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DIGITAL PEDAGOGY: A REVOLUTIONARY SHIFT IN THE PEDAGOGICAL PARADIGM

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Abstract. The article explores the concept of digital pedagogy as a fundamental transformation in the educational paradigm of the 21st century. It analyzes how the integration of digital technologies into teaching and learning processes reshapes traditional models of education, enhances learner autonomy, and fosters interactive and inclusive environments. The paper emphasizes the shift from teacher-centered to learner-centered approaches, supported by digital platforms, artificial intelligence, and big data analytics. It investigates the role of digital literacy as a core competence for both educators and students, underscoring the need for continuous professional development and technological adaptability. Furthermore, the study discusses ethical challenges related to data privacy, algorithmic bias, and unequal access to digital resources. Through comparative analysis of international practices and case studies, the research highlights effective digital pedagogy models implemented in higher education institutions worldwide. The findings suggest that successful digital transformation in education requires systemic support, innovative curriculum design, and a balanced combination of technology and pedagogy. Ultimately, digital pedagogy is not merely a technological trend but a cultural and philosophical shift redefining the goals and methods of education in the knowledge society.

Keywords: digital pedagogy, e-learning, artificial intelligence, higher education, innovation, digital literacy, transformation

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ЦИФРЛЫҚ ПЕДАГОГИКА: ПЕДАГОГИКАЛЫҚ ПАРАДИГМАНЫҢ ТӨҢКЕРІСТІК ӨЗГЕРІСІ

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Аннотация. Мақалада цифрлық педагогика ұғымы ХХІ ғасырдағы білім беру парадигмасының түбегейлі өзгерісі ретінде қарастырылады. Цифрлық технологиялардың оқыту процесіне енгізілуі дәстүрлі білім беру үлгілерін жаңаша форматқа көшіруге, білім алушылардың дербестігін арттыруға және интерактивті, инклюзивті орта қалыптастыруға ықпал ететіні талданады. Зерттеу барысында оқытушыға бағытталған тәсілден білім алушыға бағытталған тәсілге көшу үрдісі, сондай-ақ цифрлық платформалар мен жасанды интеллекттің рөлі атап өтіледі. Цифрлық сауаттылық қазіргі педагог пен студент үшін негізгі құзырет ретінде сипатталады. Сонымен қатар, дербес деректердің қауіпсіздігі, алгоритмдік бейтараптық және цифрлық теңсіздік мәселелері қарастырылады. Әлемдік тәжірибе мен нақты мысалдарға сүйене отырып, жоғары оқу орындарында қолданылып жүрген тиімді цифрлық педагогика модельдері көрсетілген. Зерттеу нәтижелері бойынша білім берудегі табысты цифрлық трансформация жүйелі қолдауды, оқу бағдарламаларының инновациялық жобалануы мен технология мен педагогиканы үйлестіре білуді талап етеді. Цифрлық педагогика – бұл тек технологиялық үрдіс емес, білім беру мақсаты мен мазмұнын қайта анықтайтын мәдени және философиялық бағыт.

Түйін сөздер: цифрлық педагогика, электрондық оқыту, жасанды интеллект, жоғары білім, инновациялар, цифрлық сауаттылық, трансформация

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ЦИФРОВАЯ ПЕДАГОГИКА: РЕВОЛЮЦИОННЫЙ СДВИГ В ПЕДАГОГИЧЕСКОЙ ПАРАДИГМЕ

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Аннотация. В статье рассматривается феномен цифровой педагогики как фундаментальное преобразование педагогической парадигмы ХХІ века. Анализируется влияние цифровых технологий на систему образования, их роль в трансформации традиционных методов обучения и формировании интерактивной, инклюзивной

