

CURRENT GLOBAL DEVELOPMENTS IN EDUCATION**ПОТОЧНІ ГЛОБАЛЬНІ ПОДІЇ У ГАЛУЗІ ОСВІТИ**

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[https://doi.org/10.31652/3041-1203-2024\(1\)-7-13](https://doi.org/10.31652/3041-1203-2024(1)-7-13)**E-learning and artificial intelligence as key factors in the digital transformation of higher education: challenges, opportunities and development prospects****Nataliia Lazarenko, Yana Hapchuk**

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Abstract

The article examines the role of e-learning and artificial intelligence in the digital transformation of higher education, addressing the contemporary challenges and demands of the digital society. In the context of globalization and rapid technological progress, educational institutions are obliged not only to transfer knowledge, but also to form students' flexibility and ability to adapt to dynamic conditions. The authors note that the digital transformation of education provides increased accessibility, flexibility and inclusiveness of the educational process, opening up new opportunities for individualization of learning. E-learning is considered as a tool that contributes to the formation of important skills and knowledge through online courses, interactive modules, virtual laboratories and other means that provide flexible access to educational materials and support for the individual pace of information assimilation. In addition, the article highlights the impact of artificial intelligence on changing educational approaches, emphasizing its importance in creating adaptive learning systems that adapt to the knowledge, needs and interests of each student, contributing to increasing motivation for learning and facilitating the assimilation of the material. Particular attention is paid to the challenges that teachers and students face in the process of digitalization of education. The use of the latest technologies not only simplifies routine tasks, but also requires the development of new skills in teachers. It is emphasized that teachers must rethink their role in the educational process and develop the ability to work with digital tools, as their role changes from a traditional source of knowledge to a mentor or facilitator who helps students effectively interact with technology. In addition to the opportunities, the article analyzes the risks associated with the digitalization of education, such as data privacy, ethical issues, as well as the psychological aspects of the impact of technology on students. The authors emphasize the need for further scientific research in the field of digital transformation of education, in particular in the aspects of personalization, reducing cognitive load and ensuring equal access to educational resources. The proposed prospects for scientific research include the development of recommendations for educational institutions on the effective implementation of e-learning and artificial intelligence, taking into account ethical and pedagogical aspects.

Keywords: e-learning, artificial intelligence, digitalization of education, digital transformation, digital transformation of higher education.

Е-навчання та штучний інтелект як ключові фактори цифрової трансформації вищої освіти: виклики, можливості та перспективи розвитку

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Анотація

Стаття присвячена аналізу ролі е-навчання та штучного інтелекту як ключових складових цифрової трансформації вищої освіти, що відображають сучасні виклики та потреби цифрового суспільства. В умовах глобалізації та швидкого технологічного прогресу навчальні заклади зобов'язані не тільки передавати знання, але й формувати у студентів гнучкість та здатність адаптуватися до динамічних умов. Автори зазначають, що цифрова трансформація освіти забезпечує підвищення доступності, гнучкості та інклюзивності освітнього процесу, відкриваючи нові можливості для індивідуалізації навчання. Е-навчання розглядається як інструмент, що сприяє формуванню важливих навичок і знань за допомогою онлайн-курсів, інтерактивних модулів, віртуальних лабораторій та інших засобів, які забезпечують гнучкий доступ до навчальних матеріалів і підтримку індивідуального темпу засвоєння інформації. Крім цього, стаття висвітлює вплив штучного інтелекту на зміну освітніх підходів, підкреслюючи його значення у створенні адаптивних навчальних систем, що підлаштовуються під знання, потреби та інтереси кожного студента, сприяючи підвищенню мотивації до навчання і полегшуючи засвоєння матеріалу. Особлива увага у статті приділяється викликам, з якими стикаються викладачі та студенти у процесі цифровізації освіти. Використання новітніх технологій не тільки спрощує рутинні завдання, а й вимагає розвитку нових навичок у педагогів. Наголошується, що викладачі повинні переосмислити свою роль у навчальному процесі та розвивати здатність працювати з цифровими інструментами, оскільки їхня роль змінюється з традиційного джерела знань до наставника чи фасилітатора, який допомагає студентам ефективно взаємодіяти з технологіями. Крім можливостей, стаття аналізує ризики, пов'язані з цифровізацією освіти, такі як конфіденційність даних, етичні питання, а також психологічні аспекти впливу технологій на студентів. Автори наголошують на необхідності подальших наукових досліджень у сфері цифрової трансформації освіти, зокрема в аспектах персоналізації, зниження когнітивного навантаження та забезпечення рівного доступу до освітніх ресурсів. Запропоновані перспективи наукових досліджень включають розробку рекомендацій для освітніх закладів щодо ефективного впровадження е-навчання та штучного інтелекту з урахуванням етичних та педагогічних аспектів.

