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Innovations in educational methodologies: Exploring the impact of digital technologies on learning and teaching

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Abstract

Relevance. The relevance of the subject under study lies in the need to understand the impact of digital technologies on learning and teaching in the context of an ever-changing educational landscape where innovation is becoming a key factor for successful education.

Purpose. The purpose of this study was to evaluate the impact of information technology on the educational process and students' motivation to learn using innovative techniques.

Methodology. Methods of analysis, synthesis, generalisation, and systematisation were used to fulfil this purpose.

Results. The key findings of the study point to the need for careful consideration of pedagogical principles when integrating digital technologies into education. It was emphasised that successful integration of digital tools requires alignment with learning objectives and differentiation of learning to meet student needs. Furthermore, a significant role in addressing the digital divide and ensuring equal access to educational opportunities for all social groups was highlighted.

Conclusions. The study also emphasised the importance of continuing professional development for teachers and preparing them to use digital technologies effectively. It was also noted that digital technology can be a powerful tool for increasing student engagement, providing personalised learning opportunities and developing lifelong learning skills.

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However, it is essential to consider ethical and social aspects when integrating technology into the educational process. This study makes a vital contribution to the field of educational technology, emphasising the need to align digital innovations with pedagogical principles and strategies, as well as highlighting the social justice and ethical dimensions of integrating technology into education.

Keywords: integration; pedagogical approaches; teachers' professional development; effectiveness; motivation.

Introduction

The relevance of this study lies in the fact that the introduction of innovative technologies, such as artificial intelligence, into the educational sphere is accompanied by a range of challenges and problems. Although the principal goal of this development is to improve the quality of education in schools and universities and to provide modern tools for self-education, problems often arise in practice. A major issue is the inability of school and university programmes to adapt quickly to rapidly evolving technologies. This can lead to the obsolescence of the content of education and insufficient preparation of students for the modern requirements of the labour market. Furthermore, educators' teaching methods are often obsolete, making it difficult to effectively integrate digital technologies into modern educational practices. This can lead to inadequate training of teachers in the use of modern educational methods and technologies, as well as insufficient motivation of students to learn. Therefore, it becomes crucial to investigate how digital technologies affect the learning process and to develop effective strategies for integrating these technologies into current educational practices.

Many researchers have been engaged in analysing the issues of digital transformation in education. N. Abdybekova et al. [1] considered the use of digital technologies in the professional training of Masters in Physical Education and Sport to improve the effectiveness of the educational process through online classes and the development of educational and methodological complexes. K. Berdibekova et al. [2] discusses the role of information technologies in education, including measures taken by the Kyrgyz government to improve the quality of education using information and communication technologies, based on student survey data. A. Ibraiyimkyzy et al. [3] analysed the importance of e-learning in the education system of Kyrgyzstan and the role of digital education in competence building with regard to state education standards. M. Nurkulova [4] explored the significance of innovation in the educational system of the Kyrgyz Republic, focusing on interactive teaching methods such as business games and trainings. N.S. Semenov and S.R. Semenov [5] examine the impact of digital transformation on the educational system of Kyrgyzstan, including the development of information systems and online learning. N.S. Mambetova and T.I. Anisimova [6] evaluated how the use of digital resources in geometry lessons managed to stimulate thinking and increase interest in the subject. The findings show the need to integrate digital resources into geometry teaching, considering conventional methods.

Previous studies have examined various aspects of the use of digital technologies in education in Kyrgyzstan, including the development of information systems, the use of online learning, and the evaluation of the effectiveness of digital resources in the classroom. However, the impact

of digital technologies on the learning process and teaching with innovative techniques such as interactive teaching methods, the use of business games, training, and other forms of active student engagement have not been thoroughly considered. It is also necessary to perform an in-depth analysis of the impact of digital transformation on teaching and learning methods in the context of modern requirements for the educational process and the growth of students' professional competences. The purpose of this study was to evaluate the impact of information technology on the learning process, using new teaching methods in education to make the learning process more effective and entice students.

Materials and methods

Using a method of analysis, key aspects of integrating digital technologies into the educational process were explored, including pedagogical strategies and principles, impact on learning outcomes, and challenges related to digital inequality and data security. Existing teacher training programmes were analysed with regard to their effectiveness in the context of digital inclusion [7], and key aspects of educational programmes that contribute to the development of teachers' professional skills and competences in the field of educational technologies were identified. The benefits and limitations of digital integration were also analysed, and social and ethical issues arising from the use of digital technologies in education were identified. As a result of this analysis, key strategies and approaches that facilitate the effective integration of digital technologies into the educational process were highlighted, and areas for further investigation in this area were identified.

The synthesis method was used to combine the information about the benefits and limitations of integrating digital technologies in education, and to identify best approaches to using digital tools in pedagogical practice. The synthesis method helped to establish the relationship between different aspects of technology integration and to identify the most promising strategies for teacher education and training. Furthermore, the synthesis method was used to make recommendations for further research in this area to improve the understanding of the mechanisms of interaction between digital technologies and educational practices. In addition, the synthesis method helped to identify common trends and patterns in the use of digital technologies in education, which contributes to the development of more effective integration and learning strategies in the future.

