EMBRACING DIGITAL ADVANCEMENTS IN EDUCATION: OBSTACLES AND FUTURE DIRECTIONS

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Abstract: This article examines the use of technology in modern education, identifying challenges, prospects, and practical recommendations for educational institutions. In the context of rapid digital technology advancements and the evolving educational needs of students, implementing new tools has become an integral part of the educational process. Despite potential benefits such as increased accessibility to education and enhanced quality of learning, technology integration also faces challenges, including lack of funding, staff readiness, and data security issues. The article provides practical recommendations for optimising the use of technology in the educational process and highlights prospects for further research in this field. By analysing existing literature reviews and current studied, the article emphasises the need for a balanced approach to integrating technology into education, considering various social, cultural, and economic contexts. It discusses the contemporary challenges and prospects of applying technology in the educational process, focusing on critical aspects such as expanding access to education, improving the quality of learning, and preparing students for the digital age. The main challenges identified include a lack of funding, insufficient staff training, and data security concerns. Based on an analysis of existing literature and current research, the article offers practical recommendations for educational institutions to optimise the use of technology education.

Keywords: education technologies, digital transformation, education accessibility, education quality, challenges and prospects, educational institutions, educational innovations, technology efficiency.

1 Introduction

In a world where technology is advancing rapidly, the educational sector needs to integrate new technological advancements to meet the needs of both students and educational institutions. This article aims to analyse contemporary educational technologies by examining both the opportunities and challenges they present within the context of higher and secondary education. The proliferation of digital technologies in education opens new horizons for learning and interaction. Research such as that of Altawalbeh et al. (2023) and Anand et al. (2015) indicates that digital platforms and design thinking frameworks are becoming increasingly influential in forming educational processes and methodologies. In parallel, the application of Massive Open Online Courses (MOOCs), as observed by Batsurovska (2021), demonstrates an evolution in distance learning methods, providing students with flexibility and access to quality education regardless of geographical location.

Conversely, integrating artificial intelligence and machine learning into educational processes, as discussed in the works of Liu et al. (2021) and Harika et al. (2022), represents a pivotal aspect of contemporary educational strategies. These technologies not only facilitate the personalisation of learning but can also markedly enhance the quality and efficacy of the educational process. Nevertheless, the implementation of new technologies is also associated with several challenges. As noted by Štefančík and Stradiotová (2021), issues related to ensuring equal access to educational resources, training educators, and resistance to change require a comprehensive approach and strategic planning. This article seeks not only to consider successful practices and achievements in educational technologies but also to identify the key barriers and constraints that stand in the way of their effective integration into the educational process.

In the context of globalisation and technological transformation, modern education is confronted with a range of fundamental challenges that require not just a rethinking of traditional approaches to teaching and interaction with educational material but also the development of new, more flexible, and adaptive educational strategies. However, despite the significant potential benefits, integrating modern technologies into the educational process still needs to be completed, generating a whole new range of complexities. On the one hand, using digital technologies, such as artificial intelligence, machine learning, and virtual and augmented reality, promises significant enhancements to the educational process, rendering it more accessible, personalised and effective. On the other hand, a series of obstacles impede the comprehensive integration of these innovations into educational practice. These barriers include inadequate technical training for educators, a lack of necessary infrastructure in educational institutions, issues with the protection of student personal data, and disparities in technology access among students, exacerbating educational inequality. Thus, an important issue becomes the selection of appropriate technological solutions for educational institutions and the creation of conditions for their effective implementation and use. It requires a comprehensive analysis of existing limitations and the development of strategies to overcome them.

This article comprehensively examines how modern technologies affect the educational process, identifies the main challenges and problems associated with their integration into educational institutions of different levels, and develops recommendations for optimising technological solutions in education.

This work has the following objectives:

1. To assess the current state of technological infrastructure in educational institutions.
2. To study the impact of technology on the accessibility and quality of education.
3. To analyse opportunities to improve the educational process's efficiency through innovative technologies such as artificial intelligence and machine learning.
4. To explore the barriers and challenges educational institutions face in implementing and using new technologies.
5. To develop practical recommendations for educational institutions to optimise the use of technology in the educational process.