Ключові слова: е-навчання, штучний інтелект, цифровізація освіти, цифрова трансформація, цифрова трансформація вищої освіти.

Statement of the problem. The evolving digital society imposes new demands on the educational system, particularly in higher education. Amid globalization and the rapid advancement of technology, the educational process must extend beyond mere knowledge transfer, fostering in students the skills needed to navigate and adapt within a constantly evolving environment. Digital transformation, which is actively reshaping various domains of human activity including education presents new opportunities to enhance the efficiency, accessibility, flexibility, and interactivity of learning. Central to this transformation

are e-learning and artificial intelligence (AI), which significantly impact traditional teaching and learning approaches, enabling a tailored, student-centered educational experience.

The urgency of digital transformation in higher education is underscored by the accelerating pace of technological development, which necessitates that both educators and students acquire a suite of new competencies, particularly those related to effective engagement with digital environments and tools. E-learning facilitates the acquisition of essential knowledge and skills by leveraging online courses, virtual

laboratories, interactive modules, and other resources, which allow students flexible, anytime-anywhere access to educational content, thus supporting individualized learning paces. This adaptability has become especially pertinent in light of the COVID-19 pandemic, which dramatically increased the need for remote learning solutions (Lazarenko & Hapchuk, 2023).

AI, with its capabilities for automation and personalization, has the potential to redefine conventional educational methodologies. AI-driven systems enable adaptive learning environments that adjust to each student's knowledge level, interests, and learning needs, which can enhance motivation and improve comprehension. Additionally, AI provides real-time feedback, aids in tracking academic progress, and offers tailored support for students with diverse learning backgrounds, promoting a more responsive and effective educational experience aligned with contemporary pedagogical paradigms (Chen et al. 2023).

Digital transformation also profoundly influences educators, as these new technologies not only simplify routine tasks such as grading but also prompt the development of innovative teaching methods. Educators must be prepared to integrate digital tools into their practice and understand how best to leverage these technologies to optimize learning outcomes (Zheng, 2024). This evolution necessitates ongoing professional development in digital competency, as well as a redefined educational role in which teachers serve more as mentors and facilitators, guiding students in a technology-enhanced learning environment.

Given the challenges and potential of digital transformation, rigorous research into the integration of e-learning and AI in higher education is essential. Such research can advance the effectiveness of educational practices and support students' adaptation to a digitalized world where they are empowered to thrive professionally. It is equally important, however, to consider the risks and limitations inherent to educational digitalization, including potential technical issues, ethical concerns such as data privacy, and psychological factors like decreased motivation stemming from limited teacher-student interaction (Park et al., 2024). Addressing these challenges is not only relevant but also crucial to developing a resilient and effective educational system capable of responding to the demands of the digital era.

Analysis of recent research and publications. Numerous aspects of employing e-learning and AI as pivotal elements in the digital transformation of higher education have been extensively explored by researchers. Key areas of focus include the personalization of learning (Bates, 2015; Carmi, 2024; Geng, 2024), as well as the use of AI in monitoring and

evaluation processes (Alwerthan, 2024; Zhou, 2024; Luckin et al. 2016; Martinez-Garcia et al. 2023), providing support in educational activities (Chen et al. 2023; Fischer et al. 2024; Poseletska et al., 2020), and enhancing the accessibility of education for diverse populations (Ding et al. 2024; Ge & Wang, 2018; Lazarenko & Hapchuk, 2023; Zheng, 2024).

Studies highlight the application of AI for automated knowledge assessment and progress tracking, significantly alleviating educators' administrative burden while ensuring greater objectivity in evaluations. Moreover, AI serves as a valuable tool for student support, offering functionalities such as chatbots capable of assisting with problem-solving, clarifying complex concepts, and streamlining organizational aspects of the learning process. These chatbots deliver real-time feedback, enabling students to effectively engage with learning materials a feature of particular importance for remote learners with limited teacher interaction (Ding et al. 2024; Ge & Wang, 2018; Lazarenko & Hapchuk, 2023; Zheng, 2024).

