

LATEST TECHNOLOGIES IN EDUCATION IN THE CONDITIONS OF DIGITALIZATION

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Abstract The article provides a comprehensive analysis of current trends in the implementation of new technologies in education, covering gamification, mobile learning, adaptive systems, and artificial intelligence tools.

Keywords: innovative learning technologies, gamification, mobile learning, adaptive systems, artificial intelligence, digitalization of education.

Introduction In the 21st century, education is undergoing a period of rapid change driven by the development of digital technologies, the growth of information volumes, and new requirements for graduates' competencies. Artificial intelligence (AI) is becoming a key factor in the transformation of educational processes, as it provides opportunities for automation, personalization, adaptive learning, data analysis, and increasing the efficiency of educational activities. Therefore, the problem of finding effective models of using AI to improve the quality of education, ensure individualization of the educational process, and expand access to knowledge is relevant.

Purpose and objectives of the study To investigate and highlight the role of artificial intelligence (AI) tools in the latest learning technologies and describe the essence of the use of innovative technologies based on AI in pedagogical education.

Research results and their discussion The challenges of our time – information overload, the growth of educational materials, the need for rapid adaptation to changes in the labor market – necessitate the use of intelligent systems capable of analyzing large amounts of data, offering personalized solutions, and supporting the development of critical and creative thinking, which requires clear strategic planning, an ethical framework, and infrastructural support [1].

The 2023-2025 All-Ukrainian study [2] showed that most teachers have an average or low level of proficiency in AI tools, but express a willingness to learn and

implement such tools. At the same time, AI is still used more as an auxiliary tool, but significant expectations from its potential are already noticeable, in particular in testing, creating creative tasks, and monitoring student progress. At the same time, there are concerns about ethical aspects and risks of violating academic integrity [3]. But almost a year later, studies are analyzing approaches to using AI to design individual learning trajectories in secondary education, which confirms the need for further research and development of adaptive learning models [4].

Leading universities in the world and international educational platforms are actively implementing AI to create adaptive courses, intelligent assessment systems, automated translation, and learning support. Thus, the review [5] shows that research is focused on such areas as personalization of learning, intelligent support systems (tutoring systems), and automated assessment. At the same time, attention is drawn to potential negative aspects, ethical issues, and possible future ways of implementing AI in education. The authors of the review believe that the adoption of a new technology with the simultaneous implementation of preventive measures to prevent its abuse is the only step forward.

Studies of the use of intelligent tutoring systems (ITS) and adaptive learning systems (ALS) show a generally positive impact on learning outcomes (increase in scores, better encouragement). But the effect depends on the quality of implementation, the context (school/higher education), the duration of the study, and the choice of control group. For example, a 2025 review of the analysis of K-12 student achievement (from kindergarten to grade 12 inclusive) reports generally positive results, but notes the need for longer experiments and larger samples [6]. Classic meta-reviews also show that a well-tuned intelligent tutor can increase results on average by a noticeable amount (average effects vary depending on the review), that is, the effect is real, but not automatic - pedagogical integration is required [7].

The latest learning technologies have emerged on the basis of AI. Their overview and comparative characteristics are briefly presented in Table 1.

Table 1 – Overview and comparison of the latest AI-based learning technologies

Technology	What it is	Examples	Advantages	Limitations
AR/VR – augmented and virtual reality	Reproducing an educational center in an imaginary form or superimposing digital objects on real ones	Google Arts & Culture (imaginary museums), PhET, Labster (imaginary laboratories)	Safe experiments, visualization of complex phenomena, increased motivation	High price of equipment, dependence on equipment
Distance and blended learning	Education using IT software, combining distance and face-to-face learning	Moodle, Google Classroom, Zoom, MS Teams	Ease of access and adaptation to the time and place of study, combining learning forms, multimedia	Obstacles to internet connection, the need for self-control

