидов прекращает свое существование. Вместо более или менее централизованного Саманидского государства Средняя Азия разбивается на ряд уделов, центром одного из них становится Тараз.[1, 201с.] В этот период города Таласской долины пережили резкий подъем в экономической и культурной жизни. Они, подобно городам других районов Средней Азии, по существу, сформировались как самостоятельные феодальные города со своей классовой структурой, резко отличной от той, которая была у них, когда пульс городской жизни находился в шахристане. Это явилось результатом интенсивного развития городской жизни в условиях сложившегося феодального уклада и тех изменений, которые произошли в классовом составе населения городов. Политическая самостоятельность Тараза и автономность округа способствовали их дальнейшему развитию. Значение и мощь города при одном из правителей, а именно – Яган-тегина, были настолько велики, что он самостоятельно выступил в военный поход против Самарканда и временно овладел последним. Был завоеван Кашгар, находившийся в течение 15 месяцев под властью Тараза. [2, 17 с.] Естественно , что эта политическая сила была следствием экономической мощи города. В караханидский период в его жизни основная часть города, то есть шахристан и цитадель, по-видимому, оставались в тех же границах, которые они занимали и в предыдущий -

карлукско-саманидский период, хотя древняя цитадель утратила свое главное назначение, а средоточием экономической и культурной жизни города становится шахристан, где размещались все военно-административные, культурные и другие учреждения, ведавшие укрепленной округой средневекового феодального города.

В результате расширения жилых строений торгово-ремесленной знати, духовенства и зависимого от них населения, а также процесса, происходившего в сельском некрополе округи, быстро растет численность жителей, заселявших огражденную стенами площадь рабада. Эти процессы внесли соответствующие изменения в материальную культуру и планировку города. Если в предшествующий период (VIII-IX вв.) в городе имелись водоотстойник только в шахристане и колодцы в цитадели, то теперь в городе появилась магистраль для подачи воды посредством водопровода. Изменилась и планировка северо-восточной части шахристана. Появилось монументальное сооружение - баня. Недалеко от нее находилась сложной конструкции гончарная печь с двойными стенками и подведенной к основанию системой гончарных труб. Здесь же располагались мастерские по производству стекол. Существование бани с двумя отделениями говорит о высоком уровне градостроительства. Подобного типа сооружения пока не обнаружены в других местах Средней Азии. Орнамент на стенах и на архитектурных фрагментах от куполов склоняет к тому, что в Таразской бане налицо античная традиция расписывать интерьеры. Она занимала площадь в 512 кв.м. и сложена из жженого кирпича. Виднейшие мусульманские врачи IX-XI вв. приписывали росписям бани гигиенические свойства. Врачи древности, зная о расслабляющем воздействии бани на человека, считали необходимым расписывать ее помещения сценами, созерцание которых должно было укреплять жизненные силы человека. Ибн Сина (980-1037 гг.) заявлял, что в хорошей бане должна быть умеренная температура, яркий свет, просторный предбанник, а в нем картины (сувар) хорошей работы, явной красоты, вроде влюбленного и возлюбленной, и вроде парков и садов. "Эти картины и подобные им один из деталей совершенной бани", - говорил он. Таким образом, в условиях феодального уклада происходило быстрое развитие Тараза. Города, не вмещавшиеся в прежние границы шахристана, стали разрастаться, и центр городской жизни переместился в торгово-ремесленные рабады. Предместья города рабады сильно расширились, включив в свои пределы не только ряд замков землевладельцев-феодалов, но и некоторые, начавшие приходить в упадок города, расположенные вокруг Тараза, как, например, Нижний Барсхан (территория нынешнего свеклосовхоза), Джикиль (теперешний Жалпактобе) и другие. По-прежнему русло р. Талас делило город на две части. Перекинутый через нее каменный мост (о наличии которого известно из письменных источников, на его месте сооружен современный мост) служил основной магистралью, соединившей обе части города. Через него же проходил известный "Шелковый путь". Развитие феодальных отношений и начавшийся в степи распад родоплеменных отношений привели к большому притоку в город как кочевого, так и сельского населения, изменили топографический облик городов округи, а также к быстро развивавшемуся в это время горному промыслу на юге-востоке округи. [3, 405с.] В результате этого Тараз и города его округи стали не только торгово-ремесленными центрами, но и центрами сосредоточения в их пригородах сельских поселений и вновь образовавшихся рудников. Крупные разработки на серебро и золото находились в горной части Таласской долины, в средневековой области Шельджи. О том, что здесь добывали много серебра и вывозили его в города Казахстана, Средней Азии и Среднего Востока, сообщает автор X в. ал-Макдиси. [4, 278 с.] Из бронзы, серебра и золота делались браслеты, подвески, серьги, бляшки. Здесь были обнаружены многочисленные рудные разработки, собраны орудия горного дела, обнаружены места плавок, шлаки, тигели, остатки плавильных печей. Развитие феодальных отношений, повлиявших на увеличение разработки рудников в Шельджи, способствовало не только росту числа крупных городов, но и концентрации вокруг них сельского типа усадеб и поселений, а в связи с этим замиранию жизни в мелких городах северо-западной округи. В этом процессе значительную роль играли кочевники, которые, отражая процесс феодализации и физически уничтожая существовавшую ранее "многополисную" систему расселения, способствовала вымиранию многих мелких городов, обеспечив тем самым расцвет и рост отдельных крупных городов.

Однако подъем крупных городов Таразского округи не следует рассматривать как изолированное явление. Рост городов за счет увеличения площади отмечен и в соседней с Таласской Шуской долине. Это наблюдалось и в других районах Средней Азии. Данный процесс был связан с интенсивным развитием производительных сил, который имело место в среде населения, проживавшего как в этих городах, так и в окружавших их поселениях.

Развитие производительных сил, происходившее в условиях новой социально-экономической формации, явилось главной причиной дальнейшего роста различного рода ремесел. Это проявилось, прежде всего, в совершенствовании керамического производства, когда появились не только отдельные стандартные формы неполивной, но и широкого распространения получила поливная керамика. Улучшилась также и обработка поверхности керамических изделий, теперь посуду стали не только ангобировать и лощить, но и раскрашивать в виде потолков и наносить фигуры. В этот период гончары Тараза начали производить посуду новым способом, собирать ее из отдельных частей, заготовленных в специальных формах. К нововведению данного периода относится и клинкерный обжиг, каким сделаны так называемые сфероконусы - небольшого объема толстослоенные сосудики с очень узким отверстием в невысоком горле, оформленном по краю валиком. Изготовлялись пиалы, близкие по форме к конусовидным чашкам, тарелки с

перегибом стенки, на кольцовой поддоне, цилиндрической формы туваки и т.д. В поливной керамике Тараза большое место занимали растительные узоры: цветок, плод и т.д. Древо жизни лежали в основе сюжетов. Несмотря на значительные изменения в керамическом производстве, все еще немало посуды изготовлялось ручной лепкой. [5, 28 с.]

В IX-X вв. в Таразе - этом крупнейшем ремесленном центре, оказывавшем большое влияние на культуру городского и кочевого населения Семиречья, побеждает новая феодальная линия в искусстве. Она содействовала почти полному исчезновению реалистических образов и замене их орнаментальными формами. Происходившие в это время тесные контакты Тараза с городами Средней Азии способствовали проникновению в Согд, некоторых форм неполивной керамики Тараза. Разнообразие форм и высокое художественное мастерство гончаров-ремесленников, ярче всего выразившееся в стандартизации и разнообразном узоротворчестве поливных изделий (роговые мотивы, узоры граната, крыльев птиц, лев, лиса и пр.) способствовали не только широкому спросу на рынке и расширению денежных оборотов, но и влиянию ремесленников Тараза на гончарное искусство других городов Семиречья и Средней Азии: Самарканда, Асхикета, Узгена, Ташкента, Согда, которые были тесно связаны с Передней Азией и в свою очередь воздействовали на культуру городов Семиречья. Росту нарождавшегося феодального общества содействовало не только усовершенствование гончарного производства, но и развитие других ремесел: кузнечного, ювелирного, а также появление новой отрасли производство стеклянных изделий.[6, 185 с.] Эти достижения проявляются как внедрение в производство новых технологических приемов, инкрустации серебром, медью, цветными камнями, так и в применении токарного станка. Наряду с изделиями хозяйственного и военного назначения большое место стало занимать изготовление изделий религиозно-эстетического характера. Так, например, путем отливки и дополнительной обработки производились подставки для богато предъявленных в Таразе курильниц, связанных с отправлением религиозных культов.[7, 78 с.] Нетрудно заметить, что прототипом этих сложно-составных приборов были сакские бронзовые светильники с архитектурными ножками и плоским однообразным завершением. Но в отличие от сакских светильников, в которых отдельные части, в том числе и бронзовые скульптурки, соединены спайкой, на круглых блюдцах подставок форме богато орнаментированными крышками и ручкой. Наряду с изделиями, выполненными путем литья и орнаментированными гравировкой, стали изготовляться предметы, в отделке которых применялись инкрустация серебром.

Следует отметить, что инкрустация медных предметов серебром считалось большим мастерством и она применялась для украшения особо ценных предметов, предназначенных для знати. Таразские ювелиры производили эти изделия на широкий рынок. Из Семиречья (район Тараза) происходит кувшин с грушевидным туловом, верхняя часть которого выполнена в виде волчьей головы. Глаза волка инкрустированы красной медью. На кончике носа выгравировано изображение двух пальметт и сердцевидных растительных завитков с четырьмя точками внутри. Уши животного также украшены сердцевидными завитками. На тулове узор в виде медальона с вписанными в него концами с двадцатью ямками в каждом (возможно, гнезда для инкрустации самоцветами или стеклом). Сделан кувшин в XI-XII вв.

Наряду с ювелирными изделиями большим спросом пользовались хозяйственные предметы, которые по-прежнему изготовлялись из железа путем ковки. Это топоры, дверные скобы, гвозди с массивными шляпками, которые производились не только в городах округи, но и в самом Таразе. С ростом экономики развивалось и производство стеклянных изделий: миски, тарелки, рюмки, флаконы, графины, оконные диски и т.д. Они изготовлялись методом свободного выдувания полых стеклянных изделий сложной профилировки и выдувания изделий в форме. Редкие формы стеклянных изделий представлены обломками сфероконусов из голубоватого толстого стекла и аламбиками - алхимическими сосудами в виде колпачка с трубкой-отводом для испаряющегося вещества. Аламбики - обычная находка в комплексах стеклянных изделий средневековых городов. Кроме посуды стеклоделы умели изготавливать оконное стекло в виде небольших дисков. Они производились в большом количестве, что свидетельствует о довольно высоком уровне развития стекольного ремесла в Таразе.

В этот период по-прежнему обрабатываются камень и кость. Наличие специализированных ремесел в городах Семиречья, свидетельствующих о дальнейшем развитии социально-экономических отношений, способствовавших укреплению господства феодалов, подтверждается словами из "Кудатгу билиг" Юсуфа Баласагуни.[8, 348 б.] В ней отмечается, что земледелец должен близко держать кузнецов, ткачей, сеяльщиков, мастеров стрел и луков. Но не только специализация различного рода ремесел способствовала расширению феодальных отношений, значительную роль в этом процессе сыграли и основные направления хозяйственной деятельности населения Тараза и городов его округи.

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HISTORY OF ART

АЛЬ –ГЕЗАРИ, ОТЕЦ МЕХАНИКИ И РОБОТОТЕХНИКИ

Эйлазов Ф.
научный сотрудник
Нахчыванское отделение НАН Азербайджана
Orcid: 0009-0004-1249-2951

AL-GEZARI, THE FATHER OF MECHANICS AND ROBORTICS

Eylazov F.
Researcher
Nakhchivan Branch of the National
Academy of Sciences of Azerbaijan
DOI: 10.5281/zenodo.20737144

Аннотация

В статье рассматривается вклад незаслуженно забытого великого турецкого ученого, инженера, гениального механика и «отца робототехники» Аль-Гезари в мировую науку. Его научные труды и изобретения оказали огромное влияние на развитие европейской науки и проложили путь для ряда научных инноваций. Подчеркивается, что научные достижения и идеи Аль-Гезари сыграли важную роль в формировании возрождения европейской науки.

Рассматриваются незаменимые, важные научно-исторические достижения и многочисленные великие открытия, которые Аль-Гезари подарил миру. Анализируются «забытые» изобретения этого блестящего турецкого ученого в Европе.

Abstract

The article examines the contribution of the unjustly forgotten great Turkish scientist, engineer, genius mechanic and "father of robotics" Al-Gezari to world science. His scientific works and inventions had a great impact on the development of European science and paved the way for a number of scientific innovations. It is emphasized that Al-Gezari's scientific achievements and ideas played an important role in the formation of the revival of European science.

The irreplaceable, important scientific and historical achievements and numerous great discoveries that Al-Gezari gave to the world are reviewed. The "forgotten" inventions of this brilliant Turkish scientist in Europe are reviewed.

Ключевые слова: коленчатый вал, водоподъемные механизмы, автоматы, роботы.

Keywords: crankshaft, water lifting mechanisms, automatons, robots.

Введение

Эпоха Средневековья, которая на Западе незаслуженно воспринимается как период варварства, якобы остановивший развитие европейской цивилизации, для мусульманского мира стала золотым веком изобретений и открытий. Простиравшая, от Испании до Афганистана и от Ближнего и Среднего Востока до Северной Африки, исламская империя стала обладательницей огромного арсенала знаний [2,с.68].

В VIII-XIII в. нашей эры исламская наука переживала свой золотой век и изобретения ученых Востока, эпохи ренессанса мусульманского мира стал основой современной цивилизации. Исламская наука был целенаправленным результатом многочисленных научных изысканий полученных профессиональными учеными. Мусульманскими учеными были сделаны важные открытия по всех областей науки.

Сегодня письменные и графические работы достижений мусульманских ученых, насчитывающие более 10 тысяч манускриптов и более тысяч различных инструментов, хранятся в библиотеках, содержатся в музеях, частных коллекциях всего мира. Несмотря на это на западе до сих пор не существует серьезные исследование наследие великих мусульманских ученых и эти работы мусульманских ученых, хранящиеся в библиотеках Европы, до сих пор остаются неизвестными для ученых мира. Сегодня историки находят все больше и больше материалов о разнообразных научных открытий исламских ученых, которые оказали огромное влияние на возрождение новой научной мысли и в развитие науки в Европе [2,с.68].

Например, известный ученый Бернард Льюис на своем работе «Ближний Восток» утверждает, что «Средневековая исламская наука была более практичной в таких областях, как медицина, химия, астрономия, агрономия, механика и это наследие была расширено и дополнено научными наблюдениями и экспериментами».

Вклад мусульманских ученых в развитии мировой науки до сих пор остается непризнанным на западе, и намеренно игнорируются и большинство людей в мире до сих пор остаются в неведении относительно исламской науки. Они видят в них варваров, которые кроме бессмысленных разрушений, не способны делать ничего и, основываясь на эти

измышления, составляют мнение о миллионах мусульман.

Европейский ученый Кевин Кристиунас утверждал, что «на западе существует распространенное заблуждение о том, что исследования в астрономии пришли в упадок после Птолемея и не возобновлялись до времен Коперника».

Наследник Британской Монархии принц Чарльз сказал: “Как много неправильно на Западе понимается о природе Ислама, также сильно игнорируется долг нашей культуры и цивилизации перед Исламским Миром. В средневековом исламском мире, от Средней Азии до берегов Атлантики, был мир, в котором процветали ученые и исследователи. Но так как мы склонны видеть ислам в качестве врага Запада, как чужую культуру и систему убеждений, мы склонны игнорировать и стирать его огромное значение в нашей истории”.

К сожалению и в наши время на западе игнорируя вклады мусульман в мировой науки. К мусульманам относятся с предубеждением. В мусульманах видят террористов, которые якобы кроме бессмысленных разрушений, не способны делать ничего [5,с.91].

Желая придержаться проверенным фактам, рассмотрим некоторые великие открытие и изобретение великого ученого, который сегодня незаслуженно «забыть» в Европе:

Сегодня в мире лидером в области робототехники является Япония. В этом японцы обошли даже научно продвинутый Запад. Сегодня чуть ли не каждый день из средств массовой информации можно узнать о создании того или иного «чуда» техники, которое призвано упростить жизнь человека в самых различных областях его деятельности.

Однако первым изобретателем программируемого робота был отнюдь не Запад и Япония, а мусульманский Восток. Сделано это было свыше 800 лет назад, в эпоху Исламского возрождения, в конце XII и в начале XIII века. Изобретения мусульманских ученых эпохи ренессанса мусульманского мира сыграли ключевую роль в промышленной революции в Европе, став основой современной цивилизации [11,с.87].

Отцом современной робототехники сугодня по праву считается изобретатель, математик, астроном исламского возрождения государства империи Селджукидов Аль-Джазари. При дворе тюркской династии Селджукидов, чья столица располагалась на востоке современной Турции в Диярбакыре, как и отец служил механик-изобретатель, математик, астроном и инженер Абу аль-Изз ибн Исмаил ибн ар- Ризаз аль-Джазари (араб. الرّزاز بْنُ إِسْماعِيلِ بْنُ ٱلْعِزِ أَبُو الجزري) или просто Аль- Джазари (1136-1206) [8,с.123].

Аль-Джазари родился и до конца своих дней жил в г. Диярбакыре (Турция). Тюркское слово «gəzəri» в переводе на русский означает: непоседа, ходячий, шагающий. Но, на западе до сих пор почему то Аль-Джазари принимают как арабского ученого.

Аль-Джазари был выдающимся ученым, изобретателем первого в мире программируемых роботов. Величайший гений инженерной мысли, живший на стыке XII-XIII столетий, астроном, математик и механик-изобретатель Аль- Джазари получил в Европе прозвание «Да Винчи мусульманского мира».

На самом деле художник, изобретатель Леонардо да Винчи родился в 1452 году в городе Винчи во Флоренции (Италия) и умер в 1519 году на замке Кло- Люсе близ Амбуаза (Франция). Вполне вероятно, что Леонардо да Винчи некоторые свои изобретении заимствовал от Аль- Джазари. По этому, многие авторитетные историки, например П. Дюэм, К. Трусдели, Г.К. Михайлов подвергали сомнению ряда механических изобретений Леонардо да Винчи [1,с.58].

Аль-Джазари прославился как изобретатель диковинных механизмов. Больше всего он известен своими роботами- автоматами. Это были сложные устройства. Аль-Джазири создал свыше 50 уникальных автоматов. В том числе автоматов с выражениями лиц, а мелодии, которые они играли, были запрограммированы с помощью механизмов.

