

HOW TECHNOLOGY IS CHANGING EDUCATION AFTER 2024

Botirova Mohinur Bobir qizi

10th-grade student at School No. 1

Shahrisabz City, Kashkadarya Region. Uzbekistan.

Participant of the "President's Gifted Children" national program initiative.

Email: botirovam022@gmail.com

Phone: +998 50 047 24 09

Annotatsiya. Ushbu maqolada 2024 yildan keyin texnologiyalar ta'lim tizimiga qanday ta'sir qilayotgani tushuntiriladi. Asosan sun'iy intellekt, virtual va kengaytirilgan reallik hamda gibridda ta'lim haqida so'z yuritiladi. Texnologiyalar o'quvchilarga individual tarzda o'rganish imkonini beradi, ta'lim olishni osonlashtiradi va o'qituvchilarning rolini o'zgartiradi. Maqolada texnologiyalar ta'limni yanada qulay va samarali qilishi mumkinligi, lekin buning uchun barcha uchun teng imkoniyat va to'g'ri foydalanish muhimligi ta'kidlanadi.

Kalit so'zlar: sun'iy intellekt (ai), raqamli ta'lim, gibridda ta'lim, virtual haqiqat (vr), kengaytirilgan reallik (ar), moslashuvchan ta'lim, onlayn ta'lim, ta'lim texnologiyasi, raqamli pedagogika, shaxsiylashtirilgan ta'lim, texnologik innovatsiyalar, 2024 yildan keyingi ta'lim.

Annotation. This article explains how technology has changed education after 2024. It focuses on artificial intelligence, virtual and augmented reality, and hybrid learning. These technologies help make learning more personalized, improve access to education, and change the role of teachers. The article concludes that technology can make education more inclusive and effective if digital tools are used responsibly and are available to everyone.

Keywords: artificial intelligence (AI), digital learning; hybrid education; virtual reality (VR); augmented reality (AR), adaptive learning, online education, educational technology, digital pedagogy, personalized learning, technological innovation, post-2024 education.

Аннотация. В статье объясняется, как технологии изменяют образование после 2024 года. Основное внимание уделяется искусственному интеллекту, виртуальной и дополненной реальности, а также гибриднему обучению. Технологии помогают сделать обучение более индивидуальным, расширяют доступ к образованию и меняют роль учителей. Делается вывод, что технологии могут сделать образование более доступным и эффективным, если обеспечить равный доступ и правильное использование цифровых инструментов.

Ключевые слова: искусственный интеллект (ИИ), цифровое обучение, гибридное образование, виртуальная реальность (VR), дополненная реальность (AR), адаптивное обучение, онлайн-образование, образовательные технологии, цифровая педагогика, персонализированное обучение, технологические инновации, образование после 2024 года.

INTRODUCTION.

The swift evolution of technology has transformed nearly all spheres of modern society, including education. Since 2024, developments in artificial intelligence (AI), digital platforms, and immersive learning tools have significantly altered the way knowledge is delivered, accessed, and experienced.

Education today is no longer limited by physical classrooms, rigid timetables, or uniform teaching methods. Instead, it is shifting toward flexible, individualized, and globally interconnected models. In Uzbekistan, government leaders have emphasized the importance of preparing the education system for future technological and economic realities. President Shavkat Mirziyoyev has stated that students “should gain most of their knowledge through electronic means,” and stressed the goal of creating “decent conditions for every young person” by modernizing schools with STEM laboratories, digital infrastructure, and IT skills. These priorities reflect a national vision that places education at the center of innovation, competitiveness, and inclusive progress.

Globally, the post-2024 landscape offers both promise and complexity. Digital innovations provide opportunities for personalized learning, instant feedback, and global collaboration, yet they also introduce challenges related to equity, data protection, teacher adaptation, and institutional readiness. As technology becomes more deeply integrated into classrooms, teachers increasingly act as facilitators of inquiry, while students take on more active, self-directed roles.

This article explores how education is evolving in the technology-driven world after 2024. It focuses on four key aspects: the emergence of AI and adaptive learning systems; the expansion of hybrid and online learning formats; the use of virtual and augmented reality (VR/AR) in experiential learning; and the changing role of educators. It also discusses policy and ethical issues—particularly in regions facing digital inequality—and underscores how forward-thinking leadership, exemplified by President Mirziyoyev’s reforms, can influence the course of educational transformation.