образовательной среды. Особое внимание уделено переходу от модели, ориентированной на преподавателя, к модели, ориентированной на обучающегося, что стало возможным благодаря развитию цифровых платформ, искусственного интеллекта и аналитики больших данных. Отмечается ключевая роль цифровой грамотности как важнейшей компетенции современного педагога и студента. Рассматриваются проблемы этического характера — защита персональных данных, предвзятость алгоритмов и цифровое неравенство. На основе анализа международных практик и конкретных примеров показаны эффективные модели цифровой педагогики, реализуемые в вузах разных стран. Сделан вывод, что успешная цифровая трансформация образования требует системной поддержки, инновационного проектирования учебных программ и гармоничного сочетания технологий с педагогическими принципами. Цифровая педагогика представляется не просто технологическим трендом, а философским и культурным сдвигом, переопределяющим цели и методы образования.

Ключевые слова: цифровая педагогика, электронное обучение, искусственный интеллект, высшее образование, инновации, цифровая грамотность, трансформация

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Introduction.

In the twenty-first century, education has undergone a fundamental transformation driven by the rapid advancement of digital technologies. The traditional teacher-centered model, which emphasized memorization and one-way knowledge transmission, is gradually being replaced by a digital pedagogy framework that prioritizes interactivity, collaboration, and learner autonomy (Asanova, 2022: 114). Digital pedagogy redefines the role of teachers as facilitators who guide students in the process of constructing knowledge rather than simply delivering information (Kasymbekova, 2023: 88).

The emergence of online platforms, virtual classrooms, and artificial intelligence (AI) tools has shifted pedagogical focus toward competency-based and individualized learning approaches (Abildina, 2021: 52). Students are no longer passive recipients but active participants who co-create learning content through digital engagement, multimedia tools, and peer collaboration (Arystanov, 2024: 91).

Moreover, digital pedagogy bridges geographical, cultural, and socioeconomic barriers, providing equal access to educational resources for learners across the world (Zhumabayeva, 2020: 76). The integration of digital literacy, critical thinking, and creativity into modern curricula contributes to forming future-ready individuals capable of adapting to the demands of Industry 4.0 (Amanzholova, 2024a: 110).

However, despite the opportunities, challenges such as unequal access to technology, lack of digital skills among educators, and the risk of information overload remain significant (Amanzholova, 2024b: 270). These issues require systematic reforms in teacher training programs and institutional support mechanisms.

This article explores the evolution of digital pedagogy, identifies its key principles and tools, and analyzes how digital transformation reshapes the traditional educational paradigm in Kazakhstan and globally.

Materials and methods

The methodological foundation of this research relies on an interdisciplinary approach that combines theoretical analysis, empirical investigation, and comparative evaluation of international pedagogical practices. The study explores the conceptual framework and implementation of digital pedagogy as a transformative paradigm in higher education. This approach allows for a comprehensive understanding of how digital tools, technologies, and innovative teaching methods

reshape the educational environment and influence the effectiveness of the learning process (Andreev, 2011: 52–60).

To ensure the reliability and validity of results, the research employed a mixed-methods design, integrating both qualitative and quantitative components (Amanzholova, 2024a: 89–97). The quantitative phase focused on analyzing statistical data from educational institutions in Kazakhstan and other post-Soviet countries over the period 2019–2025. Official reports from the Ministry of Science and Higher Education, UNESCO, and OECD were used to identify patterns in the adoption of digital educational technologies, distance learning tools, and electronic resource platforms (UNESCO, 2022: 211–215; OECD, 2023: 199–202; World Bank, 2023:9–15).

The qualitative phase involved in-depth interviews and focus group discussions with teachers, academic administrators, and students from five Kazakhstani universities actively introducing digital learning methods into their curricula (Barmakova, 2020: 80–97). A total of 150 lecturers and 300 students participated in the survey. The questions aimed to assess the level of digital competence, attitudes toward e-learning, perceived barriers in digital instruction, and overall satisfaction with blended and online teaching formats.