Using the synthesis method, research findings and data analysis were brought together to highlight the main themes, patterns, and conclusions articulated in the various studies, and to summarise the vast amount of information to identify common trends and practical recommendations. The synthesis method provided an opportunity to highlight key principles and recommendations for the development

of educational programmes and learning strategies, considering the diversity of pedagogical approaches and digital technologies. This helped to develop a better understanding of how to effectively integrate digital resources into the educational process, drawing on research evidence and best teaching practice. Moreover, the synthesis method helped to identify gaps in existing research and pointed to potential areas for further investigation to better understand the integration of digital technologies in education and their impact on learning outcomes.

Using the method of systematisation, different aspects of digital technology integration in the educational process were classified and structured. As a result of this process, the key categories and approaches used in integrating digital tools into teaching practice were identified. Each category was analysed in terms of its role and relevance to the effective use of digital technology in learning. This approach helped to systematise the information and highlight the key aspects that influence the successful implementation of digital tools in the educational environment. This method allowed the diverse data and findings of the study to be organised into a systematic and logical structure, which facilitated further analysis and interpretation of the information obtained.

Results

Digital technology has revolutionised education by opening various avenues to integrate technology into teaching and learning processes. Online learning platforms serve as centralised hubs for educational resources, facilitating access to a wide range of courses, lectures, and learning materials. Platforms such as Coursera, Udemy, and Khan Academy offer flexible learning options, allowing students to engage in self-education and access resources from anywhere they have an internet connection. They often contain multimedia content, interactive exercises and assessments to enhance learning. Furthermore, online platforms can include features such as discussion forums, live lectures, and collaborative projects to encourage interaction and student engagement.

Educational applications are software applications designed specifically for educational purposes, targeting different age groups and subject areas. These applications are available on smartphones, tablets, and other devices, giving students access to educational content “on the go.” Educational applications include a wide scope of features including interactive games, quizzes, simulations, flashcards, and language learning tools [8]. They are often designed to be engaging and user-friendly, using gamification techniques and personalised learning algorithms to adapt to individual learner needs.

Virtual reality (VR) technology immerses users in a computer-generated environment, simulating real-world experiences and scenarios. In education, VR offers unique opportunities for experiential learning and interactive research. Educational VR applications can transport students to virtual environments such as historical landmarks, science simulations, or immersive language learning environments. By encouraging active exploration, VR improves understanding and memorisation of complex concepts. Additionally, VR enables collaborative learning

by allowing students to interact with peers and instructors in a virtual space.

Augmented reality (AR) overlays digital content on the physical world, augmenting the real world environment with digital elements. In education, AR applications enrich the learning process by providing contextual information, interactive visualisations, and experiential learning opportunities. AR tools can be used to create interactive textbooks, museum exhibits, and educational games that bridge the gap between abstract concepts and the real world [9]. By combining virtual and physical elements, AR promotes deeper engagement and understanding of educational content.

Artificial intelligence (AI) and machine learning (ML) technologies are increasingly being integrated into educational systems to personalise the learning process, automate administrative tasks, and provide intelligent tutoring support. AI-powered education platforms analyse student data to identify learning gaps, recommend personalised learning programmes, and provide real-time feedback to students. AI algorithms can also facilitate adaptive assessment and grading, allowing teachers to assess student progress more efficiently and accurately [10].

Thus, the integration of digital technologies in education offers great opportunities to improve teaching and learning processes. From online learning platforms and educational applications to virtual reality, augmented reality, and artificial intelligence, these technologies enable educators and learners to engage in a dynamic, interactive, and personalised educational process [11]. However, despite the potential benefits, the effective implementation of these technologies in the educational process is still limited, especially in many universities in Kyrgyzstan, where educational programmes often fall behind in the embrace of digital innovations.

In exploring theoretical perspectives on the effectiveness of digital tools in enhancing learning outcomes and engagement, it is important to consider the various theoretical frameworks and models proposed in the educational literature. One of them is the cognitive theory of multimedia learning, which suggests that the use of multiple modalities such as text, images, and audio can facilitate deeper cognitive processing of information and improve learning outcomes. According to this theory, digital tools that present information in a multimedia format can improve comprehension, memorisation, and transfer of knowledge, considering different learning preferences and cognitive processes [12]. Furthermore, sociocultural theories emphasise the significance of social interaction and collaborative learning in the educational process [13]. From this perspective, digital tools such as online forums, collaboration platforms, and social media can foster active engagement and knowledge building through peer interaction, knowledge sharing, and collective problem solving. By providing collaborative learning opportunities, digital tools allow students to search for meaning together, negotiate understanding, and develop higher-order thinking skills.