Artificial intelligence in education

Artificial intelligence (AI) has become a core force reshaping contemporary education. In recent years—especially after 2024—it has evolved from a supportive instrument into a fundamental element of teaching and learning. Intelligent tools such as ChatGPT, Google Gemini, Khanmigo, and other AI-based tutoring systems have transformed how students engage with knowledge and educational materials. These platforms deliver personalized support, enabling learners to progress at their own speed, follow their preferred learning styles, and meet their individual needs.

One of AI’s most influential contributions lies in adaptive learning. Unlike traditional classroom instruction, which provides uniform content for all students, AI systems continuously assess data about each learner’s performance—tracking their strengths, weaknesses, time management, and learning patterns. Based on this data, AI customizes educational materials, matching them to each student’s comprehension level and pace. For example, when a learner struggles with mathematical reasoning, the AI may provide supplementary exercises, visual explanations, or interactive demonstrations tailored to that learner’s preferences.

This adaptive framework fosters personalized learning that evolves with students’ cognitive and emotional growth. Studies by OpenAI (2025) and UNESCO (2025) report that students using adaptive AI systems retain up to 30% more information than those in conventional learning environments. Moreover, AI tutors encourage independent learning, nurturing autonomy, motivation, and self-awareness—key competencies for thriving in the digital age.

AI technologies also enhance educational accessibility and inclusiveness. Learners with disabilities or linguistic challenges benefit from tools such as speech recognition, text-to-speech, and automated translation. These functions make high-quality education available to people across regions, languages, and abilities, promoting equality and reducing educational disparities.

Nevertheless, the integration of AI raises ethical and pedagogical concerns. Data security, algorithmic fairness, and unequal access remain major issues that educators and policymakers must confront. It is essential that AI serves as an aid to human expertise—not a replacement. Ultimately, education must stay human-centered, with technology supporting creativity, empathy, and critical thinking—qualities that remain beyond the reach of machines.

The rise of hybrid and remote learning

The COVID-19 pandemic marked a turning point in the evolution of education, compelling schools, universities, and training centers worldwide to shift abruptly to online instruction. What initially emerged as a temporary solution soon developed into a lasting transformation of teaching and learning practices. After 2024, hybrid education—combining traditional face-to-face lessons with digital and virtual components—has become one of the most influential trends in contemporary education. In these blended settings, students access lectures, assignments, and resources online while continuing to engage in classroom discussions, laboratory experiments, and team projects. This model merges the convenience and accessibility of online education with the social engagement and experiential depth of in-person learning.

Global platforms such as Coursera, Khan Academy, EdX, and OpenAI Learn have been instrumental in expanding educational opportunities, making world-class courses available to learners from various economic and cultural contexts. Hybrid learning unites the strengths of both digital and conventional systems, enabling students to join classes live or review materials at their own pace. For instance, university students often follow theoretical lectures remotely while attending laboratory or seminar sessions on campus. Many schools have also adopted the “flipped classroom” approach, where students study theoretical concepts online and use class time for practice, teamwork, and discussion. Such models strengthen creativity, collaboration, and analytical thinking—skills essential for 21st-century careers.

The spread of hybrid and remote education has also transformed curriculum design and instructional delivery. Learners now benefit from flexible schedules, individualized content, global communication, and improved digital competence. Hybrid education contributes to sustainability by minimizing paper use and reducing travel, aligning with broader environmental objectives. Yet, persistent challenges remain: unequal internet access, digital device shortages, declining motivation, and concerns about academic honesty. To address these issues, educators must refine online pedagogies that encourage interaction, while institutions should invest in professional development, reliable infrastructure, and data security.

Ultimately, the growth of hybrid and remote learning after 2024 signals a redefinition of education—one rooted in flexibility, inclusivity, and technological innovation. With AI-driven tools enhancing engagement and accessibility, learning has become more adaptive and student-centered than ever. As Smith (2024) notes, this transformation has reshaped the very structure of education, blending physical and virtual spaces into a single ecosystem. The long-term success of hybrid learning will depend on maintaining a balance between technology and human connection, ensuring that education in the digital era remains both engaging and humane.