In addition, research underscores the transformative potential of e-learning and AI in expanding access to quality education. Online platforms, including massive open online courses (MOOCs), alongside the integration of translated materials and subtitles, create inclusive opportunities for learners from geographically remote areas and individuals with physical disabilities. Such innovations contribute to bridging educational gaps and promoting equitable access to knowledge across diverse demographics (Alwerthan, 2024; Zhou, 2024; Luckin et al. 2016; Martinez-Garcia et al. 2023).

The purpose of the article is to undertake a comprehensive analysis of the influence of e-learning and AI on the digital transformation of higher education. It seeks to identify critical opportunities for enhancing educational quality and efficiency while addressing potential risks and challenges faced by various stakeholders in the educational ecosystem. The primary impetus for this analysis lies in the imperative to develop practical recommendations for the effective integration of digital technologies within educational institutions, ensuring a balanced approach that incorporates both technological advancements and pedagogical considerations in the digital transformation process.

Summary of the main material. The primary focus of this research is the analysis of the influence of e-learning and AI on the digital transformation of higher education, with an emphasis on how these innovations are reshaping the structure and methodologies of learning. The analysis is framed around exploring various dimensions of technology implementation, including its potential for personalizing and adapting educational

processes. Additionally, the study investigates the opportunities that digital tools offer for enhancing the accessibility and flexibility of learning (Alwerthan, 2024).

The digital transformation of higher education reflects an aspiration to establish new forms of interaction between students and knowledge, with a central emphasis on fostering students' ability to independently acquire knowledge. The integration of e-learning not only facilitates the use of virtual educational resources but also transforms teaching approaches, making them more interactive and flexible. E-learning encompasses a range of technological formats, such as video lectures, interactive exercises, online assessments, discussion forums, as well as virtual laboratories and simulations (Martinez-Garcia et al. 2023; Ge & Wang, 2018).

A key advantage of e-learning is its ability to expand access to education for students from diverse regions and socio-economic backgrounds. This model allows learners to progress at their own pace, which is particularly valuable for those balancing studies with work or other obligations. Studies indicate that access to online courses and massive open online courses (MOOCs) enables students to benefit from the expertise of leading universities and professionals, irrespective of geographical location. Furthermore, e-learning enhances student mobility, as it removes the requirement for physical presence in traditional classroom settings, thus broadening opportunities for acquiring knowledge (Zhou, 2024).

One of the most significant advancements in digital transformation is the application of AI to personalize the learning process. Machine learning algorithms facilitate the development of adaptive educational platforms that dynamically respond to each student's knowledge level, learning pace, and individual needs. For instance, adaptive learning systems can automatically identify areas of weakness in a student's understanding and recommend supplementary resources to address these gaps. This approach enhances the effectiveness of learning by enabling students to progress at their own pace, thereby mitigating the risks of cognitive overload or disengagement with overly familiar material (Bates, 2015; Millidonis et al. 2023; Slushny et al., 2020).

AI technologies also enable the implementation of "learning analytics", which involves collecting and analyzing data on students' learning behaviors. This analytical process provides insights into individual progress, measures engagement within the course, and identifies topics that present particular challenges. For example, AI-driven platforms can track metrics such as time spent on specific topics, performance on assessments, and patterns of interaction, thereby constructing an objective and comprehensive profile of

each student's academic development (Poseletska et al., 2020; Carmi, 2024).

Moreover, AI supports the creation of sophisticated recommendation systems that suggest tailored learning materials aligned with a student's interests and performance. For example, a student encountering difficulties with a specific topic might receive recommendations to view targeted video lectures or complete additional practice tests. By leveraging these capabilities, AI technologies contribute to a more interactive and individualized learning experience, fostering personalized academic growth and enhancing student engagement (McFarlane, 2019).

The integration of chatbots and virtual assistants into the learning process has recently gained significant traction as a means of supporting students. These AI-powered tools can address routine inquiries, assist with organizational tasks, and provide clarifications on educational content. By offering round-the-clock assistance, virtual assistants reduce the workload of educators while enhancing the efficiency of the educational process. Additionally, chatbots serve as supplementary resources for reinforcing knowledge, enabling students to engage with mini-tests or interactive exercises designed to consolidate their understanding (Ding et al. 2024).

For instance, some higher education institutions have implemented chatbots capable of automatically grading straightforward tasks, such as multiple-choice questions, and delivering immediate feedback on completed assignments. This functionality allows students to promptly evaluate their knowledge and address errors, thereby facilitating a more effective learning experience (Luckin et al. 2016).

