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Research interests: *digitalization of higher education, digital university, digital transformation of the educational environment, artificial intelligence in education, educational ecosystems, innovative digital platforms.*

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УДК 32:002:004 (477) (045)

https://doi.org/10.32405/2411-1317-2025-2-27-34

Подано до редакції: 15.04.2025
Прийнято після рецензування: 21.04.2025
Затверджено до друку: 01.05.2025
Опубліковано: 30.06.2025

DIGITALIZATION OF EDUCATION IN THE CONTEXT OF THE FORMATION OF A NEW GENERATION UNIVERSITY

Abstract. The article analyzes the digitalization of higher education as a complex phenomenon of modern society that determines the formation of a new generation university. It is stated that digitalization is an integral part of the development of social institutions, encompassing the economy, culture, medicine, management, and, in particular, the educational sphere. Particular attention is paid to the transformational processes taking place in higher education institutions as a result of the widespread implementation of digital technologies. It is noted that digital solutions – distance education platforms, chatbots, artificial intelligence, messengers, electronic registration services, and virtual libraries – contribute to the change of pedagogical models, form new communication strategies for interaction between teachers and students.

The article highlights the positive aspects of the digital transformation of education, including the flexibility of learning, personalization of educational trajectories, and optimization of educational and administrative processes. At the same time, the challenges accompanying this process are emphasized: digital inequality, technical difficulties, insufficient digital literacy of both students and teachers. Particular attention is paid to the problem of information security in the digital educational environment, which is exacerbated by the rapid expansion of digital technologies and the threat of cybercrime.

Considerable attention is paid to the changing role of the teacher and the need to adapt their pedagogical practices to the modern requirements of the digital society. The emphasis is placed on the fact that a modern teacher should not only be proficient in the latest digital tools but also be able to effectively integrate them into the learning process, taking into account the specifics of digital habits and the educational needs of students.

The article also examines the specifics of implementing innovative digital solutions, including the use of chatbots and artificial intelligence in the educational process, which allow automating routine processes, increasing the efficiency of information exchange, but at the same time raise a number of issues for the pedagogical community to preserve the quality of education and students' ability to think independently.

It is generalized that the digitalization of education is not just a technological update of the educational environment, but also a fundamental change in the pedagogical paradigm based on

interactivity, adaptability, and continuous updating of knowledge and skills. The key priorities for the development of new generation universities, focused on sustainable development and training of competitive professionals capable of operating effectively in the digital reality, have been identified.

Keywords: digitalization of education; digital university; digital educational environment; digital competencies; artificial intelligence in education, chatbots; digitalization; pedagogical transformation.

Problem statement. The digitalization of education in the context of global transformations is a key factor in the modernization of higher education, necessitating the renewal of the content, forms, and means of organizing the educational process. New generation universities are increasingly positioned not only as traditional educational institutions but also as open digital ecosystems capable of providing continuity of education, flexibility of educational trajectories, and adaptability to a changing socio-technological environment (Bobro, 2025a). This process involves not just the implementation of individual technologies, but a comprehensive rethinking of the institutional role of the university, the digital culture of participants in the educational process, and ways to manage the educational environment.

Despite the growing interest in the digital transformation of education, there are a number of challenges related to ensuring information security, overcoming digital inequality, and developing the digital competencies of teachers and students. Particularly relevant is the problem of implementing artificial intelligence, chatbots, adaptive platforms, and other learning tools that, on the one hand, open up new opportunities for personalization and automation of the educational process, and on the other hand, question traditional pedagogical models and the role of the teacher as a carrier of knowledge (Wambsganss et al., 2024; Lysenko et al., 2024). Universities are facing the need to form a new architecture for managing digital data and information flows, which requires the implementation of strategically sound digital solutions (Bobro, 2025b).

During the war in Ukraine, the digital transformation of education received an additional impetus as a tool to ensure the educational process in extreme circumstances. Online formats, hybrid learning, digital services, and cloud platforms have become not only a means of communication and knowledge transfer but also important channels for supporting psychoemotional resilience, social cohesion, and access to quality education for internally displaced persons and students from the temporarily occupied territories. In these conditions, digitalization performs the function of stabilizing the educational environment and supporting academic equality.