В 1206 году Аль-Джазари написал трактат «Китаб фи марифат аль-хиял аль-хандасийя» (Книга об изучении геометрических воображений), (Книга знаний об остроумных механических устройствах), где описал конструкцию около 50 механизмов, в том числе часов, роботов и кодовых замков. Многие механизмы Аль-Джазари уникальны и в более ранних источниках не упоминаются.

В XIII веке это сочинение не имело аналогов в Европе и считалось очень важным техническим трудом о теоретической и практической механике. Это книга был известен в Европе под названием «Книга знаний об остроумных механических устройствах». Была выпущена много копий этой книги. В книге описывались те механизмы, которые Аль- Джазари соорудил собственноручно. Из известных 16 копий этой книги 10 хранятся в музеях Европы, 6 в библиотеках Топкапы в Турции [3,с.106].

Аль- Джазари принадлежат не только изобретения роботов. В его активе имеется и такие технологические новшества своего времени, как использование масштабных моделей изобретений (ученый делал их из бумаги), притирка движущихся частей механизмов, металлические двери, кодовые замки, гибрид компаса с универсальными солнечными часами для любых широт и т.д. Именно Аль-Джазари изобрёл столь важную механическую деталь как коленчатый вал. **Коленчатый вал изобретенный** Аль-Джазари сегодня используется не только в автомобилях. Кроме того, он сконструировал клапанные насосы, водоподъёмные машины.

Аль-Джазари приобрел широкую известность во всем мире и даже спустя века был идейным вдохновителем для таких выдающихся ученых, как Норберт Винер, Ампер, Джеймс Клерк Максвелл, Шолем Мандельбройт и д.

На рисунках Аль-Джазари объясняя разнообразные устройства, оставил весьма ценное для истории машиностроения произведение. По мнению историков, именно он изобрел гидравлический

насос. Причем произошло это на три столетия раньше, чем подобные устройства появились в Европе. По его чертежам строились двухтактные клапанные насосы, дамбы, водоподъёмные машины и многое другое [10].

Даже в наш просвещенный век сохраняется огромный интерес к жизни и творческому наследию этого великого тюркского гения науки. Британский инженер и историк науки Дональд Хилл писал: «Трудно переоценить важность вклада Аль-Джазари в развитие инженерии. Его разработки легли в основу пособий по дизайну, производству и сборке машин».

Арабский ученый, проживающий в Англии Салим Т С Аль-Хассани пишет: «Около 1000 лет назад. Аль-Джазари довел исламских технологий и новаторских работ до кульминации».

Аль-Джазари с непосредственным натуральным созданием различных роботов и автоматов, воспроизводившие функции живых существ, в средние века интенсивно развивал свои автоматы-роботы натуральной величины по полученным знаниям *анатомии и физиологии человека*.

Внизу показаны несколько механизм и роботов изобретенные **Аль- Джазари:**

1. Коленчатый вал:

Аль- Джазари изобрел первого в мире технического новшества, коленчатого вала, умеющий преобразовывать вращательное движение в поступательное и наоборот. Революционность этого технического прогресса состоял в том, что механические движение возвратно-поступательной формы превращался во вращательное и наоборот. Изобретение коленчатого вала являлся революцией в машиностроении *(Рис.1.):*

Рис.1. Коленчатый вал.

Несмотря на эти неоспоримые факты, гораздо позже коленчатый вал якобы был «изобретен» в Европе. Впервые о коленчатом вале в Европе в 1474 году написал Франческа Джорджио “Трактате о гуситской войне». В 1780 г. изобретенный Аль-Джазари коленчатого вала запатентовал как свое собственное изобретение, некий Джеймс Пикард из Бирмингема получив свидетельство о том, что якобы именно он является изобретателем этого механизма [6,с.118].

2. Водоподъёмные машины:

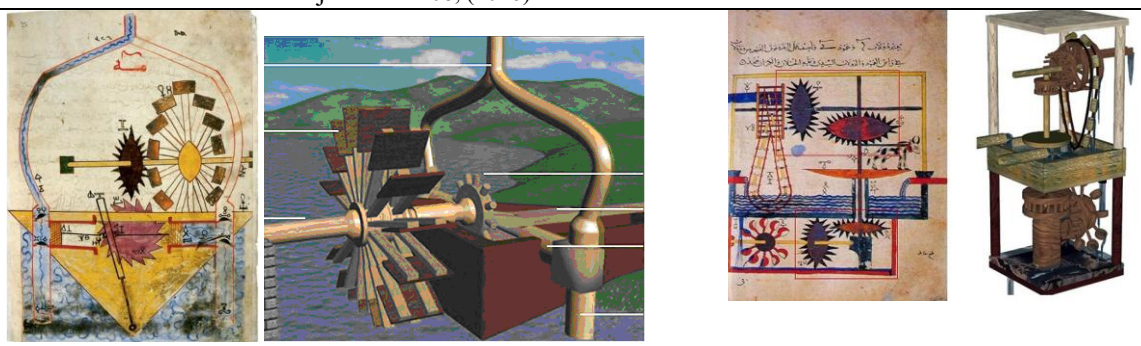
По свидетельству историков гидравлический насос был впервые изобретен Аль-Джазари на три столетия раньше, чем подобные устройства появились в Западной Европе. По его чертежам строились двухтактные клапанные насосы, дамбы, водоподъёмные машины и т. д.

Водоподъемные механизмы Аль-Джазари для подъема воды из реки или колодца, заменяли труд животных энергией воды. Водяной насос состоял из шестеренок, медных поршней, труб всасывания, нагнетания и клапанов [2,с.68]. С помощью этих насосов, вода поднимался на высоту 12 метров. *(Рис.2.):*

Рис.2. Схемы водоподъёмных насосов

Эти насосы представляли с собой один из самых ранних поршневых насосов с двойным действием. Революционный прорыв в этих гидравлических водяных насосах произошел с началом использования коленчатого вала Аль-Джазари в качестве центрального механизма водяного насоса [7,с.64].

На рис. 3 показан модель водоподъемного насоса построенный по рукописям Аль- Джазари. Водяное колесо приводить в движение механизмы из шестеренок, которые приводить в движение поршни с рычагом и две всасывающих поршня синхронно приводится в движение лопастным колесом вращающихся струей в



а *б*

Рис. 3. Чертежи насоса двойного действия (а) и цепного водоподъемного насоса (б).

Некоторые водоподъемные механизмы Аль-Джазари работают до сих пор *(Рис.3.):*

Рис.3. Работающий водоподъемный механизм Аль-Джазари.

3. **Механические роботы-музыканты:**

Механические роботы-музыканты Аль-Джазари представляли собой фигуры музыкантов, сидящие в лодке, которые были программированы играть на барабанах и цимбалах. Эти роботы пользовались успехом при дворе и запускались в озеро во время больших праздников. По мнению специалистов, они были первым программированными автоматами *(Рис.4.):*

Рис. 4. Механические роботы- музыканты.

Эти сложные люди-роботы благодаря встроенной в их внутри системе небольших сосудов, при переливании воды из одного сосуда в другой сосуд, умели играть на разных музыкальных инструментах, и заранее можно было программировать мелодии и изменить ритм музыки, которую они играли. По описанию очевидцев в это время их тела и лица двигались и обладали 50 выражений лиц [4,с.37].

4. **Замковые часы:**

Великий гений Аль-Джазари смастерил различных часов. Этих технически сложных часов в полной мере можно считать первыми в мире роботами. Не случайно, что создатель таких диковинных часов и других хитроумных механизмов Аль-Джазари сегодня справедливо считаются «отцом робототехники» (Рис.5.):

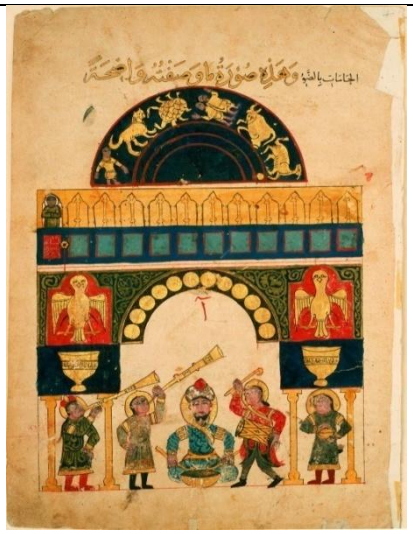


Рис.5. Замковые часы

«Замковые часы» являлись самыми большими астрономическими часами и приводились в действие водой. Это сложное устройство являлся первым программируемым компьютером. Он показывал знаков зодиака, орбиты солнца и луны. Продолжительности дней и ночей можно было повторно программировать. Часы были оснащены пятью автоматизированными музыкантами, которые исполняли мелодичные восточные песни.

Работа этих часов в течение суток сопровождался сменой механических изображений, движением фигур и музыкой. В дневное время на часах показывался солнечный, «всходящий» на востоке диск и шесть зодиака от Овна до Девы [6,с.49].

Вечером полумесяц постепенно перемещался слева направо. Когда полумесяц оказывался между двумя дверцами, верхний дверь открывался и в ней показывался мужская фигура, а нижний дверь «окрашивался» в другой цвет. По окончанию каждого часа соколы, стоявшие на боковых окошках, расправляли крылья и наклонились и из их клюкв падали в вазу по шарику. В это время слышался звук цимбал. После этого соколы, складывая крылья, возвращались в начальное положение [9,с.68].

5. Слоновые часы:

Автомат-робот Аль-Джазари «слоновые часы» являются самым знаменитым часами времен расцвета мусульманской науки (Рис.6.):

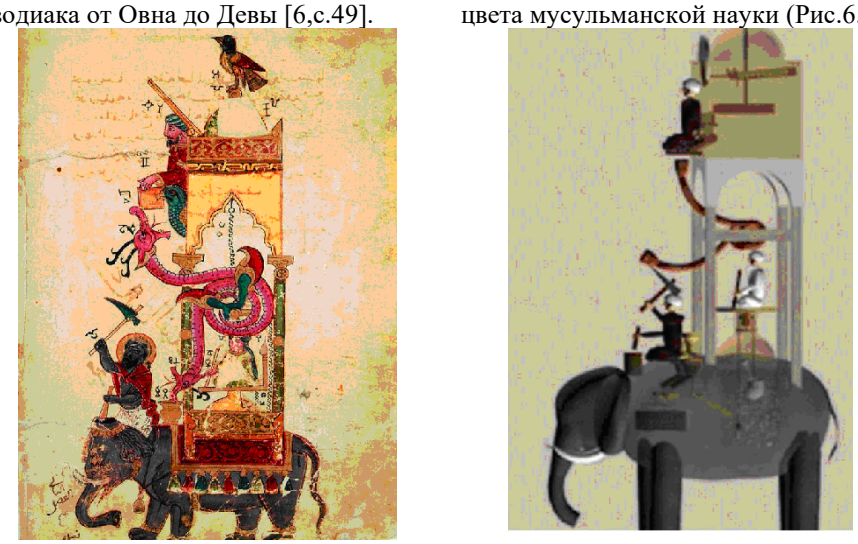


Рис.6. Слоновые часы

В этих часах, состоявшихся из индийского слона, египетского птицы- феникса, восточных фигур людей и китайских драконов применялся технологический процесс применением воды. Слон олицетворял символ власти и величия, феникс перерождение жизни, дракон могущество и несокрушимость [4,с.86].

Механизм «**Слоновых часов»** представлял собой чашу с отверстиями, расположенный в резервуаре с водой, который находился в животе слона. Через каждые полчаса чаша наполнялся и погружался в воду, что приводил в движение металлические шарики и нити, идущие от трона на спине у слона, которые в свою очередь вызывали, целую череду различных сложных движений.

На протяжении дня, когда получасовой цикл точных движений этих сложных механизмов заканчивался, чаша автоматически поднимался на поверхность и процесс начинался снова. Ввиду того, что в течение года продолжительность дня и ночи менялись два раз в сутки, во время восхода солнца и заката часы переводились в исходное положение.

Для этого шары возвращались на свое первоначальное место, и заново регулировался уровень воды [2,с.194].

В январе 2010 года на выставке «1001 изобретение мусульманской наследии в нашем мире» в Британии была продемонстрирована копия Слоновых часов работы Аль-Джазари, ставший основной достопримечательности выставки.

6. Автомат для сдачи крови:

Действия два писца сидящие над устройством, заключалось в описании количество сданной крови. (Рис.7.):

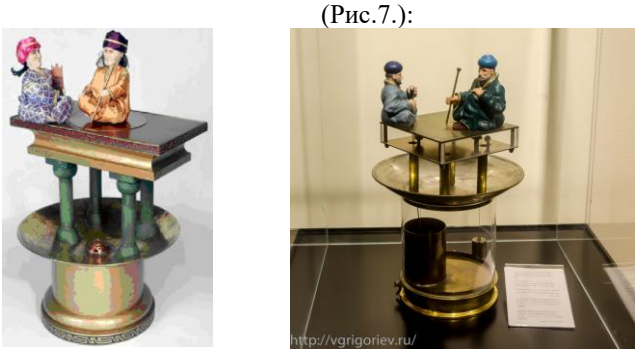


Рис.7. Автомат для сдачи крови

Описанная Аль-Джазари и реконструированная в 1977 году это устройство для сдачи крови измеряла количество крови во время сеансов кровопускания, популярной терапии в исламском мире.

7. Автомат для поения птицу-утку водой:

Автомат для поения птицу-утку начинал работать, когда птица производил звук и служанка из большого кувшина лил воду в нижнюю чашу (Рис.8.):

Рис. 8. Автомат для поения птицу-утку водой

Утка пил воду из этой чаши и после питья воды птица выпускал воду через хвост в контейнер, спрятанный под троном. Когда чашка во внутри контейнере наполнялся, рука служанки приходил в движение поднимал чашу и наполнял кувшин [10].

Мы привели несколько примеров из многочисленных механизмов и роботов изобретенные **Аль-Джазари:** Как видно **невозможно оценить масштабы важности работ Аль-Джазари** сыгравшие ключевую роль в промышленной революции в мире. **Эти работы содержать много научных мыслей и инструкций даже применяются при изготовлении современных машин и роботов.**

Выводы:

1. Рассмотрены выдающиеся исторические достижения исламской науки и множество великих открытий, которых тюркские ученый Аль-Джазари подарил миру.

2. Анализированы незаслуженно «забытые» в Европе изобретения Аль-Джазари великого тюркского ученого.

3. Показаны научный вклад Аль-Джазари в мировую науку и оказанные этим ученым огромное влияние в научной мысли Европы.

4. Анализировано достижения научной мысли Аль-Джазари, которые сыграли важную роль в эпохе Возрождения в Европе.

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MOLECULAR BIOLOGY

BIOMARKERS IN RHEUMATOLOGY: CLINICAL SIGNIFICANCE AND PROSPECTS (LITERATURE REVIEW)

Bukach O.,
Bukovyna State Medical University,
assistant of the department of internal medicine
Ilko A.,
Dudko L.,
Olijnik V.
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Abstract

Rheumatological diseases are among the most common chronic pathologies of immunoinflammatory genesis, accompanied by progressive damage to joints, connective tissue and internal organs. A significant incidence of disability, reduced quality of life and a high level of comorbidity determine the relevance of early diagnosis and timely control of disease activity. In modern rheumatology, biomarkers are of particular importance - objective laboratory indicators that can reflect pathogenetic mechanisms, the degree of inflammation, prognosis and response to therapy.

The article summarizes current data on classical and novel biomarkers in rheumatic diseases, their clinical significance and prospects for use in personalized medicine. The role of autoantibodies, cytokines, protein, genetic and multi-biomarker systems in the diagnosis and monitoring of rheumatic pathology is considered. Special attention is paid to modern molecular technologies, multi-biomarker indices and the integration of artificial intelligence into rheumatic practice.

Keywords: biomarkers, rheumatology, rheumatoid arthritis, autoantibodies, cytokines, personalized medicine, MBDA.

Introduction

Rheumatological diseases are one of the leading causes of chronic pain, disability and disability of the population worldwide. Their medical and social significance is determined not only by their high prevalence, but also by the progressive nature of the course, systemic organ damage and a significant decrease in the quality of life of patients. The most common rheumatic diseases include Rheumatoid Arthritis, Systemic Lupus Erythematosus, Ankylosing Spondylitis, Psoriatic Arthritis, systemic vasculitis, systemic scleroderma, dermatomyositis and other autoimmune diseases of the connective tissue [1].

Modern ideas about the pathogenesis of rheumatic diseases indicate the complex multifactorial nature of these pathologies. Genetic predisposition, disorders of innate and adaptive immunity, activation of pro-inflammatory cytokines, epigenetic mechanisms, as well as the influence of environmental factors play an important role in the development of diseases. Chronic immunoinflammation leads to damage to the synovial membrane, destruction of cartilage and bone tissue, the formation of systemic manifestations and the development of comorbid conditions, in particular cardiovascular complications, osteoporosis and kidney damage [13].

Despite significant progress in the treatment of rheumatic diseases, the problem of early diagnosis and timely appointment of effective therapy remains extremely relevant. In many cases, clinical manifestations in the early stages are nonspecific, which complicates the verification of the diagnosis and leads to the loss of the “therapeutic window of opportunity”. It has been established that early detection of the pathological process and timely appointment of basic therapy significantly reduce the risk of structural damage to the joints and improve the long-term prognosis [10].

In this context, biomarkers are of particular importance - objective biological indicators that can reflect the activity of the pathological process, the degree of immune inflammation, the risk of disease progression and the body's response to treatment. The use of biomarkers in rheumatology allows to increase the accuracy of diagnosis, assess disease activity, predict the development of complications and monitor the effectiveness of therapy [16].

Traditionally, nonspecific markers of systemic inflammation, such as erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP), have been widely used in rheumatology practice. However, modern rheumatology is actively developing in the direction of finding more specific molecular and genetic indicators that can more accurately reflect the pathogenetic mechanisms of the disease. Particular attention is paid to autoantibodies, cytokines, matrix metalloproteinases, acute phase proteins, genetic markers and epigenetic mechanisms [5].

An important achievement in recent years has been the introduction of multi-biomarker disease activity assessment systems that combine several laboratory parameters into a single integrated index. Such approaches allow for a more objective assessment of the activity of rheumatic diseases and personalization of therapeutic tactics. One example is the MBDA (Multi-Biomarker Disease Activity score), which is used to quantitatively assess the activity of rheumatoid arthritis [20].