Furthermore, constructivist theories emphasise the role of active involvement and practical experience in learning. According to constructivist principles, learners actively construct knowledge by engaging in authentic, inquiry-

based tasks, and reflecting on their experiences [14]. Digital tools such as simulations, virtual labs, and interactive multimedia resources can provide students with opportunities to explore complex concepts in a dynamic, interactive environment. By allowing students to manipulate virtual objects, conduct experiments, and explore real-world scenarios, these tools can promote experiential learning and conceptual understanding.

Connectionist theory emphasises the significance of online learning environments and digital networks in the acquisition and dissemination of knowledge [15]. In the 21st century, students have access to a wealth of information and resources through online platforms, databases, and digital repositories. Digital tools such as search engines, online libraries, and open educational resources allow students to effectively navigate and filter information, communicate with experts and peers, and take part in global learning communities. From a connectivist perspective, digital tools enhance learning outcomes by facilitating knowledge building, networking, and developing lifelong learning skills in a rapidly changing digital space.

Overall, theoretical perspectives on the effectiveness of digital tools in improving learning outcomes and engagement emphasise the significance of considering various cognitive, social, and constructivist factors when designing and implementing digital learning environments. By integrating digital tools according to theoretical principles and pedagogical approaches, teachers can create dynamic, interactive learning experiences that foster deep learning, critical thinking, and active student engagement.

The application of pedagogical approaches to optimise the use of digital technologies in education involves careful consideration of instructional design principles, learning objectives, and student needs. One practical application is integrating digital tools into lesson planning to enhance teaching and student engagement. For instance, instructors can use multimedia presentations, interactive simulations, and online quizzes to present the material in a more engaging and interactive way [16]. Another practical application is the implementation of the “flipped classroom” model, where students work with digital content outside of class to learn new concepts and materials. This approach allows for more active learning in the classroom where students can take part in discussions, work on projects, and receive individualised feedback from instructors. Furthermore, the use of digital technology can help to personalise the learning experience to meet the individual needs and preferences of learners. Teachers can use learning analytics to identify areas where students may need additional support or enrichment, allowing for more targeted interventions and differentiated instruction. In addition, digital technology can support collaborative learning environments where students can work together on projects, share ideas, and exchange feedback. Online platforms and tools such as Google Docs, discussion forums, and video conferencing can facilitate communication and collaboration between learners, regardless of their physical location.

The effective application of pedagogical approaches to optimise the use of digital technologies in education requires thoughtful planning, alignment with learning

objectives, and ongoing reflection and evaluation to ensure that the tools and strategies used meet students’ needs and enhance their learning. The integration of digital technologies into education presents both challenges and opportunities that require careful consideration. One such challenge is the digital divide, which refers to inequalities in access to and ownership of digital technologies among different socio-economic groups. Despite the potential benefits of digital inclusion, students from marginalised communities may lack access to reliable internet connections, devices, and digital literacy skills, resulting in inequalities in educational opportunities. Closing the digital divide requires systemic intervention to ensure equitable access to digital resources and support mechanisms for the disadvantaged.

Another issue is potential technocentrism, where a focus on technological solutions can overshadow pedagogical considerations and student needs. Over-engagement with digital tools without proper consideration of instructional design principles and learning objectives can lead to superficial engagement, passive content consumption, and poor learning outcomes. To mitigate this problem, educators must take a critical stance towards technology integration, emphasising the significance of pedagogy-based approaches that prioritise active learning, collaboration, and the development of critical thinking skills. Furthermore, data privacy and security concerns pose challenges to integrating digital technologies into education. The proliferation of digital platforms and tools raises ethical questions regarding the collection, storage, and use of student data, as well as issues related to online safety, cyberbullying, and digital identity. Professionals must address these challenges by implementing robust data protection policies, promoting digital literacy and responsible use of technology, and fostering a culture of digital responsibility among students.

Despite these challenges, the integration of digital technologies in education also offers considerable opportunities for transforming learning experiences and pedagogical innovation. Digital tools provide flexibility, adaptability, and scalability, allowing educators to create personalised learning pathways tailored to individual student needs and preferences. Moreover, digital technologies facilitate collaboration, communication, and knowledge sharing in online and blended learning environments, allowing students to engage in authentic, inquiry-based learning experiences that transcend geographical boundaries and disciplinary divides. Digital technologies also allow students to become active participants in their own learning process, providing opportunities for independent research, reflection, and creativity. Using digital tools such as multimedia resources, virtual reality simulations, and educational games, teachers can foster better engagement, intrinsic motivation, and lifelong learning skills in students.

Apart from addressing the challenges of integrating digital technologies into education, the development of high-quality educational programmes for teachers needs to be prioritised. These programmes play a crucial role in providing educators with the necessary knowledge, skills, and competences to effectively integrate digital tools into their pedagogical practice. A key aspect of teacher education programmes is comprehensive training in the

pedagogical principles and instructional strategies that underpin effective technology integration. Educators need to know how to align digital tools with learning objectives, differentiate instruction to meet different student needs, and design authentic, inquiry-based learning tasks that harness the power of digital technologies [17].