The relevance of the research is determined by the need for scientific understanding of digital transformation as a systemic phenomenon that encompasses technological, organizational, pedagogical, and ethical dimensions of higher education institutions. The analysis of digitalization factors allows us to form strategic guidelines for the development of new generation universities capable of providing quality education in the face of constant challenges. The development of effective digital university models should be based on an interdisciplinary approach that takes into account the needs of students, teachers, administration, and external stakeholders.

Analysis of recent research and publications. The problems of digitalization of education and the formation of a digital university are considered in the works of modern researchers who analyze both the general theoretical foundations of digital transformation and the applied aspects of the implementation of digital technologies in the educational environment. In particular, digital interactive learning technologies as an integral part of the modern educational process were studied by O. Skliarenko, S. Yahodzinskyi, O. Nikolaievskyi, A. Nevzorov (Skliarenko et al., 2024), and the impact of interactive approaches on the development of higher education students was studied by O. Khomenko, M. Paustovska, and I. Onyshchuk (Khomenko et al., 2024).

The socio-economic determinants of the formation of educational ecosystems are revealed in the works of H. Lopuschnyak, O. Chala, and Poplavska (Lopuschnyak et al., 2021), and analytical approaches to assessing digital changes in corporate and educational management in the works of A. Krap, S. Bataiev, N. Bobro, V. Kozub, N. Hlevatska (Krap et al., 2024). Artificial intelligence as a factor

in improving the effectiveness of cybersecurity in a digital university is analyzed in the research by S. Lysenko, N. Bobro, K. Korsunova, O. Vasylchyshyn, and E. Tatarchenko (Lysenko et al., 2024).

The issues of digital transformation in the broader economic and social context are discussed in the works of A. Kozhyna (Kozhyna, 2022), S. Kubiv, G. Lopushnyak et al. (Kubiv et al., 2020), as well as in the research of C. Safarli, S. Kolach, M. Zhyvko, O. Volskyi (Safarli et al., 2024), which deals with the impact of globalization processes on the formation of digital strategies. Moreover, the conceptual foundations of digital transformation are substantiated in the works of N. Verina and J. Titko (Verina & Titko, 2019), and the practical application of machine learning tools in the educational process is analyzed by T. Wambsganss, A. Janson, M. Söllner, K. Koedinger, J. M. Leimeister (Wambsganss et al., 2024).

Therefore, modern scholarship is increasingly focusing on the institutional, infrastructural, legal, and technological dimensions of the digitalization of education, which creates the basis for the formation of new generation universities focused on openness, flexibility, and sustainable development in the digital environment.

The aim of the article is to analyze the process of digitalization of education in the context of the formation of a new generation university, to identify the main advantages, risks, and challenges of this process, and to clarify the peculiarities of implementing digital technologies in the educational process.

Considering the aim, the objectives of the article are as follows:

- To analyze the peculiarities of digitalization of modern society and determine its impact on the higher education system.
- To identify the positive and problematic aspects of the digital transformation of education, in particular in the context of global challenges.
- To identify the key risks of implementing digital technologies in the learning process, including digital inequality, information overload, and cybersecurity threats.
- To assess the impact of digitalization on the role of the teacher and student in the new educational environment, as well as to identify methodological changes in pedagogical approaches.
- To outline promising areas of application of innovative digital tools (messengers, chatbots, artificial intelligence, cloud technologies) in the process of organizing educational activity.

The performance of these objectives allows us to determine the strategic directions of development of higher education institutions in the context of digitalization and contributes to the formation of an effective educational model that meets modern socio-economic challenges.

The research methods included analysis and synthesis of scientific literature, systematization and generalization of existing practices of implementing digital technologies in higher education, as well as a comparative analysis of the positive and negative aspects of the educational environment digitalization.

Research results and discussion. In modern society, digitalization is increasingly viewed as an integral component of social development, which leads to the formation of a new phenomenon - the digital society. Digitalization refers to the process of systematic implementation and dissemination of digital technologies in key areas of public life, including the economy, culture, education, healthcare, management, etc. (Wambsganss et al., 2024) Despite the presence of both supporters and critics of digital transformation, it is worth noting that this process is irreversible, and the development of modern society is inextricably linked to the digital path.