Continuation of Table 1

Technology	What it is	Examples	Advantages	Limitations
Gamification	Application of game-specific elements in learning, such as scorecards, levels, cards, etc.	Kahoot, Quizizz, Classcraft	Increased engagement, formation of teamwork skills, development of personal motivation	Risk of superficial learning of educational material due to excessive gamification
M-learning, or mobile learning	Distance learning, using mobile devices, such as smartphones and tablets to provide access to educational content anywhere, anytime	Duolingo, Coursera, EdX, EdApp	Learning anywhere and anytime with an internet connection, short lessons (5–10 min) at your own pace.	Connection to the type of mobile device, distracting environmental impact on the quality of learning.
Adaptive platforms	Computer systems are able to adapt educational material and its complexity based on the analysis of student feedback	ALEKS (mathematics, chemistry, statistics), Knewton, Smart Sparrow	Individualization of education, improvement of achievements, reduction of threats of not mastering the material	Challenges of protecting personal information, high cost of implementation
Automation of routine tasks	Test control, task development, lesson planning	FlowForma Copilot, KITABOO	Time saving and teacher support	English-speaking systems
Artificial Intelligence (AI) Tools	AI assistants for generating text, photo and video materials, developing tests, designing	ChatGPT (texts), Copilot (MS Office), Midjourney/ DALL·E (images) Figma AI, Canva AI	Time saving, creativity, project work support	Threat of academic integrity violation, AI errors, algorithm flaws

Although the use of AI in education has been shown to improve the quality of education [7], it also highlights the persistent problem of unequal access to technology. Bias and inaccuracy are significant obstacles. AI algorithms can reproduce biases in data. This can lead to “hallucinations” (false statements) in generative models. Therefore, it is necessary to follow the rules of ethical use of AI tools and verify the reliability of the information obtained with their help [1]. In the process of using adaptive learning platforms, the issue of storing applicants' personal data and ensuring secure access to it arises [8]. We note that the positive impact of AI in education can only be achieved with its proper integration into the educational process, with the understanding that AI tools do not replace teachers [9].

Finally, we provide an overview of practical recommendations based on literary sources for university teachers on the introduction of AI in the educational process.

1. It is recommended to begin with managing small projects. It is optimal to use an adaptive module for a single discipline, study the results (pre- and post-implementation indicators), and compare them with a control group. Only then can a full-scale project based on evidence of implementation be launched [7].

2. The implementation of artificial intelligence in education should be carried out together with live mentoring. In this case, AI can be used as an auxiliary tool for preparing individual tasks, providing feedback. At the same time, the organization of the process of collective problem-solving in the group (facilitation) and assessment should be carried out by the teacher. [10].

3. It is necessary to ensure transparent and reliable rules for storing and using student data [9].

4. It is necessary to teach students to work critically with AI. To do this, modules on source verification and ethical use of generative models should be included in the course [10].

5. It is imperative to regularly assess the quality of AI use in education, its impact on success, engagement, satisfaction, and adjust system settings.

Conclusions. The study showed that AI tools play a major role in the latest learning technologies. The prospects for further scientific research lie in finding ways to implement the latest AI-based technologies, the tools of which are constantly being updated and improved.

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РОЗРОБКА СТРАТЕГІЇ ІНФОРМАЦІЙНОЇ БЕЗПЕКИ ПІДПРИЄМСТВА В УМОВАХ СЬОГОДЕННЯ

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Сучасні підприємства функціонують у динамічному середовищі цифровізації та глобалізації, що, у свою чергу, призводить до суттєвого зростання ризиків, пов'язаних із витоком конфіденційної інформації та порушенням цілісності даних. Активне ускладнення кіберзагроз зумовлює необхідність приділення особливої уваги питанням захисту інформаційних ресурсів на рівні стратегічного управління компаніями. Як демонструє практика, недостатній рівень інформаційної безпеки може спричинити не лише прямі фінансові збитки, але й суттєво підірвати імідж організації, знизивши довіру клієнтів і ділових партнерів. Зростання обсягів оброблюваної інформації робить особливо актуальною потребу у формуванні системного підходу до її охорони, адже внутрішні та зовнішні атаки здатні паралізувати ключові бізнес-процеси та поставити під загрозу діяльність партнерських структур. У зв'язку з цим, на нашу думку, роль державного регулювання є визначальною, оскільки саме воно повинно забезпечувати впровадження загальнообов'язкових стандартів безпеки та контроль за дотриманням законодавчих вимог у сфері захисту даних. Таким чином, в умовах сучасних викликів особливої ваги набуває завдання розробки комплексної стратегії інформаційної безпеки підприємства.