In addition to traditional laboratory methods, modern research is actively focused on the study of new

technologies - genomics, proteomics, metabolomics and transcriptomics. Another promising direction is the study of the role of the intestinal microbiome in the formation of autoimmune inflammation. It is believed that changes in the composition of the intestinal microflora can affect the activation of the immune system and participate in the development of rheumatic diseases [16].

The development of personalized medicine, the concept of which involves individual selection of therapy based on the patient's biomarker profile, is also of significant importance. The use of modern information technologies and artificial intelligence algorithms opens up new opportunities for analyzing large sets of clinical and molecular data, creating prognostic models, and optimizing treatment [22].

Thus, biomarkers are an important tool in modern rheumatology, which allows not only to deepen the understanding of the pathogenesis of rheumatic diseases, but also to improve diagnostic and therapeutic approaches. Further study of molecular mechanisms and the introduction of new biotechnologies will contribute to the development of personalized medicine and improve the treatment outcomes of patients with rheumatic pathologies.

The aim of the study is to analyze current data on the clinical significance of biomarkers in rheumatology, to assess their role in diagnosis, disease prognosis, and monitoring the effectiveness of therapy.

Materials and Methods

An analysis of modern scientific publications, international clinical guidelines, and research results on the use of biomarkers in rheumatology practice was conducted. Methods of systematization, comparison, and generalization of literature data were used.

Results and Discussion

According to the definition of the National Institutes of Health, a biomarker is an objectively measurable indicator that characterizes normal biological processes, pathological changes, or the body's response to a therapeutic intervention [1].

In rheumatology, biomarkers are conventionally divided into several main groups (Table 1) [3]:

Category	Clinical significance
Diagnostic	Confirmation of the disease
Prognostic	Assessment of risk of complications and progression
Activity markers	Determination of the degree of inflammation
Predictors of response to therapy	Prediction of treatment effectiveness
Markers of organ damage	Detection of target organ damage

Traditional markers of systemic inflammation

The most common laboratory markers of inflammation include erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP).

ESR is a nonspecific indicator of systemic inflammation and is widely used in the assessment of rheumatic disease activity. Elevated values are often observed in rheumatoid arthritis, systemic lupus erythematosus, and vasculitis. However, ESR levels can be affected by age, gender, anemia, and comorbidities [15].

CRP is an acute phase protein, the synthesis of which is stimulated mainly by interleukin-6. Unlike ESR, CRP responds more quickly to changes in the intensity of the inflammatory process and more accurately reflects the activity of the disease [4].

Pentraxin-3 (PTX3) as a modern biomarker remains one of the promising local markers. Unlike CRP, which is synthesized in the liver, PTX3 is produced in the focus exclusively by macrophages, endothelial cells, fibroblasts and neutrophils [18].

PTX3 synthesis is activated under the influence of IL-1β, TNF-α and bacterial components. Pentraxin-3 is involved in complement regulation, angiogenesis and tissue remodeling. An increase in its level is associated with the aggressive course of rheumatoid arthritis, the development of erosive changes and vascular lesions [18].

The advantage of PTX3 is its high sensitivity to local vascular inflammation, making it a promising marker for assessing vasculitis and cardiovascular risk.

In Table 2, we can see the differences between CRP and pentraxin-3.

Table 2

Comparison of pentraxin-3 with C-reactive protein (CRP)

Sign	Pentraxin-3	C-reactive protein
Source	Local tissues	Liver
Response speed	Very fast	moderate
Specificity	Higher (local inflammation)	Lower
Vascular inflammation	High sensitivity	limited

However, the use of PTX3 is limited in routine practice, requires further investigation, and is not available in testing.

It should be used to predict response to biological therapy and to monitor vasculitis and vascular risk, which will significantly improve the diagnosis and monitoring of rheumatic diseases.

Immunological biomarkers include autoantibodies [2].

Rheumatoid factor is an autoantibody directed against the Fc fragment of IgG. It is detected in the majority of patients with rheumatoid arthritis. High RF titers are associated with a more severe course of the disease and the development of erosive joint lesions.

Antibodies to cyclic citrullinated peptide (anti-CCP) are highly specific for rheumatoid arthritis and can be detected long before clinical symptoms appear. Their presence is associated with a more aggressive course of the disease.

Antinuclear antibodies (ANA) are important markers of systemic connective tissue diseases. They are widely used in the diagnosis of systemic lupus erythematosus, systemic scleroderma, and dermatomyositis.

Anti-dsDNA (antibodies to double-stranded DNA) have high specificity for systemic lupus erythematosus and correlate with the risk of lupus nephritis [2].

Proinflammatory cytokines, including TNF-α, IL-1, IL-6, and IL-17, play a leading role in the pathogenesis of rheumatic diseases. Their increased expression supports chronic inflammation, stimulates joint destruction, and the formation of systemic manifestations [20].

Elevated levels of these cytokines are associated with active rheumatic diseases and have become targets for biological therapy. Matrix metalloproteinases (MMPs) are involved in the degradation of cartilage and bone. Elevated levels of MMP-3 may indicate progression of joint damage [20].

Genetic and epigenetic biomarkers, particularly HLA-DRB1 ("shared epitope"), have been associated with an increased risk of developing rheumatoid arthritis and a more severe course of the disease [11]. Epigenetic mechanisms, including microRNAs, regulation of DNA methylation, and histone modifications, are considered promising areas of research. They may serve as novel biomarkers of disease activity and response to treatment [11].

These molecules have become the main therapeutic targets for modern biological drugs. It has been established that the level of individual cytokines can be a predictor of the effectiveness of targeted therapy

Let us consider protein biomarkers and their role in the pathogenesis of rheumatic diseases (Table 3) [7].

Table 3

Protein biomarkers of tissue damage

Biomarker	Clinical significance
MMP-3	Cartilage destruction marker
Calprotectin	Indicator of neutrophilic inflammation
VEGF	Reflects angiogenesis
14-3-3η	Associated with RA severity
MBDA	Comprehensive activity assessment

That is, with the development of biological and targeted synthetic drugs, the need for markers that can predict the effectiveness of treatment has increased. For example, IL-6 levels can be a predictor of response to IL-6 inhibitors, while TNF-α expression can predict response to anti-TNF therapy [14].

Achieving clinical remission is the main goal of treating rheumatic diseases, but the absence of clinical symptoms does not always correspond to the complete cessation of the inflammatory process. A number of studies have shown that even with normalization of activity indices (DAS28, CDAI), subclinical inflammation persists in some patients, which can lead to further structural damage to the joints [7].

In this context, biomarkers such as [21] play an important role:

- high-sensitivity C-reactive protein (hs-CRP),
- calprotectin (S100A8/A9)
- 14-3-3η-protein.

Calprotectin is considered a more sensitive marker of synovial inflammatory activity than CRP and may remain elevated even in clinical remission. Elevated levels of 14-3-3η are associated with progression of erosive changes and may indicate a high risk of relapse after tapering therapy [6].

Thus, the use of remission biomarkers allows for a more accurate assessment of the effectiveness of treatment and informed decisions regarding its de-escalation. In addition to markers of inflammation, biomarkers that reflect the degradation of cartilage and bone tissue are important in rheumatology.

These include [8]:

- matrix metalloproteinases (MMP-1, MMP-3),
- collagen type II fragments (CTX-II),
- osteoclast-associated markers.

Elevated MMP-3 levels correlate with rheumatoid arthritis activity and radiographic progression. Markers of type II collagen degradation allow for the assessment of the extent of cartilage damage before visible changes appear on radiographs. This opens up prospects for earlier intervention and prevention of irreversible structural changes [16].

In systemic rheumatic diseases, biomarkers are of particular importance for early detection of vital organ damage. For example, in systemic lupus erythematosus, an increase in anti-dsDNA titer and a decrease in complement (C3, C4) levels correlate with disease activity and the risk of developing lupus nephritis.

In systemic vasculitis, ANCA antibodies are important, the level of which may reflect the activity of the vasculitic process, although their use for monitoring the course of the disease remains a subject of debate. Detection of biomarkers of organ damage allows for timely adjustment of therapy and reduces the risk of severe complications [16].

Therefore, an increase in MMP-3 levels correlates with the progression of structural joint damage. Calprotectin is considered a more sensitive indicator of synovial inflammation compared to CRP.

A modern direction in rheumatology is the creation of multi-biomarker systems for assessing disease activity.

MBDA (Multi-Biomarker Disease Activity score) is a multi-biomarker disease activity index developed to quantitatively assess the activity of Rheumatoid Ar-

thritis based on laboratory analysis of a set of serum biomarkers. The method was created to increase the objectivity of monitoring the course of the disease and optimize therapeutic tactics in rheumatological practice [19].

MBDA is an integrated algorithm that includes the determination of 12 biomarkers that reflect different pathophysiological mechanisms of rheumatoid inflammation, including cytokine activation, angiogenesis, tissue remodeling, acute phase response, and metabolic changes. The panel includes [9]:

- C-reactive protein (CRP);
- interleukin-6 (IL-6);
- serum amyloid A (SAA);
- vascular cell adhesion molecule-1 (VCAM-1);
- tumor necrosis factor receptor type I (TNF-RI);
- epidermal growth factor (EGF);
- vascular endothelial growth factor A (VEGF-A);
- matrix metalloproteinase-1 (MMP-1);
- matrix metalloproteinase-3 (MMP-3);
- leptin;
- resistin;
- YKL-40 (human cartilage glycoprotein-39).

Based on a mathematical algorithm, a final score is formed in the range from 1 to 100, which correlates with the level of activity of rheumatoid arthritis [9]:

- <30 points - low activity;
- 30–44 points - moderate activity;
- 44 points - high disease activity.

The main advantage of MBDA is the ability to objectively assess the inflammatory process independently of the subjective components of clinical indices such as DAS28 or CDAI, which are largely dependent on the patient and physician's assessment of pain. This is especially important in cases of concomitant fibromyalgia, obesity, or chronic pain syndrome, where clinical scales may overestimate disease activity.

It has been proven that high MBDA values are associated with [12]:

- progression of erosive changes in the joints;
- increased risk of radiographic progression;
- lower probability of achieving remission;
- higher incidence of cardiovascular complications in patients with rheumatoid arthritis.

In addition to its diagnostic and prognostic role, MBDA is used for [17]:

- monitoring the effectiveness of basic therapy;
- assessing the response to biological drugs;
- stratifying the risk of disease progression;
- personalizing treatment according to the treat-to-target concept.

However, the method has certain limitations. MBDA results can vary depending on age, sex, body mass index, and concomitant infectious or metabolic conditions. In addition, the cost of the test and its limited availability in many countries hinder its widespread implementation in routine clinical practice.

Current studies demonstrate that MBDA is a promising tool in precision rheumatology, which allows combining laboratory assessment of systemic inflammation with disease progression prediction and individualization of therapeutic strategies in patients with rheumatoid arthritis.

Therefore, MBDA allows for a more objective assessment of rheumatoid arthritis activity, especially in patients in whom clinical indices may be confounded by comorbid conditions. Despite its limited availability, this approach shows potential for future clinical application.

Among genetic factors, HLA-DRB1 is of particular importance, as it is associated with an increased risk of developing rheumatoid arthritis.

In recent years, epigenetic mechanisms have been actively studied [11]:

- microRNA;
- DNA methylation;
- histone modifications.

These molecular mechanisms may become new tools for early diagnosis and prediction of the course of rheumatic diseases.

Despite significant progress, the use of biomarkers in rheumatology has certain limitations. No biomarker is completely specific or sensitive, and their levels can change under the influence of concomitant diseases, infections or drug therapy. In addition, the high cost of some molecular and genetic tests limits their widespread use in everyday practice. Therefore, the interpretation of biomarkers should be carried out exclusively in conjunction with clinical data and the results of instrumental research methods.

The future of rheumatology lies in the implementation of personalized medicine. Combining biomarker profiles with imaging methods, genetic technologies, and artificial intelligence algorithms opens up new possibilities for predicting the course of the disease and individualizing therapy.

Of particular interest are technologies [4]:

- genomics;
- proteomics;
- metabolomics;
- intestinal microbiome analysis.

The use of machine learning systems will allow the creation of personalized predictive models and the optimization of treatment strategies.

Conclusions

Biomarkers are an integral part of modern rheumatology and are important for early diagnosis, assessment of disease activity, prognosis and monitoring of treatment effectiveness. Modern molecular technologies and multi-biomarker systems create the basis for the development of personalized medicine and improved clinical outcomes in patients with rheumatic diseases.

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MOLECULAR PHYSIOLOGY AND GENETICS

ASSESSMENT OF THE EFFECTIVENESS OF SIMULATION SCENARIOS IN FORMING CLINICAL COMPETENCES OF MEDICAL UNIVERSITY STUDENTS

Bukach O.,
Bukovyna State Medical University,
assistant of the department of internal medicine
Vataman K.,
Tomchuk A.,
Nykoriak D.,
Bodnar V.
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Abstract

Modern medical education is undergoing a profound transformation, accompanied by a transition from the traditional model of knowledge transfer to competency-based learning. One of the most effective tools for training future doctors today is considered to be simulation technologies, which allow the formation of clinical skills, professional thinking, team interaction and communication competencies without risk to the patient. The article analyzes the role of simulation scenarios in modern medical education, their impact on the development of clinical thinking, decision-making under stressful conditions, the formation of interprofessional interaction skills and the safe performance of medical manipulations. Special attention is paid to the importance of digital technologies, virtual reality, adaptive learning systems and debriefing as a key stage of reflective learning. It has been established that the systematic use of simulation scenarios increases the level of professional readiness of students, helps reduce the number of clinical errors and ensures compliance with international standards of medical education.

Keywords: simulation training, clinical competencies, medical education, debriefing, virtual technologies, clinical thinking, competency-based education.

Introduction

The medical education system in the 21st century is undergoing significant structural and conceptual changes. Globalization, the rapid development of digital technologies, the introduction of international patient safety standards, and increased requirements for the professional training of doctors have necessitated a review of traditional teaching methods. The classical model of doctor training, which was based mainly on theoretical training and passive observation of clinical practice, is gradually losing its effectiveness in modern conditions [1].

One of the most promising areas of reforming medical education is the introduction of simulation technologies. Simulation training allows you to create a controlled educational environment that is as close as possible to real clinical practice, in which the student can safely practice professional skills, analyze their own mistakes and improve clinical thinking. Unlike traditional bedside training, simulation scenarios provide a standardized approach to the formation of practical competencies and minimize risks to patient health [2].

Simulation learning has become particularly relevant in the context of the transition to competency-based education, where the main goal is not the amount of information learned, but the student's ability to effectively apply knowledge in real clinical situations. Simulation technologies have become an important tool for assessing the level of professional competence, clinical thinking, communication skills, and team interaction [3].

Modern simulation centers use high-tech mannequins, virtual reality, interactive digital patients, and artificial intelligence systems, which significantly increases the level of realism of the educational process. This allows you to simulate both typical clinical situations and rare critical conditions that the student may not encounter during normal clinical practice [4].

The modern model of medical education focuses on the formation of specific professional competencies necessary for the safe and effective provision of medical care. The competency-based approach involves the integration of theoretical knowledge, practical skills, clinical thinking and professional behavior [5].

In this context, simulation scenarios are one of the most effective methods for assessing students' clinical readiness. They allow testing the future doctor's ability to act under uncertainty, make quick decisions, and work in a team. Simulation technologies provide the possibility of multiple repetition of procedures until the required level of mastery is achieved, which corresponds to the modern concept of mastery learning [6].

One of the main arguments in favor of implementing simulation technologies is ensuring patient safety. The traditional principle of “see one, do one, teach one” in modern medicine is considered insufficiently safe, since the first practical manipulations of a student may be accompanied by a high risk of errors [7].

The simulation environment allows the learning process to be transferred from the clinical department to the controlled conditions of a training center. Students have the opportunity to practice skills in cardiopulmonary resuscitation, tracheal intubation, vascular catheterization, emergency care, and other manipulations without risk to the patient's life [7].

In addition, simulation scenarios form a culture of safety and responsibility in future doctors. Error analysis during debriefing allows students to understand the cause-and-effect relationships between incorrect actions and clinical complications [8].

Clinical thinking is a key component of a physician's professional activity. It includes the ability to analyze clinical information, form diagnostic hypotheses, conduct differential diagnostics, and make optimal treatment decisions [8].

Simulation scenarios create conditions for the active development of clinical thinking. During the execution of the scenario, the student must assess the patient's condition, interpret laboratory and instrumental data, determine the priority of actions and choose the right treatment tactics [9].

Of particular importance is the simulation of critical conditions, such as anaphylactic shock, acute coronary syndrome, multiple organ failure, or sepsis. Working under conditions of artificially created stress contributes to the development of resistance to emotional stress and increases readiness to work in real emergency situations [10].

The digitalization of medical education has significantly expanded the possibilities of simulation training. Virtual patients, VR/AR technologies, and interactive platforms allow for the creation of highly realistic clinical practice scenarios [10].

Virtual reality provides the effect of complete immersion in the clinical environment. The student can work in a virtual operating room, intensive care unit or waiting room, practicing care algorithms in conditions of maximum realism [11].

Artificial intelligence systems allow adapting the level of complexity of scenarios to the individual characteristics of the student. By analyzing errors and decision-making speed, the program can automatically change the parameters of the clinical situation, creating a personalized learning trajectory [12].

Modern medicine is multidisciplinary, so effective interaction between members of the medical team is crucial. A significant number of clinical errors arise precisely because of communication breakdowns between medical professionals [12].

Simulation scenarios allow students to practice the principles of teamwork, crisis management, and standardized communication. Using the SBAR protocol helps students structure clinical communications and minimize the risk of losing important information [13].

Another important area is the development of empathy and communication skills with patients. Working with standardized patients allows students to learn how to deliver bad news, collect medical history in difficult psychological situations, and maintain professional ethical behavior.

Debriefing is an integral part of simulation training. It is at this stage that a deep understanding of the experience gained, analysis of errors, and formation of professional reflection take place [14].

Modern debriefing models are based on the principles of psychological safety and partnership between the teacher and the student. During the discussion, the emphasis is not on criticism, but on analyzing the logic of clinical decision-making.

Using video recordings of the scenario allows students to objectively evaluate their own actions, nonverbal behavior, and the effectiveness of team interaction. This contributes to the development of metacognition and the formation of the ability to continuous professional improvement [15].

Conclusions

Simulation training is one of the most effective directions of modernization of modern medical education. The use of simulation scenarios allows to form clinical competencies, practical skills, professional thinking and communicative abilities of future doctors in a safe controlled environment.