To complement survey data, semi-structured interviews were conducted with senior teachers and experts in educational technology. These interviews helped identify pedagogical strategies that effectively combine digital platforms with classical teaching principles. Special attention was given to identifying the psychological and methodological challenges educators face during the digital transition — including technological resistance, lack of digital literacy, and difficulties in maintaining student engagement.

The study also employed content analysis of academic and policy literature. Sources included peer-reviewed journals, government regulations, university reports, and open educational resources. The analysis of secondary materials focused on detecting terminological and conceptual differences between “digital pedagogy,” “e-learning,” and “technology-enhanced learning” (Arkeshev, 2014: 109–122).

To process the empirical data, descriptive statistics and thematic coding techniques were used. The data from questionnaires were processed using the statistical software package SPSS 26.0. The reliability of responses was verified through Cronbach’s alpha coefficient ($\alpha = 0.84$), confirming internal consistency. Qualitative data were coded manually and categorized into themes related to teaching transformation, learner autonomy, and institutional readiness for digitalization.

Furthermore, comparative analysis was applied to identify similarities and differences in digital pedagogy implementation across universities of Kazakhstan, Russia, and European countries. This allowed the study to determine the degree of integration of interactive learning tools such as Learning Management Systems (LMS), MOOCs, and AI-based tutoring systems (Amanzholova, 2024b: 270–284.).

In addition, the research considered ethical and academic integrity principles, ensuring that all participants gave informed consent, and all secondary data were cited according to academic standards. The triangulation of data sources, combined with methodological pluralism, ensured the comprehensiveness and accuracy of conclusions drawn from both empirical observations and theoretical interpretation.

Thus, the methodological design of this study provides a solid framework for assessing the depth and dynamics of the digital transformation of modern pedagogy, offering a balanced perspective on the opportunities and challenges associated with the integration of digital technologies into educational practice (Aspanova, 2025: 401–408).

Results and discussion

The analysis revealed that digital pedagogy represents not merely the integration of digital tools into traditional classrooms but a profound rethinking of the entire educational paradigm. It transforms the teacher’s role from a transmitter of information to a facilitator and co-creator of knowledge, while students evolve from passive recipients into active participants in the learning

process (Arkeshv, 2014: 109–122). The findings demonstrate that this paradigm shift is characterized by three interconnected dimensions: technological innovation, pedagogical transformation, and cognitive adaptation.

1. Technological Innovation and Infrastructure Development

The results indicate that universities that have successfully adopted digital pedagogy possess a robust technological infrastructure—including reliable internet connectivity, modern LMS platforms, and digital resource repositories. Data collected from surveyed institutions show that 68 % of higher education institutions in Kazakhstan have implemented platforms such as Moodle, Canvas, or Google Classroom. However, only 34% have developed customized systems designed to meet national educational standards.

Teachers reported that the integration of artificial intelligence (AI) tools, such as automatic grading, chatbots for academic advising, and personalized learning analytics, has significantly improved the efficiency of educational processes. According to respondents, AI-assisted feedback mechanisms reduced grading time by 45% and enhanced student engagement in self-directed learning.

Nevertheless, the study revealed a digital divide between urban and regional universities. Institutions in major cities like Almaty and Astana demonstrate higher digital readiness, while rural universities continue to face challenges such as unstable connectivity, insufficient digital skills among faculty, and limited access to licensed educational software. This inequality underscores the need for national programs that would support infrastructure development and teacher training across all regions.

2. Pedagogical Transformation

The qualitative data show that the shift toward digital pedagogy requires a fundamental transformation in teaching philosophy and methodology. More than 70% of surveyed teachers acknowledged that they had to redesign their curricula to integrate interactive and student-centered learning methods. Project-based and collaborative learning approaches have become increasingly popular due to their compatibility with digital platforms and their ability to develop critical thinking and problem-solving skills.

Teachers highlighted that multimodal instruction—combining text, video, audio, and interactive simulations—has significantly increased students’ retention and comprehension rates. For example, one university introduced virtual laboratories for engineering courses, which improved students’ practical understanding by 28% compared to traditional labs.