The integration of e-learning and AI is also redefining the educator's role, transitioning it from that of a traditional knowledge provider to that of a facilitator, mentor, and consultant. In this capacity, educators guide students in navigating complex information landscapes and support them in developing autonomous learning skills. However, to fully leverage digital tools, educators must acquire advanced competencies, including proficiency in working with adaptive learning platforms, chatbots, and analytics tools for tracking and enhancing student progress (Fischer et al. 2024).

A significant challenge in the digital transformation of higher education is the imperative to enhance teachers' digital literacy. This extends beyond technical proficiency with digital tools to include a nuanced understanding of pedagogical strategies for their effective integration. Educators must learn how to incorporate these tools into the learning process in ways that complement, rather than replace, traditional

teaching methods. As noted by Geng (2024), the mere availability of digital resources does not ensure their effective utilization; the success of digitalization ultimately hinges on educators' readiness to continuously develop their skills and adapt to emerging technologies (Geng, 2024).

Digital transformation has the potential to significantly enhance the quality and accessibility of education by providing flexible and convenient learning opportunities for students. E-learning enables learners to study from any location and at their own pace, an advantage particularly relevant for those balancing education with work or other commitments. Furthermore, MOOCs and other digital resources broaden students' access to diverse disciplines, fostering greater knowledge acquisition and increasing overall educational mobility (Ge & Wang, 2018).

Despite these advantages, the digital transformation of higher education also brings challenges, particularly in addressing disparities in access to digital technologies. Limited technical infrastructure or insufficient internet connectivity can hinder students from remote areas or economically disadvantaged groups from fully leveraging the benefits of e-learning. Mitigating this inequality necessitates concerted efforts from both governments and educational institutions to create equitable conditions that ensure all students have access to the tools and resources necessary for effective learning (Chen et al. 2023).

The potential of AI and e-learning presents expansive prospects for the continued evolution of the digital transformation of higher education. In the coming years, advancements in AI technologies are anticipated to further enhance adaptive learning platforms, thereby advancing the personalization of education while fostering new opportunities for interactive and collaborative learning. Future developments may include the refinement of educational data analytics systems, enabling educators to make data-informed decisions tailored to the specific needs of students (Millidonis et al. 2023).

The findings of this study underscore that digital transformation particularly through the integration of e-learning and AI holds the capacity to drive significant qualitative improvements in higher education. However, the success of these transformations will hinge on the ability of educational institutions to effectively respond to contemporary challenges, cultivate digital competencies among educators and learners, and ensure equitable access to digital tools and resources (Chen et al. 2023).

Conclusions. The findings of this study highlight that the digital transformation of higher education,

particularly through the integration of e-learning and AI, presents substantial opportunities for enhancing the quality, flexibility, and accessibility of educational processes. However, this transformation is not without its challenges, which necessitate further investigation and the development of effective strategies for the seamless incorporation of emerging technologies into educational practice. This concluding section synthesizes the key outcomes of the study and outlines potential avenues for future research that may facilitate the successful implementation of digital transformation in higher education.

The application of e-learning and AI technologies enables educational institutions to develop flexible and inclusive educational models, particularly benefiting students who face constraints in attending in-person classes due to geographical, socio-economic, or financial barriers. The study's results underscore the capacity of digital technologies to enhance educational mobility, allowing students to access learning opportunities at a time and place that suits their needs. AI-powered adaptive learning platforms further optimize the educational process by tailoring instruction to the individual requirements of each student, thereby increasing efficiency. A personalized learning approach accommodates diverse learning paces, preparation levels, and interests, ultimately boosting student motivation and improving learning outcomes (Lazarenko & Hapchuk, 2023).

Moreover, digital technologies are redefining the role of educators, transitioning them from traditional sources of knowledge to facilitators, mentors, and coordinators of the learning process. This shift emphasizes the need for teachers to develop competencies in guiding students through technology-enhanced, student-centered learning environments. Future research should focus on addressing the challenges associated with the digital transformation of higher education, including equitable access to digital resources, the ethical implications of AI integration, and the development of effective pedagogical frameworks for technology adoption. By exploring these areas, scholars can contribute to the creation of robust, inclusive, and adaptive educational systems that align with the demands of the digital age.

The digital transformation of higher education, facilitated by e-learning and AI, represents a pivotal trajectory for advancing the quality, accessibility, and interactivity of educational processes. However, the effective realization of this transformation necessitates continued research to address existing challenges and to develop more robust and efficient models of learning.

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