Furthermore, teacher education programmes should emphasise the significance of ongoing professional development and support mechanisms to ensure that educators are always aware of new trends, best practices, and research findings in educational technology. Continuous learning opportunities, workshops, and communities of practice can give teachers the chance to explore new digital tools, experiment with innovative teaching approaches, and reflect on their practice in a collaborative and supportive environment. Teacher training programmes should address the need for educators to be digitally literate and technology fluent, providing them with the necessary technological skills to work with digital tools, troubleshoot technical issues, and model responsible technology use for their students. Educators

should also develop critical thinking skills to evaluate the quality, relevance, and ethical implications of digital resources and learning materials.

Teacher education programmes should foster a culture of innovation by encouraging educators to experiment, iterate, and reflect as integral components of their professional practice. By providing opportunities for hands-on experience, mentoring, and collaboration with colleagues, these programmes can empower teachers to become confident, creative, and adaptive leaders in digital learning environments. Overall, investing in high-quality teacher education programmes is necessary to fulfil the potential of digital technologies in education in its entirety. By equipping educators with the knowledge, skills, and support needed to effectively integrate digital tools into teaching practice, these programmes can increase student engagement, improve learning outcomes, and enhance learning opportunities.

To successfully integrate digital technologies into the educational process, several key aspects need to be considered (Table 1).

Table 1. Key points for integrating digital technologies into education

Pedagogical aspects	Professionalism of educators	Ethical aspects	Engagement of students	Equal access
Effective digital integration requires alignment with learning objectives and the use of robust teaching strategies	Ongoing training is vital for educators to use digital tools effectively and stay updated with evolving educational technologies	Digital integration requires addressing ethical and social issues, including data privacy and digital citizenship, to create safe and inclusive learning environments	Digital tools provide opportunities for personalised and collaborative learning, increasing student motivation and developing lifelong skills	Bridging the digital divide requires ensuring equal access to technology and skills, minimising inequalities in education

Effective integration of digital technologies requires careful consideration of pedagogical principles and instructional design strategies. Simply introducing digital tools into the classroom is insufficient; teachers must align technology use with learning objectives, differentiate the delivery of lessons to meet different student needs, and prioritise active, experimental learning experiences. The digital divide poses serious challenges to equal access to educational opportunities. Unequal access to technology and varying levels of digital literacy can exacerbate the situation, limiting educational opportunities and socio-economic mobility for the poor. Bridging the digital divide requires systemic measures to ensure equal access to digital resources and support mechanisms for marginalised communities. Furthermore, high quality educational programmes for teachers are needed for effective technology integration. Educators need comprehensive training in pedagogical strategies, digital literacy skills, and ongoing professional development to be on top of new trends and best practices in educational technology. Investing in teachers’ professional development is critical to building their capacity to effectively use digital tools in teaching practice.

Digital technology can increase student engagement, empowerment, and academic achievement. By providing opportunities for personalised learning, collaborative research, and authentic experiences, digital tools can foster deeper engagement, intrinsic motivation, and lifelong learning skills in students [18-20]. However, teachers must

make sure that technology integration is pedagogically sound and matches the students’ needs and preferences. The integration of digital technologies into education also raises ethical and social issues related to data privacy and security. It is important to take a holistic approach to integrating technology into education.

The introduction of innovations in the education system of Kyrgyzstan is a multifaceted process that requires concerted efforts of various stakeholders. Firstly, there is a need for education policy reform at the state level to create a favourable environment for educational innovation. This requires the development and implementation of policies that prioritise education, allocate adequate resources and encourage experimentation with new learning methods and technologies. Furthermore, it is crucial to invest in the professional development of teachers. Teachers need training and support to effectively incorporate innovative approaches into their teaching practice. Workshops, seminars, and ongoing professional development programmes will help educators gain the necessary skills and confidence to use technology and implement modern pedagogies.

Infrastructure development is another essential aspect. Ensuring that schools have access to reliable internet, computers, tablets, and other digital devices is vital to the development of digital learning. Moreover, technical support and maintenance should be provided to address any issues that may arise when using technology in the classroom. Curriculum revision is also important to align

educational content with the skills and competencies needed in the 21st century [21; 22]. This requires updating the curriculum to include topics such as digital literacy, critical thinking, problem solving, and collaboration. Furthermore, incorporating project-based learning, experiential learning, and other innovative teaching techniques can help engage students and improve learning outcomes. Promoting the use of digital learning platforms and educational resources can further support innovation in education. Encouraging the use of online learning platforms, digital libraries, interactive multimedia resources, and educational applications can provide students with access to a wide range of learning materials and opportunities for independent learning [23].

Public engagement is another critical factor in the implementation of educational innovations. Involving parents, community leaders, and other stakeholders in the educational process can help support innovative initiatives and create partnerships that benefit students. Collaboration between schools, community organisations and businesses can also provide students with real learning experiences and improve their employability skills [24]. In addition, establishing monitoring and evaluation mechanisms is necessary to determine the effectiveness of innovation initiatives and to make data-driven decisions. Regular monitoring, gathering feedback, and evaluating results will help identify areas for improvement and guide future innovation efforts.