The integration of digital technologies, virtual reality and artificial intelligence significantly increases the effectiveness of the educational process and ensures the personalization of educational trajectories. Of particular importance are debriefing and reflective learning, which contribute to a deep analysis of clinical experience and the formation of professional identity.

Further development of simulation technologies in medical education will help improve the quality of medical personnel training, reduce the number of medical errors, and ensure a high level of patient safety.

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PEDAGOGY

WAYS TO IMPROVE QUALITY IN EDUCATION

Hasanova G.
Teacher, Sumgayit State University, Azerbaijan
Mammadova A.
Teacher assistant, Sumgayit State University, Azerbaijan
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Abstract

In the modern era, the education system acts as one of the main factors of the sustainable development of society, and globalization together with technological innovations creates new demands for it. Education is no longer limited only to the transfer of knowledge, but is also regarded as a complex process that ensures the intellectual, social, and emotional development of the individual. In this regard, the concept of quality in education acquires a broad meaning and is closely connected with the formation of human capital. The teacher factor plays a decisive role in ensuring quality in education. A modern teacher is not only a provider of knowledge, but also a guide, motivator, and organizer of the learning process. Therefore, the professional training, continuous development, and social welfare of teachers are of particular importance. At the same time, the modernization of curricula, their orientation toward the development of practical skills, and their adaptation to labor market requirements are among the essential conditions. The application of digital technologies increases accessibility and effectiveness in education and creates new learning opportunities. In addition, a formative and transparent assessment system creates conditions for monitoring students' development and improving the teaching process. The educational environment, infrastructure, management and leadership, as well as the participation of parents and society, are also important factors affecting quality. Furthermore, the training of qualified teaching staff, international cooperation, and the application of innovative approaches contribute to the development of the education system. The grounding of educational programs in national values serves to preserve the cultural identity of society. As a result, improving quality in education is a strategic process that requires a comprehensive and continuous approach.

Keywords: education, quality in education, teacher training, curriculum, digital technologies, assessment system, inclusive education, educational management, innovation, national education model.

In the modern era, the education system acts as one of the main pillars of the sustainable development of society. Globalization, technological progress, and the formation of the information society place new and more complex responsibilities on education. Education is no longer merely a mechanism for transferring knowledge, but also a multifaceted system that ensures the intellectual, social, and emotional development of the individual. In this regard, the concept of "quality in education" acquires a broader meaning and is associated not only with academic outcomes but also with the formation of human capital. Therefore, improving quality in education is a strategic issue that requires a comprehensive approach.

The most important aspect of the educational process is its quality. The quality of education is the ability of education workers to respond to the needs and demands of society at the expected level through their knowledge, skills, and behavior (Bayrak, 2001). Bayrak, S. (2001). "Eğitim ve Kalite İlişkisi". Türk Yurdu, vol.17, issue: 123, p.40.

One of the main components of ensuring quality in education is the teacher factor. The teacher stands at the center of the educational process, and his or her professionalism directly affects the outcomes of teaching. A modern teacher is not only a person who imparts knowledge, but also acts as a facilitator, mentor, and guide. He or she should encourage students to think independently, conduct research, and realize their potential. This makes the continuous professional development of teachers essential. Various trainings, seminars, professional development programs, and international exchange of experience create opportunities for teachers to update their knowledge and skills. At the same time, increasing the prestige of the teaching profession, improving teachers' social welfare, and enhancing their motivation are also important factors positively influencing the quality of education.

Stimulating the work of students and teachers is also one of the important factors in achieving quality. This is because the teaching process is not the transfer of ready-made knowledge from the teacher to the student (learner), but a collaborative activity between educators and learners, involving the acquisition of scientific knowledge and the rules for applying it in practice by learners. This process requires the assimilation of humanity's acquired experience by learners, as well as the stimulation and management of their external and internal activities (Mammadzade, 2010). Mammadzade, R. (2010). Quality in Education as One of the Leading Directions. "Müəllim" publishing house. 169 p.

The content and structure of curricula also play an important role in shaping quality in education. While the traditional education system mainly prioritized the transfer of theoretical knowledge, modern approaches emphasize the development of practical skills and competencies. Today, the labor market needs individuals who are not only knowledgeable but also flexible thinkers, capable of solving problems and working in teams. Therefore, curricula should be connected with real life and aimed at developing students' analytical and creative thinking abilities. Project-based learning, problem-

oriented teaching, and research activities are of particular importance in this regard.

The development of digital technologies has led to revolutionary changes in the education system. The widespread use of the internet, the accessibility of mobile devices, and the availability of various educational platforms have made the teaching process more flexible and interactive. Electronic textbooks, virtual laboratories, online courses, and artificial intelligence-based educational tools create learning opportunities tailored to students' individual needs. In particular, distance and hybrid education models increase accessibility to education by eliminating time and space limitations. Along with this, the formation of digital literacy is also important, because the ability to use technology correctly is considered one of the main competencies of the modern era.

The assessment system is one of the important indicators of quality in education. While traditional assessment methods mainly focus on final results, modern approaches envisage continuous monitoring of the learning process. Formative assessment makes it possible to determine students' development dynamics and identify their strengths and weaknesses. This helps teachers regulate teaching methods more effectively. At the same time, a fair and transparent assessment system increases students' motivation and positively changes their attitude toward education.

✓ According to M.V. Klarin, the following should be taken into account in the technological approach to the assessment and study of the quality of education:

Determining objectives and maximum precision in order to achieve results;

Preparing teaching materials and organizing all directions of instruction in accordance with educational objectives;

✓ Evaluation of current results;

✓ Adjustment of training in order to achieve objectives;

✓ Final evaluation of results (Klarin, 1984: 4).

The educational environment and infrastructure also play an important role in improving quality. Modern educational institutions are not only places where lessons are conducted, but also favorable social environments for learning. Comfortable and safe classrooms, modern technical equipment, laboratories, and rich library resources increase students' interest in the learning process. Along with this, creating an inclusive educational environment is of particular importance in ensuring social equality. Every child has the right to receive quality education regardless of individual characteristics, and ensuring this right is one of the main responsibilities of the state.

Educational management and leadership are also among the important factors in ensuring quality in education. Without an effective management system, it is difficult for reforms carried out in the field of education to produce successful results. School leaders should think strategically, encourage innovative approaches, and support the professional development of teachers. At the same time, it is important to adhere to the principles of transparency and accountability in decision-making. This leads to increased trust in the education system and an overall rise in quality.

The training of qualified teachers is one of the most important directions of the education system. The role of the teacher is of decisive importance in ensuring quality and successful education. For this reason, the training of professional teaching staff is considered a priority issue for countries aiming to achieve high results in education. Quality, efficiency, and effectiveness in education directly depend on the level of teachers' professionalism. High quality in the teaching profession is possible through the application of a systematic training model based on scientific principles. In general, increasing the level of service in any field depends on the professional training of specialists working in that field. In this regard, it is important to prepare special teacher training programs that combine both theoretical and practical components in order to train teachers who meet the requirements of the modern era. The implementation of such programs in all higher education institutions of the country and their systematic teaching to students studying in teaching specialties are of great importance in terms of improving the quality of education.

The participation of parents and society in the educational process is also among the noteworthy factors. The family environment directly affects a child's education, and parental support plays an important role in students' success. Strengthening cooperation between schools and families, involving parents in the educational process, and increasing their awareness positively affect the quality of education. In addition, the value and attention that society gives to education also play an important role in the development of this field.

International cooperation and exchange of experience are also of special importance in the modern education system. Integration into the global educational space, studying and applying the advanced experiences of different countries contribute to improving quality in education. Student and teacher exchange programs, international projects, and scientific cooperation are important tools in this regard. Such initiatives also create conditions for broadening individuals' worldviews and forming multicultural values.

Innovation and creativity also play an important role in the process of improving quality in education. The application of new ideas, testing alternative teaching methods, and sharing experiences ensure the dynamic development of the education system. Encouraging startup thinking, research-oriented education, and creative activities help reveal students' potential.

The education program should be national. Every nation tries to prepare its children for the future by educating them based on its own values. Since nations know very well the value and place of education for preserving their existence, they show particular sensitivity to influences that distance younger generations from their history, culture, and origins (Kayadibi, 1994). Kayadibi, F. (1994). The Importance of Education and Teaching in Development. Diyanet Journal. Volume: 30, Issue: 3, Ankara, p. 79.

In conclusion, improving quality in education is a multifaceted and continuous process. This process depends on teachers' professionalism, the relevance of

curricula, the proper application of technologies, an effective assessment system, modern infrastructure, and the general approach of society. Only through the interaction and systematic development of these factors is it possible to form a high-quality and competitive education system. Such an education system creates the foundation for raising future generations as knowledgeable, creative, and responsible citizens and ensures the sustainable development of society.

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ІНФОРМАЦІЙНІ ТЕХНОЛОГІЇ ТА ІННОВАЦІЙНІ МОДЕЛІ УПРАВЛІННЯ У ВИКЛАДАННІ ФІЗИЧНОЇ КУЛЬТУРИ В ЗАКЛАДАХ ЗАГАЛЬНОЇ СЕРЕДНЬОЇ ОСВІТИ В УМОВАХ РЕАЛІЗАЦІЇ КОНЦЕПЦІЇ НУШ

Ливацький О.
кандидат педагогічних наук, доцент,
ДЗ «Луганський національний університет імені Тараса Шевченка», Україна
ORCID ID: https://orcid.org/0000-0002-8012-9116
Отравенко О.
кандидат педагогічних наук, доцент,
ДЗ «Луганський національний університет імені Тараса Шевченка», Україна
ORCID ID: https://orcid.org/0000-0001-8308-5895
Семенов М.
кандидат педагогічних наук, доцент,
ДЗ «Луганський національний університет імені Тараса Шевченка», Україна
ORCID ID: https://orcid.org/0000-0003-4989-8109

INFORMATION TECHNOLOGIES AND INNOVATIVE MANAGEMENT MODELS IN PHYSICAL EDUCATION IN GENERAL SECONDARY EDUCATION INSTITUTIONS IN THE CONTEXT OF THE NEW UKRAINIAN SCHOOL CONCEPT

Lyvatskyi O.
PhD in Pedagogical Sciences, Associate Professor,
State Institution "Luhansk Taras Shevchenko National University", Ukraine
ORCID ID: https://orcid.org/0000-0002-8012-9116
Otravenko O.
PhD in Pedagogical Sciences, Associate Professor,
State Institution "Luhansk Taras Shevchenko National University", Ukraine
ORCID ID: https://orcid.org/0000-0001-8308-5895
Semenov M.
PhD in Pedagogical Sciences, Associate Professor,
State Institution "Luhansk Taras Shevchenko National University", Ukraine
ORCID ID: https://orcid.org/0000-0003-4989-8109
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Анотація

У статті проаналізовано роль інформаційних технологій та інноваційних моделей управління в системі фізичного виховання НУШ. Обґрунтовано перехід до управління, базованого на аналізі даних, та впровадження моделі «перевернутого навчання». Визначено напрями вдосконалення управлінської діяльності педагогів в умовах цифровізації.

Abstract

The article analyzes the role of IT and innovative management models in the physical education system of the NUS. The transition to data-driven management and the implementation of the "flipped learning" model are substantiated. Directions for improving the management activities of teachers in the context of digitalization are identified.

Ключові слова: фізична культура, НУШ, інформаційні технології, управління, цифровізація, моніторинг, компетентність.

Keywords: physical education, NUS, information technologies, management, digitalization, monitoring, competence.

Актуальність теми. Сучасний етап розвитку системи загальної середньої освіти в Україні, що ґрунтується на положеннях Концепції «Нова українська школа» [11] та Державного стандарту базової середньої освіти [13], передбачає фундаментальну трансформацію освітнього процесу. Пріоритетного значення набуває перехід від традиційної трансляції знань до формування ключових компетентностей учнів, де фізична культура розглядається як важливий інструмент здоров'язбереження, розвитку особистості та формування культури здорового способу життя [1]. Як підкреслюють А. Величко та Ю. Мусхаріна [1], розвиток здоров'язбережувальної компетентності потребує інтеграції сучасних європейських практик і цифрових освітніх рішень у систему шкільного фізичного виховання.

Водночас стрімкий розвиток цифрового суспільства зумовлює необхідність оновлення організаційно-управлінських моделей діяльності закладів загальної середньої освіти. У працях О. Мармази [9], В. Танської та співавторів [16] наголошується, що цифровізація освіти суттєво змінює підходи до управління освітнім процесом, планування навчальної діяльності, моніторингу результатів навчання та професійної взаємодії педагогів. У сучасних умовах особливого значення

набуває використання цифрових платформ, мобільних застосунків, SMART-технологій та засобів аналітики даних для персоналізації фізичного виховання учнів і підвищення ефективності педагогічного менеджменту.

Проблема дослідження полягає в тому, що, попри активне впровадження цифрових технологій у систему освіти, методика викладання фізичної культури в закладах загальної середньої освіти часто зберігає традиційний характер і недостатньо орієнтується на сучасні інформаційно-цифрові можливості. Існує суперечність між потребою в реалізації особистісно зорієнтованого та компетентнісного підходів, на чому акцентують Н. Денисенко, О. Дишко та М. Палюх [5], і недостатнім рівнем використання цифрових інструментів у професійній діяльності вчителя фізичної культури. Як зазначають В. Гейтенко, С. Шинкарьов та Н. Шинкарьова [2], застосування цифрових технологій на уроках фізичної культури здебільшого має фрагментарний характер і потребує системного методичного та організаційного забезпечення. Ю. Ямполь [18] наголошує на доцільності ширшого використання інформаційно-цифрових технологій для підвищення якості управління освітнім процесом, а О. Столяренко та співавтори [15] підкреслюють необхідність удосконалення підготовки педагогічних кадрів до професійної діяльності в умовах цифрової трансформації освіти.

Мета статті полягає в теоретичному обґрунтуванні та систематизації інноваційних моделей управління освітнім процесом із фізичної культури на засадах використання сучасних інформаційних технологій (ІТ) в умовах реалізації Концепції НУШ.

Завдання дослідження:

– проаналізувати можливості використання цифрових засобів для моніторингу та корекції фізичної активності учнів;

– обґрунтувати ефективність інноваційних цифрових моделей організації навчального процесу з фізичної культури;

– визначити напрями вдосконалення організаційно-управлінської діяльності вчителя фізичної культури в умовах цифровізації освіти.

У процесі дослідження використано такі методи: аналіз і узагальнення науково-методичної літератури, системний аналіз, порівняння та метод теоретичного моделювання.

Виклад основного матеріалу. Сучасний етап розвитку системи фізичного виховання в закладах загальної середньої освіти характеризується активним упровадженням цифрових технологій, трансформацією організаційно-управлінських підходів та переорієнтацією освітнього процесу на компетентнісну модель навчання, визначену Концепцією НУШ. У цих умовах фізична культура поступово виходить за межі традиційного підходу до організації уроку та набуває ознак інтегрованого освітнього середовища, у якому поєднуються педагогічні, інформаційно-технологічні та управлінські компоненти. Саме тому сучасний менеджмент фізичного виховання потребує відходу від директивних моделей організації освітнього процесу на користь аналітичних, гнучких та адаптивних систем управління.

Як зазначають О. Ливацький, О. Отравенко та Л. Ваховський [11], системний аналіз виступає фундаментальною основою прийняття ефективних управлінських рішень у галузі фізичної культури. Науковці наголошують, що сучасне фізичне виховання повинно базуватися на комплексному врахуванні педагогічних, фізіологічних, психологічних та організаційних чинників. У контексті цифровізації це передбачає використання сучасних інформаційних технологій для збору, аналізу та інтерпретації даних щодо фізичної активності учнів, рівня їхньої мотивації та ефективності освітнього процесу.

Особливого значення набуває впровадження SMART-технологій у систему фізичного виховання. Н. Денисенко, О. Дишко та М. Палюх [5] обґрунтовують доцільність застосування SMART-підходів як дієвого інструменту оптимізації структури уроку, персоналізації навчання та активізації залучення учнів до освітнього процесу. Такі технології сприяють формуванню інтерактивного освітнього середовища, у якому учні стають активними учасниками навчальної діяльності. У практиці фізичного виховання це може реалізовуватися через використання інтерактивних презентацій, QR-кодів, відеоінструкцій, цифрових платформ для самоконтролю фізичної активності та онлайн-сервісів оцінювання рухових умінь.

У сучасних умовах цифровізації змінюється і роль учителя фізичної культури. Педагог уже не виступає виключно джерелом інформації, а виконує функції фасилітатора, координатора та організатора освітнього середовища. На переконання О. Столяренко та співавтори [15], інноваційні підходи у підготовці педагогічних кадрів повинні передбачати розвиток цифрової компетентності, готовності до використання інформаційних технологій та здатності до реалізації інноваційних освітніх проєктів. У зв’язку з цим важливого значення набуває підготовка вчителя до роботи в умовах цифрового освітнього простору, де необхідними стають навички цифрової комунікації, управління інформаційними потоками та використання електронних освітніх ресурсів.

Одним із перспективних напрямів модернізації фізичного виховання є впровадження моделі «перевернутого навчання». Згідно з дослідженнями М. Семенова та Д. Кириченка [12], цифрова педагогічна комунікація створює умови для перенесення теоретичного матеріалу на етап самостійного опрацювання, що дозволяє ефективніше використовувати навчальний час під час практичних занять. У системі фізичного виховання така модель може реалізовуватися через попереднє ознайомлення учнів із технікою виконання фізичних вправ за допомогою відеоматеріалів, цифрових платформ, мобільних застосунків та інтерактивних навчальних ресурсів. Це забезпечує підвищення рівня усвідомленості навчальної діяльності та сприяє формуванню навичок самостійної роботи.

На думку О. Дубасенюк та О. Вознюк [6], інформаційні технології є важливим інструментом

професійної підготовки педагогів до роботи в нових освітніх реаліях. Їх використання дозволяє модернізувати традиційні підходи до організації освітнього процесу, забезпечити диференціацію навчання та реалізувати індивідуальну освітню траєкторію учнів. У фізичному вихованні це особливо актуально в умовах різного рівня фізичної підготовленості школярів, коли цифрові технології допомагають адаптувати навантаження відповідно до функціональних можливостей учнів.

Важливим компонентом сучасного управління фізичним вихованням є цифровий моніторинг фізичної активності школярів. Аналіз інновацій в управлінні освітою, запропонований О. Мармазою [9], свідчить про необхідність переходу до моделей управління, заснованих на аналізі фактичних даних. Це передбачає систематичний контроль показників фізичної активності, функціонального стану та рівня залучення учнів до рухової діяльності. У сучасній школі цифровий моніторинг може реалізовуватися через використання фітнес-браслетів, мобільних застосунків, електронних журналів фізичної активності та онлайн-платформ для оцінювання результатів навчання.

