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Blyznyuk Tetyana Palvivna Doctor of Sciences in Economics, Professor, Head of Creative Management and Design Department, Simon Kuznets Kharkiv National University of Economics**,** Kharkiv, https://orcid.org/0000-0002-8291-4150

Hryhorova Larysa Serhiivna Ph.D. of Pedagogical Sciences, associate professor, Head of Design and Technology Department, H.S. Skovoroda Kharkiv National Pedagogical University, Member of the Union of Designers of Ukraine, Kharkiv, https://orcid.org/0000-0002-8291-4150

DIGITAL EDUCATIONAL ENVIRONMENT OF AN EDUCATIONAL INSTITUTION: ESSENCE AND CHARACTERISTICS

Abstract. Educational institutions are moving from the traditional model of education to hybrid and digital formats, within which a digital educational environment is formed. The article provides a theoretical understanding of the essence of the concept of a "digital educational environment of an educational institution" in the context of the digital transformation of society and the modernization of Ukraine's educational system. It is substantiated that the digital educational environment is not only a set of information and communication technologies but also a holistic pedagogical system that integrates digital resources, management tools, communication platforms, and didactic approaches to ensure the quality, accessibility, and individualization of learning. The regulatory and legal principles of digital education are analyzed, and the key approaches of domestic and foreign researchers to interpreting the concept of a digital educational environment are outlined. The main structural components of the digital educational environment are identified, in particular, digital content, infrastructure, educational process management systems, communication services, and analytical tools. Its leading functions are revealed: educational, communication, adaptive, diagnostic, organizational, information, coordination, management, and control-analytical. The importance of personalizing learning, forming individual educational trajectories, developing digital competence, and ensuring cybersecurity is emphasized. The advantages of the digital educational environment compared to traditional forms of organizing learning are outlined, and current challenges related to digital inequality, the level of ICT competence of participants in the educational

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process, and issues of academic integrity are also identified. It is concluded that the effective functioning of the digital educational environment requires a systematic approach, infrastructure development, methodological support, and the training of pedagogical personnel, thereby fostering a new pedagogical culture and improving the quality of education.

Keywords: digital educational environment, digitalization of education, educational platforms, distance learning, educational space, educational institution, inclusiveness of the educational environment, quality of education.

Близнюк Тетяна Павлівна доктор економічних наук, професор, завідувач кафедри креативного менеджменту і дизайну, Харківський національний економічний університет імені Семена Кузнеця, м. Харків, https://orcid.org/0000-0002-8291-4150

Григорова Лариса Сергіївна кандидат педагогічних наук, доцент, завідувачка кафедри дизайну і технологій, Харківський національний педагогічний університет імені Г.С. Сковороди, член спілки дизайнерів України, м. Харків, https://orcid.org/0000-0002-8990-8861.

ЦИФРОВЕ ОСВІТНЄ СЕРЕДОВИЩЕ ЗАКЛАДУ ОСВІТИ: СУТНІСТЬ ТА ХАРАКТЕРИСТИКИ

Анотація. Сучасний етап розвитку суспільства характеризується стрімким зростанням ролі цифрових технологій у всіх сферах життєдіяльності, що зумовлює трансформацію освітніх систем. Заклади освіти переходять від традиційної моделі навчання до гібридних та цифрових форматів, у межах яких формується цифрове освітнє середовище. У статті здійснено теоретичне осмислення сутності поняття «цифрове освітнє середовище закладу освіти» в умовах цифрової трансформації суспільства та модернізації освітньої системи України. Обґрунтовано, що цифрове освітнє середовище постає не лише як сукупність інформаційно-комунікаційних технологій, а як цілісна педагогічна система, що інтегрує цифрові ресурси, інструменти управління, комунікаційні платформи та дидактичні підходи, спрямовані на забезпечення якості, доступності й індивідуалізації навчання. Проаналізовано нормативно-правові засади цифровізації освіти, окреслено ключові підходи вітчизняних і зарубіжних дослідників до трактування поняття цифрового освітнього середовища.

Визначено основні структурні компоненти цифрового освітнього середовища, зокрема цифровий контент, інфраструктуру, системи управління освітнім процесом, сервіси комунікації та аналітичні інструменти. Розкрито його провідні функції: освітню, комунікаційну, адаптивну, діагностичну, організаційну, інформаційну, координаційну, управлінську та контрольно-аналітичну. Наголошено на значенні персоналізації навчання, формування індивідуальних освітніх

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траєкторій, розвитку цифрової компетентності та забезпечення кібербезпеки. Окреслено переваги цифрового освітнього середовища порівняно з традиційними формами організації навчання, а також визначено актуальні виклики, пов'язані з цифровою нерівністю, рівнем ІКТ-компетентності учасників освітнього процесу та питаннями академічної доброчесності. Зроблено висновок, що ефективне функціонування цифрового освітнього середовища потребує системного підходу, розвитку інфраструктури, методичного супроводу та підготовки педагогічних кадрів, що забезпечує формування нової педагогічної культури й підвищення якості освіти.