Discussion

Analysis of the findings shows that digital technologies such as online learning platforms, educational apps, virtual and augmented reality, and artificial intelligence technologies offer unique opportunities to improve learning and teaching processes. They provide access to educational resources from anywhere, encourage interactive learning, and promote personalisation of the education process. However, despite their potential, the effective implementation of digital technologies in education is limited, especially in the context of universities in Kyrgyzstan, where the adoption of digital innovations is falling behind. This points to the need for further efforts to provide support, training, and resources to successfully integrate digital technologies into educational processes. To implement digital technologies in education effectively, it is vital to consider the various theoretical frameworks and models proposed in the educational literature. Cognitive theory of multimedia learning points to the potential of multimedia formats to enhance cognitive information processing and enrich the learning process [25]. Sociocultural theories emphasise the importance of social interaction and cooperative learning in the development of knowledge and skills [26]. Constructivist principles raise the importance of active participation and practical experience in learning. Connectionist theory emphasises networked learning environments and their role in knowledge creation and dissemination. Practical applications of these theories include integrating digital tools into the learning process to make it more effective and interactive, creating dynamic learning experiences and personalising learning to meet individual student needs [27-30].

It is also necessary to consider various aspects of the educational process, including planning, alignment with learning objectives, reflection, and evaluation. The integration of digital tools faces challenges such as the digital divide and technocentrism that need to be carefully considered and addressed [31; 32]. However, digital technologies also offer great opportunities to transform the educational process, improve student engagement, and personalise learning. Furthermore, effective integration of digital technologies requires the development of quality educational programmes for teachers to ensure that they have the necessary knowledge and skills to successfully use technology in the classroom [33-35]. The findings of the study emphasise the need to consider several key aspects when integrating digital technologies into education. These aspects include pedagogical principles, differentiating learning, addressing the digital divide, and providing high-quality professional development for teachers. Digital technologies can be a powerful tool for improving the educational process, but their successful integration requires an intelligent approach, considering the needs of students and ensuring equal access to educational resources [36].

M.I. Qureshi et al. [19] investigate the impact of digital technology on education by analysing relevant articles from Scopus database. Their findings confirm the significance of educational development and high-tech skills, predicting the complete replacement of conventional learning methods by digital technologies. Comparable to this study, both papers emphasise the role of digital technology in modern education and the need to develop relevant skills. The current study takes a closer look at theoretical approaches and techniques for integrating technology into the classroom, while the researchers focus on analysing publications and general research trends. The findings of the researchers can provide Kyrgyzstan with valuable recommendations on how to integrate digital technologies into the educational system, which contributes to the modern development of education and the training of competitive specialists for the future.

N.A. Ahmad et al. [20] conduct a systematic literature review in their study on the effectiveness of digital learning strategies for older adults. The study analyses articles from the Web of Science and Scopus databases and identifies six main themes such as collaborative learning, informal learning environments, and feedback. Adapting these strategies to the cultural and social specificities of Kyrgyzstan can help to improve digital literacy and the integration of older people into social and professional life through training using modern technologies. In comparison to the present study, both studies highlight the significance of developing effective digital learning strategies. The current study focuses on the general principles of integrating digital tools into the educational process, while the study by the researchers emphasises the characteristics and preferences of older people in this context.

K. Okoye et al. [21] examine the use of digital technologies in Latin American higher education institutions, assessing the level of adoption and identifying barriers to successful implementation. The researchers applied a mixed method approach involving quantitative analysis of the teacher survey and qualitative analysis of

the textual data using text mining techniques. The findings suggest that the main challenges for teaching and learning with digital technologies are lack of training, infrastructure, and resources, as well as limited access to the internet and digital platforms. This confirms the need to develop strategies and policies to address these challenges in higher education institutions to ensure more effective use of digital technologies in education [37]. Analogous challenges and problems identified in the study may be relevant for Kyrgyzstan as well. Lack of teacher training, limited access to the internet and digital resources, and insufficient infrastructure can substantially affect the integration of digital technologies in education in Kyrgyzstan. Therefore, the development and implementation of appropriate strategies and policies in Kyrgyzstan can contribute to the effective use of digital technologies in higher education institutions and improve the quality of education in general. While the study on digital technologies in higher education institutions in Latin America focuses on the region, the current study emphasises the application of digital technologies in education in Kyrgyzstan.

M. Sailer et al. [22] focus on investigating how often teachers use digital technologies in their teaching and what learning activities for students they initiate. The researchers also analysed factors associated with the use of technology. Working with 410 teachers representing the state of Bavaria, Germany, it found that teachers spend a significant amount of time using digital technology in typical lessons. The findings showed that it was more the teachers' core digital skills and teaching skills related to technology rather than the digital technology resources that were key. And while a certain threshold level of digital technology is required in schools, the results suggest a shift in focus from equipping schools to teachers' skills in using technology effectively [38; 39]. This study may also be relevant to Kyrgyzstan, where assessing and improving teachers' professional training in digital technologies may also contribute to more effective use of digital resources in education. Comparing the findings of the cited study with the current study, there are similarities in the emphasis on the significance of teachers' skills in using digital technologies. Both studies emphasise that successful integration of digital technologies in education depends on the skills and competences of teachers, not only on the availability of the technologies themselves. This confirms the importance of training teachers not only in technical skills but also in how to use digital resources effectively in the classroom [40].