О. Мостецька та Г. Лаврін [10] доводять доцільність використання сучасних гаджетів, що дозволяє отримувати об'єктивні показники фізичного стану учнів та оперативно коригувати освітній процес. Використання цифрових засобів контролю забезпечує підвищення точності оцінювання фізичної підготовленості, сприяє формуванню навичок самоконтролю та підвищує мотивацію школярів до систематичних занять фізичною культурою. Крім того, цифрові технології створюють можливості для візуалізації індивідуального прогресу учнів, що позитивно впливає на формування внутрішньої мотивації до рухової активності.

Інтеграція ігрових елементів (гейміфікації) у цифрове середовище, що є предметом дослідження О. Даниско, С. Хлібкевич та В. Дереза [4], сприяє підвищенню мотивації покоління цифрової молоді до рухової активності. Упровадження цифрових освітніх платформ, інтерактивних рухових завдань, онлайн-змагань та рейтингових систем дозволяє створювати сучасне мотиваційне середовище, орієнтоване на потреби покоління цифрової молоді. Особливого значення це набуває в умовах НУШ, де одним із ключових завдань є формування позитивного ставлення учнів до здорового способу життя.

Важливим напрямом цифрової трансформації фізичного виховання є розвиток комунікаційної взаємодії між учителем, учнями та батьками. Використання електронних платформ, месенджерів та цифрових освітніх сервісів дозволяє оперативно організовувати зворотний зв'язок, надавати методичні рекомендації та координувати самостійну рухову активність школярів. У цьому аспекті цифрові технології виступають не лише інструментом навчання, а й засобом організації освітнього менеджменту.

Сучасні інформаційні технології також відкривають нові можливості для реалізації проєктної діяльності у фізичному вихованні. Організація онлайн-челенджів, створення цифрових проєктів, використання мобільних платформ для фіксації результатів рухової активності сприяють формуванню в учнів навичок командної роботи, самоорганізації та відповідальності за власний фізичний стан. У контексті НУШ такі підходи відповідають компетентнісній парадигмі освіти та забезпечують інтеграцію фізичного виховання з сучасним цифровим середовищем.

Разом із позитивними аспектами цифровізації існують і певні ризики. Надмірне використання цифрових технологій може спричиняти зниження рівня безпосередньої рухової активності учнів та формування залежності від гаджетів. Саме тому використання інформаційних технологій у фізичному вихованні повинно мати допоміжний характер та бути спрямованим насамперед на активізацію рухової діяльності школярів. Важливим завданням учителя є збереження балансу між цифровими інструментами та реальними формами фізичної активності.

На думку О. Язловецької [15], інноваційні технології у фізичному вихованні мають поєднуватися з традиційними педагогічними підходами та враховувати вікові, психофізіологічні й мотиваційні особливості учнів. Ефективність цифровізації значною мірою залежить від педагогічної доцільності використання технологій, професійної компетентності вчителя та рівня організаційно-управлінського забезпечення освітнього процесу.

Водночас важливим чинником успішної цифрової трансформації фізичного виховання є управлінська підтримка адміністрації закладу освіти. Як зазначає О. Ямполь [18], використання інформаційно-цифрових технологій у менеджменті освіти сприяє підвищенню якості організації освітнього процесу, оптимізації внутрішньої комунікації та забезпеченню ефективного контролю результатів навчання. У системі фізичного виховання це дозволяє координувати освітню діяльність, здійснювати моніторинг рухової активності учнів та створювати умови для впровадження інноваційних методик навчання.

Отже, цифровізація фізичного виховання в умовах реалізації Концепції НУШ є складним багатокомпонентним процесом, що охоплює методичний, організаційний та управлінський аспекти. Інтеграція сучасних інформаційних технологій сприяє підвищенню ефективності освітнього процесу, розвитку цифрової компетентності учнів і педагогів, формуванню мотивації до рухової активності та модернізації системи управління фізичним вихованням у закладах загальної середньої освіти.

Висновки. У результаті проведеного теоретичного аналізу встановлено, що впровадження сучасних інформаційних технологій у систему фізичного виховання є важливим напрямом модернізації освітнього процесу в умовах реалізації Концепції НУШ. Використання цифрових платформ, SMART-технологій, мобільних застосунків, інтерактивних засобів навчання та елементів гейміфікації сприяє підвищенню мотивації учнів до занять фізичною культурою, забезпечує індивідуалізацію навчання та створює умови для

ефективного моніторингу фізичної активності школярів.

З'ясовано, що сучасні моделі управління фізичним вихованням повинні базуватися на системному аналізі, цифровому моніторингу та використанні аналітичних підходів до організації освітнього процесу. Важливого значення набуває розвиток цифрової компетентності вчителя фізичної культури, його готовності до використання інноваційних технологій та реалізації проєктної діяльності в умовах цифрового освітнього середовища.

Установлено, що модель «перевернутого навчання», інтерактивні освітні ресурси та цифрові засоби комунікації створюють передумови для оптимізації навчального часу, активізації самостійної діяльності учнів та підвищення ефективності практичної складової уроків фізичної культури.

Перспективи подальших досліджень полягають у розробці та експериментальній перевірці комплексних цифрових програм і моделей управління фізичним вихованням у закладах загальної середньої освіти відповідно до сучасних вимог НУШ.

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A CLINICAL AND RADIOGRAPHIC APPRAISAL OF ESTHETIC REHABILITATION AND UNDERLYING ORAL HEALTH: A CASE STUDY FROM DENTAL CLINIC *GRANADA*

Omiadze S.
Associate Professor
Salome Omiadze Dental Clinic: "GRANADA", Departments of Therapeutic and Prosthodontic; Departments of Prosthodontic and Therapeutic, Faculty of Dentistry, European University
Rtveladze T.
Assistant Professor
Salome Omiadze Dental Clinic: "GRANADA", Departments of Therapeutic and Prosthodontic; Departments of Prosthodontic and Therapeutic, Faculty of Dentistry, European University
Beriashvili S.
Associate Professor
Salome Omiadze Dental Clinic: "GRANADA", Departments of Therapeutic and Prosthodontic; Departments of Prosthodontic and Therapeutic, Faculty of Dentistry, European University
DOI: 10.5281/zenodo.20737200

Abstract
The integration of restorative and prosthodontic dentistry requires a balance between esthetic outcomes and biological health. This case study presents a multidisciplinary treatment performed at Salome Omiadze Dental Clinic (Granada), involving direct restorations and prosthodontic rehabilitation. Clinical and radiographic findings were analyzed to assess both visible esthetic outcomes and underlying oral conditions. The results emphasize the importance of comprehensive diagnosis, interdisciplinary collaboration, and long-term maintenance. These findings are consistent with established principles in prosthodontics, periodontology, and restorative dentistry [1–4].
Keywords: Esthetic dentistry, prosthodontics, direct restoration, panoramic radiograph, interdisciplinary treatment.

1. Introduction

Esthetic dentistry plays a crucial role in modern dental practice; however, treatment success depends on biological, functional, and biomechanical principles [1]. Fixed prosthodontic restorations must respect periodontal health and occlusal stability to ensure long-term outcomes [2].

Radiographic examination is essential for detecting underlying pathology and guiding treatment planning [3]. Additionally, restorative and endodontic considerations must be integrated into a comprehensive treatment approach to ensure structural integrity and longevity [4].

2. Case Presentation

2.1 Clinical Examination

Figure 1. Intraoral frontal view with cheek retractors

The intraoral examination revealed highly esthetic maxillary anterior restorations characterized by uniform shape, alignment, and color. These features are consistent with prosthodontic rehabilitation aimed at achieving optimal smile esthetics [5].

Direct restorations were performed by Salome Omiadze, Sesili Beriashvili (therapist), focusing on caries management and structural reinforcement. Adhesive restorative techniques emphasize preservation of tooth structure and functional stability [6].

However, mild gingival inflammation was observed around the restoration margins. Such findings may be associated with marginal discrepancies or inadequate oral hygiene, which can contribute to periodontal complications [2].

The mandibular dentition showed plaque accumulation and discoloration, indicating the need for improved oral hygiene and preventive care [7].

2.2 Radiographic Findings

Figure 2. Panoramic radiograph (orthopantomogram)

Radiographic evaluation provided essential diagnostic information regarding underlying structures [3].

The following findings were identified:

Impacted mandibular third molars with mesioangular positioning

Endodontically treated posterior teeth requiring follow-up

Mild to moderate alveolar bone loss indicating periodontal involvement

These findings highlight the importance of correlating clinical and radiographic data for accurate diagnosis and treatment planning.

3. Treatment Approach

The treatment was performed at Salome Omiadze Dental Clinic (Granada) using an interdisciplinary approach:

Therapeutic phase: Direct restorations performed by Salome Omiadze

Prosthodontic phase: Esthetic rehabilitation performed by Tekla Rtveladze

This approach follows established prosthodontic principles, emphasizing proper tooth preparation, marginal adaptation, and occlusal harmony [1].

4. Discussion

This case demonstrates the potential discrepancy between esthetic appearance and underlying oral health. While the prosthodontic restorations achieved excellent visual results, clinical and radiographic findings revealed conditions requiring ongoing management.

Periodontal health remains a key determinant of long-term success, as even minor inflammation can lead to complications if untreated [2]. Radiographic evaluation plays a critical role in identifying hidden pathology and monitoring treatment outcomes [3].

The interdisciplinary approach used in this case reflects modern dental practice, where therapeutic and prosthodontic procedures must be integrated to achieve optimal results.

5. Clinical Implications

The following clinical recommendations are proposed:

Periodontal evaluation and maintenance [2]

Regular radiographic monitoring [3]

Follow-up of endodontically treated teeth [4]

Maintenance of prosthodontic restorations [1]

Reinforcement of oral hygiene practices [7]

6. Conclusion

This case highlights the importance of integrating esthetic dentistry with biological and functional principles. The collaboration between therapeutic and prosthodontic disciplines ensured a comprehensive treatment outcome.

Long-term success depends not only on esthetic results but also on maintaining periodontal health, structural integrity, and functional stability [1–4].

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ПСИХОФІЗИЧНА ІНТЕГРАЦІЯ У ПРОЄКТУВАННІ ТРЕНУВАЛЬНИХ ПРОГРАМ У СИСТЕМІ ПІДГОТОВКИ ФАХІВЦІВ ІЗ ФІЗИЧНОЇ КУЛЬТУРИ І СПОРТУ: ОЗДОРОВЧІ ТА ПСИХОРЕГУЛЯЦІЙНІ ТЕХНОЛОГІЇ

Ливацька С.Ю.
викладачка кафедри олімпійського та професійного спорту,
ДЗ «Луганський національний університет імені Тараса Шевченка» Україна
ORCID ID: https://orcid.org/0009-0002-8808-1249
Дубовой В.В.
доктор філософії,
старший викладач кафедри олімпійського та професійного спорту
ДЗ «Луганський національний університет імені Тараса Шевченка» Україна
ORCID ID: https://orcid.org/0000-0002-9400-3012

PSYCHOPHYSICAL INTEGRATION IN THE DESIGN OF TRAINING PROGRAMS WITHIN THE TRAINING SYSTEM FOR PHYSICAL CULTURE AND SPORTS SPECIALISTS: WELLNESS AND PSYCHOREGULATORY TECHNOLOGIES

Lyvatska S.
Lecturer at the Department of Olympic and Professional Sports,
State Institution "Luhansk Taras Shevchenko National University", Ukraine
ORCID ID: https://orcid.org/0009-0002-8808-1249
Dubovoy V.
PhD, Senior Lecturer at the Department of Olympic and Professional Sports, State Institution "Luhansk Taras Shevchenko National University", Ukraine
ORCID ID: https://orcid.org/0000-0002-9400-3012
DOI: 10.5281/zenodo.20737208

Анотація

У статті розкрито особливості психофізичної інтеграції у проєктуванні тренувальних програм для фахівців із фізичної культури і спорту. Обґрунтовано доцільність впровадження стретчингу та пілатесу, а також психорегуляційних технологій для оптимізації відновлювальних процесів та підвищення стресостійкості тренерів. Запропоновано проєктний підхід до структурування занять, що забезпечує синергію між фізичним навантаженням та психологічним відновленням в умовах професійної діяльності.

Abstract

The article reveals the peculiarities of psychophysical integration in the design of training programs for physical culture and sports specialists. The feasibility of implementing stretching and Pilates, as well as psychoregulatory technologies to optimize recovery and increase coach stress resistance, is substantiated. A project approach to structuring sessions is proposed, ensuring synergy between physical exertion and psychological recovery in professional activities.

Ключові слова: психофізична інтеграція, тренувальні програми, професійна підготовка, фахівці з фізичної культури і спорту, стретчинг, пілатес, психорегуляція.

Keywords: psychophysical integration, training programs, professional training, physical culture and sports specialists, stretching, Pilates, psychoregulation.

Актуальність дослідження. Сучасна система підготовки фахівців із фізичної культури і спорту функціонує в умовах суттєвих соціальних, освітніх та професійних трансформацій, що супроводжуються зростанням психоемоційного навантаження, необхідністю швидкої адаптації до змінних умов діяльності та підвищенням вимог до професійної компетентності майбутніх тренерів. Особливої актуальності ця проблема набуває в умовах цифровізації освітнього простору, післякризових соціальних викликів та воєнного стану, коли ефективність професійної діяльності значною мірою залежить від здатності фахівця підтримувати високий рівень психофізичного здоров'я.

На думку О. Дубового, В. Дубового, М. Андрєєва, Р. Павлова та Д. Сіпакової [1], сучасна професійна діяльність спортивного тренера характеризується поєднанням педагогічних, психологічних та інноваційних викликів, що потребують формування нових моделей професійної підготовки. Водночас О. Свєртнєв, С. Хлібкевич та А. Кравченко [12] підкреслюють, що практико-орієнтований характер навчання створює передумови для формування професійної стійкості та готовності майбутніх фахівців до діяльності в умовах підвищеного стресового навантаження.

У зв'язку з цим особливого значення набуває проблема інтеграції оздоровчих, психорегуляційних та фізкультурно-оздоровчих технологій у процес проєктування тренувальних програм. Такий підхід дозволяє розглядати фізичну підготовку не лише як засіб розвитку фізичних якостей, але і як важливий механізм підтримання психоемоційної рівноваги, когнітивної працездатності та професійної адаптації майбутніх фахівців.

Проблема дослідження полягає у наявності суперечності між необхідністю підготовки конкурен-

тоспроможних фахівців, здатних проєктувати сучасні адаптивні тренувальні програми, та недостатнім використанням психорегуляційних технологій у структурі професійної підготовки. Як зазначають О. Ливацький та С. Ливацька [7], в умовах воєнного стану особливого значення набувають засоби саморегуляції та підтримання психофізичного благополуччя здобувачів освіти, оскільки ігнорування зазначених компонентів призводить до зниження функціональних резервів організму та професійної ефективності.

Мета дослідження – теоретично обґрунтувати модель психофізичної інтеграції оздоровчих та психорегуляційних технологій у процес проєктування тренувальних програм для підготовки майбутніх фахівців із фізичної культури і спорту.

Виклад основного матеріалу дослідження. Сучасні тенденції розвитку фізкультурно-спортивної освіти свідчать про поступовий перехід від вузькоспеціалізованих моделей фізичної підготовки до комплексних систем, орієнтованих на розвиток фізичних, психоемоційних та професійно значущих якостей особистості. У цьому контексті особливого значення набуває концепція психофізичної інтеграції, яка передбачає цілеспрямоване поєднання засобів фізичного виховання, оздоровчих технологій та психорегуляційних практик.

На думку О. Ливацького та О. Отравенка [8], ефективне проєктування освітніх і тренувальних програм повинно базуватися на принципах системного підходу, що дозволяє інтегрувати різні компоненти професійної підготовки в єдину функціональну систему. Такий підхід забезпечує не лише розвиток фізичних якостей, а й формування здатності до саморегуляції, професійного самовдосконалення та адаптації до стресових чинників діяльності.

Важливим теоретичним підґрунтям психофізичної інтеграції виступають сучасні уявлення про взаємозв'язок між функціональним станом організму та психоемоційними процесами. Як зазначає Т. Комісова [4], психофізіологічні показники учасників освітнього процесу безпосередньо залежать від рівня нервово-емоційного напруження, особливостей адаптації до стресу та здатності до відновлення після інтенсивних навантажень. Саме тому використання спеціально підібраних оздоровчих технологій дозволяє здійснювати позитивний вплив на функціонування центральної нервової системи, когнітивні процеси та емоційний стан здобувачів освіти.

Особливе місце серед сучасних оздоровчих систем посідають пілатес, хатха-йога, стретчинг та різноманітні дихальні практики. Як зазначають О. Дубовой, С. Ливацька, О. Ливацький та Н. Бикадорова [2], розвиток оздоровчих систем відбувався в напрямі поєднання фізичного вдосконалення людини з формуванням навичок самоконтролю, психічної рівноваги та усвідомленого ставлення до власного здоров'я. Автори підкреслюють, що пілатес сьогодні розглядається не лише як форма фізичної активності, а як ефективна система психофізичного вдосконалення особистості.

Додатково С. Ливацька [5] наголошує, що хатха-йога сприяє підвищенню мотивації до рухової активності, розвитку навичок саморегуляції та покращенню психоемоційного стану здобувачів освіти. Використання йогічних практик дозволяє зменшувати прояви тривожності, покращувати концентрацію уваги та формувати стійкість до психоемоційних навантажень.

Важливим компонентом психофізичної інтеграції виступає стретчинг. Як доводять О. Ливацький та С. Ливацька [6], систематичне застосування стретчингу сприяє прискоренню відновлювальних процесів після фізичних навантажень, покращенню функціонального стану опорно-рухового апарату та оптимізації психоемоційного стану. Крім того, вправи на розтягування дозволяють знижувати рівень м'язового напруження, що позитивно впливає на когнітивну працездатність і загальне самопочуття здобувачів освіти.

Окрему увагу в сучасних дослідженнях приділено дихальним технологіям. О. Очкалов [10] зазначає, що правильно організовані дихальні вправи сприяють нормалізації функціонального стану серцево-судинної та дихальної систем, покращують процеси оксигенації тканин і позитивно впливають на діяльність центральної нервової системи. Подальший розвиток цієї проблематики представлений у роботах О. Очкалова [11], де доведено ефективність практик глибокого розслаблення як засобу психофізичного відновлення та профілактики стресових станів.