2 Literature Review

Digital technologies have become an integral part of the educational process in recent decades. The development of artificial intelligence, virtual reality, and other innovative approaches has opened up a wide range of research opportunities, from analysing effectiveness to developing new educational platforms. This article aims to present an analysis of recent studies and publications.

Altawalbeh et al. (2023) explored the impact of factors on university students' use of digital educational technologies. Chen G. & Q. Yuan (2021) examined the application and challenges of computer networking technologies in artificial intelligence. Liu et al. (2021) discussed the origins of accurate artificial intelligence and its role in education, while Z. Liu et al. (2022) presented a basic model of using intelligent technologies to transform teaching methods. Batsurovska et al. (2021) addressed the acquisition of competencies by undergraduates in higher education institutions through a digital environment. Pham et al. (2020) studied the educational model of sustainability

considering modern educational technologies. Qian et al. (2019) dedicated their research to exploring the paths of student learning design thinking in educational technology. Zaripov et al. (2021) analyse the processes of course quality optimisation based on cloud computing. Sener et al. (2020) dedicate their work to machine learning programs through cloud platforms. Anand et al. (2015) investigate issues of creating educational technology research through design thinking frameworks. X. Chen & S. Du (2023) focus their research on developing a learning platform based on cloud services. Chenyu et al. (2023) aimed to develop the design of an interactive direct teaching model in virtual educational communities. Masaeid et al. (2022) included the interconnection between educational technologies and entrepreneurial education and the influence on student achievement. Peng et al. (2022) provided an overview of the reform of experimental teaching programmes in the information age. Harika et al. (2022) reviewed the application of artificial intelligence and deep human reasoning in education.

The research examined the use of technologies in specialised fields of education, specifically MOOCs in the e-learning system for a master's degree in electrical engineering (Batsurovska, 2021a). It also developed a technological educational model for a master's degree in electrical engineering focusing on electrical installation and commissioning work (Batsurovska, 2021b). The application of 3D models in electrical engineering for laboratory work was revealed (Soloviev et al., 2021).

The works of Epaminonda et al. (2022) and Uchitel et al. (2020) highlight the potential of technology to enhance the quality of education and its accessibility. The implementation of technology for teaching future agricultural engineers in the information and educational environment is discussed by Štefančík & Stradiotová (2021). Furthermore, the obstacles and limitations in using modern technologies in higher education during the COVID-19 pandemic are analysed. The use of educational technologies for developing critical thinking, creativity, and wisdom in his works was studied by N. P. Dalal (2011).

Liu Y. et al. (2020) address the development of teaching methods using modern technologies in creating a virtual reality system for industrial training. Q. Wu (2021) presents a design of a blended mode of teaching a Chinese subject considering modern educational technologies. L. Zhao (2022) proposes an interactive mode of learning based on big data for blended learning in English.

3 Methods that have been applied

This article's research methods are based on analysing literature sources and expert opinions on technology use in education. The main methods that can be used are:

1. *Literature review.* Examine existing scientific papers, studies, reports, and articles related to the use of technology in education to identify current trends, challenges, and recommendations.
2. *Case studies.* Study-specific examples and experiences of different educational institutions that have successfully implemented technology in the educational process to identify critical success factors and practical recommendations.
3. *Expert interviews and surveys.* Conducting interviews with experts in education and information technology, as well as surveys with teachers and administrators of educational institutions to obtain expert opinions and practical experience.
4. *Collective discussion and consensus building.* Organising focus groups or consultations with stakeholders such as teachers, administrators and students to identify standard views, needs and preferences regarding the use of technology in education.
5. *Systems analysis.* The study of the relationships between different aspects of the educational process, technological infrastructure and user needs to identify critical factors that influence the effectiveness of technology use in the learning process.

These research methods can be combined or used separately to analyse technology use in education, identify challenges and opportunities, and develop practical recommendations for educational institutions.

4 Research results

Evaluating the current state of technological infrastructure in educational institutions represents a crucial aspect of research aimed at understanding the extent to which educational facilities are equipped with the necessary technological resources to implement and utilise modern educational tools and methods. This assessment encompasses several significant components.

