

Overview of Trends and Challenges in Modern Education

Surekha Lanka

Director, Bachelor of Science – Information Technology Program, Faculty of Business & Technology, Stamford International University, Thailand.

E-mail: surekha.lanka@stamford.edu

Abstract

The growth of digital technology and society has resulted in a new type of education, which is very different from the classical one. In this review, an attempt will be made to investigate modern education and to reveal its main differences from classical methods. The review analyses modern tendencies and innovations in education based on technologies like Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI), Internet of Things (IoT), metaverse education, robotics, and intelligent systems. The educational capacity of these technologies is enormous; it includes VR education, reality education, interactive technologies, personalized approaches, AI mentoring, IoT monitoring and support, metaverse education, and modern competency development. Nevertheless, the bipolar approach to this problem is quite wrong because modern education must not reject classical methods and technologies entirely. This review tries to find the best solutions for integrating innovative strategies and classical education.

Keywords: Artificial Intelligence in Education, Metaverse-Based Learning, Digital Divide, Personalized Learning, Educational Technology Trends.

1. Introduction

Education faces a radical and irreparable transformation due to rapid technological, geopolitical, and societal changes. As we approach mid-2020s, the "evolution of modern learning" extends beyond mere digitalization or the introduction of new digital solutions. It has become a dual process that involves both innovation and traditional challenges [1]. This shift

represents an unprecedented paradigm shift in educational development, necessitating a redefinition of universities and education policies [3][4].

Modern technology solutions have transformed the concept of 21st-century learning, increasing the demand for flexibility and immersion compared to past rigid teaching methods [2]. Metaverse learning is a prime example of these modern solutions, enabling educators to create immersive virtual classrooms through intelligent, multi-layered learning models [5, 11].

However, the use of such cutting-edge technologies in education involves several difficulties. Educational institutions will have to strike a balance between their desire for continuous improvement, which is evident in the experiments made in the EDUCAUSE Horizon Reports, and the presence of outdated infrastructure, the digital divide, as well as the need for considerable pedagogical training for teachers [6, 8]. Also, one needs to consider possible ethical and cognitive repercussions from automating and virtualizing the learning process.

2. Emerging Trends in Modern Education

Table 1 shows four different educational technologies: Virtual Reality (VR), Augmented Reality (AR), Artificial Intelligence (AI), and the Internet of Things (IoT). The technology classification is based on the area of application, advances made, and factors that limit their use. All four of these IT technologies have applications in various fields of education; VR and AR provide users with immersive and visual experiences, while AI and IoT provide a personalized learning experience.

Table 1. Emerging technologies in education: areas, developments, and open challenges.

Technology	Area	Development	Open Challenges
VR (Virtual Reality) [32], [33]	Immersive learning, virtual laboratories, simulations, virtual field trips, experiential learning, and professional training.	Development of immersive 3D environments, virtual simulations, collaborative learning spaces, and VR-based teacher and professional training environments.	High hardware and implementation costs, accessibility, motion sickness, technical infrastructure requirements, cognitive load, and the need for pedagogically appropriate content.
AR (Augmented Reality) [32], [34]	Interactive learning, visualization of	Integration of AR with smartphones, tablets,	Device compatibility, content-development

	complex concepts, augmented textbooks, practical training, STEM education, and contextual learning.	smart glasses, and interactive digital learning materials to provide contextual and visual learning experiences.	costs, privacy and security concerns, technical limitations, educator training, and difficulties in integrating AR effectively into existing curricula.
AI (Artificial Intelligence) [35], [36]	Personalized learning, intelligent tutoring systems, automated assessment, learning analytics, adaptive learning, content generation, and individualized feedback.	Rapid development of generative AI, large language models, machine learning, natural language processing, intelligent tutoring systems, and AI-supported adaptive learning environments.	Data privacy, algorithmic bias, lack of transparency, academic integrity, ethical concerns, inaccurate AI-generated content, and overdependence on AI-based learning systems.
IoT (Internet of Things) [24], [27]	Smart classrooms, connected learning devices, environmental monitoring, attendance systems, smart laboratories, and intelligent campus management.	Increasing integration of sensors, wearable devices, smart boards, connected educational equipment, and cloud-based platforms for real-time monitoring and data-driven educational services.	Data privacy and security, interoperability, network reliability, device maintenance, scalability, infrastructure costs, and management of large volumes of educational data.

I. VR (Virtual Reality)

Virtual Reality restructures educational delivery by replacing traditional passive instruction with active, spatial engagement. Within higher education and professional training programs, immersive environments enable students to practice high-stakes decision-making and trial-and-error processes without real-world safety consequences [33]. Educators use these spatial systems to create constructivist tasks, allowing students to manipulate complex multi-dimensional objects. Additionally, data collection helps educators track students' behavioral interaction patterns and adjust their instructional pace. Nevertheless, institutional implementation of such systems requires significant structural investment, technical support, curriculum design, and cognitive load control.