Міжнародні дослідження також підтверджують високу ефективність психорегуляційних технологій. Так, P. Tsakona, I. Kitsatis, T. Apostolou, O. Papadopoulou та A. Hristara-Papadopoulou [16] встановили, що діафрагмальне дихання сприяє зниженню рівня стресу у дітей та підлітків, покращує показники психоемоційного благополуччя та стабілізує функціональний стан організму. У свою чергу B. Nair, S. Khan, N. Naidoo, S. Jannati, B. Shivani та Y. Banerjee [15] довели ефективність прогресивної м'язової релаксації як засобу підвищення психологічної стійкості та адаптаційних можливостей студентської молоді.

Ураховуючи результати аналізу наукової літератури, нами запропоновано модель психофізичної інтеграції оздоровчих та психорегуляційних технологій у процес проєктування тренувальних програм майбутніх фахівців із фізичної культури і спорту.

Таблиця 1

Модель психофізичної інтеграції оздоровчих та психорегуляційних технологій у тренувальну програму

Етап заняття	Технологія	Зміст діяльності	Очікуваний психофізіологічний ефект
Вступний	Діафрагмальне дихання	Контроль дихального циклу, концентрація уваги	Зниження психоемоційного напруження, стабілізація діяльності ЦНС
Основний	Пілатес, хатха-йога, фітнес-технології	Виконання комплексів вправ на стабілізацію корпусу, координацію та контроль рухів	Підвищення функціональної готовності, розвиток координації та саморегуляції
Відновлювальний	Стретчинг	Вправи на розтягування та мобільність суглобів	Прискорення відновлення, зменшення м'язового напруження
Заключний	Глибоке розслаблення та прогресивна релаксація	Релаксаційні вправи та відновлювальні техніки	Відновлення психоемоційної рівноваги, підвищення стресостійкості

Запропонована модель дозволяє розглядати тренувальне заняття як цілісну психофізичну систему, у межах якої кожний структурний компонент виконує не лише фізкультурно-оздоровчу, а й психорегуляційну функцію.

Практична реалізація такої моделі потребує використання сучасних освітніх технологій. На думку С. Караулової та Ю. Коваленко [3], інноваційні технології у професійній підготовці фахівців фізичної культури і спорту забезпечують підвищення ефективності освітнього процесу, сприяють індивідуалізації навчання та розширюють можливості для формування професійних компетентностей. Водночас О. Школа, О. Отравенко, О. Фоменко та Д. Сичов [9] підкреслюють значний потенціал оздоровчих фітнес-технологій щодо розвитку рухової активності, зміцнення здоров'я та формування культури здорового способу життя.

Важливим напрямом удосконалення професійної підготовки також виступає розвиток проєктних компетентностей. Як зазначає М. Трояновська [13], формування здатності до проєктування освітніх і тренувальних програм дозволяє майбутнім фахівцям ефективніше реалізовувати інноваційні підходи та адаптувати зміст професійної діяльності до потреб різних категорій населення.

Водночас під час впровадження психофізичної інтеграції необхідно враховувати низку можливих ризиків. С. Караулова та Ю. Коваленко [3] звертають увагу на ймовірність надмірного насичення освітнього процесу інноваційними методиками без належного наукового обґрунтування їх застосування. Тому використання психорегуляційних технологій повинно здійснюватися відповідно до принципів педагогічної доцільності, індивідуалізації та поступового збільшення навантаження.

Додаткове підтвердження ефективності комплексного підходу представлено у дослідженні D. Koźlenia, R. Szafraniec, J. Jarosz, L. Mazur та J. Domaradzki [14], які встановили позитивний вплив короткотривалих програм ізометричних вправ на функціональний стан організму, фізичну працездатність та загальні показники здоров'я учнівської молоді.

Висновки. Проведений аналіз наукової літератури дозволив обґрунтувати доцільність використання психофізичної інтеграції як сучасного підходу до проєктування тренувальних програм у системі підготовки фахівців із фізичної культури і спорту. Встановлено, що поєднання засобів фізичної підготовки, пілатесу, хатха-йоги, стретчингу, дихальних практик та технологій глибокого розслаблення забезпечує комплексний вплив на фізичний, психоемоційний та когнітивний стан особистості. Запропонована модель психофізичної інтеграції сприяє підвищенню адаптаційних можливостей організму, розвитку стресостійкості, оптимізації відновлювальних процесів та формуванню професійної готовності майбутніх фахівців до діяльності в сучасних умовах. Перспективи подальших досліджень полягають в експериментальній перевірці ефективності запропонованої моделі в системі підготовки здобувачів вищої освіти спеціальностей фізкультурно-спортивного профілю.

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PHILOSOPHY

MEDIA TEXTS IN CONTEMPORARY COMMUNICATION: A TYPOLOGICAL PERSPECTIVE

Moshynska O.
Candidate of Philosophical Sciences, Associate Professor
Yaroslav Mudriy National Law University,
Kharkiv, Ukraine
DOI: 10.5281/zenodo.20737225

Abstract
The rapid development of mass communication technologies at the turn of the 20th and 21st centuries has fundamentally changed the structure of social interaction and the nature of textual communication. In modem society, everyday life is inseparable from the Internet, television, radio and digital platforms, which allow people to receive up-to-date information, exchange messages and respond to events almost instantly. These technologies have transformed not only the speed and scale of communication, but also its qualitative characteristics, giving rise to new forms of text that differ significantly from traditional written discourse. As a result, media texts have become the dominant form of social communication, occupying a central place in public life and influencing the perception of reality, the formation of knowledge and the interpretation of social processes.
Keywords: media communication, media text, social interaction, mass media, typological analysis, thematic dominance, media discourse.

The growing importance of media texts is closely linked to the expansion of the media sphere, within which information is continuously produced, distributed and consumed. Today, information circulates in a unified media space regardless of whether it appears on the Internet, on television, on the radio or in print, since in all cases it is addressed to a mass or segmented audience. In these conditions, communication is no longer limited to the transmission of neutral facts, but increasingly includes interpretation, evaluation and influence. Media texts thus function not only as channels of information, but also as instruments of influence, shaping public opinion, social attitudes and collective worldviews.

Contemporary social reality is largely mediated by the mass media. Most of what people know about political events, economic processes, cultural trends, and social conflicts comes not from personal experience but from media representations. This mediation enhances the ability of media texts not only to reflect reality but also to construct it. Media discourse selects, structures, and frames events, emphasising some aspects and suppressing others, thereby forming dominant narratives. In this sense, media texts act as mechanisms through which society understands itself, develops values, and sets priorities.

The manipulative and persuasive potential of media texts is particularly evident in the digital environment. Online platforms and social networks have not only accelerated the circulation of information, but also changed the dynamics of communication, enabling interactive audience participation. Users are no longer passive recipients of media content, but actively comment, distribute, reinterpret and create media texts themselves. This interactivity enhances the emotional intensity and impact of media discourse, as messages spread rapidly on social networks and gain legitimacy through repetition and collective approval. Numerous contemporary political and social movements demonstrate how digital media texts can mobilise audiences, influence public behaviour and impact real-world events.

The emergence of the term "media text" in international scientific discourse at the end of the 20th century was a response to profound changes in communication practices. Traditional pnnted texts, predominantly verbal and linear, were supplemented and, in many cases, replaced by new forms of communication that integrate vanous semiotic resources. Photographs, graphics, sound, video, animation, and digital interfaces have become integral components of textual communication, which has required an understanding of text as a complex multimodal construct rather than an exclusively linguistic object. The concept of media text thus reflects an expanded understanding of textuality, within which meaning is formed through the interaction of vanous sign systems in a single communicative space.

In a broad and inclusive sense, a media text can be defined as any message created for public distribution through the mass media and intended for interpretation by a collective audience.This definition covers a wide range of communication products, including journalistic articles, news reports, interviews, television programmes, radio broadcasts, advertising and PR (public relations) materials, as well as digital content distributed through websites, social networks and blogs. Common to all these forms is their orientation towards a mass or target audience, their dependence on media technologies, and their inclusion in the institutional framework of communication.

One of the defining characteristics of media texts is their multimodal, or polycode, nature. Unlike classical written texts, which rely primarily on verbal language, media texts combine several semiotic systems within a single communicative structure. Even modern newspaper publications typically include visual elements—photographs, diagrams, infographics, typography—while television and internet media integrate speech, sound, moving images, and graphic design. The meaning in such texts arises not only from the verbal

component, but from the interaction of different modalities, each of which contributes to the overall communicative effect. Such multimodality requires the addressee to process information simultaneously on several levels, combining linguistic interpretation with visual and auditory perception.

The polycode nature of media texts is closely linked to the processes of media convergence. In the modern media environment, the boundaries between different communication channels are becoming increasingly blurred. Newspapers publish electronic versions with video and interactive elements, television programmes are available on digital platforms, and radio broadcasts are distributed in podcast format. As a result, media texts circulate on different platforms, adapting their form while retaining their basic content. Convergence leads to the emergence of hybrid text forms that combine features of different media traditions and blur the usual genre boundaries.

The specificity of media texts is also determined by the external conditions of their production and distribution. Media communication is characterised by collective authorship, mediated interaction between producer and recipient, and a high dependence on technical means of information transmission. Unlike fiction, where individual authorship prevails, media texts are most often created by teams that include journalists, editors, producers, designers, cameramen, and technical specialists. This collective nature of production complicates the concept of authorship and emphasises the institutional nature of media communication, within which individual voices are embedded in organisational structures and editorial policies.

An important external factor influencing media texts is the economic dimension of media production. The mass media operate in a competitive environment and depend on advertising revenue, ratings and commercial success. These conditions determine editorial strategies, topic selection, and stylistic choices, often encouraging sensationalism, simplification, and emotional presentation of material. As a result, media texts are rarely neutral or purely informative, they are designed to attract attention, retain audiences, and generate profit, which inevitably affects their form and content.

Media texts are also characterised by their temporary nature and rapid loss of relevance. Unlike traditional written texts, which can retain their significance over a long period of time, media texts are designed for immediate consumption and quickly become outdated as new information emerges. News reports, television stories and internet updates are consumed once and then replaced by subsequent material. This time pressure influences the structure of media texts, favouring brevity, clarity and immediacy at the expense of depth and reflection.

Despite a significant amount of research, there is currently no universally accepted classification of media texts. The lack of a unified typology reflects the complexity and diversity of media discourse, as well as the rapid development of communication technologies. Attempts to classify media texts based on a single criterion have proved insufficient, as no single parameter can simultaneously cover the technological, functional, pragmatic and semiotic aspects of media communication. As a result, contemporary science is dominated by multi-level and integrative approaches to the typology of media texts, combining several overlapping criteria.

A productive starting point for typological analysis is the classical models of communication, which view communication as a process involving a sender, a message, a channel, a recipient, and an effect. Each of these components can serve as a basis for distinguishing between types of media texts. Thus, classification by distribution channel allows us to distinguish between print, audio, audiovisual, and digital media texts. Each channel imposes certain restrictions on linguistic form, genre conventions, and modes of perception, shaping the characteristics of message construction and interpretation.

Print media texts, such as newspaper and magazine publications, usually rely on verbal language and a linear structure supplemented by visual elements, and are often associated with analytical depth and a relatively stable genre system. Auditory texts, represented by radio broadcasts, are based exclusively on sound perception, which makes intonation, timbre and speech rhythm particularly significant. Audiovisual texts, characteristic of television, combine speech, sound and image, creating a powerful communicative effect, but often limiting the ability to comprehend information due to the high speed and simultaneity of presentation. Digital media texts integrate all these modalities, adding interactivity, hypertextuality and user participation, which fundamentally changes the nature of communication.

An essential typological parameter is the functional and genre affiliation of media texts. Depending on the communicative goal, there are informational texts aimed at communicating facts, analytical texts focused on interpretation and evaluation, as well as artistic and journalistic texts that include elements of imagery and subjective interpretation. Advertising and PR texts form a separate group, the main purpose of which is to persuade, shape image, and influence audience behaviour. However, in contemporary media discourse, genre boundaries are becoming increasingly blurred as a result of convergence and diffusion processes.

Genre diffusion is particularly evident in digital media, where the traditional distinctions between news, commentary and advertising are often blurred. Online platforms publish hybrid texts that combine factual information with evaluation, personal opinion, and promotional elements. This hybridity complicates the typological classification of media texts and raises questions about transparency, credibility, and ethics in media communication.

From a pragmatic point of view, media texts can also be classified according to their institutional function in the field of journalism, advertising or public relations. Journalistic texts are traditionally focused on informing the public about socially significant events, advertising texts on promoting goods and services, and PR texts on forming and maintaining the reputation of organisations and individuals. In practice, these areas often overlap, which is associated with the commercialisation of the media and the strategic use of language to

influence the attitudes of the audience. As a result, media texts often perform several functions at once, combining information, persuasion and entertainment.

Authorship and semiotic organisation are additional dimensions of media text typology. Media texts can be individually authored or collective, as well as verbal, non-verbal or polycoded in structure. In modern media environments, polycoded texts predominate, as technological developments encourage the integration of text, images, sound and interactive elements within a single communication product. Such integration expands the expressive possibilities of media texts, but at the same time complicates the process of their interpretation.

Another important parameter for the typology of media texts is their thematic dominance. The mass media structure the flow of messages around relatively stable thematic areas such as politics, economics, culture, sports, religion, science, and social conflicts. These topics shape the media agenda and audience expectations. At the same time, the priority of topics varies depending on the national and cultural context, reflecting differences in social values, historical experience and political conditions.

Although media texts are formally accessible to a wide audience, each media product is aimed at a specific target group defined by age, profession, interests or social identity. Contemporary media increasingly operate in segmented markets, creating content for niche audiences rather than for an abstract 'mass'. This audience orientation influences vocabulary, style, genre preferences, and thematic choices, as media producers adapt their communication strategies to the expectations and experiences of their audience.

The segmentation of the media space contributes to reducing the communicative distance between the producer and the recipient. In the digital environment, the audience actively participates in the creation, evaluation, and distribution of content by commenting on news, sharing their own interpretations, and engaging in dialogue with media producers. This participation leads to an inversion of traditional communication roles, in which the audience becomes a co-author of media discourse rather than a passive consumer of information. As a result, modem means of mass communication are gradually losing their strictly "mass" character and moving towards personalised and interactive forms of communication.

In conclusion, it should be noted that media texts in the modern communicative space are complex, dynamic and multifunctional phenomena shaped by technological innovations, social changes, economic conditions and cultural diversity. They cannot be adequately described using a single classification principle or analytical approach. The absence of a generally accepted typology reflects the internal complexity of media communication and the constant evolution of media forms. A multi-level integrative approach, combining communicative, functional, genre, pragmatic, and semiotic criteria, seems to be the most productive basis for analysing media texts, allowing them to be viewed not only as linguistic constructions, but also as key tools for social communication, cultural meaning-making, and the construction of reality in the modem world.

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POLITICAL SCIENCES

AVROPA İTTİFAQINDA DİNİ MÜXTƏLİFLİYİN MİQRANTLARIN SOSİAL İNTEQRASİYASINA TƏSİRİ

Cəbrayılova S.E.
Bakı Slavyan Universiteti

THE IMPACT OF RELIGIOUS DIVERSITY ON THE SOCIAL INTEGRATION OF MIGRANTS IN THE EUROPEAN UNION

Jabrayilova S.
Baku Slavic University
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Xülasə

Avropa İttifaqında dini müxtəliflik miqrantların sosial inteqrasiyası prosesinə həm müsbət, həm də mənfi təsirlər göstərir. Avropa İttifaqı multikulturalizm, insan hüquqları və dini azadlıq prinsiplərinə əsaslanan hüquqi çərçivə formalaşdırmışdır. Bu çərçivə miqrantların öz dini kimliklərini qoruyaraq cəmiyyətə inteqrasiya olunmasına imkan yaradır. Dini icmalar sosial şəbəkələrin qurulmasında, mənəvi dəstəyin göstərilməsində və yeni mühitə adaptasiyada mühüm rol oynayır. Lakin, dini fərqliliklər bəzən sosial məsafə, stereotiplər və diskriminasiya halları ilə nəticələnə bilər. Xüsusilə müsəlman miqrantların Avropa cəmiyyətlərinə inteqrasiyası zamanı mədəni və dini identiklik məsələləri ictimai-siyasi müzakirələrin mərkəzində dayanır. Bu isə sosial inteqrasiyanın yalnız hüquqi deyil, həm də mədəni və psixoloji ölçülərini aktuallaşdırır. Nəticə etibarilə, dini müxtəliflik düzgün idarə olunduqda sosial kapitalın artmasına, qarşılıqlı tolerantlığın güclənməsinə və inklüziv cəmiyyətin formalaşmasına töhfə verir. Effektiv inteqrasiya siyasəti isə qarşılıqlı hörmət, dialoq və inklüzivlik prinsiplərinə əsaslanmalıdır.

Abstract

Religious diversity in the European Union has both positive and complex effects on the process of social integration of migrants. The European Union has formed a legal framework based on the principles of multiculturalism, human rights, and religious freedom. This framework allows migrants to integrate into society while preserving their religious identity. Religious communities play an important role in building social networks, providing spiritual support, and adapting to the new environment. However, religious differences can sometimes result in social distancing, stereotypes, and discrimination. Especially during the integration of Muslim migrants into European societies, issues of cultural and religious identity are at the center of socio-political discussions. This makes not only legal, but also cultural and psychological dimensions of social integration relevant. Consequently, religious diversity, when properly managed, contributes to the increase of social capital, strengthening mutual tolerance, and the formation of an inclusive society. An effective integration policy should be based on the principles of mutual respect, dialogue, and inclusion.

Açar sözlər: Avropa, miqrasiya, dini müxtəliflik, multikulturalizm, tolerantlıq, diskriminasiya.

Keywords: Europe, migration, multiculturalism, religious diversity, tolerance, discrimination.