Infrastructure resources:

- analysing the availability of computers, interactive whiteboards, specialised educational software and other technological devices used in the learning process;
- assessing the quality and speed of the Internet connection, which is critical for accessing online resources and conducting distance learning.

Technical training and support:

- studying the level of technical preparedness of teachers and administrative staff to use technology in the educational process;
- assessing the availability and effectiveness of technical support in educational institutions to ensure the smooth operation of technological equipment.

Software and applications:

- analysing the educational programmes and applications regarding their relevance to the curriculum and effectiveness in achieving educational goals;
- researching licences and updating software to meet current security and functionality requirements.

Data security and confidentiality:

- evaluating the measures taken by educational institutions to protect the personal data of students and teachers;
- analysing the risks associated with the storage and processing of data in educational institutions and measures to minimise them.

The evaluation of technological infrastructure enables the identification of strengths and potential vulnerabilities within the education system. It is an essential step in developing strategies to enhance technological equipment and improve the quality of education. Furthermore, it facilitates a more effective adaptation of educational institutions to the constantly changing technological requirements. It, in turn, provides a basis for further planning and investment in educational infrastructure.

The research into the impact of technologies on the accessibility and quality of education is an essential aspect of contemporary educational policy and practice. In the context of this study, the critical directions presented in Figure 1 are considered.

Expanding geographic coverage is achieved through technology to provide educational services to students in remote or underserved regions where access to quality education is traditionally limited. Online platforms and distance learning remove physical barriers between students and educational institutions. Convenience for individuals with disabilities refers to adaptive technologies such as screen reading programs, customised interfaces, and specialised learning materials, which make education accessible to people with various disabilities. The flexibility of learning allows students to choose their own

pace and schedule, enabling them to combine education with work or other responsibilities.

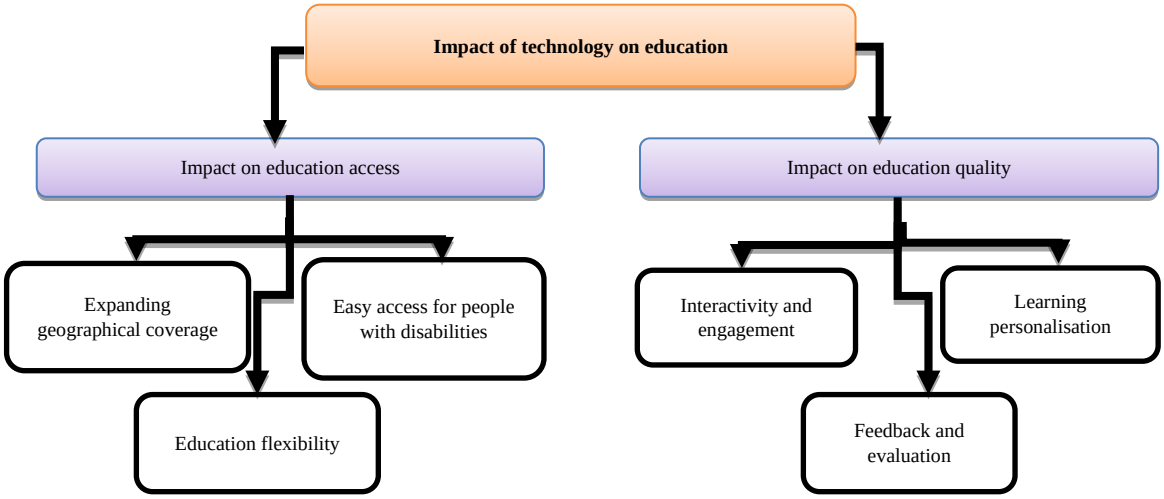


Figure 1. The impact of technology on education

The personalisation of learning is facilitated by intelligent educational systems and machine learning algorithms that can analyse students' performance and offer individualised learning materials and tasks. This approach leads to a deeper and more adequate understanding of the material, considering each student's individual characteristics and needs. Using multimedia and interactive tools, such as videos, animations, and virtual laboratories, facilitates interactivity and engagement, enhancing student involvement and understanding of complex concepts. Gaming elements and simulations can be employed to interact more deeply with the learning material. Technology provides opportunities for immediate feedback to students about their progress and results, which is a critical factor in the learning process. Automated assessment and analytics systems allow educators to track student achievements and issues more effectively, enabling them to make adjustments to the educational process promptly.