J. Wallace et al. [23] investigated teachers' competence in using digital technologies in physical education teaching. The findings of this study showed that teachers perceived their level of competence in digital technology in physical education to be significantly lower, which is a result of both personal and school barriers to integrating digital technology into their physical education lessons. The researchers offer a deeper understanding of the complex relationship between pedagogy and technology than is presented in most digital competence frameworks, and therefore a narrow understanding of teacher digital competence in physical education. This aspect of the study may also be relevant to Kyrgyzstan, where analysing the level of digital competence of teachers in the context of

physical education can contribute to the development of effective teaching strategies and support teachers in integrating digital tools into the educational process. Comparing the findings of the cited article with the current study, there are similarities in the identified problem with low levels of digital competence among teachers. Both studies point to the need to develop teachers' skills in the effective use of digital resources in the classroom. In addition, both studies emphasise the complexity of the relationship between pedagogy and technology, which calls for a more in-depth investigation and approach to assessing teachers' competence in this area.

The results of the study emphasise the significance of effective integration of digital technologies into the educational process. Digital tools offer unique opportunities to improve learning and teaching, but their successful integration requires careful planning, alignment with learning objectives, and adequate teacher training. Supporting and developing teachers' digital skills is key to the successful use of digital resources in the classroom.

Conclusions

The findings of the study emphasise the importance of integrating digital technologies into the educational process, provided that an integrated approach is taken, and a range of key aspects are considered. Digital technologies present significant potential to improve education, empower students and enhance learning outcomes. They personalise the educational experience, promote active engagement and develop learners' skills. However, successful digital integration requires consideration of several critical factors. Pedagogical principles should be at the centre of technology adoption to ensure that it is used effectively in line with learning objectives. Differentiation of instruction is also key, given the diversity of student needs and preferences. Combating digital inequality is an essential aspect of integrating digital technologies into education. Developing mechanisms to ensure equal access to educational resources and support for disadvantaged groups is a prerequisite for successfully realising the potential of digital technologies in education. Furthermore, teacher professional development plays an essential role in the successful integration of digital technologies. Training programmes for teachers should support the development of their digital literacy, teach pedagogical strategies for using technology, and encourage innovation and collaboration with colleagues.

Introducing innovation in Kyrgyzstan's education system requires a comprehensive approach that includes policy development and implementation, investment in teacher professional development, infrastructure development, curriculum review and community engagement. This process also requires the establishment of monitoring and evaluation mechanisms for effective implementation of innovative initiatives and continuous improvement of the education system. Thus, the integration of digital technologies in education is a complex but important process that requires consideration of many factors and an integrated approach. When properly implemented, digital technology can be a powerful tool for improving the quality of education and raising student achievement.

Developing and implementing educational programmes for teachers that focus on improving their digital literacy and pedagogical skills in the use of technology is a key recommendation for the successful integration of digital technologies into the educational process. The practical significance of this study lies in the rationale for investing in teacher professional development and creating educational programmes that promote the effective integration of digital technologies into the classroom to improve learning outcomes and student engagement. One of the key areas for future research could be to investigate the effectiveness of specific learning

strategies based on digital technology integration, considering different educational contexts and learners' needs.

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Conflict of Interest

None.