Müasir qloballaşma şəraitində miqrasiya prosesləri beynəlxalq münasibətlərin əsas mövzusuna çevrilmişdir. Xüsusilə də Avropa İttifaqı son onilliklərdə Yaxın Şərq, Afrika və Asiya regionlarından artan miqrasiya axınları ilə qarşılaşmışdır. Bu proses yalnız demoqrafik və iqtisadi deyil, eyni zamanda mədəni və dini müxtəlifliyin genişlənməsi ilə də müşayiət olunur. Təsadüfi deyil ki, dini müxtəliflik Avropa cəmiyyətlərinin sosial strukturunda mühüm yer tutaraq inteqrasiya siyasətlərinin əsas müzakirə mövzularından birinə çevrilmişdir. Bu məqalənin əsas məqsədi Avropa İttifaqında dini müxtəlifliyin miqrantların sosial inteqrasiyasına təsir mexanizmlərini sistemli şəkildə təhlil etməkdir. Tədqiqat çərçivəsində dini identikliyin sosial kapitalın formalaşmasına, əmək bazarına çıxış imkanlarına və institusional münasibətlərə necə təsir göstərdiyi araşdırılır. Məqalədə əsas tədqiqat sualı belə formalaşdırılmışdır: dini müxtəliflik inteqrasiya prosesində daha çox birləşdirici resurs kimi, yoxsa sosial məsafə yaradan faktor kimi çıxış edir?

Avropa İttifaqı uzun müddətdir ki, insan hüquqları, dini azadlıq və bərabərlik prinsiplərinə əsaslanan hüquqi-normativ baza ilə fəaliyyət göstərir. Bu çərçivə miqrantların dini kimliyini qorumaqla yanaşı, onların qəbul edən cəmiyyətə sosial, iqtisadi və mədəni baxımdan inteqrasiyasını hədəfləyir. Lakin, biz dini müxtəlifliyə birmənalı proses kimi baxa bilmərik. Bu isə o deməkdir ki, bir tərəfdən dini icmalar miqrantlar üçün sosial dəstək şəbəkəsi rolunu oynayır, onların adaptasiyasını asanlaşdırır və sosial kapitalın formalaşmasına töhfə verir. Digər tərəfdən isə dini fərqliliklər bəzən sosial məsafənin artmasına, stereotiplərin formalaşmasına və diskriminasiya hallarına səbəb ola bilər.

Sosial inteqrasiya anlayışı dedikdə yalnız hüquqi status əldə etməyi nəzərdə tutmuruq; bu proses əmək bazarına çıxış, təhsil imkanları, sosial iştirak, mədəni uyğunlaşma və qarşılıqlı qəbul kimi çoxşaxəli komponentləri əhatə edir. Dini identiklik isə bu komponentlərin hər birinə təsir göstərən mühüm faktordur. Xüsusilə islamofobiya, radikallaşma qorxusu və milli identiklik kimi mövzu müzakirələri Avropada inteqrasiya siyasətlərinin istiqamətini müəyyənləşdirən əsas amillərdən olmuşdur.

Ona görə də, Avropa İttifaqında dini müxtəlifliyin miqrantların sosial inteqrasiyasına təsirinin araşdırılması həm nəzəri, həm də praktik baxımdan önəmlidir. Mövzunun təhlili multikulturalizm, sosial kapital nəzəriyyəsi və inklüziv idarəetmə yanaşmaları kontekstində aparıldıqda daha dolğun nəticələr əldə etmək mümkündür. Beləliklə, dini müxtəlifliyin düzgün idarə olunması sosial harmoniyanın təmin edilməsinə, qarşılıqlı tolerantlığın gücləndirilməsinə və davamlı inteqrasiya modelinin formalaşdırılmasına xidmət edə bilər.

Avropa İttifaqı məkanında dini müxtəliflik miqrasiya proseslərinin struktur elementinə çevrilmiş və sosial inteqrasiya siyasətlərinə birbaşa təsir göstərmişdir. Xüsusilə 2015-ci ildən sonra artan miqrasiya dalğası dini identiklik məsələsini inteqrasiya strategiyalarının mərkəzinə gətirmişdir. Bu kontekstdə dini müxtəlifliyin sosial inteqrasiyaya təsiri üç əsas istiqamətdə təhlil oluna bilər: sosial-mədəni, iqtisadi və siyasi-institusional aspektlər[1,s.34].

Birinci aspekt sosial-mədəni ölçüdür. Dini icmalar miqrantlar üçün bir növ ilkin adaptasiya platforması rolunu oynayır. Məscidlər, kilsələr və digər dini mərkəzlər sosial şəbəkələrin qurulmasına, informasiya mübadiləsinə və psixoloji dəstəyə şərait yaradır. Bu da öz növbəsində, "bonding social capital" ın formalaşmasına səbəb olur. Lakin yalnız daxili icma əlaqələrinin güclənməsi "bridging social capital" ın – yəni yerli əhali ilə əlaqələrin – zəifləməsinə gətirib çıxara bilər. Nəticədə paralel icmaların formalaşması riski artır və bu, inteqrasiyanı ləngidə bilər.

İkinci istiqamət iqtisadi inteqrasiyadır. Dini identiklik birbaşa əmək bazarına çıxış imkanlarına həm müsbət, həm də mənfi təsir göstərə bilər. Araşdırmalara əsasən görürük ki, bəzi hallarda dini mənsubiyyətə görə gizli diskriminasiya mövcuddur. Bu isə işsizlik səviyyəsinin artmasına və sosial-iqtisadi bərabərsizliyin dərinləşməsinə səbəb olur. Eyni zamanda dini etik dəyərlər – əməksevərlik, icma həmrəyliyi və qarşılıqlı yardım prinsipləri – sahibkarlıq və kiçik biznes fəaliyyətini də təşviq edə bilir. Bu baxımdan dini müxtəlifliyin həm maneə, həm də resurs kimi çıxış edə biləcəyini qeyd etməliyik[2,s.401].

Üçüncü aspektə gəldikdə isə siyasi və institusional ölçünü vurğulaya bilərik. Reallıq odur ki, Avropa ölkələrində sekulyarlıq modeli müxtəlif formalarda tətbiq olunur. Məsələn, Fransada tətbiq olunan sərt sekulyarlıq modeli dini simvolların ictimai məkanda məhdudlaşdırılmasını prioritet hesab edir ki, bu da çox vaxt assimilyasiya təzyiqi kimi qəbul olunur. Almaniyada isə dini icmaların hüquqi tanınması və institusional əməkdaşlıq modeli daha inklüziv çərçivə formalaşdırır. Böyük Britaniyada isə multikultural yanaşma ənənəsi uzun müddət müxtəlif dini qrupların icma strukturlarını qoruyaraq inteqrasiyasını təşviq etmişdir. Bu model çərçivəsində xristian, müsəlman, yəhudi və hindu icmalarının dini məktəbləri və mədəniyyət mərkəzləri müəyyən hüquqi çərçivə daxilində fəaliyyət göstərir. Lakin, son illərdə təhlükəsizlik və sosial uyğunlaşma məsələləri ilə bağlı debatlar bu modelin də yenidən qiymətləndirilməsinə səbəb oldu. Niderland və İsveç kimi ölkələrdə sosial dövlət modeli dini azlıqların sosial xidmətlərə çıxışını asanlaşdırmaqla inteqrasiyanı təşviq edir. Bu ölkələrdə dini müxtəliflik sosial siyasətin bir elementi kimi qəbul edilir və dövlət orqanları ilə dini təşkilatlar arasında dialoq mexanizmləri qurulur. Buna baxmayaraq, bəzi hallarda radikallaşma qorxusu ictimai fikirdə müsəlman icmalarına münasibətdə əlavə stereotiplərin formalaşmasına səbəb olur. Polşa və Macarıstan kimi daha homogen dini struktura malik ölkələrdə isə xristian kimliyi milli identikliklə daha sıx əlaqələndirilir. Bu kontekstdə, qeyd etməliyik ki, yeni miqrant dini qruplarının inteqrasiyası bəzən daha çətin sosial qəbul prosesi ilə müşayiət olunur. Bu fərqlər göstərir ki, dini müxtəlifliyə münasibət yalnız hüquqi çərçivə ilə deyil, milli kimlik və tarixi yaddaş faktorları ilə də müəyyənləşir. Bu fərqlər isə öz növbəsində inteqrasiya nəticələrində struktur müxtəliflik yaradır. Dini simvolların ictimai məkanda istifadəsi, dini təhsil və hüquqi tanınma məsələləri inteqrasiya debatlarının əsas mövzularındandır. Dövlətin inklüziv və dialoq əsaslı siyasəti sosial harmoniyanı gücləndirə bilər, lakin sərt assimilyasiya yanaşması sosial gərginliyi artıra bilər[3,s.320].

Avropada multikulturalizmə dair aparılan araşdırmalar göstərir ki, Avropa İttifaqında sekulyarlıq prinsipi vahid model üzrə tətbiq olunmur və bu, müxtəlif dini qruplara münasibətdə fərqli yanaşmaların formalaşmasına səbəb olur. Xristian icmaları bir çox Avropa ölkələrində tarixi və institusional köklərə malik olduqları üçün onların dini strukturları daha çox hüquqi tanınma və dövlətlə əməkdaşlıq imkanlarına sahibdir. Katolik və protestant kilsələri bəzi ölkələrdə rəsmi və ya yarı-rəsmi status daşıyır və bu, onların ictimai sahədə fəaliyyətini daha legitim edir.

Müsəlman icmaları isə əsasən son onilliklərdə miqrasiya nəticəsində formalaşmış və daha gec təşkilatlanmışdır. Bu səbəbdən onların dini təhsil, ibadət məkanlarının hüquqi statusu və dini simvolların ictimai məkanda istifadəsi məsələlərində daha çox ictimai-siyasi müzakirələrlə qarşılaşdıqları müşahidə olunur. Xüsusilə baş örtüyü, məscid tikintisi və halal qida məsələləri sekulyar dövlət modelinin praktik tətbiqi ilə bağlı debatların mərkəzində dayanır deyə bilərik.

Yəhudi icmaları Avropada tarixi mövcudluğa malik olmaqla yanaşı, antisemitizm təcrübəsi səbəbindən xüsusi hüquqi qoruma mexanizmləri ilə əhatə olunmuşdur. Hindu və digər azsaylı dini qruplar isə daha kiçik demoqrafik paya sahib olduqları üçün ictimai diskursda daha az görünürlər, lakin onların dini praktikalarının tanınması məsələsi multikultural siyasətin inklüzivlik səviyyəsini göstərən mühüm indikatorlardan biridir. Beləliklə, belə bir nəticəyə gələ bilərik ki, sekulyarlıq prinsipi formal olaraq bütün dini qruplara neytral münasibət göstərməyi hədəfləsə də, tarixi kontekst, demoqrafik struktur və ictimai diskurs real praktikada fərqli nəticələr doğurur.

Avroməkanda fərqli dini icmalar arasında münasibətlər inteqrasiya prosesinin mühüm sosial aspektini təşkil edir. Xristian, müsəlman, yəhudi və digər kiçik dini icmalar arasında qarşılıqlı münasibətlər yalnız teoloji fərqlərlə deyil, həm də tarixi yaddaş, miqrasiya təcrübəsi və ictimai rəyin təsiri ilə kompleks şəkildə formalaşır. Bu münasibətlər bəzi hallarda əməkdaşlıq və dialoq formasında, digər hallarda isə stereotiplər və sosial məsafə şəklində təzahür edə bilir.

Bir çox Avropa şəhərlərində dini icmalar arasında dialoq platformaları yaradılmış və bu təşəbbüslərin dini icmalar arasında qarşılıqlı anlaşmanın güclənməsinə xidmət edəcəyinə ümid edilir. Məsələn, xristian və müsəlman dini liderlərinin birgə sosial layihələrdə iştirakı miqrantların adaptasiyasına və yerli icmalarla münasibətlərin yumşalmasına müsbət təsir göstərir. Bu cür əməkdaşlıq dini müxtəlifliyin sosial kapitala çevrilməsi prosesinin praktik nümunəsi kimi qiymətləndirilə bilər.

Bununla yanaşı, təəssüflə bildirməliyik ki, bəzi hallarda dini qruplar arasında rəqabət və ya qarşılıqlı ehtiyatlı münasibət də müşahidə olunur. Bəzi hallarda yeni miqrant icmalarının formalaşması yerli dini strukturlarla resurs bölüşdürülməsi, ibadət məkanlarının yerləşməsi və ictimai görünürlük kimi məsələlərdə gərginlik yaradır. Bu proseslər dini müxtəlifliyin sosial inteqrasiyaya təsirinin təkcə hüquqi deyil, həm də sosial-psixoloji xarakter daşıdığını göstərir. Yəhudi icmalarına qarşı antisemit stereotiplər, müsəlman icmalarına münasibətdə islamofobiya diskursu və bəzi hallarda xristian icmalarına qarşı sekulyar tənqidlər dini qruplar arasında etimad səviyyəsinə təsir edən mühüm faktorlar kimi çıxış edir. Bu stereotiplərin zəiflədilməsi üçün mədəniyyətlərarası dialoq proqramları və birgə sosial təşəbbüslər həyata keçirilməlidir. Bu baxımdan, dini müxtəlifliyin idarə olunmasında əsas məqsəd yalnız fərqli icmaların yanaşı mövcudluğu deyil, onların qarşılıqlı etimad və əməkdaşlıq əsasında sosial əlaqələr qurmasını təmin etmək olmalıdır.

Bir sıra Avropa ölkələrində müsəlman əhalinin payı digər regionlarla müqayisədə daha yüksəkdir. Xüsusilə Fransa və Almaniya kimi qərbi avropa ölkələrində uzun illər davam edən miqrasiya prosesləri nəticəsində böyük müsəlman icmaları formalaşmışdır. Bu icmalar əsasən böyük şəhərlərin ətraf rayonlarında məskunlaşmış və zamanla öz sosial-mədəni "strukturlarını" qurmuşlar.

Çox vaxt dil baryeri, sosial-iqtisadi çətinliklər və qarşılıqlı etimadın zəifliyi inteqrasiya prosesinin ləngiməsinə səbəb olmuşdur. Bu vəziyyət ictimai diskursda "paralel cəmiyyətlər" fenomeninin meydana çıxmasına gətirib çıxarmışdır.

Son illərdə Avropada islamofobiya və digər dinlərə qarşı dözümsüzlük daha çox görünməyə başlayıb. Bunun əsas səbəblərindən biri terror hadisələri ilə bağlı yaranan təhlükəsizlik narahatlıqlarıdır. Radikal dini qrupların törətdiyi hücumlar, təəssüf ki, müsəlman icmalarına qarşı stereotiplərin dərinləşməsinə səbəb olub. Xüsusən Böyük Britaniya və Fransa kimi dominant dövlətlərdə kütləvi media islam dini ilə ekstremizmi tez-tez bir-birinə bağlayır. Bu isə insanların qorxularını artırır və müsəlman miqrantlara qarşı ayrı-seçkilik hallarını çoxaldır. Bəzi ölkələrdə isə dini simvollar və müqəddəs mətnlərlə bağlı provokativ aksiyalar ictimai gərginliyi daha da yüksəldir və dinlərarası münasibətləri mənfi təsir edir. Bununla da qeyd edə bilərik ki, dini müxtəliflik təkcə qanunla qorunan məsələ deyil, həm də insanların emosional və sosial münasibətləri ilə bağlıdır.

2015-2020-ci illərdə Paris, Brüssel, Berlində onlarla insanın həyatını itirməsinə səbəb olan irimiqyaslı terror hücumları, həmçinin, Vyana, Drezden, Liverpoolda məktəb, xəstəxana və ictimai məkanlarda törədilmiş miqyasca daha kiçik terror hadisələri, Praqa, London kimi şəhərlərdə polislərə ardıcıl hücum edilməsi və.s kimi hadisələrin araşdırılmasından ortaya çıxan faktlar, bu hücumları törədənlərin ya birbaşa radikal qruplaşmaların üzvü olduğunu ya da müəyyən əlaqələrinin olduğunu göstərdi. Bütün bunlar, Avropa ölkələrinin təhlükəsizlik siyasətini sərtləşdirməsinə, sərhəd nəzarətinin gücləndirilməsinə və radikallaşmaya qarşı yeni sosial proqramların hazırlanmasını zəruri etdi.

Hal-hazırda qlobal multikulturalizm çağırışlarına rəğmən görünən odur ki, bir sıra Avropa ölkələrində əsas da Almaniya və İtaliyada sağçı və populist siyasi qüvvələrin ictimai dəstəyi artmışdır. Bu partiyalar miqrasiya və təhlükəsizlik ritorikasını ön plana çəkərək özlərinin seçici bazasını genişləndirmişlər. Onların siyasi proqramlarında əsas məsələlərdə sərhəd nəzarətinin gücləndirilməsi, miqrasiya kvotalarının azaldılması və milli identikliyin qorunması durur. Bu tendensiyanı xüsusilə Fransa, Almaniya, İtaliya, Niderland və Macarıstan kimi ölkələrdə daha aydın müşahidə edirik.

Fransada "Milli Mitinq" partiyası sərhəd nəzarətinin gücləndirilməsi, qeyri-qanuni miqrantların deportasiya prosesinin sürətləndirilməsi və vətəndaşlıq əldə etmə qaydalarının sərtləşdirilməsi kimi, Almaniyada "Alternative für Deutschland" partiyası miqrasiya siyasətinin sərtləşdirilməsi və sığınacaq prosedurlarının, ailə birləşməsi proqramlarının məhdudlaşdırılması ilə bağlı təkliflər irəli sürmüşdür. İtaliyada Giorgia Meloninin rəhbərliyi altında fəaliyyət göstərən "Italyan Qardaşları" partiyası qeyri-qanuni miqrasiyanın qarşısının alınmasını prioritet elan etmişdir. Hökumət Aralıq dənizi üzərindən gələn miqrant axınının məhdudlaşdırılması, insan qaçaqmalçılığına qarşı sərt cəzaların tətbiqi və sığınacaq prosedurlarının sürətləndirilməsi kimi qərarlar qəbul etmişdir. Macarıstanda Viktor Orbanın rəhbərliyi altında hökumət sərhəddə fiziki baryerlərin qurulması və sığınacaq müraciətlərinin məhdudlaşdırılması, həmçinin xarici maliyyə ilə fəaliyyət göstərən bəzi miqrasiya təşkilatlarına hüquqi məhdudiyyətlər tətbiq etmişdir.

Miqrantlara, dini müxtəlifliyə qarşı mənfi rəyin formalaşmasında digər səbəblərə isə, onların üz tutduqları ölkənin "milli kimliyinə" uyğunlaşmamaları, özlərini bir növ izolyasiya edərək, inteqrasiya etməkdən çəkinmə tendensiyası, demoqrafik böhrana səbəb olmaq, həmçinin, onsuzda mövcud olan işsizlik problemini daha da artırmaqlarıdır. Pew Research Center-in (Pew Araşdırma Mərkəzinin) rəsmi mənbələrinə əsasən, Fransa, Almaniya və İsveç kimi ölkələrdə müsəlman əhalinin sayı təxminən 5-6 milyon civarındadır ki, bu da, ümumi əhalinin təxminən 8 %-ni təşkil edir. Bu qruplar arasında sosial-iqtisadi təcrid və işsizlik səviyyəsinin yüksək olması, sosial gərginlik və kriminal hadisələrin artması ictimai diskursda miqrasiya və inteqrasiya məsələsini ön plana çıxardığını görürük.