Analysis of current digital transformation practices allows us to identify both positive effects and problematic aspects of this process. In particular, in the field of e-commerce, the formation of new models of consumer behavior, increased availability of goods and services, optimization of logistics processes, and reduction of transaction time are observed (Safarli et al., 2024). At the same time, these benefits remain inaccessible to certain categories of the population who do not have the proper level of digital competence or technical support.

Similar trends are also characteristic of the education system, where digitalization contributes to the transformation of the organizational and pedagogical model of higher education institutions. The formation of a new generation university involves the comprehensive implementation of digital services:

distance learning platforms, electronic registration systems, virtual libraries, chatbots, digital teacher avatars, etc. At the same time, these innovations are accompanied by challenges in the form of digital inequality, technical barriers, lack of motivational and psychological readiness of individual participants in the educational process to move to a digital environment (Lysenko et al., 2024).

The digitalization of healthcare, which has developed in parallel with educational processes, shows similar patterns. Mobile applications for making an appointment with a doctor, online access to medical records, and the ability to choose a specialist are all driven by the need for basic digital skills. By analogy, in the educational context, effective participation in the digitized learning process is possible only if there is an appropriate level of digital literacy.

The COVID-19 pandemic has become a catalyst for intensifying digital transformations in education. The widespread implementation of remote learning formats has helped to consolidate digital technologies as tools not only for emergency but also for ongoing educational practice. An important role in this process was played by communication platforms, such as Zoom, Microsoft Teams, Moodle, and Google Workspace for Education, which became the main channels of educational interaction between all participants in the educational process (Khomenko et al., 2024).

However, the active use of digital technologies is also accompanied by a number of risks. In particular, the excessive use of social media can lead to addiction, information overload, and negatively affect the psycho-emotional state of students. The likelihood of cybercrime, fraud, leakage, or unauthorized access to personal data is increasing, which poses a serious threat to the information security of the digital educational environment.

Thus, digitalization is not only a global trend but also a determining factor in the structural modernization of the higher education system. It creates new requirements for the organizational architecture of the university, restructures the educational process in accordance with the competency-based approach, and actualizes the need to develop a digital culture. A new generation university is emerging not only as a carrier of knowledge but also as an adaptive, technology-oriented institution capable of responding quickly to the challenges of the digital age.

Considering the rapid penetration of digitalization in all spheres of modern human life, the importance of personal data protection is growing, which, in turn, leads to the intensive development of both information technology in general and cybersecurity technologies and practices (Skliarenko et al., 2024). The list of industries covered by digital transformation is constantly expanding, but the education system occupies a special place among them. This is because it is in the educational environment that the personality, values, competencies, and professional skills of future specialists are formed, which directly affect both the quality of life of the individual and the socio-economic progress of society as a whole, in particular, the further improvement of digitalization processes.

In the context of the functioning of higher education institutions - a key space for the formation of a professional personality – we can confidently state that digitalization has already become a necessary component of the university educational process. The question is not whether it should be implemented, but whether institutions, teachers, and students are ready for it, or whether the process of digitalization itself rethinks and transforms the educational space regardless of readiness for change (Krap et al., 2024).

At the same time, it is important to distinguish between the concepts of digitalization of education and online learning. Despite certain interdependence, these phenomena are not identical. Online education is just one of the tools of digitalization, which covers a much wider range of technologies, practices, and strategies - from the implementation of artificial intelligence to the use of digital teacher avatars, personalized learning paths, and educational data analytics.

The advantages and disadvantages of distance learning have already been widely discussed in the scientific discourse, but this research focuses on digitalization as a systemic phenomenon. Amidst the accelerated changes taking place in society, it is worth considering that a significant number of teachers received their pedagogical education under the dominance of the traditional model of teaching, focused on direct interaction between teacher and student. In the modern educational environment, the object of pedagogical influence is a new type of student with different cognitive needs, digital habits, and expectations.

Moreover, even the younger generation of teachers who have basic digital experience have often been trained under educational models that no longer meet modern professional challenges. If earlier higher education provided a sufficient basis for long-term professional realization, nowadays the key condition for the competitiveness of a specialist is continuous updating of knowledge, development of flexible skills, and formation of new competencies, especially digital ones.