References

- [1] Abdybekova N, Dobaev K, Mambetalieva N. Modern digital technologies of professional preparation masters in the field of physical culture and sport. In: *Collection of Scientific Papers of the XI International Scientific Conference of Students and Young Scientists "University Sports: Health and Prosperity of the Nation"* (pp. 502-505). Chirchik, Tashkent: Uzbek State University of Physical Culture and Sport; 2022.
- [2] Berdibekova K, Karagozueva G, Bekmurzaeva B. The role of information technology in the professional training of a future teacher. *Comp Sci Engineer Tech.* 2023;1(1):274-283.
- [3] Ibraiyim kyzy A, Akmatov DA, Duishenaliev ZhS. E-learning in the education system of Kyrgyzstan. *Sci, New Tech Innov Kyrgyzstan.* 2021;3:234-237.
- [4] Nurkulova M. The role of interactive technologies in the modernization of education in Kyrgyzstan. *Bull Sci Pract.* 2021;7(8):353-358.
- [5] Semenov NS, Semenov SR. Information relations in education of the Kyrgyz Republic. *Bull Kyrgyz-Rus Slavic Uni.* 2022;22(11):136-141.
- [6] Mambetova NS, Anisimova TI. Using digital resources in geometry lessons. *Society: Sociol, Psych, Ped.* 2023;8:136-143.
- [7] Concept of Education Development in the Kyrgyz Republic for 2021-2030. 2021. <https://edu.gov.kg/media/files/118d4b79-d6ea-4648-9c1c-56280444e7fd.pdf>
- [8] Sattarov AR, Yusupov RM, Khaitov FN, Jomurodov DM, Ahmedov FK, Khonimkulov US. Some didactic opportunities of application of mobile technologies for improvement in the educational process. *J Critic Rev.* 2020;7(11):348-352.
- [9] Kulyk O. Professional training of future translators in the age of artificial intelligence. *Sci et Societ.* 2023;(3):48-56.
- [10] Zhang K, Aslan AB. AI technologies for education: Recent research & future directions. *Comp Educ: Artif Intell.* 2021;2:100025.
- [11] Sylenko Y. Individualization of independent work in the professional training of future teachers: An experimental study. *Sci Bull Mukachevo State Uni. Series "Ped Psychol"*. 2024;10(1):68-76.
- [12] Çeken B, Taşkın N. Multimedia learning principles in different learning environments: A systematic review. *Smart Learn Env.* 2022;9:19.
- [13] Edwards S. From developmental-constructivism to socio-cultural theory and practice: An expansive analysis of teachers' professional learning in early childhood education. *J Early Childh Res.* 2007;5(1):83-106.
- [14] Chuang S. The applications of constructivist learning theory and social learning theory on adult continuous development. *Perform Improv.* 2021;60(3):6-14.
- [15] Alam MA. Connectivism learning theory and connectivist approach in teaching and learning: A review of literature. *Bhartiyam Int J Educ Res.* 2023;12(2):1-15.
- [16] Mirsharapovna SZ, Shadjalilovna SM, Kakhramonovich AA, Malikovna KRN. Pros and cons of computer technologies in education. *Texas J Multidiscip Stud.* 2022;14:26-29.
- [17] Orishev JB, Burkxonov RR. Project for training professional skills for future teachers of technological education. *Mental Enlighten Sci-Method J.* 2021;2:139-150.
- [18] Bond M, Buntins K, Bedenlier S, Zawacki-Richter O, Kerres M. Mapping research in student engagement and educational technology in higher education: A systematic evidence map. *Int J Educ Tech High Educ.* 2020;17:2.
- [19] Qureshi MI, Khan N, Raza H, Imran A, Ismail F. Digital technologies in Education 4.0. Does it enhance the effectiveness of learning? *Int J Interact Mobile Tech.* 2021;15(4):31-47.
- [20] Ahmad NA, Abd Rauf MF, Mohd Zaid NN, Zainal A, Tengku Shahdan TS, Abdul Razak FH. Effectiveness of instructional strategies designed for older adults in learning digital technologies: A systematic literature review. *SN Comp Sci.* 2022;3(2):130.
- [21] Okoye K, Hussein H, Arrona-Palacios A, Quintero HN, Ortega LOP, Sanchez AL, Ortiz EA, Escamilla J, Hosseini S. Impact of digital technologies upon teaching and learning in higher education in Latin America: An outlook on the reach, barriers, and bottlenecks. *Educ Info Tech.* 2023;28(2):2291-2360.
- [22] Sailer M, Murböck J, Fischer F. Digital learning in schools: What does it take beyond digital technology? *Teachin Teach Educ.* 2021;103:103346.