Ümumiyyətlə, dini müxtəlifliyin miqrantların sosial inteqrasiyasına təsiri kontekstual və çoxşaxəlidir. Effektiv nəticə dövlət siyasətinin inklüzivliyindən,

vətəndaş cəmiyyətinin fəallığından və qarşılıqlı tolerantlıq səviyyəsindən asılıdır. Dini müxtəliflik düzgün idarə olunduqda sosial kapitalı artıran və davamlı cəmiyyət modelini gücləndirən mühüm faktor kimi çıxış edə bilər[4,s.456].

FRA-nın (European Agency for Fundamental Rights) bəzi son statistik məlumatlarına əsasən ən yüksək məşğulluq səviyyəsi Niderlandda (70%), daha sonra Almaniyada (67%) və İsveçdə (65%) müşahidə olunur. İtaliyada bu göstərici 62%, Fransada isə 59% təşkil edir[5,s.120].

Bununla belə, məşğulluq göstəricilərinin yüksək olması avtomatik olaraq tam sosial inteqrasiyanı ifadə etmir. Əmək bazarında iştirak sosial qəbul, mədəni uyğunlaşma və diskriminasiya səviyyəsi kimi digər faktorlarla qarşılıqlı əlaqədə qiymətləndirilməlidir.

Göstəricilər ölkələr arasında inteqrasiya siyasətinin effektivliyi, əmək bazarının elastikliyi və sosial adaptasiya mexanizmlərinin səviyyəsi ilə bağlı fərqləri əks etdirir. Məşğulluq səviyyəsinin yüksək olması miqrantların iqtisadi inteqrasiyasının daha uğurlu olduğunu göstərir və sosial inteqrasiyanın əsas indikatorlarından biri hesab olunur. Aşağı göstəricilər isə əmək bazarına çıxışda struktur maneələrin, dil baryerinin və ya sosial diskriminasiya hallarının mövcud ola biləcəyini göstərir[6,s.240].

Nəticə

Avropa İttifaqında dini müxtəliflik miqrantların sosial inteqrasiyasına kompleks və çoxşaxəli təsir göstərir. Aparılan təhlil göstərir ki, dini identiklik həm sosial dəstək mexanizmi, həm də potensial sosial məsafə amili kimi çıxış edə bilər. Dini icmalar miqrantların ilkin adaptasiyasında, sosial şəbəkələrin formalaşmasında və mənəvi sabitliyin qorunmasında mühüm rol oynayır. Bu isə inteqrasiyanın sosial və psixoloji aspektlərini gücləndirir.

Eyni zamanda, əmək bazarına çıxış imkanları, təhsil səviyyəsi və ictimai iştirak kimi göstəricilər inteqrasiyanın əsas indikatorlarıdır. Statistik məlumatlar göstərir ki, ölkələr üzrə fərqli nəticələr mövcuddur və bu fərqlər dövlət siyasətinin inklüzivliyi, sekulyarlıq modeli və multikultural yanaşmanın tətbiqi ilə sıx bağlıdır. Dini müxtəlifliyin düzgün idarə olunmaması sosial gərginlik, stereotiplər və diskriminasiya riskini artıra bilər.

Dini müxtəliflik Avropa İttifaqında sosial inteqrasiyanın qarşısında yalnız çətinlik deyil, eyni zamanda sosial kapital və mədəni zənginlik mənbəyi kimi də qiymətləndirilməlidir. Effektiv inteqrasiya siyasəti qarşılıqlı hörmət, tolerantlıq, dialoq və bərabər imkanlar prinsiplərinə əsaslanmalıdır. Yalnız bu halda dini müxtəliflik inklüziv və davamlı cəmiyyət modelinin formalaşmasına töhfə verə bilər. Beləliklə, sonda belə bir nəticəyə gəlirik ki, müxtəlif miqrantların sosial inteqrasiya siyasətinin uğurunu dini müxtəlifliyin məhdudlaşdırılmasında deyil, onun institusional çərçivədə konstruktiv şəkildə idarə olunmasında axtarmaq lazımdır.

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STATE AND LAW

INCLUSIVE EDUCATION, SANITARY LEGISLATION AND VALUE-DRIVEN INNOVATION IN LEARNING ENVIRONMENTS

Hotsuliak S.
Candidate of Science of Law,
Assistant Professor of the Department of Theory and History,
Yaroslav Mudryi National Law University, Kharkiv, Ukraine,
https//orcid.org/0000-0003-4562-6210
DOI: 10.5281/zenodo.20737248

Abstract
The article conceptualises inclusive education as a form of value-driven innovation that reshapes learning environments around human dignity, equity and meaningful participation. It argues that ethical, pedagogical and institutional dimensions of inclusion need to be examined together with sanitary legislation and international WASH standards in order to move from declarative to operational inclusion. Building on frameworks from UNESCO, the CRPD, the OECD and Universal Design for Learning, the paper illustrates how accessible infrastructure, disability-inclusive WASH and thoughtfully used digital tools can transform governance, teaching practices and school culture. Inclusive education is presented as a critical test of educational modernisation, in which innovation is judged by its ability to remove barriers, broaden participation, and ensure healthy, safe, and dignified conditions for all learners.
Keywords: inclusive education, value-driven innovation, Universal Design for Learning, educational equity, sanitary legislation, WASH in schools, disability-inclusive infrastructure.

Introduction

Inclusive education is often discussed as a legal obligation, a pedagogical method, or a social justice project. This paper argues that it should also be understood as a form of value-driven innovation. In this framing, innovation is not limited to new technologies, digital tools, or institutional modernisation. Rather, innovation becomes meaningful when it reorganises educational environments around human dignity, equal participation, and the capacity of every learner to flourish. The central thesis is that inclusive education represents one of the most important value-driven innovations in contemporary education because it transforms the basic question of schooling: from "How can learners adapt to existing institutions?" to "How can institutions be redesigned so that diverse learners can participate meaningfully?"

The international policy foundation for this argument is well established. The Salamanca Statement affirmed that every child has unique characteristics, interests, abilities, and learning needs, and that education systems should be designed to take this diversity into account (UNESCO Salamanca Statement). The UN Convention on the Rights of Persons with Disabilities further recognizes the right of persons with disabilities to education and calls for an inclusive education system at all levels on the basis of equal opportunity (UN CRPD Article 24 text via ALLFIE). More recent international reports have broadened the idea of inclusion beyond disability alone, emphasizing that inclusive education must address exclusion related to identity, background, ability, language, migration status, poverty, gender, and other intersecting forms of disadvantage (UNESCO Global Education Monitoring Report).

This paper proposes that inclusive education should be analysed through three interrelated dimensions of value-driven innovation: ethical value, pedagogical value, and institutional value. Ethical value refers to the recognition that learners are not problems to be managed but persons whose dignity, agency, and belonging must be protected. Pedagogical value refers to the redesign of teaching, assessment, curriculum, and classroom interaction so that diversity becomes a resource for learning rather than an obstacle to uniform instruction. Institutional value refers to the long-term transformation of educational governance, teacher preparation, support services, infrastructure, and monitoring systems in order to make inclusion sustainable rather than symbolic. The paper also argues that inclusive education cannot be separated from sanitary legislation and standards in schools. Ensuring safe water, sanitation and hygiene (WASH) in educational settings is a precondition for meaningful participation, particularly for learners with disabilities and those in vulnerable situations.

Background and Problem Statement

The need for inclusive education has become increasingly urgent because contemporary classrooms are characterised by growing diversity in language, culture, social background, ability, learning profile, and life experience. The OECD argues that education systems need holistic approaches to diversity, equity, and inclusion, including governance, resourcing, capacity building, school-level interventions, and monitoring and evaluation (OECD). This means that inclusive education cannot be reduced to individual teacher goodwill or isolated support for selected groups. It requires system-level innovation that connects policy, pedagogy, professional training, data, and institutional culture.

At the same time, many education systems still treat inclusion as an "additional" concern rather than a core principle of quality education. UNESCO's 2020 Global Education Monitoring Report identifies barriers

such as narrow understandings of inclusion, insufficient teacher support, lack of data on excluded learners, inaccessible infrastructure, parallel systems, weak political will, and fragmented governance (UNESCO GEM Report). These barriers show that exclusion is not only the result of individual prejudice or disability. It can be produced by the design of curricula, assessment regimes, school buildings, digital platforms, bureaucratic categories, and everyday expectations about what a "normal" learner should be.

A crucial but often under-discussed dimension of inclusive education concerns sanitary legislation and WASH (water, sanitation and hygiene) standards in schools. International monitoring shows that disability-inclusive drinking water, sanitation and hygiene services are essential to creating safe and inclusive learning environments, yet many education systems still lack accessible toilets, safe water, and hygiene facilities for all learners. These gaps in sanitary regulation and enforcement disproportionately affect girls, learners with disabilities, and students from marginalized communities, thereby reinforcing educational exclusion despite formal commitments to inclusion.

The problem, therefore, is not whether schools should include diverse learners in principle. The problem is how educational institutions can move from declarative inclusion to operational inclusion. Declarative inclusion recognizes the value of equality in official documents. Operational inclusion changes the lived experience of learners by making classrooms, materials, technologies, assessments, and social relations genuinely accessible. A value-driven innovation perspective is useful because it asks whether reforms actually embody the values they claim to promote.

Aim and Research Questions

The aim of this paper is to conceptualise inclusive education as a value-driven innovation and to identify the main principles that can guide its implementation in schools and universities. The paper addresses the following research questions:

- How can inclusive education be understood as an innovation rather than only as a corrective policy when analysed together with school sanitary legislation and international WASH standards?
- What values should guide inclusive educational transformation? What ethical, legal and public-health values should guide inclusive educational transformation in learning environments where the right to education intersects with the rights to water, sanitation and hygiene?
- Which institutional and pedagogical changes are necessary for inclusion to become sustainable under sanitary and WASH rules?
- How can digital and organisational innovations support inclusion without reinforcing new forms of exclusion?

The argument is theoretical and policy-oriented. It draws on international frameworks in inclusive education, especially UNESCO's rights-based and equity-oriented approach, the CRPD's legal recognition of inclusive education, the OECD's systems perspective, and Universal Design for Learning as a practical pedagogical framework.

Theoretical Framing: Inclusion, Equity, and Universal Design

Inclusive education is based on the premise that learner diversity is normal, valuable, and educationally significant. The Salamanca Statement emphasised that regular schools with an inclusive orientation are an effective means of combating discriminatory attitudes, creating welcoming communities, and building an inclusive society (UNESCO Salamanca Statement). This principle remains important because it links education to wider democratic and social outcomes. Inclusion is not only about placing learners in the same physical space. It is about creating conditions in which they can participate, be recognized, and succeed.

Equity is essential to this understanding. Equality often implies giving everyone the same resources, while equity requires attention to different needs, barriers, and starting points. In education, equity means that support should be distributed in ways that enable fair participation and meaningful learning outcomes. The OECD's framework stresses that equity and inclusion are interconnected and require attention to governance, resources, capacity building, school-level practice, and evaluation (OECD). This systems perspective prevents inclusion from becoming a moral slogan without institutional mechanisms.

From a systems perspective, equity and inclusion are not limited to curriculum and assessment but also depend on school health and sanitary regulation. School health acts and sanitary regulations in many countries explicitly link students' health protection with the design of school facilities, including water supply, sanitation, and hygiene infrastructure, which are foundational for inclusive participation.

Universal Design for Learning offers a practical bridge between values and classroom practice. CAST defines UDL as a framework for designing learning experiences that help learners access and participate in meaningful and challenging opportunities (CAST UDL Guidelines). UDL emphasizes multiple means of engagement, representation, and action or expression, which means that students should have varied ways to become motivated, access information, and demonstrate learning (CAST). This approach is especially relevant to value-driven innovation because it shifts the burden from individual learners to the design of the learning environment.

Universal Design for Learning is closely connected to the physical and sanitary design of learning environments. Disability-inclusive WASH facilities, gender-sensitive toilets and accessible hand-washing stations are examples of environmental design features that remove participation barriers before they arise and thus operationalize UDL principles at the level of school infrastructure.

Main Argument

Inclusive education is value-driven innovation because it changes the moral and organizational logic of education. Traditional educational systems often assume standardization: one curriculum, one pace, one assessment format, one model of classroom participation, and one implicit image of the successful learner. Inclusive education challenges this model by insisting

that learner diversity must be anticipated from the beginning rather than accommodated only after difficulties appear. This is an innovative shift because it changes both the design process and the definition of educational success.

First, inclusive education creates ethical value by making dignity and belonging measurable concerns of educational quality. A school cannot be considered successful if it produces high average performance while systematically marginalizing some learners. The CRPD's recognition of inclusive education as part of the right to education demonstrates that inclusion is not optional charity but a rights-based obligation grounded in non-discrimination and equal opportunity (UN CRPD Article 24 text via ALLFIE). In this sense, value-driven innovation requires institutions to ask who benefits from reform, who remains invisible, and whose participation is made conditional.

Ethical value also includes the obligation to protect learners' dignity through adequate sanitary conditions. Reports of the UN Special Rapporteur on the right to education stress that access to safe water, sanitation and hygiene in schools is a prerequisite for the effective enjoyment of the right to education, especially for girls and learners with disabilities

Second, inclusive education creates pedagogical value by improving the quality of teaching for all learners. When teachers use flexible materials, varied assessment methods, accessible communication, collaborative learning, and differentiated support, these practices can benefit not only learners with identified needs but also students with different language backgrounds, learning preferences, emotional challenges, or temporary difficulties. UNESCO argues that inclusion should include all learners, regardless of identity, background, or ability, and that education systems should treat diversity as a strength rather than a deficit (UNESCO GEM Report). This means that inclusive pedagogy is not a separate branch of special education. It is a general quality principle for contemporary education.

Pedagogical innovations are undermined if learners cannot attend regularly or participate fully because of inadequate WASH facilities. Evidence from disability-inclusive WASH programmes shows that accessible toilets and hygiene facilities increase attendance and participation of learners with disabilities, which in turn amplifies the impact of inclusive teaching practices

Third, inclusive education creates institutional value by strengthening trust, participation, and social cohesion. Schools and universities are not only places for knowledge transmission. They are institutions where societies communicate who belongs, whose voice matters, and what forms of difference are respected. Inclusive education can therefore contribute to democratic culture by normalizing cooperation across differences and reducing stigma. The Salamanca Statement explicitly connects inclusive schools with welcoming communities and inclusive societies (UNESCO Salamanca Statement). This broader social function makes inclusion highly relevant to a conference theme focused on values.

At the institutional level, value-driven innovation requires aligning education policy with sanitary legislation and school health regulations. Integrating disability-inclusive WASH indicators into education management information systems demonstrates how legal and regulatory frameworks can support monitoring of inclusion in everyday school conditions.

Practical Implications

The implementation of inclusive education requires coordinated action at several levels. At the classroom level, teachers need training in accessible communication, differentiated instruction, formative assessment, trauma-sensitive practice, and UDL-based course design. Teacher preparedness is crucial because inclusion often fails when teachers are expected to solve structural problems without sufficient support. The OECD identifies capacity building for teachers and school leaders as a central policy area for equitable and inclusive education systems (OECD).

At the institutional level, schools and universities should audit barriers in curricula, assessment, digital platforms, buildings, administrative procedures, and student support services. Innovation should not be equated with simply introducing new technology. Digital tools can support inclusion through captions, screen-reader compatibility, translation, flexible pacing, and multimodal materials, but they can also deepen exclusion if learners lack access, devices, connectivity, or digital literacy. Therefore, digital innovation must be assessed through the question of accessibility and equity rather than novelty alone.

At the policy level, inclusive education requires stable funding, cross-sector cooperation, data systems that identify exclusion without stigmatizing learners, and accountability mechanisms. UNESCO identifies governance, finance, curricula, assessment, teacher education, infrastructure, and relations with families and communities as key areas that can unlock inclusion (UNESCO GEM Report). This suggests that inclusive education is not a single reform but a continuous institutional learning process.

At the institutional level, value-driven innovation requires aligning education policy with sanitary legislation and school health regulations. Integrating disability-inclusive WASH indicators into education management information systems demonstrates how legal and regulatory frameworks can support monitoring of inclusion in everyday school conditions.

This implies closer cooperation between education authorities, public health agencies and sanitary inspection bodies so that educational reforms and sanitary regulations reinforce rather than contradict each other.

Expected Contribution

The contribution of this paper is to connect inclusive education with the concept of value-driven innovation. This connection is important because many educational innovations are evaluated mainly through efficiency, competitiveness, digitalization, or measurable performance. Inclusive education invites a richer evaluation framework. A reform should be considered innovative not only when it is new, but when it advances human dignity, removes barriers, expands participation, and improves the quality of learning for diverse communities.

The paper also contributes a practical conceptual distinction between declarative and operational inclusion. Declarative inclusion appears in mission statements, policy documents, and public commitments. Operational inclusion appears in accessible classrooms, flexible curricula, trained teachers, responsive assessment, student voice, adequate resources, and reliable support systems. This distinction helps institutions evaluate whether their commitment to inclusion is symbolic or transformative.

Conclusion

Inclusive education is not an accessory to educational modernization. It is one of its central tests. If innovation is truly value-driven, it must be judged by its capacity to create learning environments where every learner is respected, supported, and able to participate. International frameworks from UNESCO, the CRPD, the OECD, and UDL-based pedagogy all point toward the same conclusion: inclusion requires a shift from adapting learners to institutions toward redesigning institutions around learner diversity.

The central argument of this paper is that inclusive education should be understood as a transformative form of value-driven innovation. It creates ethical value by protecting dignity and rights, pedagogical value by improving teaching and learning, and institutional value by strengthening belonging and social cohesion. Its success depends on whether educational institutions can translate values into everyday practices, resources, and structures. In this sense, inclusive education is not only about who enters the classroom. It is about how the classroom, the curriculum, the institution, and the wider society are

In this perspective, inclusive education and sanitary legislation are deeply interconnected: without safe, accessible and dignified WASH conditions in schools, commitments to inclusion remain declarative rather than operational.

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