Ключові слова: цифрове освітнє середовище, цифровізація освіти, освітні платформи, дистанційне навчання, освітній простір, заклад освіти, інклюзивність освітнього середовища, якість освіти.

Problem statement. The current stage of society's development is characterized by the rapid expansion of digital technologies across all spheres of life, transforming educational systems. Educational institutions are moving from the traditional model of education to hybrid and digital formats, within which a digital educational environment is formed. It becomes not only a technical tool to support the educational process, but also a holistic pedagogical system that defines new approaches to organizing learning, management, communication, and students' personal development.

The active introduction of information and communication technologies into the educational process necessitates revising the content, forms, and methods of teaching, as well as rethinking the role of the teacher himself.

In this regard, the problem is creating an effective digital educational environment that not only provides access to educational materials but also creates conditions for high-quality interaction among participants in the educational process, fostering the development of critical thinking, creativity, independence, and students' digital literacy [10].

The importance and urgency of the digital modernization of the education system in Ukraine is confirmed by the active development of the conceptual and regulatory framework for its implementation [9].

At the same time, the basis for the successful digital transformation of the education system in Ukraine is, first of all, a thorough, comprehensive study of various aspects of this complex problem and the substantiation of the most effective ways to address it.

Analysis of recent research and publications. The digitalization of the educational process is the subject of numerous studies and publications that highlight various aspects of this process.

Thus, V. Bykov analyzes the development of innovative technologies in the context of digital transformations [2]. L. Kartashova and V. Lapinsky analyze the digitalization of education in the context of changes in the social structure and the impact of these processes on the organization of education [7].

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V. Bykov, O. Spirina, and O. Pinchuk analyze the problems and tasks of the modern stage of informatization of education, innovative tools, and their promising directions [12].

O. Voronkin and V. Chychuk reviewed the history of development and analysis of research on information and communication technologies in Ukraine and the world [8]. V. Bykov, M. Zhaldak, N. Morse, O. Ovcharuk, O. Pinchuk, and others studied the use of digital educational environment tools during classes [2].

A group of scientists led by O. Topuzov considered and analyzed key issues of the digitalization of education within the framework of research on distance learning in quarantine conditions [3]. S. Trubacheva, O. Mushka, Yu. Lyulkova investigated the didactic features of the formation of students' academic competence in the conditions of the digitalization of the educational environment of a general secondary education institution during martial law [11].

Currently, there is a need for research on the digitalization of education during martial law, which would adapt and place new emphasis on existing developments, supplementing them in light of the need to ensure the security and inclusiveness of the educational environment in educational institutions.

The purpose of the article is to theoretically understand the concept of a digital educational environment in an educational institution, analyze its structure, functions, and principles of formation, and determine its development prospects.

Presentation of the main material. The digitalization of an educational institution's educational process aims to improve the quality of teaching and professional training of future specialists, optimize teachers' professional and pedagogical activities, and ensure effective interaction using digital tools.

The main regulatory documents that currently regulate the process of digitalization of Ukrainian education are:

1) Digital Europe Program (DIGITAL/2021–2027) [16], aimed at supporting the implementation of digital technologies and innovations, ensuring access to digital infrastructure and services in priority areas – artificial intelligence, cloud technologies, digital skills, information technologies, cybersecurity, etc.;

2) “Digital Compass 2030: Europe's path for the digital decade” [13], which focuses on important digital principles, such as: universal access to Internet services; a safe and secure online environment; universal digital education and skills for people to participate in society and democratic processes actively; access to digital systems and devices; ethical principles for human-centric algorithms; protection and empowerment of children in the online space;

3) Concept of Digital Transformation of Education and Science for the Period Until 2026 [5] aimed at creating a single digital environment that will facilitate the unification of all subjects of educational and scientific activity; providing space for communication and data exchange, optimization of management, regulation and monitoring processes; transparent, convenient and effective services and processes in the field of education and science;

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4) The Concept of Digital Competence Development [4], which states that a person acquires digital education using information resources, new educational technologies, and digital educational resources aimed at improving the level of digital skills and digital competencies, ensuring the continuous development of professional digital competencies, etc.