It can be stated that the digitalization of higher education not only rethinks the teaching tools but also forms a new pedagogical paradigm based on the dynamic updating of educational content, adaptability of educational strategies, and active involvement of digital technologies as tools for personal and professional development.

Modern students are actively using multifunctional digital tools, including messengers such as Telegram, WhatsApp, etc. These means of communication are being transformed from purely domestic platforms into full-fledged tools for educational exchange, which allows not only for the prompt transfer of educational materials, documents, and requests, but also for continuous interaction between teacher and student, organization of thematic forums, chats of scientific events, educational blogs, and creation of social services for the storage and generation of digital content.

The idea that the teacher should speak the "language of the student," while remaining a role model, remains relevant at all historical stages of pedagogy development. This necessitates that teachers of higher education institutions not only master modern digital technologies but also integrate them into the educational process, taking into account personal pedagogical practices. In particular, messengers are widely used for asynchronous communication with groups of students during extracurricular time, for transferring large files, certificates, diplomas, homework, in cases where email is less effective.

However, along with the advantages of digitalization, a number of negative effects have been recorded. One of them is the rapid copying of educational materials, including tests and control tasks, which students take pictures of, pass between groups, archive, and distribute via messengers. This makes it impossible to reuse such tasks within other academic groups or subsequent academic cycles (Krap et al., 2024). As a result, the pedagogical novelty is depreciated, and it is difficult to assess the real level of students' training.

Moreover, in the case of tasks requiring creative thinking, adaptability, and erudition, students are increasingly resorting to instant access to search engines using smartphones, which eliminates the value of independent intellectual effort. In this context, the question arises: is it advisable to limit the use of digital devices during lessons or, on the contrary, is it necessary to transform the structure of tasks, formulating them so that the student has to look for a solution not in a ready-made form, but in a complex information environment, demonstrating the ability to analyze and filter data.

At the same time, the latest digital tools are increasingly being implemented in educational practice: educational platforms, mobile applications, cloud technologies, web quests, and adaptive learning environments. In students' research work, e-mail has become a mandatory means of communication with supervisors, because the dynamics of the educational process require constant and prompt interaction, which cannot be realized only through face-to-face communication (Kozhyna, 2022).

The use of chatbots as tools in the digital learning environment deserves special attention. Chatbots are artificial intelligence-based programs that communicate with users in real time, most often in integration with messengers or social networks. Their use enables the automation of routine information processes, answering standard queries, distributing reference materials, and regulating access to learning resources. Thus, chatbots help to rationalize teaching time and increase institutional efficiency.

At the same time, there are active discussions about the feasibility of using artificial intelligence in the educational process. Modern researchers express both concern about the possible loss of students' ability to think independently and highlight the positive experience of using AI as a tool for analytical thinking (Kozhyna, 2022). In particular, it is practiced to create tasks that involve the targeted use of artificial intelligence, followed by a critical analysis of the solutions obtained and a joint discussion of the effectiveness of the chosen strategies.

Therefore, the current stage of development of digital education involves not only the technical renewal of the educational process but also a deep rethinking of the teaching methodology, forms of pedagogical interaction, and the role of the teacher as a moderator in the digital educational environment.

Conclusions and prospects for further research. As a result of the analysis, it was found that the digitalization of higher education is a leading trend in modern society, which causes the structural transformation of universities, changes in pedagogical models, teaching methods, and roles of participants in the educational process. It is determined that the comprehensive implementation of digital technologies, including distance learning platforms, chatbots, digital avatars, artificial intelligence, and other tools, contributes to the formation of a new generation university that can quickly adapt to external challenges and the needs of students. At the same time, digital transformation is accompanied by a number of risks, including digital inequality, information overload, and cybersecurity issues, which require special attention in the context of the sustainable development of universities.

It is stated that the active digitalization of the educational environment significantly changes the role of the teacher: they turn from a traditional carrier of knowledge into a moderator and coordinator of the educational process. This transformation requires teaching staff not only to be proficient in digital technologies but also to be able to integrate them into their pedagogical strategies, taking into account the modern expectations of students. At the same time, digitalization opens up new opportunities for students to personalize their educational trajectories, flexibility in acquiring knowledge and skills, but also increases the requirements for their digital competencies.