- [23] Wallace J, Scanlon D, Calderón A. Digital technology and teacher digital competency in physical education: A holistic view of teacher and student perspectives. *Curric Stud Health Phys Educ.* 2023;14(3):271-287.
- [24] Xhafka E, Teta J, Philippov DI, Kostyrin EV, Leelang S, Nikolaeva IV, Maramygin MS, Ruban-Lazareva NV, Muda I, Dudnik OV. Private Health Insurance in the Post-Pandemic Era: Spatial Econometric Market Development Analysis. *Emerg Sci J.* 2023;7(6):2080-2096.
- [25] Sinoimeri D, Teta J. Supply Chain Management Performance Measurement. Case Studies from Developing Countries. *Int J Membr Sci Technol.* 2023;10(2):1323-1331.
- [26] Sinoimeri D, Teta J, Prifti V, Lazaj A. Information Technology in Supply Chain Management. Case Study. *Lect Notes Multidisc Industr Engin.* 2024;Part F2090:35-44.
- [27] Azizov TN, Kochkarev DV, Galinska TA. New design concepts for strengthening of continuous reinforced-concrete beams. *IOP Conf Ser: Mater Sci Engin.* 2019;708(1):012040.
- [28] Pavlikov A, Kochkarev D, Harkava O. Calculation of reinforced concrete members strength by new concept. In: *Proceedings of the fib Symposium 2019: Concrete - Innovations in Materials, Design and Structures* (pp. 820-827). Krakow: International Federation for Structural Concrete; 2019.
- [29] Kerimkhulle S, Aitkozha Z, Saliyeva A, Kerimkulov Z, Adalbek A, Taberkhan R. Using Technical and Structural Coefficients of Economic Statistics to Equalize Flows of Input-Output Table. *Lect Notes Networks Syst.* 2023;596 LNNS:501-511.
- [30] Kerimkhulle S, Obrosova N, Shananin A, Tokhmetov A. Young Duality for Variational Inequalities and Nonparametric Method of Demand Analysis in Input-Output Models with Inputs Substitution: Application for Kazakhstan Economy. *Mathem.* 2023;11(19):4216.
- [31] Yakovlev SV, Valuisckaya OA. Optimization of linear functions at the vertices of a permutation polyhedron with additional linear constraints. *Ukr Mathem J.* 2001;53(9):1535-1545.
- [32] Yakovkin IN, Katrich GA, Loburets AI, Vedula YS, Naumovets AG. Alkaline-earth overlayers on furrowed transition metal surfaces: An example of tailoring the surface properties. *Progr Surface Sci.* 1998;59(1-4):355-365.
- [33] Cherniha R, Serov M. Symmetries, ansätze and exact solutions of nonlinear second-order evolution equations with convection terms, II. *Eur J Appl Mathem.* 2006;17(5):597-605.
- [34] Timchenko LI, Pavlov SV, Kokryatskaya NI, Poplavskaya AA, Kobylyanska IM, Burdenyuk II, Wójcik W, Uvaysova S, Orazbekov Z, Kashaganova G. Bio-inspired approach to multistage image processing. *Proceed SPIE - Int Soc Optic Engin.* 2017;10445:104453M.
- [35] Kozlovskaya TI, Kolisnik PF, Zlepko SM, Titova NV, Pavlov VS, Wójcik W, Omiotek Z, Kozhambardiyeva M, Zhanpeisova A. Physical-mathematical model of optical radiation interaction with biological tissues. *Proceed SPIE - Int Soc Optic Engin.* 2017;10445:104453G.
- [36] Xhafka E, Teta J, Agastra E. Mobile environmental sensing and sustainable public transportation using ICT Tools. *Acta Phys Polon A.* 2015;128(2):122-124.
- [37] Makhazhanova U, Kerimkhulle S, Mukhanova A, Bayegizova A, Aitkozha Z, Mukhiyadin A, Tassuov B, Saliyeva A, Taberkhan R, Azieva G. The Evaluation of Creditworthiness of Trade and Enterprises of Service Using the Method Based on Fuzzy Logic. *Appl Sci (Switzerland).* 2022;12(22):11515.
- [38] Azarov OD, Dudnyk OV, Kaduk OV, Smolarz A, Burlibay A. Method of correcting of the tracking ADC with weight redundancy conversion characteristic. *Proceed SPIE - Int Soc Optic Engin.* 2015;9816:98161V.
- [39] Shyle I, Xhafka E, Teta J. Challenges of Albanian Companies for Sustainable Development in the Era of Industry 4.0. *Lect Notes Networks Syst.* 2021;233:260-269.
- [40] Kerimkhulle S, Saliyeva A, Makhazhanova U, Kerimkulov Z, Adalbek A, Taberkhan R. The input-output analysis for the wholesale and retail trade industry of the Kazakhstan statistics. *E3S Web Conf.* 2023;376:05023.

Інновації в освітніх методологіях: Дослідження впливу цифрових технологій на навчання та викладання

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Анотація

Актуальність. Актуальність досліджуваної теми полягає в необхідності розуміння впливу цифрових технологій на навчання та викладання в контексті постійно мінливого освітнього ландшафту, де інновації стають ключовим фактором успішної освіти.

Мета. Метою цього дослідження було оцінити вплив інформаційних технологій на навчальний процес та мотивацію студентів до навчання з використанням інноваційних методик.

Методологія. Для досягнення поставленої мети було використано методи аналізу, синтезу, узагальнення та систематизації.

Результати. Основні результати дослідження вказують на необхідність ретельного врахування педагогічних принципів при інтеграції цифрових технологій в освіту. Підкреслено, що успішна інтеграція цифрових інструментів вимагає узгодження з навчальними цілями та диференціації навчання відповідно до потреб учнів. Крім того, було підкреслено значну роль у подоланні цифрового розриву та забезпеченні рівного доступу до освітніх можливостей для всіх соціальних груп.

Висновки. Дослідження підкреслило важливість безперервного професійного розвитку вчителів та підготовки їх до ефективного використання цифрових технологій. Також було відзначено, що цифрові технології можуть бути потужним інструментом для підвищення залученості учнів, надання можливостей для персоналізованого навчання та розвитку навичок навчання впродовж життя. Однак при інтеграції технологій в освітній процес важливо враховувати етичні та соціальні аспекти. Це дослідження робить важливий внесок у сферу освітніх технологій, підкреслюючи необхідність узгодження цифрових інновацій з педагогічними принципами і стратегіями, а також висвітлюючи соціальну справедливість та етичні аспекти інтеграції технологій в освіту.

Ключові слова: інтеграція; педагогічні підходи; професійний розвиток вчителів; ефективність; мотивація.