A comprehensive approach is required to research these aspects, including data collection, analytical processing, and evaluating the impact of technology implementation on educational outcomes. It will not only help to understand the current state of affairs but also develop strategic recommendations for improving the quality and accessibility of education.

The analysis of the possibilities of enhancing the efficiency of the educational process through the application of innovative technologies, especially Artificial Intelligence (AI) and Machine Learning (ML), reveals significant potential for the transformation of the educational sector. The application of these technologies has the potential to significantly enhance the quality and accessibility of education, offering a range of opportunities (Table 1).

Table 1. Analysis of Opportunities to Improve the Effectiveness of the Educational Process by Using Innovative Technologies

Technology	Opportunity to improve the efficiency of the learning process
1. Adaptive learning	AI can analyse the learning process in real-time, adapting learning materials and strategies to the individual needs of each student. Adaptive learning systems can: - identify the weaknesses and strengths of students, offering exercises to strengthen knowledge where necessary, - adjust the complexity of tasks and the pace of learning, ensuring optimal workload and keeping students motivated.
2. Personalised feedback	AI can automate collecting and analysing student responses, allowing teachers to provide more effective and personalised feedback. It includes: - instant detection and correction of errors in the process of completing tasks, - provide detailed recommendations on how to improve performance and develop skills further.
3. Optimising learning content	Machine learning can analyse large amounts of educational data to identify the most effective teaching methods and materials, which makes it possible to - improve the structure of courses and curricula based on the analysis of student performance, - adapt teaching materials to maximise the effectiveness of the subject.
4. Predicting academic performance	Artificial intelligence can predict students' academic success or possible difficulties based on their current performance and educational history, allowing them to: - proactively intervene and provide additional support to those students who may face difficulties, - adapt curricula to prevent students from falling behind or losing interest in the subject.
5. Automating administrative tasks	AI can significantly reduce the time spent by teachers on routine administrative tasks such as keeping journals, checking tests, and managing documentation. It frees up resources for more quality work with students and individual attention.

Implementing these technologies necessitates a comprehensive approach that encompasses the development of regulatory frameworks, the provision of staff training, and the construction of technical infrastructure. Nevertheless, the potential benefits of their use render this task of paramount importance in contemporary education.

Examining the obstacles and challenges educational institutions encounter during the implementation and utilisation of new technologies is a crucial aspect of comprehending the difficulties they encounter in digital transformation. Some of the principal obstacles and challenges include the following aspects:

1. Lack of funding and resources. Acquisition and updating of technological equipment, licensed software and staff training require significant investments, which are unaffordable for many educational institutions, especially in low-income areas.

2. Lack of staff training. Many teachers lack the skills and knowledge of technology to integrate it successfully into the classroom. Training and support are needed for staff to use new technologies effectively in classroom practice.

3. Accessibility and infrastructure issues. Some regions may need help with access to high-speed internet and infrastructure, making distance learning and the use of online resources difficult. Infrastructure, network equipment, and computers need to be upgraded to support the use of modern technologies.

4. Lack of standardisation and integration. The diversity of technological solutions and the need for integration standards between different systems can lead to difficulties in managing and interoperability educational technologies. A unified strategy and policy for integrating technology into the educational process is needed to ensure consistency and efficiency of use.

5. Data security and privacy issues. Protecting the personal data of students and teachers from leakage and abuse is necessary. It is crucial to ensure that educational institutions comply with regulatory requirements for data protection and confidentiality.

6. Resistance to change and cultural barriers. Some teachers and administrators may resist changes in teaching practices associated with introducing new technologies. There is a need to create a culture of innovation and to train staff to change and adapt to new technologies.

Identifying these barriers and challenges allows us to ascertain the obstacles that impede the successful integration of new technologies into the educational process and devise strategies to overcome them. It enables educational institutions to more effectively harness the potential of digital innovations to improve the quality and accessibility of education.