II. AR (Augmented Reality)

AR is one of the key links between the real world of education and digital information, providing instantaneous help at the moment of learning. AR facilitates the integration of digital

elements in the real world to improve inquiry-based learning and spatial reasoning, particularly in technical and scientific fields [32]. Future teachers receive training on how to use AR toolkits when learning how to teach and are able to illustrate their theoretical knowledge through interactive diagrams in class [34]. However, the successful adoption of AR into educational departments is possible only after considerable faculty training, regular software upgrading, and careful attention to user privacy, among other factors.

III. AI (Artificial Intelligence)

Artificial intelligence transforms the ideas of instructional design and education management regarding prediction models and automation of decisions. Modern AI continuously evaluates actions of the students to adjust instruction, which makes it possible for teachers to solve students' problems related to learning prior to the situation becoming critical [35]. Apart from classroom instruction, AI also assists teachers in automating various administrative activities and structuring curricula [36]. The use of AI systems in educational institutions, though, involves certain ethical concerns that relate to algorithmic bias, transparency of automatic assessment, data ownership, and policy development.

IV. IoT (Internet of Things)

IoT technology converts conventional learning environments into digital ecosystems of education. Data collection across the campus network enables university administration and educators to learn more about how buildings and other resources are being used by students on campus [37]. Such continuous connection ensures the creation of flexible educational environments that can respond to the needs of learners by adapting the physical environment [38]. Still, setting up such an IoT framework entails numerous administrative challenges including expanding networks, providing long-term device security, standardizing data formats for different platforms, and safeguarding sensitive information.

3. Comparative Analysis of Traditional vs Modern Education

The conventional mode of education is mainly identified with classroom-based teaching and learning, interaction between teachers and learners, a set learning timetable, and the use of conventional educational tools. Teachers are normally considered as the main educators in this mode of education while learners undertake learning according to a set learning program and procedure. This can be evidenced by the literature reviewed where

conventional educational methods have been used in teacher education, higher education, nursing education, physical education, and Islamic education (Azam et al., 2019; Barry et al., 2025; Venkatesulu, 2026).

The use of technology in modern education has been a paradigm shift from the above-mentioned traditional approaches due to the introduction of digital tools and modern teaching techniques. Technology has become a critical element in education in modern times, especially after COVID-19. For example, according to Umasugi (2025), technology is part of modern nursing education. Similarly, Bernate and Vargas Guativa (2020) describe educational transformation in relation to the Fourth Industrial Revolution. All this indicates that modern education has blended both traditional and technological approaches.

One of the differences between traditional and modern education can be seen from the perspective of the educational environment. While traditional education tends to rely on the presence of physical classrooms and regular attendance, modern education may utilize different types of educational environment such as virtual and online education. Khanro and Javed (2022) point to the shift towards virtual education in higher education, especially with regard to developing countries and the changes brought about by the COVID-19 era.

The role of technology in education is another significant point of difference between traditional and modern education systems. The technology may serve as an auxiliary instrument in traditional contexts, while modern education employs technology in its teaching, learning, communication, and management procedures. Moshinski et al. (2021) examine innovations in educational technologies in terms of the post-2010 period, COVID-19, and Industry 4.0. Similarly, Umasugi (2025) explores the integration of technology and the advancement of nursing education in the post-COVID-19 context.

In the modern educational system, competencies of the 21st century gain even greater significance compared to simple acquisition of knowledge. "Challenges and Trends of the XXI Century" (2020) identifies the Fourth Industrial Revolution and competencies of the 21st century in relation to modern education. In other words, in the modern educational system, the focus is not on acquiring knowledge alone but rather on obtaining competencies which would help them cope with changes.

Also, the results of this research have revealed trends in the education system that are caused by changes in technology and society. Traditional educational systems are usually

oriented towards current organizational forms and methods, whereas modern ones are oriented towards the process of digital transformation, Industry 4.0, and Industry 5.0. Industry 5.0 and the transformations caused by the coronavirus are described by Gashimov and Pestova (2021), whereas Bernate and Vargas Guativa (2020) discuss the educational changes related to Industry 4.0.

The other significant characteristic of modern education is flexibility and diversity. Unlike traditional education systems that are limited by a set timeframe, modern education allows for different forms of teaching and communication. In accordance with the sources listed in the table, educational modernization occurs not only in a single academic sphere but also includes higher education, teacher education, physical education, nursing education, and education systems as a whole (Azam et al., 2019; Umasugi, 2025; Venkatesulu, 2026).