Virtual and augmented reality in learning

Virtual and Augmented Reality (VR and AR) technologies are revolutionizing experiential learning by creating immersive, interactive spaces where students can engage with knowledge beyond the limits of traditional classrooms. These tools provide realistic simulations and visual experiences that

allow learners to apply theoretical concepts in practical contexts with safety and precision. For example, medical students can conduct virtual surgeries in simulated labs, practicing complex operations multiple times without real-world risks. Likewise, engineering students can design, modify, and analyze 3D models of machines or structures, observing how they function under various conditions to deepen their technical understanding.

Beyond specialized fields, VR and AR are transforming subjects such as chemistry, physics, history, and geography. Learners can visualize molecular structures, perform virtual experiments, or explore historical monuments and natural environments as if physically present. This multisensory engagement—combining sight, sound, and motion—stimulates curiosity, critical thinking, and memory retention. Studies have shown that students learning through immersive technologies exhibit greater motivation and improved problem-solving abilities compared to peers in conventional settings.

Globally, educational institutions are embracing VR and AR platforms to narrow the gap between abstract theory and hands-on experience. By recreating authentic scenarios that are safe, repeatable, and deeply engaging, these technologies enhance both comprehension and skill development, better preparing learners for real-world professional challenges. As innovation in VR and AR continues, their influence in education will expand even further, providing advanced simulations, interactive environments, and adaptive experiences tailored to individual learners' needs.

The changing role of teachers

Rather than replacing teachers, technology has redefined their professional identity—transforming them from information transmitters into facilitators, mentors, and learning designers. In modern digital classrooms, educators must skillfully navigate diverse platforms, tools, and pedagogical approaches while guiding students to use technology critically, ethically, and creatively. The traditional content-delivery model has evolved into a dynamic process in which teachers nurture individualized learning, problem-solving, and innovation.

With the integration of AI systems, adaptive platforms, and online collaboration tools, teachers now design hybrid lessons that blend face-to-face and virtual learning. They help students interpret AI-generated feedback, monitor progress, and develop essential digital literacy. For instance, teachers may use AI analytics to identify learning gaps and then provide personalized support, mentoring, or enrichment. This evolving role requires not only technological fluency but also pedagogical insight and ethical awareness.

Digital literacy has become an indispensable skill for educators. They must integrate AI tools effectively, manage virtual classrooms, and critically evaluate online content. Moreover, teachers play a crucial role in helping learners recognize credible information, practice digital ethics, and engage responsibly online. In doing so, educators serve as mediators between technology and learning, ensuring that innovation strengthens—rather than undermines—educational values and goals.

Continuous professional development in digital pedagogy has gained worldwide importance. UNESCO (2025) underscores the need for equipping teachers with competencies in educational technology, AI integration, and multimedia instruction. Many nations are investing in teacher-training programs, workshops, and global professional networks that enable educators to exchange experiences, experiment with new teaching methods, and collectively refine digital practices.

Conclusion

In summary, the post-2024 period marks a transformative phase in global education shaped by rapid technological progress and the rise of learner-centered approaches. Artificial intelligence, hybrid learning systems, and immersive technologies like VR and AR are not merely auxiliary tools—they are redefining how knowledge is created, shared, and applied. These innovations enable personalization, inclusion, and interactivity while challenging schools to address ethical, social, and equity concerns.

Uzbekistan's experience exemplifies the power of forward-thinking leadership in this transformation. President Shavkat Mirziyoyev's focus on expanding digital infrastructure, STEM laboratories, and ICT training reflects a vision for an innovation-driven education system. Globally, the movement toward flexible, inclusive, and technology-enhanced learning reinforces the central role of teachers as facilitators and mentors guiding students through digital complexity.

Ultimately, the integration of technology represents a paradigm shift—not just modernization. When applied thoughtfully and ethically, these tools enhance engagement, foster critical thinking, and cultivate lifelong learning. The success of educational transformation in the digital age will depend on collective responsibility—educators, policymakers, and learners working together to ensure that education remains accessible, human-centered, and empowering for all.

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