However, challenges remain in maintaining academic integrity in online settings. Plagiarism detection software (such as Turnitin and Unicheck) has been implemented, yet teachers still struggle to design authentic assessments that minimize cheating opportunities. This issue points to the necessity of developing assessment models focused on creativity, analytical reasoning, and application of knowledge rather than memorization.

3. Cognitive and Psychological Adaptation

Digital pedagogy also affects how students perceive and process information. The study found that online learners exhibit greater autonomy but also face increased levels of cognitive fatigue and social isolation. About 60% of students reported difficulties with time management and motivation in self-paced courses. This aligns with global research emphasizing the psychological costs of excessive screen time and lack of face-to-face interaction.

To mitigate these challenges, educators began implementing hybrid models that combine synchronous and asynchronous learning. These models allow students to interact virtually while still participating in on-campus activities that foster social belonging. Teachers emphasized that digital pedagogy must remain human-centered, prioritizing emotional engagement and empathy in virtual communication.

4. Institutional Readiness and Policy Implications

From an institutional perspective, the success of digital pedagogy depends heavily on the strategic management of educational change. The analysis of administrative reports revealed

that only 40% of Kazakhstani universities have developed official digital transformation strategies aligned with national education policies. The absence of a unified framework results in fragmented implementation and inconsistent quality across institutions.

Respondents stressed the importance of continuous professional development for teachers. More than 80% of educators expressed the need for systematic training programs focused on digital literacy, instructional design, and online classroom management. Universities that established internal centers for digital competence reported a 30% improvement in teaching quality and student satisfaction.

Additionally, the study underscores the role of policy-level support in promoting open educational resources (OER) and open access publishing. Such initiatives enhance global visibility and academic exchange, allowing Kazakhstani scholars to integrate into the international research community.

5. Comparative Perspective and Global Trends

When compared to European and North American universities, Kazakhstani institutions are still at the transitional stage of digital transformation. Western universities have already moved toward AI-driven personalized learning ecosystems, while post-Soviet universities remain focused on basic digital adaptation. However, Kazakhstan demonstrates a promising trajectory, as national digitalization programs and public-private partnerships increasingly support education innovation.

The comparative analysis revealed that cultural context significantly influences how digital pedagogy is perceived and implemented. In Western contexts, education is more individualized, whereas in Central Asia, collectivist traditions still shape classroom dynamics and student expectations. Hence, digital pedagogy must adapt to local educational values rather than merely replicate global models.

6. Synthesis of Results

The results collectively suggest that digital pedagogy is not a supplementary innovation but a systemic transformation. Its implementation redefines curriculum design, communication models, and institutional governance. The study demonstrates that the effectiveness of digital pedagogy depends on three interrelated conditions:

- Adequate technological infrastructure and access;
- Continuous teacher training and methodological renewal;
- A supportive policy environment that ensures equity and innovation.

This triadic framework offers a comprehensive foundation for reforming higher education systems in Kazakhstan and beyond. Ultimately, digital pedagogy should be viewed as a cultural and epistemological revolution—one that reconfigures how knowledge is produced, shared, and experienced in the 21st century.

Conclusion.

The comprehensive analysis of digital pedagogy confirms that the contemporary transformation in education is not limited to the technological modernization of the learning process. Rather, it signifies a philosophical and methodological evolution that redefines the nature of knowledge acquisition, teaching practice, and the role of educational institutions in society. The results of this study allow us to assert that digital pedagogy is both a reflection of global technological progress and a catalyst for pedagogical innovation.

At its core, digital pedagogy represents a human-centered transformation in which technology serves as a mediator, not a replacement, of human interaction. The digital environment expands the teacher's toolkit, offering opportunities for differentiated instruction, real-time feedback, and cross-border collaboration. However, the effectiveness of these innovations depends on the teacher's ability to critically interpret technology through a pedagogical lens rather than as an end in itself. The teacher becomes an architect of learning environments that balance innovation with human empathy — a key component often lost in purely technical interpretations of education.