Currently, the design of the educational environment in educational institutions, focused on creating conditions for implementing the main tasks in the field of digitalization of education to solve urgent educational problems in society, is a priority area of development for modern education in Ukraine.

The active introduction of digital technologies into the educational process and activities of educational institutions led to the emergence of the definition “digital educational environment”.

Thus, the digital educational environment is defined by M. Bergman [14] as a systematically organized set of information-technical and educational-methodical support for an educational institution, aimed at organizing the interaction of all subjects of the educational process and implementing educational influences using modern digital technologies.

T. Hölterhof [15] considers the digital educational environment as an open set of information and digital systems designed to ensure various tasks of the educational process.

J. Roth [14] defines a digital educational environment as a purposefully built system of digital information resources for educational purposes and digital tools for organizing and managing educational activities.

According to the Description of the Digital Competence Framework for Citizens of Ukraine [5], “the digital environment is an integrated communication environment that contains a set of digital tools and services, the use of which enables users to solve life and professional tasks and satisfy needs. Digital tools and services include the Internet, other digital networks, computer programs and devices, search engines, digital content and resources, which are collectively used to ensure communication and interaction between users in the digital environment”.

N. Pavlova [7] believes that a digital educational environment is “an artificially created educational environment in which the didactic goals of learning, cooperation, and communication of participants in the educational process are achieved through the balanced and appropriate use of digital technologies.”

Ya. Topolnyk [10] notes that the digital educational environment cannot be considered as an auxiliary or optional component of the educational process. It should become an organic component of the higher education institution's educational ecosystem, aimed at achieving the modern goals of higher pedagogical education: training a competitive, mobile, innovation-oriented teacher capable of operating effectively in the conditions of the digital transformation of education.

O. Storonskaya [9] in her study concludes that the digital educational environment generally reflects a complex of material and technical, psychological and

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pedagogical, didactic conditions for the implementation of the educational process based on modern digital technologies. It encompasses a structured set of various digital educational resources, tools, devices, etc., which ensure an effective educational process in the context of the digital transformation of the educational sector. Such an environment is a holistic multifunctional complex of conditions and capabilities of an educational institution that ensure the implementation of the educational process in a digital format.

Thus, it can be concluded that the digitalization of education involves transforming the content, methods, and organizational forms of education to ensure quality and accessibility, and to enhance individualization and differentiation through the fullest possible use of digital technologies' potential.

The digitalization of the education system involves the technological modernization of educational institutions' infrastructure, the creation of a safe digital educational environment, and the development of digital competence among pedagogical, scientific, and administrative personnel who can effectively use digital technologies in the educational process [11].

One of the priority areas of digital education is the creation of a single, standardized National Platform for Digital Education. The e-platform is a comprehensive tool, an integrated environment of modern education for the most complete use of the capabilities of information and communication technologies in the educational process, which does not replace traditional forms, but complements, updates, and intensifies them.

Thus, the study [12] proposes creating a single interactive information space for an educational institution. In particular, it emphasizes the need for standardizing and testing digital educational content, as well as developing specialized electronic educational services.

The principles on which the updated project should be based are proposed, along with measures to ensure its successful implementation.

The transition to an innovative digital structure for the university is justified, and it is supported by a set of measures that include regulatory, organizational, economic, social, and ideological components.

Let us analyze in detail the main components of the digital educational environment.

As noted by O. Barabash [1], the main tasks of digitalization of an educational institution are the following:

1) The creation of digital educational content based on modern digital technologies and resources promotes high-quality learning and research, universal accessibility of educational materials, and effective communication between all participants in the educational process.

2) ensuring equal access to educational resources in the context of expanding learning opportunities for all students, regardless of their place of residence or special educational needs;

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3) automation of management processes, which involves optimizing the work of both the administration of the educational institution and all structural educational units, in particular regarding the creation of a centralized database, document management, keeping records of student success, and prompt exchange of information;

4) increasing the digital literacy of all participants in the educational process, which is aimed at increasing the level of digital competence and mastering new digital technologies, tools, and means;

5) guaranteeing the protection of personal data and cybersecurity, which is aimed at ensuring the protection of information systems, controlling access to confidential information of all participants in the educational process, as well as teaching the basics of information security in the digital educational space;

6) productive interaction, which involves establishing effective communication and rapid feedback between all participants in the educational process.

This approach to implementing the outlined tasks enables the educational institution to create a modern, innovative, and dynamic educational environment that meets the challenges of the digital age.

The digital educational environment also performs several interrelated functions, each aimed at ensuring the integrity, efficiency, and flexibility of the educational process.