Successful integration of technologies into the teaching process requires not only the implementation of new tools but also the development of a digital transformation strategy. In this context, we present practical recommendations for educational institutions to optimise the use of technology in the teaching process (Table 2).

Table 1. Practical Recommendations for Educational Institutions to Optimise the Use of Technology in the Educational Process

Recommendation	Description
Developing a digital transformation strategy	▪ to create a team in order to develop and implement a digital transformation strategy that includes management, teachers and IT specialists, ▪ to set clear goals and priorities for integrating technology into the learning process.
Staff training and support	▪ to educate and train staff on the use of new technologies and learning platforms, ▪ to provide ongoing technical support to faculty and staff on the use and configuration of equipment and software.
Infrastructure and equipment	▪ to ensure the availability and reliability of the technical infrastructure, including network equipment, computing resources and Internet access, ▪ regularly update hardware and software to meet current security requirements and standards.
Developing digital learning materials	▪ to invest in the development and adaptation of digital learning materials, including interactive lessons, online courses and multimedia resources, ▪ to maintain a library of digital learning materials and update it regularly.
Ensuring data security	▪ to develop and implement a data security policy that protects the confidentiality and integrity of student and staff information, ▪ to train staff on the rules of processing and storing confidential data.
Learning and adapting best practices	▪ to analyse the experience of other educational institutions and companies that successfully integrate technology into the learning process and learn from their successes and failures, ▪ to cooperate with other institutions and industrial partners to share knowledge and experience.
Monitoring and evaluation	▪ to evaluate the effectiveness of technology in the learning process and compare the results with the goals set, ▪ to use feedback from students and teachers to continuously improve approaches to the use of technology.
Stimulating innovation and a culture of learning	▪ to encourage and support initiatives and research of technology use in education among teachers and students, ▪ to create incentives and rewards for innovators and successful use of technology in the learning process.

The recommendations encompass a wide range of aspects, from staff training and data security to developing digital learning materials and promoting innovation in education. They will assist educational institutions in optimising the use of technology in the educational process and making education more effective, accessible, and interactive for students.

5 Discussion

The analysis of research by Altawalbeh et al. (2023) allows for the understanding of the factors that significantly impact learners' readiness to accept and use digital tools in education. It may include aspects of convenience, technology accessibility, usage skills, and attitudes towards them. Batsurovska (2021) examines the possibilities of integrating MOOCs into the educational process and proposes technological approaches to students acquiring competencies in a digital media environment. It can serve as a foundation for discussions on the efficacy of such learning formats and the obstacles and potential solutions, given that technologies can facilitate students' development of essential skills. The work of Chen and Du (2023) provides an opportunity to discuss the advantages and challenges of creating and utilising such platforms in higher education and their impact on the accessibility of learning materials and collaboration between students and teachers. The research by Liu et al. (2020) gives a foundation for examining the advantages and challenges of utilising virtual reality in learning, particularly in industrial education and training. Research by Liu, Fan, and Wang (2022) may facilitate a discussion on the potential of big data to create interactive learning environments and personalised learning. A discussion of these research aspects can assist in understanding the current state of technology use in modern education and identifying key challenges and prospects for further development.

6 Conclusions

Integrating technology into the educational process is an essential component of modern education. The use of technology can significantly expand the accessibility and quality of

education. However, successful technology integration requires financial investments, staff training, and the development of relevant policies. Data security and confidentiality of information must be considered when using educational technologies. Despite the challenges and obstacles, innovative approaches and best practices can significantly improve the learning process. The successful integration of technology into education requires active collaboration and experience-sharing among educational institutions. It is essential to continually support ongoing research and evaluation of the effectiveness of technology use to refine the educational process. The continued development of technological infrastructure and staff training in using new tools and methods play a crucial role in ensuring the success of educational institutions. Overall, integrating technology into education opens up broad opportunities for enhancing the educational process and preparing students for the challenges of the modern world. The effective use of technology in education is a necessary step towards creating more flexible, accessible, and quality educational systems.

The future research prospects in applying technology to education present a wide range of opportunities for expanding knowledge and improving practices, including more profound research on the impact of specific technologies, such as virtual reality, artificial intelligence, and blockchain, on the educational process and student outcomes.

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