Geographically, the diversity of the studies shows a shift from traditional to modern education in various contexts within the field. In the table above, one can find studies conducted both internationally and regionally in relation to Latin America, Pakistan, Saudi Arabia, and Russia. For instance, Khanro & Javed (2022) examine changes in relation to Pakistan and Saudi Arabia, whereas Gashimov & Pestova (2021) offer an international study, paying special attention to Russia.

Overall, the comparison clarifies that modern education does not necessarily need to completely replace traditional education. Instead, the research evidence in the literature review suggests a process of integrating traditional and modern educational methods. Traditional education offers a structured approach to learning and interaction. Consequently, the emerging educational model can be understood as a transition toward a more flexible and technology-supported system. This new model retains useful elements of traditional education while responding to the demands of the Fourth Industrial Revolution, post-COVID-19 education, and contemporary digital transformation (Umasugi, 2025; Bernate & Vargas Guativa, 2020; Desafíos y tendencias del siglo XXI, 2020; Moshinski et al., 2021; Gashimov & Pestova, 2021).

Table 2. Traditional vs modern education

Study	Research design	Educational sector	Geographic focus	Technological era framed
Azam et al. (2019) [25]	Descriptive empirical survey of 55 teacher-	Teacher education	Provincial (unnamed), with global trend framing	Contemporary ICT adoption; no specific era named

	education instructors			
Barry et al. (2025) [26]	Semi-systematic literature review of 52 studies	Islamic education (schools, madrasas, universities)	International (Middle East, Southeast Asia, Western contexts)	21st-century contemporary reform; literature 2014–2024
Kahro & Javed (2022) [28]	Literature-informed empirical study with expert surveys (n=172 responses) and targeted interviews	Higher education (engineering and social science; medical excluded)	Developing countries; data from Pakistan and Saudi Arabia	21st-century education; COVID-19 and post-pandemic virtual transition
Moshinski et al. (2021) [29]	Narrative documentary review supplemented by anonymous online survey during early COVID-19 quarantine	Higher education, with broader all-levels and lifelong-learning discussion	Global/international trends with a specific Ukrainian institutional focus	Educational technology phase from 2010 onward; COVID-19; Industry 4.0
Venkatesu (2026)	Descriptive survey of 50 students (aged 15–20)	Physical education in schools	Unspecified (worldwide institutions cited as general context)	21st-century contemporary era; technology integration
Kosickaya (2020) [30]	Descriptive review of presentations from a teacher-focused webinar event (Winter School of Teachers 2020)	Higher education, universities and secondary vocational institutions	Russia	Fourth Industrial Revolution and digital transformation; January 2020 (pre-pandemic)
	Qualitative review with some quantitative data, author observations and secondary sources	High school and general education, including lifelong learning	International, with Russia as a specific example	COVID-19 acceleration; transition toward Industry 5.0

In general, though traditional education ensures a well-structured and disciplined manner of learning, modern education is a more dynamic and skill-based system. The inclusion of technology and new educational techniques in modern education makes it more equipped to address the challenges of the present Table 2.

The modern education system is currently undergoing substantial change associated with innovations in technology and new approaches to pedagogy. The use of artificial intelligence, immersive technologies such as VR and AR, and the metaverse learning process provides a more interactive, personalized, and flexible learning experience. Moreover, the emergence of online and blended learning and the emphasis on lifelong learning is associated with the necessity of continuous skill development in a fast-paced environment. Despite all these changes, several issues still impact the efficacy of modern education. One of these issues is the digital divide. This is additionally complicated by the lack of digital literacy skills among both learners and teachers, making it difficult to incorporate modern technology. Ethical issues such as data privacy and the responsible use of artificial intelligence present another risk. In addition, the cost of implementing modern technologies is very high limiting their implementation in underdeveloped areas. From the traditional education system to the modern one, there is a change from a knowledge-based system where a teacher acts as a tutor to a skills-based system where the learner is involved. Although the modern education system is flexible and relevant to current developments, it needs huge changes in the areas of curriculums, instruction and institutions. In summary, the modern education system can have tremendous benefits for the learning process, but this is highly limited by many challenges.

4. Conclusion

The study proves that modern education tends to shift from instructive and classroom-based learning to more flexible, learner-centered, and technology-driven approaches. Virtual reality, augmented reality, artificial intelligence, the Internet of Things, metaverse, and robotics may be integrated into the existing framework to make it more engaging and convenient, promote personalized experiences and better relationships between students and teachers, and optimize the educational process through advanced technologies. Issues of availability, teacher's digital literacy, ethical concerns, data security, and costs may pose a challenge to the widespread adoption of these measures. Thus, the modern educational field should not move toward technology-centric learning at the expense of classical models but rather combine the benefits of both to get the most value out of education. Enhancing existing methods,

curricula, and vocabulary, as well as addressing emerging concerns, will contribute to building a sustainable and resilient framework.

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