From a pedagogical standpoint, digital transformation promotes a shift from reproductive to constructivist learning models. This change emphasizes the active role of learners in constructing knowledge through interaction, reflection, and collaboration. Such an approach aligns with global trends in competency-based education, where success is measured not by rote memorization but by problem-solving and adaptability.

Psychologically, the research reveals that digital pedagogy has dual implications. On one hand, it enhances student autonomy, enabling flexible, self-paced learning. On the other, it raises concerns about cognitive overload, reduced attention span, and social isolation among students. Therefore, digital pedagogy requires a careful psychological balance that integrates motivational design, emotional engagement, and social presence. These findings underscore the necessity for educators to acquire digital emotional intelligence, allowing them to build trust and empathy in virtual environments.

Institutional readiness emerged as a decisive factor for successful implementation of digital pedagogy. Universities that demonstrated proactive management of digital transformation — including investment in digital infrastructure, teacher training, and open resource development — achieved higher levels of student satisfaction and learning outcomes. In contrast, institutions that adopted digital tools without methodological adaptation faced limited success, revealing that technology without pedagogy remains ineffective.

At the policy level, Kazakhstan’s educational modernization strategy provides a favorable framework for developing digital learning ecosystems. However, the implementation of these policies must go beyond formal adoption and focus on sustainable integration that ensures equal access, quality assurance, and academic freedom. The creation of national repositories of digital content, the expansion of broadband access, and the inclusion of digital literacy in teacher certification standards represent essential steps toward this goal.

Ethical and Cultural Considerations

One of the most critical findings concerns the ethical dimension of digital pedagogy. The widespread use of AI, biometric monitoring, and data analytics in education raises questions of privacy, consent, and the moral responsibility of educators. Institutions must develop ethical codes and transparent governance systems to ensure that technology serves pedagogical and societal goals rather than commercial interests.

Culturally, digital pedagogy must adapt to national educational traditions rather than blindly replicating Western models. In Kazakhstan and Central Asia, where collective values and respect for authority play a significant role, digital pedagogy should promote dialogue between traditional didactic approaches and modern constructivist practices (Barmakova, Kasymova, 2020: 203). This synthesis can produce a hybrid educational model that combines technological efficiency with cultural authenticity — ensuring that digital transformation remains locally relevant and globally competitive.

Looking forward, the future of digital pedagogy lies in the integration of artificial intelligence, virtual reality, and data-driven learning analytics into personalized education systems. These technologies will enable dynamic feedback loops between teachers and learners, ensuring continuous improvement and adaptability. However, technology should remain a means of enhancing human creativity, not replacing it. The concept of “pedagogical wisdom”— the ability to apply technology responsibly, ethically, and purposefully — will define the next generation of educators.

In this regard, universities should evolve into innovation ecosystems, where research, teaching, and digital experimentation coexist. Collaborative projects between academia, industry, and government can foster open educational platforms, promote interdisciplinary research, and create inclusive educational opportunities across social and geographic boundaries.

The conducted study concludes that digital pedagogy is not a replacement of traditional pedagogy but its evolutionary continuation. It reinterprets established principles of learning through the prism of digital communication, offering a more dynamic, interactive, and flexible

framework for education. Nevertheless, successful digital pedagogy requires systemic support — technological, methodological, and ethical — to achieve its transformative potential.

Thus, the future of education depends on our collective ability to harmonize humanistic pedagogy with technological innovation. As educators, policymakers, and researchers embrace the opportunities of the digital age, they must remember that the ultimate goal remains unchanged: the development of a free, creative, and responsible individual capable of shaping the future. Only through such an integrative and ethical approach will digital pedagogy truly fulfill its mission as a revolutionary yet human-centered shift in the pedagogical paradigm.

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