As Ya. Topolnyk [10] notes that, first of all, it is worth highlighting the educational function, which consists of providing access to high-quality, relevant, and multi-level educational content. Thanks to digital technologies, educational materials have become not only interactive and multimedia, but also accessible in a convenient format - at any time and from any device, which contributes to the implementation of the principles of mobile and continuous learning.

No less significant is the communication function of the digital environment, which encompasses wide opportunities for effective interaction between participants in the educational process. This function is manifested in providing conditions and opportunities for multi-level communication among all participants in the institution's educational activity (administration, teaching staff, students, the public, etc.) in various forms and formats [9]. Using digital tools – including online forums, chats, video conferencing, interactive whiteboards, and cloud-based collaboration – creates an environment for discussion, joint problem-solving, and the development of academic and social skills.

Particularly relevant in the context of the digitalization of education is the adaptive function, which enables the construction of individual educational trajectories that correspond to the abilities, interests, personal needs, and learning pace of each applicant [10].

This creates conditions for implementing the principles of inclusiveness, a personally oriented and humanistic approach, which are priorities in modern pedagogy.

Also significant is the diagnostic function of the digital environment, which enables operational monitoring of educational achievement, the introduction of

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formative assessment tools, and the use of analytical modules to track the dynamics of educational progress. This ensures constant feedback between the teacher and the applicant, increasing learning effectiveness and motivation for self-improvement.

It is worth noting the importance of the organizational function, which optimizes the management and logistical aspects of the educational process [10].

Modern digital environments enable you to effectively plan and coordinate training sessions, automatically distribute educational materials and tasks, set up an event calendar, create individual training schedules, and monitor the implementation of educational activities.

We should not forget about the information function, which consists of providing open, unhindered access to all subjects of the institution's educational activity to various types of information (educational, methodological, financial, etc.) and the possibility of operational data exchange [9].

It is also important to separate the coordination function of the digital educational environment, which involves establishing interaction and cooperation among all participants in the institution's educational activity, and regulating their tasks and responsibilities [9].

Also important are the managerial function, reflected in the planning and management of the educational process implemented by the educational institution, and the control and analytical function, which consists of providing digital diagnostic tools and analytics of quantitative and qualitative indicators of the institution's educational activity [9].

Therefore, the functional multidimensionality of the digital educational environment creates conditions for the formation of a new pedagogical culture, in which digital interaction becomes an integral part of the teacher's professional activity and an effective tool for achieving educational goals.

The main properties of the digital educational environment, according to scientists [14; 15], are:

1) openness, which is manifested in the possibilities of integrating the results of new scientific research and technological achievements, as well as in accessibility for direct users and the general public;

2) variability, which is reflected in the possibilities of organizing different educational routes, parallel education, and the implementation of differentiated and diversified educational programs;

3) creativity, which involves providing conditions for the realization of users' creative abilities in the process of educational work; stability, which consists of the ability to maintain the conditions for the effective functioning of an educational institution, to demonstrate resistance to various external influences, etc.

According to experts [8; 14], the key advantages of the digital educational environment over traditional (pre-digital) educational environments are: individualized, personalized organization of the educational process; the absence of rigid regulations of the educational process; interactive interaction and communication of

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participants in the educational process; a wide choice of forms, methods, and means of implementing the educational process;

independent management of educational activities for education seekers, etc.

Despite existing achievements, the digitalization of education is accompanied by several challenges, including digital inequality, variability in levels of ICT competence among applicants and teachers, risks of fragmented or formalized use of digital platforms, and issues of academic integrity in the online environment. These challenges require further scientific and methodological understanding, as well as the development of effective models for the digital transformation of the educational process. That is why the following areas offer opportunities for developing the digital educational environment: integrating artificial intelligence into education; personalizing learning; developing adaptive educational platforms; fostering a digital culture; and creating a single digital educational space.

Conclusions. The digital educational environment is not only a tool for technical support of the educational process, but also an independent pedagogical phenomenon that forms a new quality of interaction between participants in the educational process, contributes to increasing motivation for learning, the development of professional reflection, digital culture, and the autonomy of education seekers. Its effective use ensures the implementation of a competency-based, personally oriented, and interactive approach, including inclusiveness that meets the requirements of modern education.

The digital educational environment must allow you to integrate tools that ensure the continuity of the educational process, formative assessment, flexibility of educational trajectories, and wide opportunities for independent and project activities. At the same time, the use of digital technologies in education requires a systemic approach: an appropriate digital infrastructure, the readiness of the teaching staff to implement innovations, methodological support, and regulatory support.

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