Digital transformation is especially important in emergencies, when digital tools become the only way to maintain academic continuity and ensure access to quality education. At the same time, it has been found that a significant increase in the volume of digital communication and information flows creates additional pressure on participants in the educational process, in particular due to overload, psychological fatigue, and the risk of cyber threats. This emphasizes the need for further research on ways to increase the resilience of the educational environment to the information and psychological challenges of the digital age.

Promising areas for further research include an in-depth analysis of the impact of digitalization on the quality and efficiency of the educational process in the long term, the development of new methodological and technological approaches to the integration of artificial intelligence, chatbots, and educational data analytics into pedagogical activity. Particular attention should be paid to the study of mechanisms for overcoming digital inequality, improving personal data protection systems, and forming digital competencies in all participants in the educational process as a strategic priority of new generation universities.

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Коло наукових інтересів: *діджиталізація вищої освіти, цифровий університет, цифрова трансформація освітнього середовища, штучний інтелект в освіті, освітні екосистеми, інноваційні цифрові платформи.*

ЦИФРОВІЗАЦІЯ ОСВІТИ В КОНТЕКСТІ ФОРМУВАННЯ УНІВЕРСИТЕТУ НОВОГО ПОКОЛІННЯ

Анотація. У статті здійснено аналіз цифровізації вищої освіти як комплексного феномену сучасного суспільства, що визначає формування університету нового покоління. Констатовано, що цифровізація є інтегральною складовою розвитку соціальних інститутів, яка охоплює економіку, культуру, медицину, управління, й зокрема, освітню сферу. Особливу увагу приділено трансформаційним процесам, які відбуваються у закладах вищої освіти внаслідок широкого впровадження цифрових технологій. Відзначено, що цифрові рішення – дистанційні освітні платформи, чат-боти, штучний інтелект, месенджери, електронні сервіси реєстрації та віртуальні бібліотеки – сприяють зміні педагогічних моделей, формують нові комунікаційні стратегії взаємодії між викладачами та здобувачами освіти.

У статті висвітлено позитивні аспекти цифрової трансформації освіти, зокрема забезпечення гнучкості навчання, персоналізації освітніх траєкторій та оптимізації освітніх і адміністративних процесів. Водночас наголошено на викликах, що супроводжують цей процес: цифрова нерівність, технічні труднощі, недостатній рівень цифрової грамотності як студентів, так і викладачів. Особливу увагу приділено проблемі інформаційної безпеки у цифровому освітньому середовищі, яка загострюється в умовах швидкого розширення цифрових технологій та загроз кіберзлочинності.

Значну увагу присвячено зміні ролі викладача та необхідності адаптації його педагогічних практик до сучасних вимог цифрового суспільства. Зроблено акцент на тому, що сучасний викладач повинен не лише володіти новітніми цифровими інструментами, але й вміти ефективно інтегрувати їх у навчальний процес, враховуючи специфіку цифрових звичок та освітніх потреб здобувачів освіти.

У статті також досліджено специфіку впровадження інноваційних цифрових рішень, зокрема застосування чат-ботів і штучного інтелекту в освітньому процесі, які дозволяють автоматизувати рутинні процеси, підвищити оперативність інформаційного обміну, але водночас ставлять перед педагогічною спільнотою низку питань щодо збереження якості освіти та здатності студентів до самостійного мислення.

Узагальнено, що цифровізація освіти є не просто технологічним оновленням освітнього середовища, а й фундаментальною зміною педагогічної парадигми, що базується на інтерактивності, адаптивності й безперервному оновленні знань та навичок. Визначено ключові пріоритети для розвитку університетів нового покоління, орієнтованих на сталий розвиток та підготовку конкурентоспроможних фахівців, здатних ефективно функціонувати в цифровій реальності.

Ключові слова: цифровізація освіти; цифровий університет; цифрове освітнє середовище; цифрові компетентності; штучний інтелект в освіті, чат-боти; діджиталізація; педагогічна трансформація.